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12,142	807	25,412	891	29,082	230	1676	604	4263	368	6365	804	8666	829
12,143	1020	25,510	861	29,088	19	1712	263	4304	945	6445	243	8689	868
15,090	800	25,710	871	29,094	131	1766	227	4340	948	6447	453	8725	150
15,539	800	25,714	793	29,122	144	1820	216	4419	145	6448	453	8740	650
15,784	1050	25,805	889	29,152	924	1878	604	4428	186	6460	505	8766	839
16,243	179	25,962	345	29,156	142	1997	19	4435	375	6476	177	8767	479
16,905	793	26,001	19	29,175	648	2020	019	4464	897	6477	552	8818	1155
16,940	793	26,084	878	29,254	227	2070	238	4480	430	6519	813	8829	483
17,017	818	26,127	15	29,325	905	2142	20	4482	263	6536	416	8837	292
17,729	787	26,138	431	29,325	905	2150	99	4539	873	6547	415	8840	604
17,731	799	26,140	889	29,359	135	2197	181	4567	879	6555	792	8877	881
17,732	799	26,224	230	29,367	413	2286	920	4569	419	6601	823	8892	702
17,837	28	26,236	866	29,421	907	2306	924	4573	861	6644	866	8919	868
18,342	19	26,259	21	29,479	135	2307	970	4574	862	6677	793	8936	16
18,357	804	26,364	142	29,507	453	2308	924	4589	374	6716	1261	8961	478
18,821	81	26,399	875	29,524	367	2309	905	4639	720	6739	552	9010	649
19,191	801	26,390	883	29,567	899	2385	967	4642	343	6767	820	9024	149
19,194	800	26,493	153	29,614	494	2393	89	4656	902	6818	356	9031	886
19,391	167	26,499	872	29,634	498	2515	948	4658	875	6855	508	9034	268
19,732	804	26,583	34	29,640	810	2548	912	4685	265	6865	838	9040	540
19,924	786	26,591	46	29,773	101	2582	284	4687	166	6866	838	9046	217
20,039	803	26,726	25	29,774	134	2626	49	4688	345	6874	348	9049	497
20,116	788	26,756	167	29,852	135	2627	40	4707	265	6897	635	9052	901
20,188	788	26,918	48	29,980	911	2629	50	4742	233	6900	829	9066	93
20,258	150	27,015	149	30,048	197	2649	414	4792	945	6948	488	9087	871
20,470	71	27,059	877	30,076	906	2650	131	4820	956	6971	867	9088	862
20,488	788	27,060	878	30,099	295	2661	284	4829	346	7054	488	9124	566
20,664	790	27,111	264			2759	264	4910	500	7061	836	9140	1131
20,716	28	27,141	89			2767	877	4937	720	7087	499	9148	799
20,793	793	27,149	35			2817	890	4938	431	7112	826	9154	860
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21,104	183	27,369	875	194	181	2866	364	5051	483	7274	364	9261	872
21,114	793	27,373	15	213	870	2941	945	5081	376	7282	346	9266	868
21,134	818	27,581	299	214	870	2948	414	5089	431	7370	436	9269	900
21,311	924	27,633	52	216	507	2950	129	5142	483	7383	374	9270	867
21,312	924	27,678	875	234	227	2971	920	5145	230	7391	478	9271	861
21,327	837	27,749	35	250	305	2988	227	5179	343	7418	818	9281	601
21,477	290	27,868	876	284	877	3114	75	5184	566	7467	807	9291	562
21,566	137	27,885	149	288	882	3158	672	5198	34	7467	807	9292	623
21,738	803	27,922	71	303	861	3174	905	5218	1236	7573	826	9295	538
21,778	199	27,962	872	353	872	3181	448	5242	357	7593	482	9315	546
21,807	837	27,963	878	367	185	3210	268	5268	897	7597	640	9333	800
21,858	181	27,985	68	420	906	3212	264	5331	166	7632	478	9341	886
21,932	866	27,994	92	437	346	3258	478	5356	286	7633	556	9344	924
22,143	848	28,015	89	476	268	3344	367	5434	651	7635	556	9367	236
22,423	179	28,069	28	482	19	3355	957	5447	831	7647	101	9370	624
22,497	21	28,072	860	501	237	3363	71	5464	436	7664	483	9390	879
22,507	786	28,187	879	558	374	3367	724	5512	447	7670	841	9396	631
22,519	803	28,188	876	564	728	3375	894	5621	263	7683	824	9413	1003
22,523	653	28,189	905	570	89	3382	915	5647	478	7700	826	9433	867
22,837	800	28,283	39	663	249	3408	350	5651	803	7757	482	9452	661
23,347	818	28,346	16	707	343	3420	906	5709	434	7762	437	9495	448
23,454	34	28,417	907	708	173	3422	186	5711	178	7814	507	9534	872
23,467	47	28,440	88	719	239	3435	688	5734	551	7866	834	9535	876
23,476	262	28,444	905	729	179	3442	88	5736	818	7916	829	9567	631
23,521	34	28,445	905	742	877	3456	295	5737	818	7920	560	9583	858
23,541	823	28,450	89	745	545	3467	276	5764	268	7928	839	9618	861
23,541	444	28,453	93	782	245	3477	834	5773	818	8006	901	9635	1260
23,738	414	28,469	138	802	350	3545	661	5825	1031	8027	848	9745	889
24,023	828	28,492	909	826	867	3572	1004	5830	423	8028	843	9775	962
24,028	286	28,500	134	834	867	3632	368	5844	181	8029	872	9783	364
24,029	827	28,537	68	849	373	3654	288	5845	413	8030	826	9821	916
24,038	263	28,550	904	884	861	3662	375	5847	784	8043	829	9846	620
24,125	39	28,565	75	902	363	3664	367	5853	787	8091	482	9918	894
24,159	245	28,569	348	908	233	3666	849	5856	431	8138	38	9919	602
24,194	88	28,575	182	910	181	3713	876	5858	415	8153	852	9921	912
24,304	835	28,629	230	933	181	3747	275	5863	807	8219	553	9923	166
24,329	824	28,631	303	1016	564	3761	343	5875	802	8270	557	9926	363
24,356	824	28,690	866	1049	867	3762	343	5876	1149	8279	540	9929	637
24,360	829	28,735	897	1056	906	3824	370	5889	234	8306	15	9939	620
24,374	19	28,742	215	1111	624	3867	447	5900	295	8364	824	9974	872
24,387	849	28,743	226	1123	601	3885	891	5905	823	8365	831	10,030	436
24,413	142	28,757	905	1133	222	3886	345	5967	434	8367	840	10,038	877
24,417	31	28,816	920	1171	971	3888	603	6016	234	8384	875	10,059	897
24,491	216	28,832	894	1188	215	3899	216	6020	346	8401	537	10,071	886
24,566	199	28,840	913	1199	238	3985	860	6061	787	8438	603	10,083	872
24,572	196	28,904	905	1200	368	4018	245	6112	131	8439	603	10,111	620
24,595	82	28,910	21	1345	215	4020	245	6113	131	8462	822	10,126	862
24,625	176	28,911	75	1368	233	4101	839	6215	806	8479	859	10,130	231
24,702	818	28,925	899	1409	149	4105	368	6227	793	8483	873	10,157	886
24,738	25	28,928	248	1410	289	4120	347	6273	448	8495	660	10,161	872
25,013	183	28,929	488	1415	897	4124	894	6274	423	8503	541	10,171	877
25,080	852	28,941	896	1425	900	4214	706	6275	94	8513	233	10,175	872
25,112	480	28,984	924	1437	142	4221	364	6317	75	8569	709	10,176	923
25,132	89	29,009	70	1438	907	4235	347	6319	380	8589	852	10,180	896
25,171	38	29,033	909	1575	914	4243	862	6328	814	8638	702	10,193	909

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10,250	648	12,328	823	14,017	982	15,820	489	17,501	378	19,373	1017	21,316	947
10,284	70	12,351	720	14,042	956	15,854	871	17,502	787	19,374	1017	21,360	1010
10,287	906	12,358	967	14,070	867	15,875	805	17,503	947	19,380	505	21,421	1225
10,304	492	12,374	901	14,113	962	15,892	1134	17,517	957	19,392	605	21,437	1196
10,312	620	12,400	706	14,115	858	15,930	15	17,557	875	19,411	876	21,448	971
10,351	601	12,454	228	14,145	852	15,949	955	17,563	900	19,457	1004	21,483	1155
10,374	920	12,463	167	14,192	497	15,960	876	17,578	852	19,473	277	21,484	1072
10,378	830	12,474	715	14,216	1049	15,961	875	17,579	92	19,487	243	21,508	999
10,383	897	12,475	799	14,226	1009	16,030	873	17,584	946	19,495	824	21,513	885
10,394	212	12,544	815	14,230	956	16,063	969	17,629	702	19,561	886	21,517	896
10,400	926	12,558	905	14,234	89	16,096	843	17,640	083	19,565	1226	21,524	971
10,408	1004	12,559	174	14,240	786	16,116	880	17,656	101	19,566	1118	21,525	1200
10,420	716	12,570	859	14,243	947	16,140	962	17,663	904	19,567	1041	21,549	918
10,488	493	12,600	962	14,295	837	16,153	868	17,667	215	19,568	1041	21,727	877
10,497	879	12,621	970	14,339	830	16,160	223	17,668	215	19,645	1118	21,737	1255
10,500	912	12,644	958	14,340	823	16,180	982	17,678	949	19,646	858	21,738	1200
10,522	478	12,653	707	14,355	806	16,185	858	17,687	166	19,652	862	21,780	1215
10,527	538	12,654	720	14,357	800	16,187	871	17,724	15	19,712	911	21,874	1204
10,582	620	12,661	1062	14,360	829	16,194	198	17,725	924	19,721	1068	21,880	1256
10,588	679	12,670	723	14,371	976	16,198	846	17,743	955	19,722	1163	21,883	1295
10,598	558	12,735	454	14,393	786	16,199	1044	17,744	970	19,750	1046	21,888	1022
10,601	878	12,762	235	14,433	479	16,208	890	17,756	963	19,769	344	21,948	1225
10,612	715	12,774	784	14,437	968	16,263	233	17,763	967	19,792	1053	21,985	1269
10,630	620	12,802	150	14,437	968	16,317	1203	17,829	963	19,809	1060	21,987	1146
10,679	223	12,818	948	14,448	962	16,335	881	17,834	606	19,816	1049	22,048	1269
10,780	1004	12,819	1006	14,456	569	16,362	882	17,859	962	19,844	182	22,057	1237
10,810	601	12,820	955	14,458	493	16,474	1160	17,876	873	19,845	1026	22,066	1236
10,833	436	12,822	956	14,459	883	16,494	800	17,882	947	19,847	1045	22,070	792
10,863	144	12,877	945	14,489	970	16,560	836	17,901	233	19,848	1047	22,080	1197
10,868	37	12,881	711	14,498	957	16,585	924	17,941	956	19,849	1020	22,138	1020
10,872	621	12,899	712	14,513	910	16,597	871	17,952	964	19,884	1081	22,145	182
10,946	982	12,916	803	14,514	910	16,620	877	18,005	835	19,901	885	22,147	1240
10,958	560	12,928	99	14,571	805	16,629	712	18,007	967	19,916	632	22,148	1245
10,972	415	12,952	673	14,615	631	16,664	884	18,023	981	19,933	899	22,158	1233
10,977	904	12,962	1045	14,618	824	16,687	286	18,025	815	19,942	1018	22,224	784
11,001	893	12,990	345	14,671	848	16,692	688	18,096	823	19,954	896	22,242	1201
11,071	1257	13,005	276	14,675	606	16,713	1045	18,103	1255	19,982	1077	22,247	792
11,103	909	13,055	606	14,682	957	16,743	803	18,199	956	20,017	1041	22,351	1260
11,107	612	13,072	606	14,734	800	16,753	264	18,215	860	20,084	703	22,356	1099
11,112	901	13,074	480	14,784	648	16,776	910	18,226	1004	20,143	507	22,361	1223
11,136	706	13,076	802	14,826	97	16,791	826	18,235	604	20,144	886	22,362	977
11,178	650	13,098	813	14,830	849	16,857	1004	18,270	970	20,145	1143	22,425	413
11,213	129	13,100	146	14,862	800	16,859	955	18,280	891	20,163	874	22,533	435
11,214	81	13,128	807	14,865	836	16,890	913	18,310	868	20,194	876	22,571	1069
11,224	621	13,129	76	14,868	972	16,918	860	18,332	1063	20,201	1195	22,586	353
11,236	926	13,138	576	14,869	955	16,946	946	18,333	985	20,227	904	22,617	1205
11,246	483	13,149	790	14,894	945	16,957	878	18,346	838	20,232	537	22,636	1041
11,247	167	13,218	71	14,954	952	16,970	909	18,354	999	20,248	380	22,645	439
11,329	917	13,235	886	14,959	212	16,981	949	18,355	999	20,258	1064	22,656	192
11,330	917	13,245	784	14,973	484	17,005	897	18,360	978	20,259	814	22,688	1211
11,345	482	13,260	199	14,975	826	17,010	241	18,381	650	20,260	873	22,714	799
11,380	909	13,332	614	14,976	858	17,024	923	18,386	88	20,353	1133	22,719	448
11,394	815	13,333	228	15,038	801	17,085	1116	18,387	1255	20,361	621	22,724	513
11,420	826	13,337	648	15,040	540	17,086	1116	18,410	970	20,457	1134	22,771	687
11,495	893	13,355	839	15,053	786	17,089	871	18,419	1045	20,467	831	22,820	629
11,562	897	13,364	1066	15,059	958	17,097	914	18,432	945	20,530	575	22,828	889
11,576	909	13,440	804	15,072	867	17,113	243	18,437	860	20,551	1099	22,840	530
11,588	960	13,448	873	15,106	832	17,117	860	18,439	964	20,552	838	22,852	905
11,610	91	13,455	792	15,212	784	17,133	876	18,460	837	20,561	958	22,909	1132
11,611	898	13,470	958	15,262	135	17,145	963	18,490	948	20,579	978	22,923	788
11,635	670	13,478	801	15,267	803	17,146	907	18,499	839	20,582	874	22,952	244
11,721	986	13,479	1092	15,271	1154	17,148	970	18,500	657	20,604	1163	23,003	846
11,743	498	13,481	680	15,275	1135	17,157	35	18,506	630	20,609	1059	23,014	1236
11,777	702	13,508	43	15,304	823	17,161	910	18,520	963	20,616	861	23,052	1236
11,799	731	13,530	505	15,334	790	17,172	971	18,523	290	20,621	803	23,089	1143
11,823	877	13,541	949	15,366	978	17,193	914	18,556	957	20,714	1139	23,146	1269
11,824	947	13,542	426	15,368	1081	17,207	862	18,558	1249	20,716	373	23,148	1212
11,950	667	13,549	803	15,370	731	17,215	902	18,559	1045	20,778	625	23,165	949
11,959	834	13,571	624	15,374	287	17,219	25	18,564	978	20,789	1157	23,181	985
12,011	1018	13,599	786	15,378	876	17,236	826	18,576	949	20,827	788	23,190	982
12,045	720	13,602	809	15,381	1082	17,253	915	18,601	961	20,832	968	23,194	1268
12,055	952	13,604	955	15,442	620	17,265	923	18,605	961	20,860	1068	23,214	1049
12,057	80	13,606	947	15,456	236	17,272	957	18,701	961	20,861	1068	23,284	1050
12,066	651	13,642	798	15,457	233	17,273	971	18,713	721	20,867	949	23,345	1146
12,073	231	13,687	961	15,463	841	17,285	1018	18,736	223	20,929	876	23,376	540
12,079	830	13,690	814	15,465	624	17,296	902	18,791	557	20,972	1145	23,386	223
12,086	901	13,696	606	15,478	919	17,311	962	18,807	1010	20,977	1154	23,414	894
12,109	444	13,699	967	15,533	193	17,318	957	18,808	1010	21,000	978	23,421	868
12,124	823	13,702	667	15,572	1020	17,319	900	18,867	1030	21,002	1204	23,460	706
12,135	667	13,703	967	15,595	841	17,322	910	18,889	970	21,052	1140	23,495	498
12,136	138	13,711	818	15,602	910	17,323	910	18,922	861	21,082	1169	23,496	967
12,141	970	13,770	825	15,617	827	17,324	1017	18,923	707	21,087	1205	23,516	824
12,153	948	13,842	962	15,654	785	17,325	875	19,028	129	21,119	1017	23,517	999
12,154	826	13,843	955	15,657	889	17,327	910	19,041	868	21,120	1196	23,564	1042
12,162	711	13,848	799	15,662	813	17,332	898	19,062	223	21,161	1049	23,626	1100
12,													

No. of Patent.	Page.	No. of Patent.	Page.	No. of Patent.	Page.	No. of Patent.	Page.	No. of Patent.	Page.	No. of Patent.	Page.	No. of Patent.	Page.
1914.		1915.		1915.		1915.		1915.		1915.		1915.	
24,029	958	84	832	1000	858	2220	837	3402	1217	6026	1249	8183	1134
24,030	1140	94	1200	1146	849	2323	823	3427	1017	6050	894	8202	1204
24,033	056	128	809	1190	879	2349	1258	3089	1261	6069	1045	8254	1136
24,009	800	138	1059	1231	1204	2394	852	3708	1007	6102	1009	8312	1005
24,106	1217	143	1018	1237	1245	2396	1205	3765	1140	6207	1146	8609	1236
24,113	894	149	877	1253	709	2411	983	3826	868	6318	1042	8705	1236
24,117	924	174	968	1283	1118	2446	884	4072	1136	6437	1215	8746	968
24,152	1165	192	1233	1289	1261	2465	688	4142	1252	6496	1196	8759	1072
24,183	901	295	1072	1329	1200	2466	802	4264	948	6529	1244	8763	904
24,196	1063	297	1217	1331	1195	2469	1196	4278	1007	6552	1160	8812	1223
24,221	047	430	1077	1332	804	2472	1162	4287	961	6671	1144	8838	1007
24,232	478	439	785	1375	501	2505	1042	4448	1205	6675	1150	8965	1197
24,249	018	450	1005	1411	1204	2633	971	4541	1062	6727	904	8996	1135
24,262	483	470	1042	1424	949	2639	875	4637	1160	6784	1004	9051	1249
24,286	884	495	1162	1441	670	2722	1268	4776	1202	7068	1066	9311	1136
24,289	1236	586	1007	1499	1163	2728	720	4820	1134	7097	1149	9375	1082
24,291	793	608	1132	1560	1196	2745	1221	4922	1163	7212	1054	9390	1233
24,347	1135	610	1084	1572	1049	2837	1243	5073	1272	7275	1138	9425	1027
24,418	1218	666	894	1613	1143	2844	809	5074	1272	7364	1045	9762	1207
24,419	1212	711	946	1672	622	2845	876	5182	1203	7385	1208	9958	1150
24,533	423	761	919	1687	871	2865	1138	5183	1006	7541	1046	10,018	1138
24,538	1140	776	515	1744	956	2919	858	5185	1221	7809	1197	10,033	1042
24,558	1208	780	1225	1849	1196	2926	1072	5260	1163	7837	1197	10,223	1234
24,588	858	784	1056	1890	648	2945	1233	5269	1257	7861	829	10,604	1258
24,605	367	801	1143	1891	703	3035	665	5395	1212	7877	1243	10,822	1086
24,680	1020	820	1160	2020	604	3036	556	5444	889	7960	1105	11,485	1207
24,735	871	844	897	2077	881	3067	1221	5445	864	7998	1009	11,526	1272
24,738	1163	855	793	2151	1204	3074	1222	5446	864	8043	1165	11,814	1260
		982	1060	2196	1146	3208	962	5563	1092	8058	828	13,970	1243
		997	1261	2219	803	3277	1143	5976	1042	8109	952		

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JOURNAL.	ABBREVIATION.	ADDRESS OF PUBLISHER AND PRICE.*
Agricultural Bulletin of the Federated Malay States	Agric. Bull. F.M.S. ..	Dept. of Agriculture, Kuala Lumpur, F.M.S. 1s. 3d.
Agricultural Journal of India ..	Agric. J. India ..	W. Thacker and Co., 2, Creed Lane, London. 3s.
Agricultural Ledger	Agric. Ledger ..	Reporter on Economic Products to the Government of India, Calcutta.
Allgemeine Zeitschrift für Bierbrauerei und Malzfabrikation ..	Allgem. Z. Bierbrau. u. Malzfabr. ..	Michaelerstrasse 25, Vienna XVIII/1. Krone 12 per annum.
American Journal of Pharmacy	Amer. J. Pharm. ..	145, North Tenth Street, Philadelphia, Pa., U.S.A. 30 cents.
American Journal of Science ..	Amer. J. Sci.	New Haven, Conn., U.S.A. \$6.40 per annum.
Analyst	Analyst	Simpkin, Marshall, Hamilton, Kent, and Co., Ltd., 2, 4, 6, 8, Orange Street, London, S.W. 2s.
Annalen der Chemie	Annalen	C. F. Winter'sche Verlagshandlung, Leipzig, Germany. M. 24 per annum.
Annales de Chimie Analytique ..	Ann. Chim. Analyt. ..	M. Crinon, 45, Rue Turenne, Paris, 3e. 1 fr.
Annales des Falsifications ..	Ann. Falsific. ..	56, Rue Madame, Paris, 6e. 2 fr.
Annali di Chimica Applicata ..	Annali Chim. Appl. ..	Via Panisperna N. 89b, Rome. Lire 34 per annum.
Annali della R. Stazione Chimico Agraria Sperimentale di Roma	Ann. R. Staz. Chim. Agrar. Sperim. Roma	R. Stazione Chimico-Agraria Sperimentale di Roma, Rome.
Apotheker-Zeitung	Apoth.-Zeit. ..	Levetzowstrasse 16b, Berlin, N.W. 87. 25 Pf.
Archiv der Pharmazie	Arch. Pharm. ..	Selbstverlag des Deutschen Apotheker-Vereins, Berlin, Germany. M. 12 per annum.
Atti della Reale Accademia dei Lincei, Roma	Atti R. Accad. dei Lincei, Roma	Tipografia della R. Accademia dei Lincei, Rome. Lire 10 per annum.
Berichte der Deutschen Chemischen Gesellschaft	Ber.	R. Friedländer und Sohn, Karlstrasse 11, Berlin, N.W. 6, Germany. M. 32 per annum.
Berichte der Deutschen Pharmazeutischen Gesellschaft ..	Ber.deuts.Pharm.Ges.	Verlag von Gebr. Bornträger, Berlin. W. 35, Schöneberger Ufer 12A, Germany. M. 20 per annum.
Biedermann's Zentralblatt für Agricultur Chemie	Biedermann's Zentr. .	O. Leiner, Königstrasse 26B, Leipzig, Germany. M. 22 per annum.
Bio-chemical Journal	Bio-chem. J.	Cambridge University Press, Fetter Lane, London, E.C. 7s.
Biochemische Zeitschrift	Biochem. Zeits. ..	Verlag von J. Springer, Berlin, W. 9, Linkstrasse 23/24. M. 14 per volume.
Board of Trade Journal	Bd. of Trade J. ..	Messrs. Wyman and Sons, Fetter Lane, London, E.C. 3d.
Brewers' Journal	Brewers' J.	F. W. Lyon, Eastcheap Buildings, Eastcheap, London, E.C. 2s.
British and Colonial Pharmacist	Brit. and Col. Pharm.	194-200, Bishopsgate, London, E.C. 1s.
Bulletin de l'Association Chimique de Sucre et de Distillerie	Bull.Assoc.Chim.Sucr.	156, Boulevard Magenta, Paris, 10e, France. 2 fr.
Bulletin of the Bureau of Agricultural Intelligence and of Plant Diseases	Bull. Bureau Agric. Intell.	International Institute of Agriculture, Rome. 2 fr.
Bulletin of the Bureau of Standards (U.S.A.)	Bull. Bureau of Standards (U.S.A.)	Government Printing Office, Washington, D.C. 25 cents.
Bulletin de la Société Chimique de Belgique	Bull. Soc. Chim. Belg.	M. J. Wauters, Palais du Midi (Galerie du Travail, 7), Brussels.
Bulletin de la Société Chimique de France	Bull. Soc. Chim. ..	Masson et Cie., 120, Boulevard Saint-Germain (6e), Paris. 38 fr. per annum.
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Bulletin de la Société Industrielle du Nord de la France	Bull. Soc. Ind. Nord	Rue de l'Hôpital Militaire 116, Lille, France.
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Bulletin de la Société d'Encouragement pour l'Industrie Nationale	Bull. Soc. d'Encour. ..	Secrétariat, Rue de Rennes 44, Paris, France. 36 fr. per annum.
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Chamber of Commerce Journal ..	Ch. of Comm. J. ..	Oxford Court, Cannon Street, London, E.C. 1s.
Chemical News	Chem. News	E. J. Davey, 16, Newcastle Street, Farringdon Street, London, E.C. 4d.
Chemical Trade Journal	Chem. Trade J. ..	Davis Bros., Danes Inn House, 265, Strand, London, W.C. 4d.
Chemical World	Chem. World. . .	J. and A. Churchill, 7, Great Marlborough Street, London, W. 6d.

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Chemiker-Zeitung	Chem.-Zeit.	Dr. v. Vietinghoff-Scheel, Cöthen, Anhalt, Germany. M. 28 per annum.
Chemische Industrie	Chem. Ind.	Weidmann'sche Buchhandlung, Zimmerstrasse 94, Berlin, S.W., Germany. M. 20 per annum.
Chemische Revue über die Fett- und Harz-Industrie	Chem. Rev. Fett-Ind.	Dr. L. Allen, Catherinenstrasse 25, Hamburg, Germany. M. 1.75.
Chemisches Zentralblatt	Chem. Zentr.	R. Friedländer und Sohn, Karlstrasse 11, Berlin, N.W. 6, Germany. M. 80 per annum.
Chemist and Druggist	Chem. and Drug. ..	42, Cannon Street, London, E.C. 6d.
Collegium	Collegium	K. Schorlenumer, Sebastian-Munster-Strasse 28, Worms am Rhein, Germany. 2s.
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Comptes-Rendus hebdomadaires des Séances de l'Académie des Sciences	Comptes rend. ..	Imprimerie Gauthier-Villars, Quai des Grands Augustins 55, Paris. 44 fr. per annum.
Comptes-Rendus des Travaux de Laboratoire de Carlsberg	Comptes-rend. Trav. Lab. Carlsberg	H. Hagerup, Copenhagen. 2 Kr. 50 Ore.
Deutsche Zuckerindustrie ..	Deuts. Zuckerind. ..	Verlag der Gesellschaft, Die Deuts. Zuckerindustrie, Berlin. M. 24 per annum.
Elektrochemische Zeitschrift ..	Elektrochem. Zeits. ..	F. Siemenroth, Hafenplatz 9, Berlin, S.W. 11. M. 1.50.
Engineering	Engineering	C. R. Johnson, 35 and 36, Bedford Street, Strand, London, W.C. 6d.
Engineering and Mining Journal	Eng. and Min. J. ..	505, Pearl Street, New York City. 15 cents.
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Internationale Zeitschrift für Metallographie	Internat. Z. Metallog.	Gebr. Bornträger, Schöneberger Ufer 12a, Berlin, W. 35. M. 40 per annum.
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Journal de Chimie Physique ..	J. Chim. Phys. ..	Gauthier-Villars, 55, Quai des Grands Augustins, Paris. 25 fr. per annum; the price of a single copy varies according to the size.
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JOURNAL.	ABBREVIATION.	ADDRESS OF PUBLISHER AND PRICE.
Journal of the College of Engineering, University of Tokyo	J. Coll. Eng., Univ. Tokyo	The University, Tokyo.
Journal of the College of Science, Imperial University of Tokyo	J. Coll. Science, Tokyo	Director of the College of Science, Tokyo Imperial University, Japan. Price varies.
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Journal of the Royal Society of Arts	J. Soc. Arts	G. Bell and Sons, York House, Portugal Street, London, W.C. 6d.
Journal of the Russian Physical-chemical Society	J. Russ. phys.-chem. Soc.	Laboratoire de Chimie, Université Impériale, Petrograd, Russia. R. 1.50.
Journal of the Society of Dyers and Colourists	J. Soc. Dyers and Col.	Pearl Assurance Buildings, Market Street, Bradford, Yorks. 2s.
Journal of the Washington Academy of Sciences	J. Wash. Acad. Sci. ..	2419, Greenmount Avenue, Baltimore, Md., U.S.A. 25 cents; 50 c. for July, Aug., and Sept. numbers.
Kolloid-Zeitschrift	Kolloid-Zeits.	T. Steinkopff, Bismarckplatz 16, I., Dresden-A, 14, Germany. M. 3-4.
L'Industria Chimica	L'Ind. Chimica ..	Associazione Chimica Industriale, Via Roma 28 (Galleria Nazionale Scala A), Turin, Italy. Lira 1.
Memoirs of the College of Science and Engineering, Kyoto Imperial University	Mem. Coll. Sci. and Eng. Kyoto Imp. Univ.	The University, Kyoto, Japan. Yen 0.65.
Mémoriale des Poudres et Salpêtres	Mém. Poudres et Salpêtres	Gauthier-Villars, 55, Quai des Grands Augustins, Paris. \$2.
Metall und Erz	Metall u. Erz	W. Knapp, Mühlweg 19, Halle on Saale, Germany. M. 28 per annum.
Metallurgical and Chemical Engineering	Metall. and Chem. Eng.	McGraw Publishing Co., 239, West 39th Street, New York City, U.S.A. 10s. per annum.
Mining and Engineering World ..	Min. and Eng. World	Monadnock Building, Chicago, Ill., U.S.A. 10 cents.
Mittheilungen aus dem königlichen Materialprüfungsamt zu Gross-Lichterfelde West	Mitt. k. Materialprüf.	Julius Springer, Linkstrasse 23/24, Berlin, W. 9, Germany. M. 16 per annum.
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Moniteur Scientifique	Monit. Scient. ..	Dr. G. Quesneville, 12, rue de Buci, Faubourg St. Germain, Paris. 2 fr.
Oesterreichische Zeitschrift für Berg- und Hüttenwesen	Oesterr. Z. Berg- u. Hüttenw.	Kohlmarkt 20, Wien I, Austria. Kr. 28 per annum.
Oil, Paint, and Drug Reporter ..	Oil, Paint, and Drug Rep.	100, William Street, New York City, U.S.A. \$6 per annum.
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Petroleum	Petroleum	Verlag für Fachliteratur, Motzstrasse 8, Berlin, W. 30. M. 1.50.
Pharmaceutical Journal	Pharm. J.	150, Holborn, London, E.C. 6d.
Philippine Journal of Science ..	Philippine J. Sci. ..	Bureau of Science, Manila, Philippine Islands. 50 cents.
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Photographic Journal	Phot. J.	Harrison and Sons, 45, Pall Mall, London, S.W. 1s.

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Proceedings of the American Society of Civil Engineers	Proc. Amer. Soc. Civ. Eng.	220, West 57th Street, New York City, U.S.A. \$8 per annum.
Proceedings of the Engineers' Society of Western Pennsylvania	Proc. Eng. Soc. W. Pa.	2511, Oliver Building, Pittsburg, Pa., U.S.A. 50 cents.
Proceedings of the Faraday Society	Proc. Faraday Soc. ..	The Secretary, 82, Victoria Street, London, S.W.
Proceedings of the Institution of Civil Engineers	Proc. Inst. Civ. Eng. ..	The Secretary, Great George Street, London, S.W.
Proceedings of the Institution of Mining and Metallurgy	Proc. Inst. Min. and Met.	1, Finsbury Circus, London, E.C. 21s. per annum.
Proceedings of the Royal Society	Roy. Soc. Proc. ..	Harrison and Sons, 45, St. Martin's Lane, London, W.C. Price varies.
Recueil des Travaux Chimiques de Pays-Bas	Rec. Trav. Chim. Pays-Bas	A. W. Sijthoff, Leiden, Holland. 6 fl. per volume.
Revue Générale des Matières Colorantes	Rev. Gén. Mat. Col. ..	L. Lefevre, 4, rue de Stockholm, Gare St. Lazare, Paris, France. 3 fr.
Revue de Métallurgie	Rev. Mét.	H. Dunot and E. Pinat, 49, Quai des Grands Augustins, Paris. 4 fr. 50.
School of Mines Quarterly ..	Sch. Mines Quart. ..	T. H. Harrington, Columbia University, New York. 50 cents.
Science Reports of Tohoku Imperial University	Sci. Reports, Tohoku Imp. Univ.	The Maruzen-Kabushiki-Kaisha, Sendai, Japan. Price varies.
Scientific American	Scient. Amer.	361, Broadway, New York City, U.S.A. 10 c.
Scientific Proceedings of the Royal Dublin Society	Scient. Proc. Roy. Dublin Soc.	Leinster House, Dublin. Price varies.
Silikat-Zeitschrift	Silikat-Zeits.	Verlag von Müller und Schmidt, Coburg, Germany. M. 12 per annum.
Sitzungsberichte der Königlich-Preussischen Akademie der Wissenschaften	Sitzungsber. Kgl. Preuss. Akad. Wiss. ..	Verlag der Königlichen Akademie der Wissenschaften, Berlin. M. 12 per annum.
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Transactions of the Iron and Steel Institute	Trans. Iron and Steel Inst.	28, Victoria Street, London, S.W.
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United States Commerce Reports, Daily Consular and Trade Reports	U.S. Comm. Rept.	Superintendent of Documents, Washington, D.C., U.S.A. \$2.50 per annum
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Wasser und Gas	Wasser u. Gas ..	G. Stalling, Oldenburg i. Gr., Germany.
West Indian Bulletin	West Ind. Bull. ..	Imperial Dept. of Agriculture, Barbados, W.I.
Wochenblatt für Papierfabrikation	Wochenbl. Papierfabr.	Güntter-Staib in Bieberach a. d. Riss, Württemberg, Germany. 50 Pf.
Wochenschrift für Brauerei ..	Woch. f. Brau. ..	P. Parey, Hedemannstrasse 10, Berlin, S.W., Germany. M. 40 per annum.
Zeitschrift der analytischen Chemie	Z. anal. Chem. ..	C. W. Kreidel's Verlag, Wiesbaden, Germany. M. 2.
Zeitschrift für angewandte Chemie	Z. angew. Chem. ..	Verlag von Otto Spamer, Nürnberger Strasse 48, Leipzig, Germany. M. 36 per annum.
Zeitschrift der anorganischen Chemie	Z. anorg. Chem. ..	Verlag von L. Voss, Leipzig, Germany. M. 12 per volume.

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Zeitschrift des Vereins der deutschen Zucker-Industrie	Z. Ver. deut. Zuckerind.	Vereins-Direktorium, Kleiststrasse 32, Berlin, W. 62, Germany. M. 45 per annum.
Zeitschrift für das gesammte Brauwesen	Z. ges. Brauw. ..	R. Oldenbourg, Glückstrasse 8, München, Germany. M. 20 per annum.
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Zeitschrift für Elektrochemie und angewandte physikalische Chemie	Z. Elektrochem. ..	W. Knapp, Mühlweg 19, Halle a. S., Germany. \$6.50 per annum.
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Zeitschrift für öffentliche Chemie	Z. öffentl. Chem. ..	M. & H. Schaper, Hannover, Germany. 50 Pf.
Zeitschrift für physikalische Chemie	Z. physik. Chem. ..	W. Engelmann, Mittelstrasse 2, Leipzig, Germany. M. 76 per annum.
Zeitschrift für physiologische Chemie.	Z. physiol. Chem. ..	Verlag von K. J. Trübner, Strassburg, Germany. M. 12 per volume.
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Zeitschrift für Zuckerindustrie in Böhmen	Z. Zuckerind. Böhm...	Die Administration, Vodickova No. 704 (Palais Lucerna), Prag 11, Bohemia. M. 17.20 per annum.

LIST OF ERRATA, 1915.

No. of Journal.	Page.	Column.	Line from Top.	Line from Bottom.	Errata.
No. 2—Jan. 30	68	2	..	17	For "Melton" read "Melton."
No. 5—Mar. 15	231	1	5	..	For "A. Arnold" read "H. Arnold."
No. 6—Mar. 31	299	2	..	4	For "J. P. Candy" read "F. P. Candy."
No. 9—May 15	489	1	..	40	Formula should read " $(\text{alkyl})_2\text{N.C}_6\text{H}_4.\text{NH.C}_6\text{H}_4.\text{R}'(\pm)$."
" "	492	1	29	..	For "492,567" read "472,567."
No. 10—May 31	542	1	..	3	For "Kliegel" read "Kliegl."
" "	575	2	16	..	For "Jolly" read "Jolley."
No. 14—July 31	806	2	3	..	For "Algar" read "Agar."
No. 15—Aug. 16	826	1	..	28	For "Strausky" read "Strausky."
No. 16—Aug. 31	861	2	..	11	For "Andrews" read "Andrew."
No. 18—Sept. 30	959	1	..	26	For "Kedesky" read "Kedesdy."
No. 20—Oct. 30	1051	1	..	25	For "Pagliano" read "Pagliani."
No. 22—Nov. 30	1160	2	..	27	For "Schiller" read "Schilling."
" "	1163	1	18	..	After "London" insert "From H. Neel."
No. 23—Dec. 15	1176	1	1—2	..	A line has been omitted between lines 1 and 2, as follows:— "should at any rate have the credit of it, and if profit."
" "	1225	1	..	34	For "49" read "94."
No. 24—Dec. 31	1272	2	..	14	For "1913" read "1914."

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JANUARY 15, 1915.

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Rudolph Messel, Ph.D., F.R.S.	1914.

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D. J. Danker.	H. P. Knapp.	H. J. Skinner.
W. C. Durrice.	W. D. Livermore.	W. S. Williams.
C. H. Fish.	L. A. Olney.	

Hon. Treasurer:

Frank W. Atwood, 216, Milk Street, Boston, Mass., U.S.A.

Hon. Local Secretary:

A. A. Clafin, 88, Broad Street, Boston, Mass., U.S.A.

Yorkshire Section.

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Vice-Chairman: J. W. Cabb.

Committee:

A. M. Auty.	W. B. Hill.	A. R. Tankard.
F. W. Branson.	L. J. Lloyd.	Geo. Ward.
E. A. Brotherton.	W. Lawson.	Thorpe Whitaker.
J. Evans.	W. McD. Mackey.	W. Gathorne Young.

Hon. Local Secretary and Treasurer:

T. Fairley, 17, East Parade, Leeds.

Canadian Section.

Meeting held at Montreal on Friday, 16th October, 1914.

PROF. J. W. BAIN IN THE CHAIR.

DEVELOPMENT OF CHEMICAL INDUSTRY IN CANADA.

BY T. H. WARDLEWORTH.

The Canadian Section of the Society of Chemical Industry at its opening meeting for the season 1914-15 finds the interests it represents in a position not likely to recur for many a long decade. Supplies of very necessary materials can no longer be secured from their usual sources, and we are compelled not only to look elsewhere for the goods, but to take steps that such a contingency does not arise again, by seeing to what extent we can provide such products in our own country, which is so rich in natural resources.

It would appear, therefore, that our Society is fulfilling its functions in a most pronounced way, when it takes upon itself the task of ascertaining to what extent the chemical industries of the country can best be helped, and as far as possible extended, to meet the needs of the present and the greater demands of the future. We may have to ask our Government to assist us in this work, and we believe we shall have a sympathetic hearing when we present our claims.

No nation has been able to compete against the scientifically managed manufactures of Germany, many of the most important of which were originally instituted in England, France, or the United States. No other country can boast of a single business combination, comprising three firms (the chemical factories of Elberfeld, Ludwigshafen, and Treptow), which employs over seven hundred qualified chemists. And yet, in spite of the unique facilities already afforded by Germany for the prosecution of pure science, further aid has been demanded and granted. The German government has for many years endowed the universities and technical schools—which indeed are under the direct control of the State—with annual sums vastly greater than those applied to similar purposes in England. In addition to this indirect method of furthering the progress of science, a Society for the Promotion of Science has recently been constituted.

The society in question is the Kaiser-Wilhelm Society, which defines in its first statute its primary object: "To promote the sciences, especially by the foundation and support of scientific institutes of research." The income of the society, subscribed by private individuals or by firms, will be devoted to the establishment of institutes of research in which distinguished investigators in the various branches of science will be afforded facilities and means for the prosecution of their chosen problems.

In prosperous times, the Canadian manufacturer thinks that he has no need of scientific assistance; in times of bad trade he believes that he cannot afford it.

As a country Canada is blessed with manifold natural advantages—our mines give us arsenic, antimony, cobalt, nickel, copper, platinum, osmium, gold, phosphates, magnesite, silver, chromium, tungsten, molybdenum, barytes, mica, graphite, asbestos, lime, salt, shale, and coal. There is no reason why many of the metals should not be refined in Canada. Why should all our crude nickel go abroad to be purified? Why should we not make our own copper sulphate—hundreds

of tons of which are imported every year? Phosphatic rock with all its possibilities is to be found in large quantities within a hundred miles of Montreal. Tons of magnesium carbonate and calcined magnesia are imported every year: yet we have large supplies of the crude material within easy reach of Montreal. There is a very large deposit of fine grade magnesia near Ottawa which is suitable for many purposes, but would be peculiarly adapted for fire-brick were it not for the fact that it lacks a small percentage of iron, a trace practically, and this want constitutes the difference between an excellent fire-brick magnesia and one which is of no value at all. One method suggested is simply to add the iron, but it is stated that large sums of money have been spent in this direction without success. It is a problem for the younger chemists, who will turn our wonderful deposits of magnesite into a commercial proposition of exceeding value if they can only find the missing link. There is an ever-increasing demand for barium peroxide, and while there are large supplies of barytes in Nova Scotia we do not produce an ounce of the peroxide, bringing it all from England and Germany. Graphite is to be found here, and as the price of pencils is likely to be advanced, would it not be worth while to pay attention to the compounding of graphite for making pencils? If we are successful we may be sure our wood workers would do the rest. Why should our phosphorus go abroad and come back in the form of phosphoric acid, the various phosphates, phosphides, and hypophosphites, at enormously enhanced prices? In Nova Scotia, it is said there are enormous deposits of shale, now the subject of financial development. Instead of shipping the shale, why should we not make the finished products? It is true that we are doing something practical with our salt deposits, but it seems to me that our enormous imports of bleach ought to suggest a great extension of this work.

Turning to wood products, we now make wood alcohol, acetone, acetic acid, acetates of lime and soda, and formaldehyde. Why cannot we make also glacial acetic acid? We produce the 80% acid, but import the 99%.

In some directions we are doing well—the calcium carbide industry is well established, and we are beginning to supply the world, thanks to our supplies of raw materials, our magnificent water powers, and the initiative and energy of the manufacturers. The same company is about to produce ferro-silicon, and it will be on the market at an early date. We may expect cyanamide and probably other products from atmospheric nitrogen in the near future.

We also produce, and produce well, commercial sulphuric, hydrochloric, and nitric acids, but we do not make as much use of this fact as we might in other branches of chemical industry by the production of resulting compounds.

Glycerin we now refine in two centres, Montreal and Toronto, and excellent results are given by both factories.

Ethyl alcohol is also produced in this country—a fact appreciated by many of our members—but it seems to me that it is our duty to ask the Government for the privilege of free alcohol for technical purposes. It is said that the refusal of the British Government to give permission for the use of free alcohol to the infant aniline industry was the main cause of its decline and transfer to Germany. I have been informed that the Government is in many respects favourable to duty-free alcohol for chemical manufactures, but those who apply to the Government will have to be very explicit in their reasons for wanting duty-free alcohol. Would it not be possible, while dealing with this question, to know more of the development of ethyl alcohol from sawdust? Under the

head of alcohol, would it not be within reason to ask the Government to make arrangements whereby manufacturers in this country could use the fusel oil, most of which is now sent to the States and comes back to us as "banana oil," so largely used by the bronze paint people, and also as amyl acetate?

We are as a country very short of potash as a product. In the past we used to produce a large quantity of potassium carbonate, but this seems to have fallen off considerably of late years, due probably to the fact that so much of the country has been cleared that there is not now the same opportunity of collecting the ashes as in the old days. At the same time we have recently heard of a process for getting potash from sawdust, but as the yield is only about 3%, it is to be feared that the process would not be profitable. The utilisation of sawdust as a basis for the manufacture of either potash or oxalic acid might be seriously considered, as we have abundant supplies of raw material, which at the present time constitutes nothing but an annoying problem to the producers. Another source of potash available to us at the present time is feldspar. We believe there are large deposits of feldspar in the neighbourhood of Kingston, containing about 18% of potash, and the problem is to extract this on a satisfactory basis. I have recently come in contact with another process which appears to be successful. Although dealing with a very much higher class of material which comes from somewhere down the St. Lawrence, still in my opinion it shows that the problem may be solved. There is also the prospect of potash deposits being found in British Columbia.

Carbolic acid is being produced in different parts of the Dominion, but so far as we can learn there is no evidence of the production of the finer grades, or of efforts to produce absolute phenol, and it would appear that this is a field which might be cultivated with advantage, because we have very large supplies of raw material and the demand for carbolic acid in the Dominion is very considerable. The making of the finer grades of phenol is a delicate operation, but we hope that in the near future we shall have offered to us crystallized carbolic acid of good quality of Canadian manufacture.

The paper industry seems to be well covered by the chemists, but I think the manufacturers could devote some attention to parchment paper in all its forms. We import enormous quantities of this article from Europe. As we have the primary materials here in such abundance, it should be possible for us to produce on the spot parchment paper equal to any in the world.

Ammonia is produced in large quantities and of excellent quality in the Dominion, but, so far, we do not seem to have succeeded in making the carbonate to compete with either the American or the English, and this is a point which I think might be taken up with advantage by our Canadian chemists, as we import large quantities of this particular article.

Allied to the production of ammonia is the naphthalene industry, and so far we have been able to produce a grade of flake naphthalene which compares favourably with the English and American products, but it is open to some objections which affect its sale to the general public, in any large measure. But the manufacturers hope at an early date to produce not only flake but ball naphthalene as well, of an improved quality.

I have outlined some of the lines on which the energies of our chemists may be directed for the development of the chemical industry in Canada, and I feel sure that we are capable in Canada of very largely extending the area of our usefulness in the domain of chemistry. We must look to the

Government and our richer citizens for assistance to foster research, as I am convinced that a great deal of the value of the future work will depend largely upon research carried on to-day by our master-thinkers in Canada. We should depend not too much upon the illusive prospects held out by the abrogation of patents or anything of that kind, but rather should we look to our younger chemists to throw themselves into the fields of earnest work for the improvement of old processes and development of new ones.

I feel confident that, as we are the followers of men who have made the forests of Canada ring with their axe and have not been dismayed by the obstacles opposed to them, we shall have the opportunity and the will to exercise our talents and our energy for the building up of a greater, a richer, and a constantly progressive chemical industry worthy of the growing Dominion of Canada.

DISCUSSION.

MR. HERBERT J. S. DENNISON wrote as follows:—

The chemical industry is one which will probably be more closely affected than any other by the present war, as Germany in particular is noted for its activity in the chemical sciences and there are probably many patents on valuable chemical products and processes which may come within the scope of some of your members. The value of patent rights as an incentive to persons or firms developing the various arts is not generally realised, but the British Government passed an Act shortly after the declaration of War whereby the British Board of Trade was empowered to order the avoidance or suspension in whole or in part of any patent, design, or trade mark or of any license under such held by a subject of any state at war with His Majesty.

The Canadian Government followed suit, but the Canada War Measures Act of 1914 only relates to patents. These Acts have been very much misquoted and misunderstood in that these patents are not thrown open to the public generally, but the Commissioner of Patents is empowered to order the avoidance or suspension of any patent or license thereunder owned by a subject of a state at war with His Majesty, and he may grant a license to anyone applying therefor upon such terms and conditions as he may think fit, but he may require the applicant to show a *bona fide* intent to manufacture or operate under the patent and that the granting of such license will be in the general interests of the country or of a section of the community or of the trade. It is also provided that if a person, during the period of such avoidance or suspension should have made application for and obtained a license, begins to manufacture, use or sell the patented invention or to operate under a patented process, such person may continue to so manufacture or operate the invention without interference and without having to account to the original owners of the patents.

It is within the power of the Commissioner of Patents to grant one or more licenses, but he may at his absolute discretion revoke the order of avoidance or suspension and further refuse later applicants on the ground that the public is already being served by license already granted. In this manner manufacturers desiring to utilise a special process, which will require a considerable outlay of money or experiment, may be assured an exclusive license, or at least limitations in the granting to others.

In regard to foreign patents, Canadians owning patents in any of the belligerent or neutral countries may rest assured that these will be maintained in full force and effect, even in Germany or Austria, as the British Government has issued

a license under which members of the Chartered Institute of Patent Agents in London may pay any fees necessary for obtaining the grant or for obtaining the renewal of patents or the registration of designs or trade marks or renewal of such registration in an enemy country. Existing patents may thus be kept in full force and effect or new applications filed which under the various international laws must be filed within certain clearly defined periods following the filing in the home countries.

Mr. MILLS said that the reason why Canada did not produce chemicals was largely due to lack of knowledge. Canadian markets for chemicals were not so large as those of other countries, and consequently Canada could not produce on the same scale as Germany. On the other hand many chemicals were very high in price because they were brought from long distances. Therefore, while the demand in Canada was not big enough to start many industries, yet it should eventually be profitable to develop some lines on a small scale. It would not be wise to attempt industries which necessitated raw materials not easily obtained in Canada, for instance the dye industry, but a number of small things could be manufactured in Canada, and should be attempted at once. The raw materials produced in Canada were the basic ones, and this was unfortunate in one sense, because it meant that the quantities handled had to be fairly large; against that must be put the advantage of having the raw material on the spot. Silver nitrate had already been made in Canada, and there were many other things of a like nature. Canada had imported many things from Germany merely because they were easily obtained and not because they could not be made in Canada.

Mr. THOMS said that oxalic acid should have been made from sawdust in Canada long ago. No country had more sawdust than Canada, and caustic soda was also plentiful. The great bulk of the oxalic acid used in Canada came from Germany and was made synthetically. Before the war the price had been \$6.00 per cwt., but almost immediately it had risen to \$23.00.

Very little silver nitrate was imported because Canada was one of the largest producers of silver in the world, and the nitrate was very easily made. Regarding the alcohol question, the duty the Government had demanded was \$1.90 per proof gallon, and \$2.40 including war tax. Manufacturers of ether and chloroform in the U.S.A., where they had duty-free alcohol, had a cheap alcohol of sufficient purity to allow them to make ether and chloroform and sell it in Canada at a price lower than the cost of the necessary alcohol alone.

Mr. GOODWIN suggested that the sawdust might be used in making dolls, which had to be painted; paraffin wax was used to make the faces. There were in Canada unusual possibilities in the supply of the rare elements, such as molybdenum. Was there any reason why they should not manufacture the iron alloys and other products based, for example, on molybdenite, sufficient for their own needs, and probably a large quantity for the United States? The attempt to manufacture potash from felspar at Kingston had not been very promising up to the present; but under conditions such as now existed it would bring some of the processes within reach of a margin of profit. Whether conditions would continue for long enough to give them a good start was the problem. They had been trying at Kingston, with good prospects of success, to make the potash contents of felspar available for agricultural purposes without extracting it from the felspar. Government assistance in efforts to extend manufactures might be dangerous

in some ways. For instance, the German Government, in order to stimulate beet sugar manufacture in Germany, had given considerable rebate upon all sugar exported. Large manufacturers had sold their sugar in foreign markets at a lower rate than in home markets. Germany also exported great quantities of fruit which Great Britain had made into jams and exported back, and undersold the Germans in their own markets.

Mr. MILLAR said that they could not hope to make copper sulphate, the larger part of which came from the copper refineries in the United States. It was a by-product of the tank liquor, and could be bought for barely the price of the copper it contained. Hydroquinone could be produced fairly cheaply. It had risen from \$1.00 a pound to \$4-5.00 a pound. The trouble seemed to be that the gas companies did not make the same use of their tar products as was done in Germany.

Mr. G. W. CHADSEY said that it was a tremendous problem to undertake the manufacture of any materials which had involved a great deal of research. They could not expect to go into the market against the Germans without some of their experience. One way was to start on easy things and work up.

Mr. B. L. EMSLIE said that patents in regard to felspar as a source of potash had been numerous, but none of them had been really successful. The first one granted was in about 1860. The U.S. Government had appropriated a sum annually to be expended in the exploitation of the actual solution of the potash, so far with very little success. One source of potash was the kelp on the Pacific Coast, but the amount was small and in any case could not compete with the German product. A process had lately been introduced at Kingston as a result of which it was said that a 50% article would be sold at \$50.00 a ton. It was questionable if it would be profitable to erect an expensive plant, because as soon as the war was over the German product would come in again and it would be impossible to compete with it. Wood ashes had been quoted as a possible solution, and were extensively used. These might be got from sawdust, which contained potash up to 3% of the ashes. Good hardwood had reached 5%, sometimes more, but the average was certainly lower. Just before the war a deposit had been reported near Sussex, N.B., but a sample of drillings had shown only a slight trace of potash in it. Recently it had been stated that further operations had revealed carnallite. On investigation they had found that there had been no further operations, but a German Potash Company believed that those deposits had been formed much in the same way as the German deposits: tidal waves had come in from the Bay of Fundy and evaporated in a dry climate. Alunite used as a fertiliser in a mixture with carnarite had been very successful, and had given results fully equal to German salts.

Mr. SOUTHWORTH said that the cobalt business had been a very close secret for many years. A process leading to cobalt oxide had been worked out at Queen's College and put in operation at their own plant and the Coniagas reduction works at Thorold. There were many complications. The ore contained among other metals, cobalt, nickel, silver, and arsenic. A good many of the chemicals they were now using were manufactured in Canada, but cyanide was not. They were manufacturing a number of products, particularly cobalt oxide and cobalt metal, and nickel oxide and nickel metal.

Mr. E. H. WOODWORTH said that the Canadian Kodak Company was now putting metol on the market, calling it "Elou," and were supplying

part of their own requirements. That had lowered the price in Canada and the United States very materially. Hydroquinone was being manufactured in the States and could now be obtained in any quantity. The cellulose acetate film was still being used, but was likely to be discarded in favour of another non-inflammable film. Eight tons of silver nitrate were used in Canada each year.

Mr. A. NIEGHORN said that if a manufacture was carried on in Canada under German Patents when the terms of peace were arranged, the original manufacturer holding a patent would undoubtedly be allowed again to enter into competition with the manufacturer in a British Colony who had obtained a partial patent. That was only fair. That could be overcome by prohibiting the importation of the article or by protection. It was peculiar that in Canada the imports totalled nearly three hundred million dollars worth more than exports. The duty on chemicals, dyes, and medicines averaged under 6% of our total imports, while the general tariff for the two last fiscal years was something over 16½%. There seemed, therefore, room for some protection to be given to their young chemical industries. There were physical difficulties in the way of manufacturing some things. For instance, molybdenite was mined in Canada and dredged at tide-water in Florida. The Government could not protect them sufficiently to overcome that. There was room for the manufacture of several chemicals in a small way, but some assistance in the way of protection by the Government might be necessary.

Mr. JAS. TURNER said that the reasons why England had not been prominent in the dye industry were due to non-support of the Government and of the capitalist. There was unlimited capital to be had for the dye industry to-day, and the Government had taken the matter up. In future England would be one of the largest producers of aniline dyestuffs and pharmaceutical products in the world. They had made α - and β -naphthol, H and G acids, and such things, but had not manufactured a great variety because the Germans had dumped their large surplus into England the same as sugar. Furthermore, in such things as nitrite of soda they could not compete, as the Germans made it by the lead process, and the English process was by sulphur. The litharge and other German by-products had made it impossible to compete. The plant where they were making β -naphthol, α -naphthol, H and G acids, and Cleve acid ought in 6—12 months to be able to supply enough dyestuffs for England and the Colonies, but there were some products which could not be made on account of complicated patents. The duty on ethyl alcohol and methyl alcohol had been a hindrance to the colour industry for a long time, but when free alcohol had been obtainable they had put down one of the largest plants in the world for making dimethylaniline, Methyl Violet, Malachite Greens, etc. They could produce as much basic colours as any German manufacturer. If such a plant were started in Canada it would mean not only a plant for manufacturing dyes, but allied manufactures, such as a distillation plant for coal tar. The processes were elaborate and the consumption in Canada would not warrant any manufacturer putting down such a plant. But some things could be manufactured with profit: benzol and nitrobenzol for instance.

Mr. R. W. BREADNER said that so far as he was aware, no bonuses were being granted in Germany on sugar, nor did the granting of bonuses ruin British refineries. In Canada raw sugar was not entitled to entry under the preferential tariff at the British preferential rate unless produced on British territory, and imported direct, and

refined sugar was not entitled to the preferential rate unless it was made from raw sugar produced on British territory.

Mr. T. H. WARDLEWORTH said that the history of the sugar question only went back about 100 years, as regards bounties. These had been instituted by Napoleon, and as a result the beet sugar manufacture was developed, bounties having been given until some ten years ago by Germany, Belgium, Russia, and France under convention. A few years ago that convention had broken up, and there was no bounty system to-day. Whatever the result of that may have been to the making of jams in England, to-day England commanded the markets of the entire world in confectionery, chocolate, and boiled sugars. From the refuse of the sugar beet was produced one of the finest carbonates of potash, 99.9%, and far more suitable than any other when a pure article was required; it might be made in Canada shortly. Canadian producers of silver could not produce metal good enough to make really good nitrate without a good deal of trouble. Some refineries left in it a trace of copper which necessitated re-working again and again. They also left bismuth and traces of other metals. What was wanted in Canada was to develop existing industries and resources, and it was better to ask not for protection in the way of duty so much as help from the Government in industrial research work. The Government should work through colleges and institutions. There seemed to be a want of co-ordination between the Government and educational institutions, and a want of co-ordination between the technical chemist and the manufacturer.

London Section.

Meeting held at Burlington House, on Monday, December 7th, 1914.

PROF. W. R. HODGKINSON IN THE CHAIR.

ON THE REDUCTION OF THE OXIDES OF ANTIMONY AND BISMUTH BY THEIR SULPHIDES.

BY W. R. SCHOELLER, PH.D.

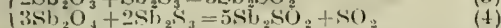
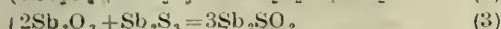
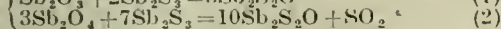
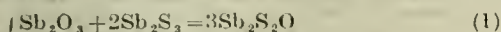
Self-reduction, or the liberation of a metal by interaction of its oxide and sulphide with simultaneous evolution of sulphur dioxide, has been applied extensively in the metallurgy of lead and copper. All the available information concerning the behaviour of other metals under the same conditions appears to be confined to iron and antimony. Ferric oxide reacts with ferrous sulphide and produces ferroso-ferric oxide (this J., 1913, 1111); and since the two former are products of the action of heat and air on pyrites, their interaction provides a simple explanation of the presence of magnetic oxide of iron in copper mattes and roasted pyritic ores (this J., 1913, 738). Antimonious oxide and sulphide are invariably stated to fuse together without decomposition, forming "antimony-glass"; on the other hand, according to an isolated statement* which I have been unable to trace to its original source, a process based on the reaction between antimony tetroxide and sulphide is used "in some places" for the production of metal; while Schnabel† states that the

* Bloxam, Chemistry, Inorganic and Organic. 10th Edition, 476
† Schnabel-Louis, Handbook of Metallurgy, Vol. II., 433.

tetroxide and sulphide when fused together yield antimony-glass. In a previous paper on the composition of liquated sulphide of antimony (this J., 1914, 169), I have shown that the latter contained a certain proportion of uncombined metal besides a considerable quantity of trioxide, from which it was inferred that self-reduction had taken place to a small extent while the material was in a fused condition.

In view of these apparently conflicting statements, I have thought it desirable to ascertain whether the formation of antimony by the interaction of the sulphide and oxide is possible, and the experimental evidence given below proves this to be the case, but only under certain conditions which will be described later. The following facts have been established in the course of this research (the figures in brackets refer to the numbers of the experiments):

Antimony tetroxide containing one atom of "active" oxygen: $\text{Sb}_2\text{O}_4 = \text{Sb}_2\text{O}_3 + \text{O}$, reacts with the sulphide just below the fusion-point of the mixture: sulphur dioxide is given off in proportion to the quantity of tetroxide present, and the fused mass which results contains trioxide and sulphide (2; 4). It follows, then, that the course of subsequent self-reduction is independent of the nature of the oxide originally present. The following equations illustrate this point:—



In either case, the solubility of the resultant product in tartaric acid (= Sb_2O_3 content) is the same, whether the trioxide or tetroxide was used. The use of the above formulae ($\text{Sb}_2\text{S}_2\text{O}$, oxysulphide; Sb_2SO_2 , "sulphoxide") is not intended to imply that the corresponding compounds are formed in the fusion, as this is quite unlikely; but it is a convenient means of denoting the composition of the two mixtures.

Antimony trioxide and sulphide, fused together in a current of inert gas (e.g., carbon dioxide), yield metallic antimony and sulphur dioxide:

$2\text{Sb}_2\text{O}_3 + \text{Sb}_2\text{S}_3 = 6\text{Sb} + 3\text{SO}_2$ (or $\text{Sb}_2\text{SO}_2 = 2\text{Sb} + \text{SO}_2$). The reaction takes place in presence of an excess of either oxide or sulphide (10; 11). It begins soon after the fusion-point of the mixture has been passed (5) and becomes rapid at higher temperatures (8), but it is never complete on account of the volatilisation of both sulphide and oxide in the gas current; the highest yield of sulphur dioxide was 50% of the theoretical (9). The extent of the reaction increases with the relative surface of the fused mass exposed to the gas: if the latter be introduced into a Rose crucible, the fusion product contains but little metal (6; 11), whereas the use of a porcelain boat heated in a porcelain tube ensures a maximum yield (7–9). The foregoing remarks also apply to antimony-glass (14; 15). Metallic antimony is not formed if the oxide-sulphide mixture is fused in a crucible under a layer of salt (12; 13). A close analogy is thus established between the conditions affecting self-reduction and the volatility of the metal itself, for the metal volatilises at a bright-red heat in the air, or in a current of a gas, but not when fused under a layer of common salt.* Another example of the volatility of antimony compounds modifying the course of a reaction is quoted from Schnabel†: if antimony tetroxide be ignited with charcoal and alkali carbonates, metallic antimony is obtained; if the alkali be omitted, the greater part of the antimony will be

volatilised as trioxide, a small part only being obtained in the metallic state.

The observations recorded above account for the formation of metallic antimony in certain metallurgical operations. First, if stibnite is roasted with insufficient access of air, some oxide will be formed and react with the unaltered sulphide, part of the antimony separating in the metallic state. This is demonstrated in Exp. 16, the two stages of which correspond to those of the Flintshire process of lead smelting, except that in the case of antimony a neutral gas current has to be maintained during the second stage. Secondly, as regards the liquation process, it is now established that self-reduction is the cause of the presence of reguline metal in crude antimony; no doubt the air charged with sulphur dioxide rising from the surface of the molten material plays the part of the gas current which is so important a factor in this reaction. It was ascertained that sulphur dioxide does not reduce antimonious oxide (17); it therefore takes no active part in the liberation of the metal. Thirdly, there is an obvious connection between self-reduction in a gas current and the converting of stibnite. Since writing my last paper I have discovered a previous reference* to the bessemerising of antimony sulphide; the article is merely a short statement to the effect that regulus of antimony may be obtained, together with sublimed sulphide, oxysulphide, or oxide, by blowing air through molten stibnite; no experimental data or details of practical working are added, and the abstract in the "Mineral Industry"† conveys as much information as the original.

Bismuth. Nothing, apparently, has been published regarding the self-reduction of bismuth, which, having a more metallic character and a feebleness of affinity for oxygen than antimony, might be expected to react similarly to lead. My experiments prove that bismuth sulphide and oxide interact easily either in a current of carbon dioxide (18) or in a crucible under a layer of salt (20). The evolution of sulphur dioxide begins at a very low temperature, and the dark powder soon becomes a mass of tiny grey globules of metallic bismuth, which run together on increasing the heat. According to the equation: $2\text{Bi}_2\text{O}_3 + \text{Bi}_2\text{S}_3 = 6\text{Bi} + 3\text{SO}_2$, the yield of metal was 90% of the theoretical (20). The quantity of liberated metal was larger than that of evolved sulphur dioxide, and the non-metallic matter in which the buttons were embedded gave a distinct sulphate reaction, showing that a small proportion of basic bismuth sulphate was formed (19). This may be represented by the equation: $6\text{Bi}_2\text{O}_3 + \text{Bi}_2\text{S}_3 = 8\text{Bi} + 3(\text{BiO})_2\text{SO}_4$. The formation of basic sulphate by oxidation of the sulphide and its stability at high temperatures are familiar facts in the metallurgy‡ and analytical chemistry§ of bismuth.

Experimental Part.

The experiments were carried out with pure antimony trioxide (Kahlbaum), tetroxide prepared from it by oxidation with nitric acid and subsequent ignition, and Japanese stibnite in large crystals. The latter is perhaps the purest form of antimony sulphide obtainable; the precipitated sulphide is almost invariably contaminated with chlorine. The mineral was ground to pass an 80-mesh sieve (I.M.M. standard); it assayed Sb 70.76%, insoluble 0.40%, As, nil, heavy metals less than 0.1%. Though crude antimony contains oxide and metal, it was used in experiments 13–15, together with a rich cervantite ore.

* Roscoe and Schorlemmer, Treatise on Chemistry, 1907, Vol. II., 943.

† Schnabel-Louis, loc. cit., 438.

* A. Germot, Revue des Produits Chimiques, 1907, 10, 375.

† Mineral Industry during 1907, 16, 53.

‡ Schnabel-Louis, loc. cit., Vol. II., 351.

§ Low, Technical Methods of Ore Analysis, 5th Edition, 1911, 53.

Table I. shows the results of four experiments in which a porcelain boat containing mixtures of sulphide and trioxide or tetroxide was heated in a glass tube in a current of dry carbon dioxide; the escaping gas was passed through iodine solution to oxidise the sulphur dioxide, which was estimated in the usual manner. The contents of the boat were heated with a Bunsen burner until just fused, and left to cool under carbon dioxide. The fusion products were ground, and boiled with 5% tartaric acid solution for 30 minutes; the filtrates were made alkaline with bicarbonate and titrated with iodine: this gives the amount of Sb_2O_3 in the material. The sulphur evolved as dioxide is given in per cent. of the total quantity present in the stibnite. The molecular proportions correspond to equations 1—4 quoted above.

TABLE I.

Exp. No.	Molecular proportion.	S evolved as SO_2		Sb_2O_3 in fusion product.	
		Found.	Calculated.	Found.	Calculated.
1	$\text{Sb}_2\text{O}_3 + 2\text{Sb}_2\text{S}_3$	0.12%	0	30.4%	30.0%
2	$3\text{Sb}_2\text{O}_3 + 7\text{Sb}_2\text{S}_3$	5.74%	4.76%	32.0%	
3	$2\text{Sb}_2\text{O}_3 + \text{Sb}_2\text{S}_3$	0.05%	0	63.2%	63.1%
4	$3\text{Sb}_2\text{O}_3 + 2\text{Sb}_2\text{S}_3$	20.98%	16.67%	64.8%	

Exp. 5. The products obtained in the preceding experiments had the appearance and softness of stibnite. Nos. 3 and 4 were again fused in the same manner, but a higher temperature was maintained for 15 minutes, during which time sulphur dioxide was slowly evolved; the products after cooling were scoriaceous and iridescent, and showed a considerable increase in hardness. The tests were interrupted as the glass tubes bulged and broke.

Exp. 6. A glazed Rose crucible was now used so as to work at higher temperature in a current of carbon dioxide. 3.366 grms. Sb_2S_3 (2 mols.) and 4.566 grms. Sb_2O_3 (3 mols.) were fused with the full heat of a large Bunsen burner for 1 hour. The resultant product consisted of brown antimony-glass, in which was found a white metallic globule of crystalline fracture, weighing 0.0258 gm. and assaying 98.9% Sb. (Compare Exp. 14.)

In the experiments summarised in Table II. a porcelain tube containing the porcelain boat was heated in a short combustion furnace. Arrangements for passing dry carbon dioxide and absorbing the sulphur dioxide were the same as in Exp. 1—4. The direct determination of the metallic antimony formed in these tests being impossible, the amount of sulphur dioxide evolved was taken as the measure of the degree of self-reduction.

TABLE II.

Exp. No.	Molecular proportion.	S evolved as SO_2 = Degree of self-reduction.
7	$2\text{Sb}_2\text{O}_3 + \text{Sb}_2\text{S}_3$	21.0%
8	$2\text{Sb}_2\text{O}_3 + \text{Sb}_2\text{S}_3$	41.6%
9	$2\text{Sb}_2\text{O}_3 + \text{Sb}_2\text{S}_3$	49.7%

Exp. 7 was interrupted before the reaction was complete, as a fairly large quantity of mixture was taken in order to obtain enough pure metal for an antimony determination: the SO_2 figure is therefore low. The metallic buttons were detached from the boat, and cleaned from adhering sulphide, etc.; they assayed 97.8% Sb.

In Exp. 8 a thermo-couple was introduced. The temperature was slowly raised, and after 40 minutes remained constant at 965°C., where it

was kept for half an hour, so as to secure a maximum yield of sulphur dioxide: 41.6% was obtained. The boat was practically empty, except for a film of yellow glass; the sublimate in the cold part of the tube consisted of white metallic globules and a steel-grey crust of sulphide and oxide.

Exp. 9. In the preceding test a 4-in. boat was heated in a 6-in. sectional furnace. Another 6-in. section was now placed behind that containing the boat, but this addition to the heated area did not greatly increase the extent of self-reduction: 49.7% of the total sulphur was evolved as dioxide. Sublimate and residue were the same as in the last experiment.

Exp. 10 and 11. Two mixtures, the first containing an excess of oxide ($5\text{Sb}_2\text{O}_3 + \text{Sb}_2\text{S}_3$), the other an excess of sulphide ($5\text{Sb}_2\text{S}_3 + \text{Sb}_2\text{O}_3$), were treated as before in the porcelain tube. In both cases much sulphur dioxide was given off, and globules of regulus formed. By-products were obtained as follows: with excess oxide, a slight residue of orange-red antimony-glass and a sublimate containing white needles of antimonious oxide; with excess sulphide, a residue and globular sublimate of sulphide, easily distinguishable from the metal itself.

Exp. 12. A covered crucible, containing a mixture of sulphide and oxide ($\text{Sb}_2\text{S}_3 + 2\text{Sb}_2\text{O}_3$) under a layer of salt, was heated in a muffle for 45 minutes. The fusion product consisted of red antimony-glass which, except for a slight silicious residue, was completely soluble in hot hydrochloric acid: no regulus could be detected. (See also Exp. 13.)

In the three following experiments, which demonstrate the formation of metal from antimony-glass, crude antimony and an oxidised ore were used. The presence of free metal in the crude did not interfere, as the tetroxide of the cervantite oxidises the antimony, thus: $3\text{Sb}_2\text{O}_4 + 2\text{Sb} = 4\text{Sb}_2\text{O}_3$. (Schnabel, p. 433.)

Exp. 13. Two covered crucibles containing the same charge, viz., equal parts of powdered crude and cervantite ore, were heated for 1 hour to about 1000°C. in a muffle; a layer of salt was used in one crucible, borax-glass in the other. In both cases reddish-brown glass was obtained, which was found to be free from metallic antimony.

Exp. 14. The glass obtained in the preceding experiment was fused under carbon dioxide in a Rose crucible for 1 hour, using a Teclu burner. No button was found as in Exp. 6, but on digesting the powdered glass with hot hydrochloric acid, a small quantity of regulus was detected by its characteristic colour and lustre. It may be stated here that antimony sulphide and the metal can be "parted" with hydrochloric acid, and that the latter cannot be mistaken for the former; the separation is not quantitative, as an appreciable amount of regulus dissolves. (This J., 1913, 280. Solubility of Sb in Sb_2S_3 : this J., 1906, 376.)

Exp. 15. The same glass was again fused in a current of carbon dioxide, this time in the porcelain tube. After 30 minutes' heating, the boat presented a striking appearance: it was full of large, white, metallic beads.

Exp. 16 illustrates the formation of metal from stibnite. The mineral was fused at a gentle heat in a current of air, which converted it into a mixture of sulphide and trioxide, part of the latter escaping as fume. The air was then replaced by a current of carbon dioxide, and the temperature raised to about 950°C. The fusion product contained a considerable proportion of metallic antimony, which was detected by "parting" with hydrochloric acid.

Exp. 17. Antimonious oxide was fused for some time in a current of sulphur dioxide, and the escaping gas passed through barium chloride solution. No decomposition of the oxide was

observed, nor was any barium sulphate obtained in the receiver.

Bismuth. The oxide was prepared by ignition of pure bismuth nitrate, and the sulphide by precipitation of the same salt with sodium sulphide. The results of the experiments are shown in Table III.

TABLE III.

Exp. No.	Molecular proportion $2\text{Bi}_2\text{O}_3 + \text{Bi}_2\text{S}_3$	Metallic Bi.	SO_2 evolved.
18	Glass tube; CO_2 current	not determined	63.1%
19	Porcelain tube; CO_2 current	78.4%*	68.1%
20	Crucible; salt cover	87.8%*	not determined

* Not quite quantitative: see below.

Exp. 18 was made in the apparatus described under antimony, Table I. At a very low temperature the mass darkened and gave off sulphur dioxide without showing any sign of fusion. The experiment was stopped after 10 minutes as the tube commenced to soften; the product after cooling consisted of minute metallic globules cemented together, which disintegrated on digestion with moderately strong hydrochloric acid: this solution was found to contain sulphate.

Exp. 19 corresponds to the high-temperature experiments with antimony, Table II. The porcelain tube was heated for 30 minutes to about 950°C . The porcelain boat was found to contain several large and small buttons of bismuth which were collected and weighed: slight losses occurred in detaching them. A colourless residue, giving sulphate reaction, coated part of the boat.

Exp. 20. A covered glazed Rose crucible containing the oxide-sulphide mixture under a deep layer of salt was heated for 15 minutes over a Teclu burner. Minute globules of metal round the inner edge of the crucible gave evidence of volatilisation, in spite of which the amount of bismuth collected and weighed was 87.8% of the theoretical.

My thanks are due to Messrs. G. T. Holloway and Co., Ltd., for facilities afforded in the experimental work and their permission to publish the results.

In reply to a question, the author said he had not carried out the reactions on any larger scale than a purely laboratory one.

THE REMOVAL OF CARBON BISULPHIDE FROM COAL GAS.

BY E. V. EVANS, F.I.C.

The numerous chemical and physical processes that have from time to time been proposed for the removal of carbon bisulphide from coal gas are briefly described by Witzeck (J. Gasbeleucht., 1903, 21 *et seq.*), whilst the history of the subject, with special reference to processes involving the heating of gas, has been compiled by Dr. Charles Carpenter, and is included in his lecture delivered recently to the Institution of Gas Engineers at Liverpool (see this J., 1914, 737).

The sulphur compounds remaining in coal gas after the extraction of sulphuretted hydrogen consist mainly of carbon bisulphide, and the proportion by volume of this constituent in the gas represents only about 0.02%. Considering the immense volumes of gas to be dealt with in the case of a modern London Gas Works it is obvious that the elimination of this impurity, owing to its state of extreme dilution, should be effected by a chemical reaction of high velocity. The initial stages of a laboratory investigation were therefore

directed towards ascertaining the relative intensities of known reactions of carbon bisulphide, provided such reactions entailed the use of reagents suitable for application on the large scale. These may be collectively described under three headings:—

(1) The extraction of carbon bisulphide by alkalis or alkaline earths, in the presence of sulphuretted hydrogen.

(2) The interaction of carbon bisulphide and certain amino compounds, such as aniline, either with or without the use of catalytic agents.

(3) The decomposition of carbon bisulphide by heat, with or without the presence of catalysts.

The "Athion" process which utilizes alkaline cellulose for the extraction of carbon bisulphide from gas previously freed from carbon dioxide is of recent origin and was not examined by the author.

1. *Alkalis and alkaline earths.*—The purification of gas by lime is based on the absorption of carbon bisulphide by an active sulphided compound, with the formation of a thiocarbonate. As thiocarbonates are readily decomposed by carbon dioxide, the extraction of this constituent of the gas is essential. Carbon dioxide, though inevitably produced in the manufacture of gas, is not an impurity, and the necessity of removing it is an impediment to the economic efficiency of any process. When lime is employed to remove carbon dioxide, the cost of raw material alone represents about $\frac{1}{4}$ d. per 1000 cubic feet of gas purified, which is more than the total working costs of a process to be described later. It has been stated by Sabatier and others that the major portion of carbon dioxide may be extracted by washing the gas with solutions of potassium carbonate, the resulting bicarbonate being decomposed by heat with regeneration of the carbonate. This reaction is a slow one, and its application on a large scale necessitates the employment of extensive apparatus. It has, further, been proposed to recover, for sale, the carbon dioxide evolved in the regeneration process, but this obviously cannot receive wide application, as the output of a few large works would crush the market.

The nature of the reactions involved in the lime process of gas purification has been demonstrated by Divers and Veley (see this J., 1884, 481, 550; 1885, 633), and the work of these investigators was repeated in the laboratory. Slaked lime yields, by the action of gas containing sulphuretted hydrogen, a sulphided compound capable of arresting carbon bisulphide with the formation of a basic calcium thiocarbonate. The intermediate and final products of this reaction were prepared, and all laboratory operations demonstrated the extreme sensitiveness of the reaction to outside influences. A portion of the intermediate sulphided compound—considered by Divers to be calcium hydroxyhydrosulphide—became oxidised and rendered inactive by oxygen contained in small quantity in the gas, whilst the final product, the basic thiocarbonate, was not only decomposed by carbon dioxide, but was dissociated at slightly increased temperatures. Taking advantage of this instability to the influence of heat, an unsuccessful attempt was made to place the lime process on a more practical basis, by rendering possible the regeneration of spent material *in situ*, and thus to overcome the nuisance associated with spent lime. This scheme proved satisfactory only when utilising pure reagents, and failed completely when applied to the coal gas mixture, owing to the oxidation of active sulphides to sulphites and thiosulphates, which preclude regeneration, and to the difficulty of determining the conditions most favourable to the extraction of carbon bisulphide; and of

completely eliminating the last trace of carbon dioxide from the gas.

The purification of large volumes of gas by a solid is objectionable, unless the reaction involved is of high chemical velocity, and such is not the case in the extraction of carbon bisulphide by lime. Finally, the process as generally adopted entails an enormous loss of sulphuretted hydrogen, which should be worked up into a marketable product.

The use of concentrated ammonia solution for removing carbon bisulphide as a thiocarbonate, was found to be technically impracticable, whilst no advantage could be taken of the reaction, $CS_2 + 4NH_3 = NH_4SCN + (NH_4)_2S$.

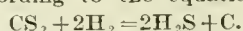
2. *Amino compounds.*—Amino compounds of the type of aniline, toluidine, etc., have been employed; solid thioureas or thiocarbamides being produced by the action of carbon bisulphide, thus, $2C_6H_5NH_2 + CS_2 = (C_6H_5NH)_2CS + H_2S$. The presence of sulphur or oxide of iron as catalyst has been recommended. This reaction presented considerable interest, as thiocarbamide forms the starting point in the manufacture of indigo by Sandmeyer's reaction, and it was demonstrated after an extended study that this process becomes a financial possibility with such an inexpensive raw material. A potent difficulty, however, existed in the loss of the amino compounds by volatilisation, and the cost of preventing this, by further washing the gas with weak acids or special oils, and of subsequently regenerating the reagent, was considered to be prohibitive.

3. *Decomposition of carbon bisulphide by heat.*—It is well known that if coal gas be heated to about $500^\circ C.$, most of the sulphur compounds are converted to sulphuretted hydrogen, which may be easily removed by oxide of iron. Vernon Harcourt, whose name stands foremost amongst all investigators of this question, has frequently recommended the application of this reaction to the large scale.

Preliminary work in the laboratory led to the conclusion that of all known reactions of carbon bisulphide, its decomposition by heat in the presence of coal gas possessed the greatest possibilities of technical application, and in 1908 the investigation was directed entirely to this aspect of the question.

Carbon bisulphide is not dissociated into its elements to any appreciable extent by conducting it, in the presence of nitrogen, over contact material heated to $500^\circ C.$ If, however, hydrogen or coal gas containing hydrogen be used as the gaseous carrier, the velocity of decomposition of carbon bisulphide is greatly accelerated. Under these conditions, moreover, the decomposition of carbon bisulphide is complete and the reaction is not a reversible one.

An experiment was performed in which purified carbon bisulphide was volatilised into a stream of pure hydrogen, at such a rate that the proportion by volume of carbon bisulphide was similar to that existing in coal gas. The gases were passed over heated fireclay which had been previously pulverised and freed from metallic impurities and carbonaceous matter. The rate of flow of the gaseous mixture was so adjusted that the carbon bisulphide was completely decomposed. The quantity of sulphuretted hydrogen evolved was determined, whilst the carbon deposited on the material was computed from the weight of carbon dioxide evolved on combustion. By this means it was proved that decomposition proceeds according to the equation,



To determine the effect of water vapour on the reaction carbon bisulphide was volatilized into a stream of moist hydrogen. Again the reaction proceeded according to the above equation; the

quantity of carbon deposited being in molecular proportion to the amount of carbon bisulphide decomposed. Further, carbon dioxide was not present in the final gas mixture and thus the reaction $CS_2 + 2H_2O = 2H_2S + CO_2$ does not take place under these conditions. It was later shown that the presence of water vapour does not increase the ease of decomposition of carbon bisulphide at a temperature of $450^\circ C.$

Coal gas, freed from sulphuretted hydrogen, was passed over various heated metals reduced to a state of fine division, in order to present a maximum surface area to the gas. Certain metals considerably increased the velocity of decomposition. This property was not a function of the specific heat or conductivity, or of the ease of formation of the sulphide of the metal. Porosity, on the other hand, was found to exert a beneficial effect, but this property in all bodies was rapidly destroyed owing to the deposition of carbon in the pores of the material. Platinum and palladium deposited on pumice, finely divided metals such as iron, nickel, cobalt, and copper, were regarded as catalysts to the reaction, whilst magnesium and aluminium were not superior to contact substances of the type of alumina, pumice, and fireclay. All these bodies, however, became coated with a deposit of finely divided carbon, which could be removed by combustion *in situ*.

Of all metals examined, iron was found to be most active, compatible with low original cost. The significant effect of temperature on the reaction was ascertained, and it was made evident that with the same catalyst, a low temperature and large surface of contact, as well as a high temperature and relatively small contact, were both capable of bringing about the required decomposition of carbon bisulphide. It appeared necessary, for the purpose of reducing to a minimum the size of plant, that the highest temperature that could be suitably maintained on a large scale should be chosen, provided that the illuminating and calorific values of the gas were not altered, and that iron pipes and containers for the catalyst could be conveniently used. From a large number of determinations it was proved that the intrinsic quality of the gas is in no way impaired when operating at temperatures between 450° and $500^\circ C.$, whilst to establish the second condition—which is indispensable to the technical success of the process—strips of wrought iron were surrounded by waste furnace gas for several weeks at a temperature of $450^\circ C.$ No destructive effect was visible and the gain in weight was negligible.

Having selected the working temperature, the amount of contact required to effect the maximum decomposition of carbon bisulphide was determined. At a temperature not exceeding $450^\circ C.$, continuous laboratory experiments were made, using iron turnings as the catalyst and purifying gas at the rate of 10 cb. ft. per hour. By this means 75 to 80% of the sulphur compounds of gas could be removed. The whole of the carbon bisulphide had disappeared and the residue, representing 7 to 9 grains of sulphur per 100 cb. ft. of gas, consisted mainly of thiophen. From the experimental data obtained in the laboratory a cast iron retort was erected at a small works of the South Metropolitan Gas Company to deal with 50,000 cb. ft. per hour (Fig. 1). Here the greatest mistake was made; the leap from 10 cubic ft. to 50,000 cubic ft. per hour was disastrous. Although the surface of contact between the gas and iron had been proportionately reproduced from the laboratory scale, and a tubular heat interchanger had been installed to recover waste heat from the treated gas, the cooling effect of this large volume of gas upon the catalyst was such that, even when maintaining the retort externally at a low

red heat, practically no reduction of sulphur compounds was accomplished.

In transferring laboratory conditions to the large scale in the case of reactions involving considerable expenditure of heat, there is a liability to overlook the fact that the laboratory furnace is usually out of all proportion to that which may be economically reproduced on the large scale.

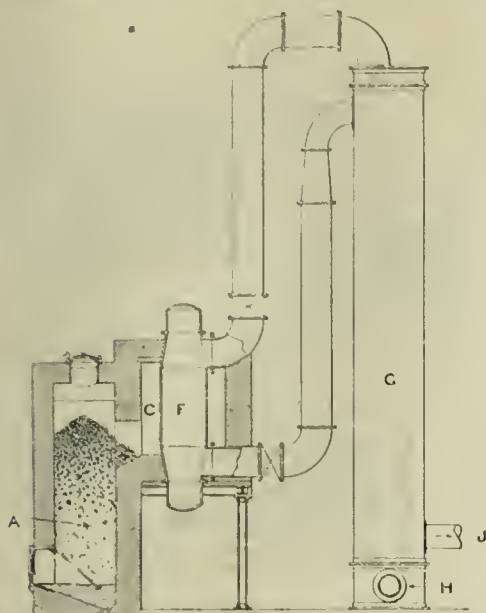


FIG. 1.

- A Furnace.
- C Heating Chamber.
- F Cast Iron Retort.
- G Heat Interchanger.
- H Gas before treatment.
- J Gas after treatment.

of all catalysts was found to be highly porous fireclay, impregnated with nickel, reduced from the chloride. From this work also, it was made evident that the higher the temperature employed, the greater is the quantity of carbon deposited on the material, and the more frequent becomes the necessity for aeration.

There is a tendency of decomposing unsaturated hydrocarbons of the gas, but the quantity decomposed even at 600° C. is insufficient to exert a definite reduction in the quality of the gas. The inconvenience caused by the deposition of carbon on the catalyst presents a greater difficulty, and to obviate this it becomes imperative to reproduce the reaction at the minimum working temperature.

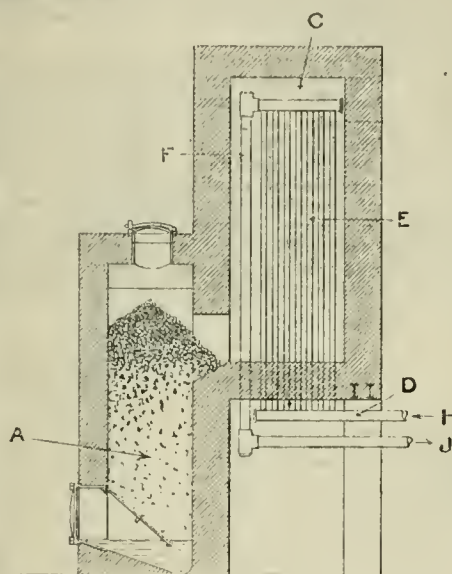


FIG. 2.

- A Furnace.
- C Heating Chamber.
- D Collector Tube.
- E Preheating Tube.
- F Preheating Tubes.
- H Gas before treatment.
- J Gas after treatment.

The most valuable experience gained with this apparatus was when attempting to aerate the apparently spent material. This operation was found to be quite unmanageable on the large scale, and not only was the catalytic material fused, but a hole was made in the side of the retort where the chemical action of reactivation by combustion was most intense. Laboratory experiments confirmed the difficulty of aerating without danger, and the idea of employing a metal catalyst, as such, was abandoned.

It was, therefore, proposed to impregnate a porous body with the catalyst, as, during the aeration, the particles undergoing change would be divided and intense local chemical action would be prevented. Other investigators have recommended the use of porous impregnated material, but it is not recorded that this device has been adopted as a means of rendering manageable the aeration process.

It was expected that impregnated material would require more intimate contact with the gas than metallic substances, but in the case of iron oxide deposited on a porous nucleus, so large was the contact required as to necessitate the search for a more active catalyst. The object of an investigation into a large number of contact and catalytic substances was to choose the material that would require the lowest temperature for the reaction, that would remain active as long as possible, and when requiring aeration, should allow of this being easily effected. Necessarily, in examining all these properties, the initial cost of the material was taken into consideration. The most active

It will serve no useful purpose to describe several further unsuccessful attempts to reproduce the laboratory conditions and results on a large scale. The determination, either by experiment or calculation, of the following salient points led to the design of a system of pipes (Fig. 2) in which the reaction was successfully reproduced:—

(1) The degree of preheating the gas before contact with the catalytic material. The temperature of the gas should be raised to that of the reaction before coming in contact with the catalyst. By this means only is the full value of the catalyst realised. With inefficient preheating the catalyst is cooled by the gas, and former experience shows that in order to bring about the required chemical action, the investigator is tempted to increase the degree of heat around the container of the catalyst, with disastrous results to the iron vessel.

(2) The surface area of catalytic material exposed per unit volume of gas passed.

(3) The porosity, specific heat, and thermal conductivity of the porous carrier of the catalyst.

(4) The volume of free space allowed between the contact surfaces, which determines the absolute velocity of the gas molecules about the catalytic material.

which are heating chambers, maintained at 420° to 440° C. and in which are assembled the 6-inch reaction tubes. The gas is preheated to a small extent within the heating chamber, but mainly by tubular heat-interchangers, in which the treated gas flows in an opposite direction to that requiring

DISCUSSION.

The CHAIRMAN said that the process was another triumph for the catalytic action of nickel. He thought it was the most interesting catalytic process yet discovered. He asked whether the nickel chloride was specially reduced beforehand.

EAST GREENWICH PLANT.

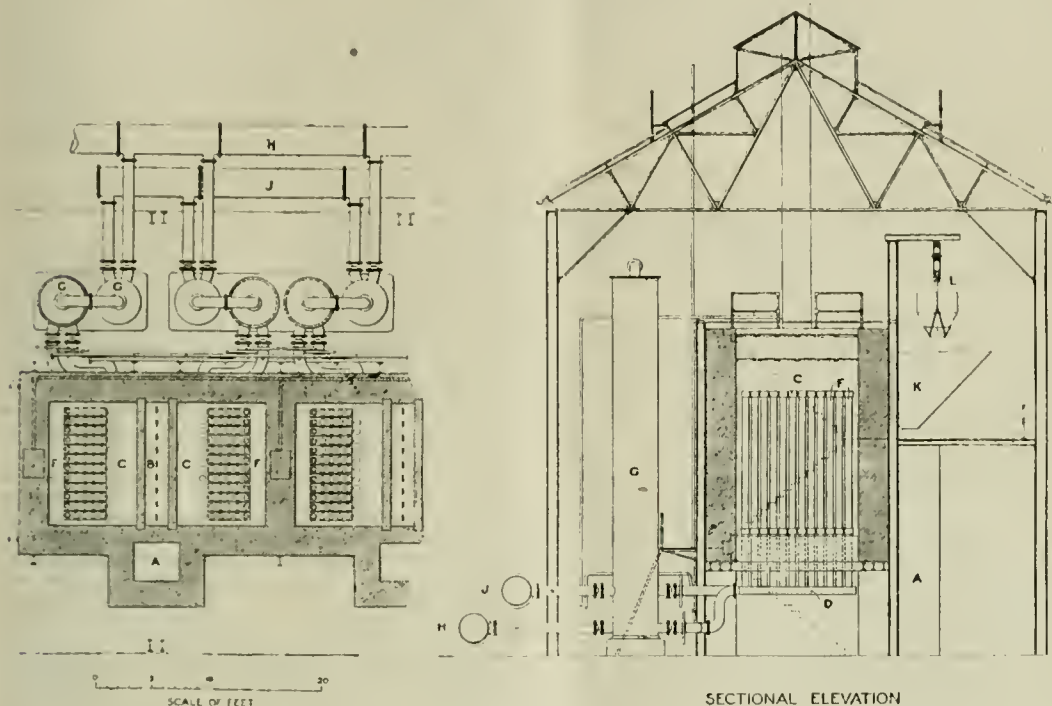


Fig. 4.

A Furnace. B Combustion Chamber. C Heating Chamber. D Collector Tube.
F Tubes containing Catalyst. G Heat Interchangers. H Gas before treatment.
J Gas after treatment. K Coke Hopper. L Coke Handling Plant.

treatment. In order to revivify the material of any one unit, the chamber temperature is lowered, and air is pumped at a definite rate through the reaction tubes. The process occupies about one week, and for the first four days the whole of the oxygen of the air is utilised and replaced by carbon dioxide. When oxygen appears in the effluent gas, the temperature of the chamber is raised to 430° C. and is maintained thus until carbon dioxide ceases to be evolved and the process is complete. When preparing for aeration, or restarting after aeration, gas or air, as the case may be, is displaced from the plant by inert waste furnace gases. The catalyst maintains its activity for about 30 to 35 days, after which period the efficiency of the reaction gradually decreases. Its original activity is, however, immediately restored by the process of aeration. After having been in operation for two years, the catalytic material shows no signs of deterioration.

The capital outlay for plant per million cb. ft. of gas per day is £1,500, whilst the working costs entailed in operating the process represent 0.3d. per 1000 cb. ft. of gas: this latter figure includes interest on capital, depreciation, and repair and maintenance.

Throughout this research advice and encouragement have been continuously given to the author by Dr. Charles Carpenter, but for whose guidance this investigation would not have attained a successful issue.

Mr. EVANS said it was specially reduced by hydrogen beforehand.

Mr. J. W. HINCHLEY asked whether the lagging was removed from one of the heat interchangers of each unit to obtain a cooler gas on exit; if so, it would appear that the coefficient of heat transfer adopted in designing was too low. Heat interchange between gas and gas was not a common operation, and it would be useful to know the actual coefficient obtained in this interesting process.

Dr. H. G. COLMAN said that one of the most interesting chemical points of the process was that nickel could be successfully employed as a catalyst without becoming "poisoned." This would not have been predicted *a priori*, for in the attempts to produce methane commercially from carbon monoxide and hydrogen by heating at 250 – 300° C. in presence of nickel, the small quantities of sulphur present in water-gas soon brought the reaction to an end owing to "poisoning" of the nickel. Mr. Evans had shown that in spite of this, if the temperature of the gases was raised to about 450° , the nickel was capable of removing the sulphur without any "poisoning" being observable after two years. The great difficulty in the way of devising a suitable process for removing the carbon bisulphide had been that of cost. Many chemical methods were available for the purpose, but all had proved prohibitive in cost. A further interesting point

was that Mr. Evans had now satisfactorily proved that the conversion of carbon bisulphide into sulphuretted hydrogen was due to its interaction with hydrogen, and not with steam. Was the slight increase in methane due to its synthesis from the carbon monoxide and hydrogen, or was it possibly really ethane formed from the ethylene and hydrogen, in presence of the nickel? In what form was the sulphur left in the gas after treatment? Probably it was chiefly in the form of thiophen, in which case it would be very difficult to remove it without affecting the benzene, with consequent considerable reduction of the illuminating and calorific power of the gas. Possibly, however, some of the sulphur was in the form of methyl or ethyl sulphides.

Mr. W. E. OAKDEN asked what difference in the percentage of decomposition was made by the presence of the catalyst. Had the process been applied to coal gas or to producer gas? What was the extent of the decomposition of sulphuretted hydrogen into hydrogen and sulphur?

Dr. R. LESSING said that the time which was occupied in bringing the process to a successful issue, even if it were seven years, was quite a record time, because it involved a great number of initial failures in small experimental plants before a working plant could be evolved. He believed that in one works alone 15,000,000 cb. ft. of coal gas was treated every day, which could not be acted on detrimentally without affecting the regular gas supply to an enormous district. Had any relation been established between the amount of carbon produced and the amount of sulphur? Was it now possible to establish a balance, so that it was possible to say that the carbon deposited on the nickel, and afterwards burned off in the form of CO_2 , tallied with the amount of sulphur recovered from the final gases? Possibly the determination of the CO_2 in the final gas, knowing the gas on the inlet side and the CO_2 , would give an answer. With regard to the methane, if hydrogenating reactions occurred, the free carbon should be rather less than that given by the equation. If they did not, and if possibly some dehydrogenation took place, the carbon would be somewhat more than the sulphur equivalent required.

Mr. F. NAPIER SUTTON said that those who had seen the process in practical use had been much struck with its wonderful practicability and beauty, both mechanically and chemically. He had not actually seen the latest improvements introduced at the East Greenwich plant, but a year or so ago he had examined the process in detail at the Old Kent Road works, and the difference in results obtained between this reaction for the removal of carbon bisulphide, as compared with the old lime process, was simply marvellous. He believed the amount of sulphur remaining in the gas was about 8 grains per 100 cb. ft., whereas he believed that in coal gas passed into the mains by most companies it was something like 30 or 40 grains. The gas thus became a sort of standard which in course of time probably every other company would adopt.

Mr. W. J. A. BUTTERFIELD said that the process was an admirable instance of the co-operation of the chemist and the engineer. Though except for the use of this particular catalyst, the chemical process was not novel, the earlier attempt on a large experimental scale 30 or more years ago had failed completely, because the engineers concerned in its development had lost heart when the first plant did not go quite properly. This process originated after the compulsion which formerly existed in regard to the removal of sulphur compounds had been removed by Parliament from the London Gas Companies. Dr. Carpenter and his

co-directors had thought it desirable that the sulphur in the form of carbon bisulphide should be removed from the gas, and this was now done on their own initiative. Without any compulsion, they had set about producing gas by an entirely novel process of a higher degree of purity than had hitherto been provided. On that account he would be rather averse to attempting to exercise compulsion on other companies, who would, in their own interests, sooner or later adopt sulphur purification. The residual sulphur which was left in the gas after treatment by the new process, was evidently mostly thiophen. If that were the case, the process of washing with alcohol, which had been advocated for the removal of carbon bisulphide, should remove the thiophen also. That process had been tried in Sweden, and he believed it was being tried, or was about to be tried, in this country. When the results were published, it would be interesting to see whether the sulphur came down from the 7 or 8 grains per 100 cb. ft. to practically nil. In the "Athion" process, as used at Heidelberg recently, the large size of the vessels relatively to the work done, convinced him that for working on a really large scale the process was quite impracticable. The "Athion" and all other processes except Mr. Evans' and the alcohol washing process, required the previous removal of the carbon dioxide from the gas, and the expense of this removal put them out of court as competitors with the new process.

Mr. EVANS, in reply, said that about 60% of the sulphur compounds remaining after the process consisted of thiophen, but the remainder had so far evaded detection or classification. During the carbonisation of coal one imagined that methyl and ethyl sulphides were produced, together with certain mercaptans, but the latter would become rapidly decomposed in a process of this nature. His company had attempted to apply a process for removing thiophen but not benzene, depending on the formation of double thiophen-mercury sulphate compounds. It was proposed to separate subsequently the benzene and thiophen and to return the former to the coal gas. It appeared that the process would be too costly for industrial use. The question as to the extent of the decomposition with and without the catalyst could be answered indirectly. The function of the catalyst was to reduce the temperature of the reaction. Contact material alone was capable of effecting exactly the same reduction of sulphur compounds, but at a temperature of about 60° to 100° C. higher, which became dangerous to the iron apparatus of the plant. The quantity of carbon oxysulphide produced would be practically unmeasurable if the amount of sulphuretted hydrogen in the gas were below 100 grains per 100 cb. ft. Dr. Lessing's question as to whether there was a relation existing between the amount of carbon dioxide and the amount of carbon bisulphide decomposed, could only be cleared up in the laboratory with the purest chemicals. They always knew after each aeration the weight of carbon that had been burned off in the plant. Calculating back to the amount of work done, it was found that the quantity of carbon was about double that represented by the carbon bisulphide decomposed, which indicated that certain unsaturated hydrocarbons in the gas had been decomposed. That decomposition, after the decomposition of carbon bisulphide, was purely a question of temperature, and it was therefore important to work at the lowest temperature compatible with high efficiency.

With regard to the average figures for the working of the plant, there was usually about 39 grains of sulphur compounds in gas made from Northumberland and Durham coal, and that was reduced to from 7 to 8 grains, representing a reduction of 80%.

Obituary.

G. V. PEARCE.

Second Lieutenant Geoffrey Vincent Pearce, Royal Warwickshire Regiment, only son of Mr. William Pearce, M.P., of 14, Park Crescent, W., has died from wounds received in action on Dec. 18th, aged 25 years. Formerly a

sergeant in the Uppingham School Corps, he afterwards joined the Artists' Rifles, with whom he went to the Front in October last. On arrival he was selected for a Commission in the Royal Warwickshire Regiment. He was elected a member of this Society in 1912, and was employed at the works of Messrs. Spencer Chapman and Messel at Silvertown. He was a most promising young chemist.

Journal and Patent Literature.

PATENT SPECIFICATIONS may be obtained by post by remitting as follows:—

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I.—GENERAL PLANT; MACHINERY.

PATENTS.

Separation and grading of various materials; Centrifugal—E. Holwill, London, Eng. Pat. 26,127, Nov. 14, 1913.

A CENTRIFUGAL drum is constructed with an outer impervious and an inner concentric porous cylindrical wall leaving a closed annular space between. The mixture of solids and liquid is passed downwards through the rotating drum and the solids are deposited on the inner surface of the porous cylinder, graded according to size, the bulk of the liquid passing away from the lower end of the drum. When a sufficient quantity of solid material has collected, the supply is stopped and the liquid which has collected in the annular space is drawn off. On the rotation being continued the liquid still retained by the deposited solids is forced through the porous wall.—W. H. C.

Centrifugal machines. A. R. Robertson, Glasgow, Eng. Pat. 8306, April 2, 1914.

THE dried material is discharged from the basket of a centrifugal-machine by a scoop device which projects from a hub surrounding the central shaft. When the machine is ready to be discharged, a brake is applied to the hub before the rotation of the drum is stopped so that the scoops move relatively to the drum and detach the lower portions of the deposit, whereupon the remainder easily falls away.—W. H. C.

Centrifugal apparatus. W. Mauss, Johannesburg, S. Africa. Eng. Pat. 15,930, July 3, 1914.

THE drums of a planetary centrifugal machine are rotated individually by means of two concentric, internally-toothed wheels which engage with a pair of planet wheels.—W. H. C.

Separators; Centrifugal—of the planetary type. W. Mauss, Johannesburg, S. Africa. Eng. Pat. 17,724, July 27, 1914.

THE separator is of the type in which the vertical drums are placed close to the main axis and from which the deposited material is removed by ploughs or scrapers (see Eng. Pat. 6478 of 1913;

this J., 1913, 858). The drums are made with a cylindrical central portion and an upper and lower conical portion.—W. H. C.

Separator; Centrifugal—driven by a low-pressure turbine. Aktiebolaget Baltic. First Addition, dated Feb. 16, 1914 (Under Int. Conv., Feb. 18, 1913), to Fr. Pat. 449,542, Oct. 17, 1912 (this J., 1913, 503).

A RECIPROCATING engine is substituted for the low-pressure turbine and a high-pressure for a low-pressure steam generator in the separator described in the original patent.—W. H. C.

Furnaces and kilns; Pulverulent and liquid fuel—S. M. Seddon, Salt Lake City, Utah, U.S.A. Eng. Pat. 27,373, Nov. 27, 1913. Under Int. Conv., Jan. 28, 1913.

THE conduit through which warm air flows to the blower is enclosed in a mixing chamber, and the fuel is led over the upper surface of the conduit and enters the latter on the under side. The proportions of the mixture are adjusted by valves or dampers, and means are provided for removing any heavy particles that may accidentally accompany the fuel.—W. H. C.

Regenerator-furnace. W. E. Moore, Peru, Ill., H. L. Moore, Executrix. U.S. Pat. 1,117,219, Nov. 17, 1914. Date of appl., Jan. 26, 1914.

TWO furnaces placed side by side are separated by a single partition wall, and a series of longitudinal regenerator chambers below the furnaces are connected with them by flues and provided with reversing dampers to change the direction of flow of the gas and air.—W. H. C.

Retort. R. G. Stiles, Parkersburg, W. Va. U.S. Pat. 1,117,923, Nov. 17, 1914. Date of appl., Nov. 4, 1913.

A RETORT of square section has a square doorway at one end. The bottom of the doorway is slightly above the bottom of the retort to provide a steam and water chamber, over which a series of grids are placed level with the sill of the doorway. The door is held in position by a swinging dog-screw and a valved steam outlet is provided for the vapours.—W. H. C.

Temperatures; Apparatus for indicating and regulating—. I. Hall, Birmingham, Eng. Pat. 28,346, Dec. 9, 1913.

IN the apparatus described in Eng. Pat. 21,072 of 1912, a single pivoted rod or lever is used, one end of which rests upon part of, and is actuated by a differential expansion device comprising a carbon or other non-metallic rod and a metal tube, and the other controls the valve through which the gas enters the burner.—W. H. C.

Drying apparatus: Rotary chamber—. G. Binder, Rochester, N.Y., U.S.A. Eng. Pat. 8936, April 8, 1914. Under Int. Conv., Jan. 21, 1914.

AIR is circulated by means of a fan continuously through a screening chamber, a heating chamber, and a rotary drying chamber. After passing the screening chamber, a portion of the air, containing the greater part of the moisture, is discharged into the atmosphere, and the remainder, together with some fresh air, is re-circulated through the train of apparatus.—W. H. C.

Desiccating organic matter. W. H. Allen, Cleveland, Ohio. U.S. Pat. 1,118,884, Nov. 24, 1914. Date of appl., Nov. 4, 1912.

THE substance is enveloped in a magnetic field and a current of dry air, heated above 110 F. (43° C.) by the magnetising current, is circulated over it.—J. H. J.

Drying granular materials; Process and apparatus for—. J. A. Topf und Söhne. First Addition, dated Feb. 11, 1914, to Fr. Pat. 461,679, Aug. 21, 1913.

THE drying apparatus is divided into compartments by vertical and inclined partitions, so that the path of the material under treatment is diverted in one direction only from the vertical. The dried material is discharged from the bottom of the apparatus through two doors which are opened alternately by mechanical means.—W. H. C.

Gases; Treatment of—. E. B. Wolcott, Chicago, Ill. U.S. Pat. 1,116,661, Nov. 10, 1914. Date of appl., Aug. 14, 1909.

THE gases are passed spirally downwards over the interior surface of a cylinder and then upwards through the central portion of the cylinder, in which is a series of electrodes or other heating means to induce chemical combination of the gases. The gases are subsequently cooled.—W. H. C.

Evaporator. F. M. de Beers, Chicago, Ill. U.S. Pat. 1,117,005, Nov. 10, 1914. Date of appl., July 19, 1913.

THE evaporator is constructed of antimonial lead, strengthened by iron angles or tees imbedded in the lead.—W. H. C.

Filtering medium [tile]. J. E. Porter, Syracuse, N.Y., Assignor to General Filtration Co., Inc., Rochester, N.Y. U.S. Pat. 1,117,601, Nov. 17, 1914. Date of appl., May 9, 1913.

A RAPID filtering tile is made by fusing a mixture of 75 to 85% of a silicious substance with 25 to 15% of powdered glass.—W. H. C.

Treating a current of liquid with a gas; Apparatus for—. G. Ornstein, Fr. Pat. 469,275, March 7, 1914. Under Int. Conv., May 9, 1913.

THE liquid is passed through a Venturi tube, and the variation in pressure before and after the

constriction, due to the variation in the quantity of liquid flowing through the tube, is utilised to control the supply of compressed gas to the liquid.—W. H. C.

Cooling compartments for rectifying columns. E. Barbet et Fils et Cie. Fr. Pat. 469,979, June 4, 1913.

THE condensed liquid which collects on the bottom of each compartment or tray, is maintained at a temperature just below that of the ascending vapour by means of cooling coils. The hoods or covers of the bubbling devices are adjustably fixed to the vertical vapour pipes.—W. H. C.

Cooling tower [for water] with aeration channels. W. Vedder. Fr. Pat. 470,191, March 28, 1914. Under Int. Conv., March 29, 1913.

COOLING chambers, grouped around a central chimney, are provided with superposed horizontal channels through which the cooling air passes to the chimney. The liquid to be cooled falls in a finely divided condition across the horizontal currents of air. Radiation from the chimney is prevented in order to obtain a good up-draught.—W. H. C.

Latent heat of evaporation of liquids; Apparatus for regenerating the—. E. Nobel and S. Bessonoff, St. Petersburg. U.S. Pat. 1,118,041, Nov. 24, 1914. Date of appl., Dec. 17, 1908.

SEE Fr. Pat. 395,108 of 1908; this J., 1909, 357.—T. F. B.

Gas-tight seals or closures between metal and vitreous material; Production of—. H. J. S. Sand, Nottingham, and F. Reynolds, London. U.S. Pat. 1,118,812, Nov. 24, 1914. Date of appl., Jan. 30, 1914.

SEE Eng. Pat. 23,854 of 1913; this J., 1914, 571.—T. F. B.

Grinding-mills. Bradley Pulverizer Co. Fr. Pat. 469,646, March 14, 1914.

SEE Eng. Pat. 6193 of 1914; this J., 1914, 950.—T. F. B.

Separating solid bodies suspended in liquids; Process for—. B. Hofer. Fr. Pat. 469,727, March 17, 1914. Under Int. Conv., March 17, 1913.

SEE Eng. Pat. 6793 of 1914; this J., 1914, 939.—T. F. B.

Centrifugal machines. H. Broadbent. Fr. Pat. 469,950, March 21, 1914. Under Int. Conv., April 9, 1913.

SEE Eng. Pat. 8376 of 1913; this J., 1914, 582.—T. F. B.

Centrifugal separators. U.S. Pat. 1,119,173, 1,119,175 and 1,119,176. See XVII.

Absorption pyrometer. Eng. Pat. 27,633. See XXIII.

Optical pyrometer. U.S. Pat. 1,119,571. See XXIII.

IIa.—FUEL; GAS; MINERAL OILS AND WAXES.

Coals available for export trade; United States—. V. H. Manning. U.S. Bureau of Mines, Tech. Paper 76, 1914. 15 pp.

ANALYSES, showing volatile matter, fixed carbon, ash, and sulphur, and a description of their physical properties and of the uses to which they

are adapted, are given for the coals from coalfields in the United States from which there are facilities for export.—O. E. M.

Coal; Oxidation of —. H. C. Porter and O. C. Ralston. U.S. Bureau of Mines, Techn. Paper No. 65, 1914. 30 pp.

EXPERIMENTS were made to show the effect on the oxidation of coal of variation of temperature and of oxygen pressure, reduction of proportion of oxygen below that in ordinary air, and addition of carbon dioxide to the atmosphere. In general, below 200° C., oxygen is absorbed to form solid products and water. Above 200° C. there is little fixation of oxygen, and carbon dioxide is produced, the proportion being larger in an easily ignited coal. Carbon monoxide is also produced by the decomposition of the solid oxygen-derivative.—W. F. F.

Coal in boiler furnaces; Factors governing the combustion of —. J. K. Clement, J. C. W. Frazer, and C. E. Augustine. U.S. Bureau of Mines, Tech. Paper 63, 1914. 46 pp.

EXPERIMENTS with a furnace having an unusually long combustion chamber, from which samples of the gases could be drawn at intervals along its length, showed that, with a constant rate of firing, the time necessary for complete combustion of the gases, and hence the length of chamber required, decrease with increasing air supply.—O. E. M.

Mixed coal- and water-gas; Separation of the illuminants in —. G. A. Burrell and I. W. Robertson. Amer. Gas Inst. J. Gas Lighting, 1914, 128, 615—616.

THE illuminants in the Pittsburgh gas, made by mixing one part of carburetted water-gas with three parts of coal gas, were separated by fractional distillation (see this J., 1914, 808). The gas was freed from carbon dioxide by caustic potash and then cooled by liquid air and subjected to a series of fractionations which gave a residue of the illuminants. A second series of fractionations removed the ethane and ethylene, a third series removed propane and propylene, and a fourth series removed butylene and butane. Benzene was determined by fractionation of a separate quantity of the gas. The composition of two samples of the gas taken on different dates was: CO₂ 2.40, 2.43; O₂ 0.80, 0.61; CO 13.25, 13.63; H₂ 37.33, 37.13; CII₄ 31.13, 30.92; C₂H₆ 2.10, 1.92; C₃H₈ 0.35, 0.32; C₂H₄ 6.05, 6.36; C₃H₆ 0.60, 0.70; C₄H₈ 0.11, 0.12; C₄H₁₀ (1 sample), 1.33; N₂ (1 sample) 4.32%. The calorific value of the illuminants alone was calculated to be 2162 B.Th.U.—W. F. F.

Hydrogen in gas mixtures; Determination of — by means of colloidal palladium. G. A. Burrell and G. G. Oberfell. J. Ind. Eng. Chem., 1914, 6, 992—994.

THE use of a solution of sodium picrate and colloidal palladium for determining hydrogen in gas mixtures is described (see Paal and Hartmann, this J., 1910, 236; Brunck, this J., 1911, 110). Hempel (this J., 1912, 911) has stated that the solution slowly loses its absorbing power even in the dark, but the authors have obtained satisfactory results with a solution which had been kept for 9 months in a pipette surrounded with black paper.—A. S.

Gasoline vapour in natural gas; Absorption of — by fuming sulphuric acid. R. P. Anderson and C. J. Engelder. J. Ind. Eng. Chem., 1914, 6, 989—992.

GASOLINE vapours are absorbed to a considerable extent by fuming sulphuric acid, the amount of

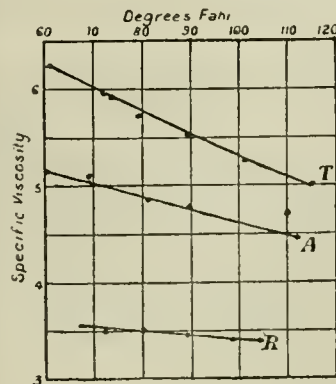
absorption increasing with the molecular weight of the hydrocarbons. The suitability of a natural gas for the manufacture of gasoline may be ascertained by determining the absorption under definite conditions, but it is desirable in such cases to determine also the composition of the gas before and after treatment with the acid. Samples of natural gas from which respectively 1 gallon of gasoline of 90° B. (sp. gr. 0.613) and 5 gallons of 97° B. (sp. gr. 0.621) per 1000 cu. ft. were recovered on a commercial scale, showed a decrease of volume of 9.8 and 30% when passed 30 times over fuming sulphuric acid (30% SO₃) in a modified Orsat apparatus (Dennis, "Gas Analysis," p. 86).—A. S.

Ammonium chloride as a by-product of coke ovens, gas works, etc. W. Strommenger. Z. angew. Chem., 1914, 27, 518—520.

THE working up of the ammoniacal liquors into pure ammonium chloride, instead of crude ammonium sulphate, is especially desirable in view of the introduction of synthetic nitrogen compounds on to the market as manures in competition with the older sources of supply. For this purpose, the liquors, which already contain some ammonium chloride, are treated with a slight excess of hydrochloric acid, and the decomposition of the other ammonium salts and the oxidation of the iron present, are facilitated by a current of air. The sulphur precipitated during this process is almost pure and forms a valuable by-product. A slight excess of ammonia is added to the filtered liquors to precipitate iron and other impurities. The filtrate is neutralised with hydrochloric acid, treated with sufficient common salt to convert all the undecomposed sulphate into chloride, evaporated to dryness, and ammonium chloride separated by sublimation, leaving a residue of sodium sulphate mixed with small quantities of sodium chloride and carbon (from the organic impurities). Recrystallisation of the sublimate is for most purposes unnecessary, but the innermost layers are liable to contain traces of volatile organic matter, which, though not recognisable by analysis, cause the crystals to darken on exposure to air and light. A single crystallisation completely removes them.—G. F. M.

Gas-oils; Determination of the viscosity of —. A. V. Hendrickson. J. Gas Lighting, 1914, 128, 600—601.

THE determination of the viscosity of oils used in the manufacture of carburetted water-gas is suggested as a means for determining the origin



of the oil. An Ostwald viscosimeter is used, immersed in a water-bath at constant temperature. The specific viscosities (viscosity of water=1)

of Texas, American, and Roumanian oils at various temperatures are represented in the graph by T, A, and R, respectively.—W. F. F.

Crude petroleum, oil-fuel, and similar substances; Rapid methods of determining water in—
H. S. Shrewsbury. *Analyst*, 1914, 39, 529—531.

Distillation method.—100 c.c. of the oil and a few pieces of pumice stone are placed in a 500 c.c. distillation flask supported with its side tube perpendicular to the bench. The tube is inserted up to the neck of the flask in a 25 c.c. graduated cylinder, which is surrounded by cold water. After the neck and surface of the flask (uncovered by the oil) have been heated by a flame to prevent the condensation of water, the oil itself is heated until the water has been driven over into the cylinder, the process being completed by distilling a few c.c. of the oil. The cylinder is then rotated rapidly, to cause the water to settle, and the volume of the water is read: dry petroleum spirit may be added to the distillate to accelerate the separation.

Turbidity temperature process.—This method depends on the possibility of extracting water from oil-fuel with glacial acetic acid, and the delicacy with which the turbidity temperature of glacial acetic acid and a standard oil responds to the presence of minute quantities of water. A suitable standard oil (giving a turbidity temperature of 49° C. with glacial acetic acid) may be prepared by mixing equal volumes of arachis and coconut oils; a correction is necessary for the effect on the turbidity temperature of substances other than water extracted from the oil-fuel, and this is found by a blank determination on oil which has been dried by boiling for a short time in an open dish. New standards must be prepared for every fresh stock of acetic acid. Ten c.c. of standardised glacial acetic acid is placed in a dry, stoppered, graduated 25 c.c. cylinder and 10 c.c. of the oil-fuel is added. The cylinder is shaken, its contents are transferred to a separator, the acid extract is drawn off, passed through a dry filter, and 2 c.c. of the filtrate is heated in a test-tube with 2 c.c. of the standard oil until the mixture is clear, the turbidity temperature being then determined in the usual way. When the oil contains more than 2.5% of water, the acetic acid extract must be diluted with the standard acid, exactly the same dilution being made with the extract which gives the figure for the blank. The results obtained by the two methods are fairly concordant. Both methods would probably be applicable to the determination of water in butter, margarine, lard, and other oils and fats.—W. P. S.

Alcohol as a substitute for benzine for driving motor cars. W. Hempel. *Z. angew. Chem.*, 1914, 27, 521—522.

IN 1912 Germany produced 179,800 tons (metric) of benzine; in 1913, 160,000 tons of benzol (of which 50,000 tons were exported to France; and in 1912—1913, 3,753,265 hl. of alcohol. All motor cars in Berlin have been adapted to use alcohol as well as benzine. The following are the respective heats of combustion of the different substances tried in the experiments:—Benzine, 9500—10,500; pure benzene, 10,260; commercial 90% benzol 9550—10,000; pure alcohol, 7402; 95% alcohol, 5875; and pure naphthalene, 9628.3 Cals. per kilo. Alcohol denatured with 2 to 20% of benzene is much more suitable for motor engines than that containing wood alcohol or pyridine. According to Dieterich a mixture of 1 vol. of petroleum spirit with 2 vols. of benzene is particularly suitable for the purpose. After suitable regulation of the tubes of a Lyma carburettor the following mixtures could be used:—(1) A mixture of 4 vols. of 95% alcohol and 1 vol. of 90% benzol

containing 200 grms. of naphthalene per litre. (2) Four vols. of 95% alcohol and 1 vol. of crude benzol containing 200 grms. of naphthalene per litre. (3) Four vols. of 95% alcohol and 1 vol. of light coal-tar oil containing 200 grms. of naphthalene per litre. In a long run 18 litres of mixture 1 gave the same result as 15 litres of ordinary petrol. Only oils purified by sulphuric acid and alkali should be used for this purpose. There is also a possibility of using a solution of acetylene in acetone (which dissolves 31 vols.) or alcohol (6 vols.). The use of pure alcohol tends to produce rust in the engine.—C. A. M.

Substitutes for benzine and benzol in motor engines.
K. Dieterich. *Z. angew. Chem.*, 1914, 27, 543—544.

THE following mixtures are recommended as suitable substitutes for petrol:—I. (a) Alcohol (95%), 70; benzol 30 parts. (b) Alcohol (90%), 50; commercial acetone, 20; benzol, 30 parts. II. (a) Alcohol (95%), 70; benzine 30 parts. (b) Alcohol (90%) 50; commercial acetone, 20; benzine, 30 parts. III. (a) Alcohol (95%) 90; ether, 10 parts. (b) Alcohol (95%), 90; ether 10; naphthalene, 1 part. IV. (a) Alcohol (95%), 70; commercial acetone, 30 parts. (b) Alcohol (90%), 50; commercial acetone, 50 parts. V. (a) Petroleum, 2; benzine, 1 part. (b) Petroleum, 3; acetone, 1 part. (c) Petroleum, 90; ether, 10 parts containing 1 part of naphthalene. All these substitutes require preliminary heating of the carburettor and reduction of the supply of air. To prevent rust one litre of motor oil should be dissolved in 100 litres of the mixture.—C. A. M.

Alcohol as a motor-spirit. O. Mohr. *Z. angew. Chem.*, 1914, 27, 558—559.

ONLY the simplest mixtures of alcohol with hydrocarbons have proved suitable as substitutes for petrol in motor engines. Mixtures of equal parts of alcohol and benzene or of alcohol (50), benzene (25), and petrol (25), have given good results, the second mixture having the advantage of not forming crystalline deposits in winter. Naphthalene proved unsuitable owing to the formation of deposits. The use of alcohol containing 0.5% ammonium perchlorate is objectionable owing to the gaseous chlorine compounds formed in the explosion.—C. A. M.

Determination of Prussian blue in cyanide mud.
Anderson. *See VII.*

Rock asphalts of Oklahoma and their use in paving.
Snider. *See IX.*

Cementing value of bituminous binders. Kirschbraun. *See IX.*

Iodine value of linseed and petroleum oils. Smith and Tuttle. *See XII.*

PATENTS.

Briquettes; Process for making—without coal.
E. L. Geelhand and J. de Man-Rocis. *Fr. Pat.* 469,293, Feb. 9, 1914.

BRIQUETTES are formed of gum copal, wood chips, bark or the like, and loam.—W. F. B.

Briquettes; Process for making— A. Epp.
Fr. Pat. 470,136, Mar. 26, 1914.

CLAY and sawdust are heated in a mixer preferably by high-pressure steam, coal tar and previously boiled pine resin are added, and nitric and sulphuric acids are then agitated with the mixture, which is cooled, moulded, and exposed to the

atmosphere for one or two days. An alternative process consists in using clinker or ashes with finely-divided pitch, tar, and sulphuric acid.—W. F. B.

Gas [firedamp] admixed with air or other gases; Apparatus for indicating the presence and estimating the proportion of a —. H. R. Webster, Horsforth. Eng. Pat. 26,001, Nov. 13, 1913.

A THIN metallic diaphragm closing a porous vessel is distended when diffusion of a gas into the vessel takes place, and makes electrical contact with a rod. To make the apparatus quantitative the original distance of the rod from the diaphragm is adjustable by a micrometer screw. The closing of the circuit is indicated by a bell or lamp.—O. E. M.

Gas-retorts; Vertical —. R. Dempster and Sons, Ltd., Elland, and F. G. Brockway, Cleethorpes. Eng. Pat. 1997, Jan. 26, 1914.

A TABLE for supporting the charge stands during carbonisation on the bottom lid of the retort, falls out of the way when the lid is opened for discharging, and is replaced by means of a chain let down through the retort.—O. E. M.

Water-gas; Production of —. R. P. Pietet, Berlin. Eng. Pat. 24,374, Oct. 27, 1913.

PURE or nearly pure oxygen is passed, with steam, continuously through fuel at 1500°—1800° C. —O. E. M.

Water-gas; Conversion of carbon monoxide in — into methane. L. Vignon. Fr. Pat. 469,907, June 2, 1913.

WATER-GAS is mixed with a determined quantity of steam and passed over quicklime heated to 350°—1200° C. Below about 850° C. calcium carbonate, methane, and hydrogen are produced, whilst above this temperature the calcium carbonate is decomposed, and the resulting gas also contains carbon dioxide. Small quantities of other hydrocarbons, such as ethylene, are also formed. (See also Fr. Pat. 416,699; this J., 1910, 1366.)—W. F. B.

Producer-gas generators. T. R. Wollaston, Manchester. Eng. Pat. 29,088, Dec. 17, 1913.

A PRODUCER, of any suitable type, is provided with a number of hermetically sealed tubes (Perkins tubes) containing a small quantity of fluid, which abstract heat from the burning fuel and transmit it to a boiler, fixed on the top of the producer. The steam from the boiler passes by a pipe, fitted with an air injector, to the jacket of the producer, and thence into the fuel bed.—W. F. F.

Gas; Manufacture of carburetted —. W. J. Watkins, Assignor to O. G. Hurdleston, Fort Worth, Tex. U.S. Pat. 1,116,653, Nov. 10, 1914. Date of appl., May 15, 1911.

THE lower half of the generating chamber is provided with a number of horizontal fibre partitions, connected by a central fibre stem. A volatile combustible liquid from a container in the upper part of the generator is distributed over layers of a mixture of pine shavings and iron borings placed on the partitions, and compressed air from a reservoir is blown downwards through the layers, the carburetted gas being drawn off from a chamber at the base of the generator.—W. F. F.

Combustion products; Generation of — under pressure for actuating turbines. The Warwick Machinery Co. (1908), Ltd., London. From General Electric Co., New York. Eng. Pat. 482, Jan. 7, 1914.

COAL dust is stored in a closed hopper under air pressure from a branch pipe of the main air supply.

A rotary valve in the base of the hopper, driven at a controllable speed, admits the coal dust into the main air pipe, from which it is blown tangentially into the conical top of the combustion chamber. The ignited mixture thus has a downward spiral movement, the ash being thrown against the sides and falling into a series of pockets formed in the bottom of the combustion chamber. The gaseous combustion products escape by a water-jacketed pipe extending from the top of the combustion chamber nearly to the base.—W. F. F.

Gases and gaseous atmospheres of non-oxidizing character; Manufacture of —. H. Frasch, New York (E. B. Frasch, New York, and F. F. Whiton, Hewlett, N.Y., executives). U.S. Pat. 1,118,899, Nov. 24, 1914. Date of appl., Sept. 28, 1914.

AIR, mixed with a small proportion of hydrocarbon vapour, is passed over incandescent carbon, the resulting gaseous mixture consisting of nitrogen, carbon monoxide and dioxide, and hydrogen. —W. F. F.

Gas-washer. H. Bentz, Montclair, N.J. U.S. Pat. 1,117,309, Nov. 17, 1914. Date of appl., June 5, 1914.

THE gas passes through a casing, where it meets a body of mist which coats the suspended solid particles. It then passes successively, at increased velocity, between two series of plates supplied with a flowing film of water, whereby suspended particles are removed and the gas is cooled, and then between a final series of plates, without a water film, to eliminate entrained moisture. —W. F. F.

Hydrocarbons of low boiling-point; Production of — from those of higher boiling-point. W. A. Hall, New York. Eng. Pat. 18,342, Aug. 12, 1913.

HYDROCARBON oil is agitated with 50% of lime-water; a small quantity of ferrous or aluminium sulphate is added, and the precipitate formed is removed by filtration. The filtrate contains the oils of lower boiling point.—O. E. M.

Mineral oils of low boiling-point; Production of — from those of high boiling point. Continental Caoutchouc und Gutta Percha Co. Fr. Pat. 469,948, March 21, 1914. Under Int. Conv., March 22 and Oct. 4, 1913.

THE fraction of high boiling-point is heated with a catalyst such as aluminium chloride, with or without mercuric, ferric, vanadium, or other chloride, or with aluminium in a stream of dry hydrochloric acid gas, or is atomised or exposed to ultra-violet rays or the silent electric discharge in presence of a catalyst. The process is continuous. Gaseous products are obtained by heating to a higher temperature, and longer, in closed vessels.—O. E. M.

Liquid hydrocarbons [pentanes]; Process of obtaining — [from natural gas]. E. Schill, Assignor to Continental Gas Compressing Corporation, New York. Reissue No. 13,829, Nov. 17, 1914, of U.S. Pat. 1,100,260, June 16, 1914. Date of appl., June 19, 1914.

NATURAL gas is highly compressed in the presence of a finely-divided inert heat-absorbing agent which is also a water absorbent, a lubricant and a conductor of heat, and has a high specific heat, specific gravity, and boiling point. The temperature is reduced to 25° C., and the liquefied portion, which contains the pentanes and other hydrocarbons of higher boiling point, is removed while still under pressure, and the pentanes separated by fractional

distillation. The method may be extended to the separation of hydrocarbons of low, medium, and high boiling points from a gaseous mixture of these substances, by condensing the portions having medium and high boiling points after the initial compression, removing the gaseous portion, and fractionating the liquid portion.—W. F. F.

[Paraffin] wax; Producing— from other hydrocarbons. W. M. Burton, Chicago, Ill., Assignor to Standard Oil Co., Whiting, Ind. U.S. Pat. 1,112,113, Sept. 29, 1914. Date of appl., Jan. 21, 1914.

FUEL oil, produced in the distillation of petroleum, and free from wax, is distilled at 650°–850° F. (343°–454° C.) under a pressure of 4 to 5 atmospheres. The residuum, about one-third of the original charge, is completely distilled at atmospheric pressure, the distillate cooled, and the paraffin wax, which amounts to about 2%, removed in a press. The expressed oil may be again treated as described, or may be mixed with a fresh charge of fuel oil.—W. F. F.

Oil-refiner. F. R. Reynolds, Bakersfield, Cal. U.S. Pat. 1,119,453, Dec. 1, 1914. Date of appl., Aug. 9, 1913.

FLAT jacketed steam drums, arranged one above the other, are connected by short vertical pipes, and the jackets are also connected together. Crude oil is passed through the jackets, entering at the uppermost. A tank with openings at top and bottom encloses the whole. On leaving the lowest jacket, the oil passes over inclined baffle-plates and is finally led away by the outlet at the bottom of the tank, the gases escaping through the outlet at the top.—W. F. F.

Petroleum; Method of distilling—. E. M. Clark, Alton, Ill. U.S. Pat. 1,119,496, Dec. 1, 1914. Date of appl., April 20, 1914.

THE liquid residue from petroleum distillation is circulated rapidly in a small stream while subjected to a cracking temperature. The vapour is condensed at 650°–850° F. (343°–454° C.), under a pressure of 3–7 atmospheres.—W. F. F.

Hydrocarbons [petroleum residues]; Method of distilling—. R. E. Humphreys, Whiting, Ind., Assignor to Standard Oil Co., Chicago, Ill. U.S. Pat. 1,119,700, Dec. 1, 1914. Date of appl., June 26, 1914.

PETROLEUM residues boiling above 500° F. (260° C.) are distilled at a pressure above 4 atmospheres, the distillate being returned to the still for further treatment. The lighter vapours, which consist of hydrocarbons of the same series but having lower boiling points, are condensed while still under pressure.—W. F. F.

Organic esters of the fatty series; New application of—[as motor spirit]. Soc. d'Etude du Carburx. First Addition, dated Feb. 25, 1914, to Fr. Pat. 461,520, Aug. 20, 1913 (this J., 1914, 191).

THE esters mentioned in the original patent may be used, mixed with aromatic or fatty hydrocarbons, in internal combustion motors.—O. E. M.

Liquid hydrocarbons [petroleum]; Electrically-heated still for—. T. Delort. First and Second Additions, dated March 6 and April 26, 1913, to Fr. Pat. 469,054, Feb. 8, 1913 (this J., 1914, 954).

THE liquid in an upper compartment of the still is heated by, and condenses, the vapour from a lower compartment; its more volatile portions

pass off to a condenser cooled by fresh, untreated liquid, while the less volatile portions pass into the lower compartment over inclined planes, the temperature of which increases from the top towards the bottom.—O. E. M.

Benzine; Regeneration of impure—. M. Granger. Fr. Pat. 469,490, March 11, 1914.

Benzene from petroleum or its distillates; Process for obtaining—. J. Holecgreber. First Addition, dated March 7, 1914, to Fr. Pat. 460,827, July 28, 1913 (see this J., 1914, 17).

INCREASED yields of benzene may be obtained from petroleum or its distillates by treatment with hydrogen in presence of a mixture of metallic oxides, instead of the metals themselves. The oxides are either used in the form of powder or deposited on pumice stone, to present a large surface. Mixtures of the oxides of nickel and copper, or cobalt and iron may be used with advantage.—T. F. B.

Fires in oil tanks, garages, and the like; Extinguishing—. J. B. and O. R. Erwin, Milwaukee, Wis., U.S.A. Eng. Pat. 2142, Jan. 27, 1914.

A SMALL vessel containing sulphuric acid is suspended by a catch which is released by the falling of a weight when a fusible link is destroyed. The acid vessel, open at the top, then sinks slowly through a mixture of sodium bicarbonate and soap bark solution contained in a deep vessel within or adjacent to the oil tank, or below the floor of the garage or other building. Violent ebullition is produced and the foam overflows on the surface of the burning oil and extinguishes the fire.—W. F. F.

Dust; Composition for agglutinating—. H. Belger, Cullercoates. U.S. Pat. 1,120,362, Dec. 8, 1914. Date of appl., Sept. 10, 1913.

SEE Eng. Pat. 6343 of 1913; this J., 1913, 690. —T. F. B.

Peat; Process for dehydrating—. Wetcarbonizing, Ltd. Fr. Pat. 469,447, March 9, 1914. Under Int. Conv., March 10, 1913.

SEE Eng. Pat. 5873 of 1913; this J., 1914, 783. —T. F. B.

Peat-dewatering process. T. Rigby and G. W. Andrew, Dumfries, Assignors to Wetcarbonizing, Ltd., London. U.S. Pat. 1,121,203, Dec. 15, 1914. Date of appl., March 6, 1914.

SEE Eng. Pat. 5873 of 1913; this J., 1914, 783. —T. F. B.

Peat-dewatering process. T. Rigby, Dumfries, Assignor to Wetcarbonizing, Ltd., London. U.S. Pat. 1,121,204, Dec. 15, 1914. Date of appl., March 6, 1914.

SEE Eng. Pat. 11,133 of 1913; this J., 1914, 912. —T. F. B.

Gaseous fuel; Apparatus for the production of—. A. W. Southey, Edgware. U.S. Pat. 1,120,857, Dec. 16, 1914. Date of appl., Dec. 6, 1913.

SEE Eng. Pat. 27,612 of 1911; this J., 1913, 77. —T. F. B.

[Gas] retort-discharging apparatus. A. Dobson, Halifax, Assignor to Drakes, Ltd., Ovenden. U.S. Pat. 1,121,551, Dec. 15, 1914. Date of appl., Feb. 17, 1914.

SEE Eng. Pat. 4105 of 1913; this J., 1914, 684. —T. F. B.

Separating gaseous mixtures into their constituents; Process of —. R. P. Pictet, Berlin-Wilmersdorf, Germany. U.S. Pat. 1,119,312, Dec. 1, 1914. Date of appl., June 27, 1913.

SEE Fr. Pat. 457,031 of 1912; this J., 1913, 1109.
—T. F. B.

Suction gas-producer apparatus. P. T. Houston, London. U.S. Pat. 1,119,603, Dec. 1, 1914. Date of appl., July 2, 1914.

SEE Eng. Pat. 15,367 of 1913; this J., 1914, 542.
—T. F. B.

Petroleum; Process for treating residues from the distillation of —. Standard Oil Co. Fr. Pat. 469,689, March 16, 1914.

SEE U.S. Pat. 1,105,961 of 1914; this J., 1914, 911.
—T. F. B.

Distilling petroleum or similar oils; Processes of — and apparatus for carrying on these processes. M. J. Trumble, Los Angeles, Cal., U.S.A. Eng. Pat. 22,497, Oct. 6, 1913. Under Int. Conv., Jan. 14, 1913.

SEE U.S. Pat. 1,070,361 of 1913; this J., 1913, 902.
—T. F. B.

Extinguishing fires; Method of —. R. Scheuffgen, Assignor to Fabrik Explosionssicherer Gefässe G.m.b.H., Salzkotten, Germany. U.S. Pat. 1,118,952, Dec. 1, 1914. Date of appl., March 21, 1912.

SEE Eng. Pat. 6327 of 1912; this J., 1912, 673.
—T. F. B.

Apparatus for automatic gas analysis. U.S. Pat. 1,111,815. See XXIII.

IIb.—DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

PATENTS.

Peat; Process for dehydrating —. Wetcarbonizing Ltd. Fr. Pat. 469,448, March 9, 1914. Under Int. Conv., March 10, 1913.

IN the dehydration of peat by wet carbonizing followed by treatment in a filter-press, a part or all of the hot liquid from the press is returned to the fresh pulp about to be treated, thereby saving heat and increasing the nitrogen content of the finished product.—W. F. B.

Heating water and other liquids; Apparatus for —. A. C. Ionides. Eng. Pat. 26,259, Nov. 15, 1913.

THE heater described in Eng. Pat. 15,455 of 1909, in which a combustible gaseous mixture is burnt without addition of further air, and from which the products of combustion are removed by downward displacement, has its heating chamber surrounded by a jacket in two parts, of which the upper can be swung aside for access to the chamber.—O. E. M.

Filaments for incandescence electric lamps. E. Morsaint. Fr. Pat. 469,902, June 2, 1913.

THE filament consists of an intimate mixture of a conductor, such as tungsten, and a refractory non-conductor, such as boron carbide; it is thicker and more resistant to mechanical shock and over-running than a metallic filament.—O. E. M.

Electrodes [for arc lamps]. J. T. H. Dempster, Schenectady, Assignor to General Electric Co., New York. U.S. Pats. 1,118,399 and 1,118,400, Nov. 24, 1914. Dates of appl., May 20, 1904, and Oct. 27, 1911.

SEE Eng. Pat. 14,196 of 1904; this J., 1905, 611.
—T. F. B.

Method of manufacture of metallic [tungsten] wires and strips. Fr. Pat. 469,212. See X.

Preparation of acetaldehyde from distillation gases. Ger. Pat. 276,764. See XX.

III.—TAR AND TAR PRODUCTS.

Toluene in benzol; Test for —. J. Gas Lighting, 1914, 128, 727.

THE Committee on the Supply of High Explosives have issued a notice to tar distillers, etc., specifying the standard distillation test for toluene in benzol. The sample is distilled from a flask having a bulb (preferably coppered) of 150—180 c.c. capacity, a neck about 5 ins. long, and a side tube at about the middle of the neck. A water-cooled condenser, 18—20 ins. long is used, and a 100 c.c. graduated cylinder for the distillate. The flask and condenser are washed with the benzol to be tested, and 100 c.c. of benzol introduced. The rate of distillation should be two drops per second. When the corrected benzol thermometer shows 84° C. (at 30 inches pressure, or $\pm 0.1^\circ$ C. for ± 0.1 inch pressure), the apparatus is allowed to cool and the distillate read off. Any deficiency from 100 c.c. when the residue is added to the distillate is considered as distillate. If the distillate amount to more than 95% and the sp. gr. of the benzol be between 0.880 and 0.890 at 15° C., it may be sold without a permit, but if the distillate be less than 95% a sample must be submitted to the Committee for test.—W. F. F.

Aniline oil and salt, and picric acid; Prohibition of exports of —. Board of Trade J., Dec. 17, 1914.

AN Order in Council, dated Dec. 11th, prohibits the export to all destinations of aniline oil, aniline salt, and picric acid and its components.

Toluol supplies and the War Office.

THE Army Council has notified the majority of British gas undertakings that for the period of the war, they are to place at the disposal of the Council their whole output in toluol or substances containing toluol (commercial benzol, light oils, etc.), so far as they are not covered by existing contracts.

Organic substances; Addition compounds of — with sulphuric acid. J. Kendall and C. D. Carpenter. J. Amer. Chem. Soc., 1914, 36, 2498—2517.

THE authors have studied the action of pure sulphuric acid (100%) at low temperatures on 33 organic compounds, including aldehydes, ketones, phenols, and aromatic and aliphatic acids. From observations of the freezing points it is concluded that addition compounds of the oxonium type are formed in the majority of cases, and that sulphonation is preceded by formation of such compounds.—R. G. P.

PATENTS.

Tar distillation products; Process for treating — with phosphoric acid. M. Melamid and L. Grötzinger. Ger. Pat. 276,765, Aug. 19, 1913. Addition to Ger. Pat. 264,811, Aug. 22, 1912.

The hydrocarbons of tar oils are converted into hydrocarbons of lower boiling point by heating with phosphoric acid. For example, one kind of tar yielded 6.5% boiling up to 200° C., sp. gr. 0.950; when the tar was heated with 25% of phosphoric acid it yielded 30% boiling below 200° C. (sp. gr. 0.897), 9% up to 230° C. (0.990), 23% up to 270° C. (0.992), and 14% up to 320° C. When the oils boiling below 200° C. were again distilled with 25% of phosphoric acid, they yielded 80% of b. pt. below 120° C. (sp. gr. 0.860), 6% below 150° C. (0.867) and 14% below 180° C. (0.880); by similar treatment the fractions boiling between 200° and 270° C. yielded 20% below 120° C. (sp. gr. 0.867), 25% below 180° C. (0.884), and 55% below 230° C. (0.965). (Compare this J., 1912, 977; 1913, 415, 820, 861, 1000).—T. F. B.

Anthraquinone; Process of making —. F. Singer, Offenbach, Assignor to Chem. Fabr. Griesheim-Elektron, Frankfurt, Germany. U.S. Pat. 1,119,546, Dec. 1, 1914. Date of appl. May 25, 1914.

ANTHRACENE is treated with nitric acid in presence of a mercury salt and an indifferent liquid at a temperature below 60° C., and the product thus obtained, which is a mixture of unstable mesonitro derivatives of anthracene, is converted into anthraquinone by treatment with an oxidising agent, in presence of a mercury salt, at a temperature above 60° C.—T. F. B.

Aminoanthraquinones; Process for preparing —. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 469,741, May 27, 1913.

SEE U.S. Pat. 1,104,943 of 1913; this J., 1914, 855. Organic amino compounds may be used in place of ammonia.—T. F. B.

Obtaining benzene from petroleum or its distillates. Addition to Fr. Pat. 460,827. See IIA.

IV.—COLOURING MATTERS AND DYES.

Aniline dyes; Manufacture of — in Great Britain. Board of Trade, Dec., 1914.

THE Government are prepared to assist an effort to establish a factory for the large-scale manufacture of aniline dyes on the following lines:—

(a) A limited company to be formed with a share capital of £3,000,000, divided into 3,000,000 shares of £1 each. This capital to be subscribed by those interested, and be paid up as to 2s. 6d. a share on allotment, and 5s. on June 30th, 1915. The remaining 12s. 6d. is not likely to be needed for some time to come, and when required will only be payable in calls not exceeding 2s. 6d. a share, at intervals of not less than six months between each call.

(b) The Government to advance to such company £1,500,000, bearing interest at the rate of 4 per cent. per annum and secured as a first charge on the assets and undertaking of the company, and repayable in 25 years.

(c) The interest on the advance and a sinking fund for its repayment are to be payable only out of the net profits of the company, but are to be cumulative.

(d) The Government advance to be made as to £750,000 on the Government being satisfied that the £3,000,000 capital of the company has been fully subscribed, and the remaining £750,000 so soon as the call of 5s. a share has been made.

(e) The Government shall have the right of appointing two directors of the company, with power to veto any undue encroachment on the businesses of British manufacturers of products other than dyes and colours, or the giving of any undue preference as regards supply prices or otherwise to consumers of the company's products. The names of the gentlemen so appointed are Sir Gilbert H. Cloughton, Chairman of the London and North-Western Railway Company, and Sir Frank Forbes Adam.

(f) The company shall remain British.

The Committee on dye supply consider that co-operation would best be secured by the subscription of the share capital by those interested, and also by a contract being entered into between the company and the consumers and users of its products whereby the consumers should agree for a period of five years after peace is established, or five years after the expiry of existing contracts and of all deliveries thereunder (whichever is the longer period), to take their supplies from the company in all cases where the company is able to supply the same of good quality and at reasonable prices, but with a provision that if a consumer should consider the prices fixed by the directors of the company too high, he may require that the prices to be charged shall be determined by an independent referee.

With the object of securing for the company impartial administration of its business as between the users of dyes, it is intended that the board of the company (other than the Government directors) shall be selected by the Committee, and mainly composed of business men who are not themselves necessarily engaged in the dyeing trade. The board will be assisted by an advisory committee, constituted from among the representatives of the users of dyes, and will, in addition, have the advantage of the advice of chemical and other experts.

The Committee have had addressed to them, among other questions, inquiries as to whether the company would not be hampered (1) by inability to secure the requisite alcohol free of duty, and (2) by restrictions at the instance of German holders of British patents. The Committee have satisfied themselves with regard to (1) that the company will be able to obtain from the Board of Customs and Excise permission to use alcohol for all industrial purposes, free from duty, by arranging that the denaturing of such alcohol shall be carried out under conditions which will not hamper its use for such purposes; and with regard to (2) that the new Act of 1914 and the rules thereunder will enable the company to obtain on reasonable terms a licence from the Board of Trade for the duration of the patents, empowering it to manufacture commodities covered by such patents, so as to enable the community to enjoy the full use of the patented invention.

It is now essential for the Committee to ascertain the extent to which they can rely on the support of those interested.

PATENTS.

Vat [anthracene] dyestuffs and intermediate products for use in making them. Badische Anilin und Soda Fabrik. First Addition, dated Feb. 13, 1914, to Fr. Pat. 458,949, June 7, 1913. Under Int. Conv., Jan. 28, 1913, and Jan. 6, 1914.

IMINES of anthracene-1.9-dicarboxylic acid in which the hydrogen of the imino group is replaced

by hydroxyl, alkyl, or aryl, are obtained by treating the acid or its anhydride with hydroxylamine or with a primary aliphatic or aromatic amine. The methylimine is obtained, for example, by heating anthracene-1,9-dicarboxylic anhydride with ten times its weight of 13% aqueous methylaniline solution for five hours at 150° C. These substituted imines are converted into vat dyestuffs analogous to those obtained according to the principal patent (see this J., 1913, 1101), by fusion with alkalis. The dyestuffs may also be obtained by treating the dyestuffs of the principal patent with alkylating or arylating agents. In general, the products dye rather bluer shades than those from which they are derived.—T. F. B.

[Azo] dyestuffs and process of manufacturing the same. E. S. Chapin, Sharon, and E. Lesser, Boston, Assignors to American Dyewood Co., New York. U.S. Pat. 1,106,781, Aug. 11, 1914. Date of appl., Dec. 20, 1910.

A DIAZOTISED aminosulphonic acid, such as 1-naphthylamine-4-sulphonic acid, is combined with an α -anhydrotetramethylhaematoxylene, an oxidation product of acetylmethylhaematoxylan.—T. F. B.

Wool [azo] dyes; Manufacture of brown—. G. B. Ellis, London, From Chemical Works, formerly Sandoz, Basle, Switzerland. Eng. Pat. 28,910, Dec. 15, 1913.

SEE Fr. Pat. 467,114 of 1914; this J., 1914, 856.—T. F. B.

Azo dyes for the arylamides of 2,3-[hydro]xy-naphthoic acid and process of making them. A. L. Laska and A. Zitscher, Offenbach, Assignors to Chem. Fabr. Griesheim-Elektron, Frankfurt, Germany. U.S. Pat. 1,121,026, Dec. 16, 1914. Date of appl., May 11, 1914.

SEE Eng. Pat. 10,085 of 1914; this J., 1914, 915.—T. F. B.

Compounds of leuco vat dyes with aralkyl compounds and process of making same. K. Reinking and A. J. Stiegelmann, Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 1,106,970, Aug. 11, 1914. Date of appl., Sept. 28, 1910.

SEE Fr. Pat. 414,937 of 1910; this J., 1910, 1247.—T. F. B.

Azo dyestuffs; Process for producing—. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 469,457, March 9, 1914. Under Int. Conv., March 11, 1913.

SEE Ger. Pats. 274,081 and 274,082 of 1913; this J., 1914, 784.—T. F. B.

Azo dyestuffs; Process for producing—. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 469,949, March 21, 1914. Under Int. Conv., April 11, 1913.

SEE Eng. Pat. 10,380 of 1913; this J., 1914, 545.—T. F. B.

[Azo] dyestuffs for half-wool or half-silk; Process for making—. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 469,901, May 31, 1913.

SEE Eng. Pat. 13,236 of 1913; this J., 1914, 194.—T. F. B.

Dyestuffs of the Quinoline Yellow series; Process for making halogenated—. Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 470,181, March 27, 1914. Under Int. Conv., May 2 and 13, 1913.

SEE Eng. Pat. 8577 of 1914; this J., 1914, 743.—T. F. B.

Condensation products of the arylamides of 2,3-hydroxynaphthoic acid and azo dyestuffs derived therefrom. Chem. Fabr. Griesheim-Elektron. Fr. Pat. 470,033, March 24, 1914. Under Int. Conv., April 19 and May 17, 1913.

SEE Eng. Pats. 3312 and 3313 of 1914; this J., 1914, 742, 855.—T. F. B.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Cellulose; Determination of the degree of bleaching of—. C. G. Schwalbe. Z. angew. Chem., 1914, 27, 567—568.

IN the determination of the cupric-reducing value of cellulose (this J., 1910, 689), the limits of variation between duplicate tests should not exceed 0.2 in the "copper value," but abnormal results, e.g., values ranging from 0.6 to 1.3, may be obtained through the presence of cupric-reducing impurities in the Rochelle salt or the water employed. Commercial specimens of Rochelle salt frequently contain small proportions of oxalate, which reduces the Fehling's solution on boiling and discolours the cellulose at the conclusion of the test. Cupric-reducing impurities have also been found when condensed steam contaminated with volatile oily matters was used for making up the reagents. The solutions used should always be controlled by a blank test, by adding the hot mixture of 50 c.c. of each of the ingredients of Fehling's solution to 400 c.c. of water and boiling for 15 mins. under a reflux condenser. The liquid should neither turn greenish in colour nor deposit a precipitate of cuprous oxide on standing. If pure normal cotton has been boiled with the mixture, it should show no brownish discoloration. In performing the determinations, the heating arrangements must be adjusted to avoid over-heating of the walls of the flask, as drops of the liquid thrown against the heated glass by the stirrer may be decomposed, forming products which affect the results.

—J. F. B.

The paper industry in Russia and Finland. Papierfab., 1914, 12, 106—108, 346—348.

THE movement for the abolition of the customs barrier between Russia and Finland, if successful, will have an important influence on the pulp and paper trade, and by some it is feared the Russian paper industry may be ruined. The value of imports of wood pulp and paper from Finland into Russia has grown from 7 million roubles (1 rouble = 2s. 1½d.) in 1900 to 22 millions in 1912; the ratio of imports to home production in Russia has increased in the same period from 16.7% to 35.1%. An import duty on Finnish pulp and paper was first imposed in 1885, and since it failed to check competition, it was increased in 1897, but still without effect. The statistics for 1912 of imports from Finland show: 885,000 poods (1 pood = 26 lb.) of mechanical pulp, 995,000 of wood pulp boards, 2,000,000 of paper made from boiled wood and 4,200,000 of white paper containing mechanical pulp. In the last 6—7 years the total exports of mechanical pulp from Finland have remained stationary while the exports of paper have gone on increasing largely, and about 80% go to Russia in spite of the duty. Thus it is more profitable to Finland to make paper and pulp boards than raw pulp, and although the production of the latter has increased yearly, the increment is all absorbed in the manufacture of the former. To other countries Finland exports 1,500,000 poods of paper, 3,600,000 of cellulose, and 2,000,000 of mechanical pulp against Scandinavian competition. As the export of mechanical pulp does not increase,

although these other countries impose no duties, it is hardly probable that the removal of the Russian barrier would sensibly benefit the Russian papermaker as regards raw materials. If it did produce any considerable fall in price there would be a danger of ruining the Russian wood grinding industry which works under relative disadvantages. As regards paper, the establishment of Russian tariffs in Finland would raise the price of imported machinery, felts, and accessories, but there would still remain a balance of advantage of about 20% in favour of Finnish paper entering Russia, against which the Russian papermaker could not compete. Further, the volume of the trade would tend to increase, since the duty on accessories would cripple Finnish competition with Scandinavian paper. Finland possesses many industrial advantages over Russia: abundant water power, amounting to 97% of the total in mechanical pulp production and 80% in the paper industry, cheap water transport, good harbours, organised water rights, dense and educated population. The Russian industry consumes a large proportion of fuel, mostly wood and imported coal. The free export of pulp wood raises the price of the material and much of it goes to Germany, whereas in Finland there is an export duty on wood. The Russian industry, moreover, is more affected by the price of wood owing to lack of water power, and, compared with Finland, 3—4 times as much wood is consumed in the production of a ton of pulp.

—J. F. B.

Paper and rag pulp mill; Effect of the waste waters of a fine — on health. Papierfab., 1914, 12, 70—71.

IN the case of a mill discharging about 4.5 cb. m. of waste water per min. into a stream running at the rate of 2.5 cb. m. per sec., comparative analyses of the original river water and the waste water taken at the point of discharge showed an increase in the total dry residue from 8.56 to 8.99 grms. per hl.; the organic matter increased from 2.16 to 2.64; increases were also recorded in the lime, magnesia, chlorine, sulphuric and phosphoric acids and decreases in the iron oxide, alumina, and silica. The principal increase was in the sediment, which rose from 0.082 to 2.47, consisting chiefly of fibre debris, calcium carbonate, and inert mineral matter, together with aluminium and calcium resins from the sizing. The waste waters showed a slightly alkaline reaction owing to the presence of lime, whereas the original water was neutral. It is concluded that none of these substances could be injurious to health, and the danger of infection from rag washing would be removed by the chemical treatment employed. A certain amount of mud would be deposited as the result of the discharge, but this would consist only of calcium carbonate and iron and aluminium compounds.—J. F. B.

Collodion enamels for leather. Callan. See XV.

PATENTS.

Wool; Method for the purification of raw —. F. Koch, Berlin, Germany. U.S. Pat. 1,117,194, Nov. 17, 1914. Date of appl., June 17, 1914.

Raw wool is extracted with a chlorinated hydrocarbon solvent, e.g. ethylene dichloride, and the remaining impurities are removed by rubbing, beating, or equivalent dry mechanical treatment.

—J. F. B.

Plant tissues; Process for dissolving the incrusting matters of cellular —. E. Lubarski. Fr. Pat. 469,669, March 14, 1914.

Wood in the form of small chips is boiled with a 10—15% solution of resin or other soap of an

alkali base for 24—36 hours at atmospheric pressure or for a shorter time under a pressure of 2—3 atmos., until the tissues are sufficiently softened to enable the mass to be disintegrated to a pulp.

—J. F. B.

Textile materials; Treatment of crude —. J. Meister. Fr. Pat. 470,128, March 21, 1914. Under Int. Conv., Sept. 25, 1913.

THE crude materials, vegetable fibres or silk, are treated at about 60° C. with a weak alkaline solution which may contain borax and ammonia, and then digested with a solution of pancreatic enzyme also containing borax, ammonia, and sodium chloride at 40°—50° C., for 5—20 hours. Instead of pancreatic secretions, industrial enzymes or cultures of bacteria having a similar effect may be employed, and hydrogen peroxide may be added to the enzyme bath.—J. F. B.

Viscose; Process of treating [coagulating] —. D. E. Reid, Assignor to Eastman Kodak Co., Rochester, N.Y. U.S. Pat. 1,117,604, Nov. 17, 1914. Date of appl., Feb. 21, 1914.

VISCOSE is treated with a saturated solution of sodium sulphite and then with several separate baths containing gradually decreasing percentages of sodium sulphite; the sulphite is removed and the material rendered insoluble. After the treatment with sodium sulphite the material may be subjected to the successive actions of ammonium sulphate and an acid. In making films or filaments the surface of the viscose may be set by heating before coagulation.—J. F. B.

Pyroxylin solvent. F. Kniffen, Assignor to E. I. du Pont de Nemours Powder Co., Wilmington, Del. U.S. Pat. 1,118,498, Dec. 1, 1914. Date of appl., Oct. 28, 1912.

THE solvent consists of substantially equal parts of ethyl acetate and benzene.—J. F. B.

Cellulose; Treatment of threads of regenerated —. P. Joliot. Fr. Pat. 469,446, May 21, 1913.

THREADS composed of continuous or discontinuous filaments of regenerated cellulose are strengthened by first converting them into alkali-cellulose by immersion for a few minutes in caustic soda solution, then exposing them to the action of carbon bisulphide, and regenerating the cellulose by decomposing the xanthogenate without dissolving it.—J. F. B.

Nitrocellulose [from wood pulp] specially suitable for the manufacture of celluloid; Preparation of —. K. Schonlau. Fr. Pat. 469,484, March 11, 1914. Under Int. Conv., April 28, 1913.

WOOD cellulose, manufactured either by the sulphite or the soda process, is bleached and treated in a beating engine with a hot mixture of water and oil of turpentine to remove the resins and other incrusting matters. The pulp is then made into a cellulose wadding formed of thin layers, which is dried at a moderate temperature before nitration. For 1 kilo. of cellulose a mixture consisting of at least 4 kilos. of 61% HNO₃, and 9.3 kilos. of 93.5% H₂SO₄ is employed.—J. F. B.

Artificial silk; Tube for use in the manufacture of —. F. Mancelin. Fr. Pat. 469,890, March 20, 1914.

THE tube for use in the coagulation of artificial threads is constructed of a metal or alloy. It has a funnel at its upper end, with or without constrictions in the internal diameter of its cylindrical portion, and terminates in a bell mouth with rounded edges where the thread issues from the bottom.—J. F. B.

Cellulose derivatives; Manufacture of plastic substances from—F. Lehmann. Fr. Pat. 469,925, March 21, 1914. Under Int. Conv., March 25, 1913.

CELLULOSE esters are incorporated by the aid of solvents with coumarone resin consisting of the resinous products formed by the polymerisation of coumarone and indene in the refining of coal-tar oils. Example:—200 grms. of coumarone resin are dissolved in a mixture of 100 grms. each of ether, alcohol, and benzene, and 700 grms. of nitrocellulose are incorporated with the solution in a manner similar to that employed in the manufacture of plastic masses containing camphor.

—J. F. B.

Cellulose; Manufacture of lustrous threads of—P. Joliot. Fr. Pat. 470,141, March 25, 1914.

CELLULOSE yarns are converted into alkali-cellulose and exposed *in vacuo* to the action of carbon bisulphide vapour; the threads are then stretched to their original length and the xanthogenate is decomposed by the usual methods. The regenerated cellulose is purified by treatment in a bath of sodium sulphide at about 70° C. The lustre of the threads may be increased by repeating the series of treatments.—J. F. B.

Paper having relief-like effects; Manufacture on the paper-machine of—Farbwerke vorm. Meister, Lucius, und Brüning. Fr. Pat. 469,358, March 6, 1914. Under Int. Conv., April 18, 1913.

THE wet web of paper on the machine wire, on which relief effects have been produced, e.g. mechanically according to Eng. Pat. 10,529 of 1908 (this J., 1908, 1130), is sprayed from above with dilute solutions of colouring matters, which may consist of the coloured backwaters which have already drained through the wire, or of solutions of different colours, specially prepared, which may contain coloured fibres, mica, etc., in suspension. These liquids settle in the hollows of the relief and produce deeper or different colours in the pattern.—J. F. B.

Sulphite cellulose waste lye; Treatment [alcoholic fermentation] of—G. T. Onsager, Drammen, Norway. Eng. Pat. 24,738, Oct. 30, 1913.

THE waste lye is subjected to alcoholic fermentation in presence of a yeast nutrient derived from milk sugar and made, for example, in the following manner:—1 litre of the lye, mixed with 1 litre of skimmed milk, is slightly acidified with sulphuric acid and heated to about 50° C.; the precipitate of casein and lignin compound is removed by filtration and the filtrate mixed with 299 litres of the waste lye. The mixture is boiled until about $\frac{1}{4}$ of its volume has evaporated and the milk sugar is hydrolysed; the liquor is then neutralised with calcium carbonate, cooled to 28° C. and sown with waste brewer's yeast in the proportion of about 400 c.c. per 100 litres.—J. F. B.

Balloon fabric and the like. B. J. D. Porritt, Assignor to North British Rubber Co., Ltd., Edinburgh. U.S. Pat. 1,118,149, Nov. 24, 1914. Date of appl., Feb. 11, 1913.

SEE Eng. Pat. 1972 of 1913; this J., 1914, 132.
—T. F. B.

Artificial thread; Manufacture of—J. C. Hartogs, Amsterdam, Assignor to N. V. Nederlandsche Kunstzijdefabriek, Vosdijk Arnhem, Netherlands. U.S. Pat. 1,119,155, Dec. 1, 1914. Date of appl., July 26, 1911.

SEE Ger. Pat. 237,744 of 1910; this J., 1911, 1249.
—T. F. B.

Textile fibres; Process of softening—C. Marx, Lambrecht, Germany. U.S. Pat. 1,120,730, Dec. 15, 1914. Date of appl., June 3, 1910.

SEE Eng. Pat. 8523 of 1910; this J., 1911, 614.
—T. F. B.

Peel, wood-waste, and other vegetable substances suitable for the manufacture of paper pulp; Process for rendering—W. Hellwig, Münsterfeld, Germany. U.S. Pat. 1,121,099, Dec. 15, 1914. Date of appl., Dec. 16, 1912.

SEE Eng. Pat. 28,489 of 1911; this J., 1912, 1075.
—T. F. B.

Regeneration of impure benzene. Fr. Pat. 469,490. See IIA.

Manufacture of fodder from waste sulphite cellulose-lyes. Fr. Pat. 469,768. See XIXA.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Skins; Preparation and dyeing of—F. König. Z. angew. Chem., 1914, 27, 529–532.

A GENERAL account of the dyeing of fur skins, describing the use of both natural and artificial dyestuffs.—F. C. T.

PATENTS.

Bleaching, disinfecting, deodorising, or preserving agent; [Electrolytically] producing a—J. T. Niblett, Denmark Hill. Eng. Pat. 26,726, Nov. 20, 1913.

A CLOSED electrolytic chamber is connected with a fan or blower, and air charged with the gases liberated during electrolysis (of a halogen compound or potassium disulphide) is passed through a heater or cooler, and then through a drying chamber before being passed into the closed chamber containing the material to be treated.
—B. N.

Bleaching vegetable or animal textile fibres in a spun, woven, or other suitable form; Use of ultra-violet rays for—J. L. Pech. Fr. Pat. 469,300, Feb. 17, 1914.

THE moistened fibres, in contact with air, are exposed to ultra-violet rays produced artificially.
—B. N.

Mercerising cotton; Process of—, which gives a very regular mercerisation without preliminary boiling of the fibre. G. Boudin. Fr. Pat. 469,242, May 14, 1913.

RAW cotton or other vegetable fibre is treated, without preliminary boiling, with caustic soda to which has been added a certain quantity of alcohol, oil of turpentine, benzene, or other suitable hydrocarbon.—B. N.

Dyeing and like machinery; Compact—J., T., and E. Brandwood, Bury, Lancs. Eng. Pat. 17,219, July 21, 1914.

THE apparatus comprises a dyeing chamber, with two turbine pumps in communication with it and also connected by pipes with a reserve tank for the dye-liquor. The pumps are driven alternately by a common motor.—B. N.

Dyeing and like apparatus; Perforated beams for — J., T., and E. Brandwood, Bury, Lanes.
Eng. Pat. 17,355, July 22, 1914.

THE perforated beam, on which the yarns are dyed, is provided with iron flanges at each end, each flange being faced on its inner surface with a thin covering plate of nickel, ebonite, etc., of smaller diameter than the flange. The edges of the facing are spun or pressed over into contact with the iron foundation, so as to form fluid-tight joints.
—B. N.

Dyeing vegetable fabrics; Process of lisleing and — A. N. Dubois, Philadelphia, Pa. U.S. Pat. 1,116,397, Nov. 10, 1914. Date of appl. Dec. 2, 1909.

THE material is boiled sufficiently to render it absorbent, washed, hydro-extracted, saturated with a carbonising solution containing alum, starch, hydrochloric acid, and iron sulphate for 15 to 20 minutes, and afterwards again hydro-extracted so as to leave in the material solution equal to 50 to 60% of the dry weight of the goods. It is then subjected to heat and attrition at 110° to 120° F. (43° to 49° C.), until the surface has the desired lisle-thread finish, treated with a neutralising, dyeing and fixing solution, washed, hydro-extracted, and dried.—B. N.

Dyeing hanks, notably of silk; Tissue-envelope for — R. von der Linde. Fr. Pat. 469,795, Feb. 28, 1914.

THE envelope is formed of a material with a large mesh, strengthened on its longitudinal or transverse edges or at other points by bands of suitable material offering a great resistance to movements during dyeing. The bands are furnished with pressure studs as a convenient mode of fastening.
—B. N.

Aniline Black; Production of ungreenable — E. Grandmougin and E. Havas. Ger. Pat. 275,845, May 10, 1913.

THE mineral acid used in the ordinary Aniline Black process is partly replaced by a strong organic acid (e.g., lactic, formic, or glycollic acid), and the colour is developed by steaming. The following quantities are given for use in cotton printing: 700 grms. of starch-tragacanth thickening, 45 grms. of aniline salt, and 30 grms. of potassium ferrocyanide are dissolved in water, 35 grms. of sodium chlorate and 80 c.c. of water are added and then 55 grms. of aniline and 55 grms. of 50% lactic acid; this mixture is printed on the fabric which is then dried, steamed in the Mather-Platt, rinsed, and soaped.—T. F. B.

Vegetable fibre effects; Manufacture of tissues of all kinds, dyed in the piece, with — P. Caminada and P. Ruggeri. Fr. Pat. 469,250, March 4, 1914. Under Int. Conv., March 18, 1913.

THE fibres are treated, before weaving, with a mixture of 15 parts of nitric acid (sp. gr. 1.5) and 85 parts of sulphuric acid (sp. gr. 1.84), washed, dried, passed through a bath of 20% calcium acetate and 15% albumin, dried, then treated in a solution of sodium stannate (sp. gr. 1.116), dried, and finally passed through a 10% solution of ammonium chloride. The prepared fibres do not take the dyestuff when dyed in the piece.—B. N.

Printing; Producing woven effects by — Soc. des Manufactures N. N. Konchine. Fr. Pat. 469,371, March 7, 1914.

CELLULOSE and its derivatives, dissolved in suitable solvents, are printed on the tissue by means of an

engraved roller, and a precipitating liquid for the cellulose is delivered on to the roller.—B. N.

Dyeing of fabrics and fibres with Aniline Black by oxidation in the air. H. Fletcher, Thaon-les-Vosges, Assignor to A. E. Vergé, Vincennes France. U.S. Pat. 1,119,075, Dec. 1, 1914. Date of appl., Aug. 20, 1913.

SEE Eng. Pat. 18,246 of 1913; this J., 1914, 747.
—T. F. B.

Gallocyanines and their leuco derivatives on cotton fabrics; Process for applying a reserve for — Manuf. de Mat. Col. anc. L. Durand, Huguenin et Cie. Fr. Pat. 469,960, March 21, 1914. Under Int. Conv., May 2, 1913.

SEE Ger. Pat. 269,933 of 1913; this J., 1914, 418.
—T. F. B.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Polash salts; Working up of the materials obtained by the electrolysis of the residual liquors from the manufacture of — Dietz. Z. angew. Chem., 1914, 27, 569—572.

BESIDES bromine and hydrogen there are obtained at the anode chlorine, on the cathode an incrustation of magnesium hydroxide, and in the cathode compartment a precipitate of magnesium oxychloride. The incrustation is preferably treated separately from the precipitate, and by washing and heating may be profitably converted into oxide or hydroxide free from chlorine. The oxychloride may be treated by the Leopoldshall process with steam to produce magnesia and hydrochloric acid; but preferably it is centrifuged and ignited to anhydrous oxychloride, $MgCl_2 \cdot 6MgO$, which is used as magnesia cement. The chlorine may be converted into hydrochloric acid either by decomposing the chlorides of zinc or aluminium with steam, and then regenerating the chloride by passing chlorine and hydrogen over the hydroxide thus formed (Hoppe, Fr. Pat. 352,419; this J., 1905, 925), by Patacky's method (Ger. Pat. 114,129; see Eng. Pat. 1831 of 1900, this J., 1900, 349), or by Nagel's method (this J., 1912, 126). Preference is given to the first-named process.—G. F. M.

Potassium permanganate; Notes on the use of — as cyanide in sand-fitting solutions. R. A. Cooper. J. Chem., Met., and Min. Soc., S. Africa, 1914, 15, 70—72.

TESTS were made of the action of potassium permanganate on normal solution from sand-filling plant containing 0.0013% KCN and 0.0015% KCNS, and on solutions of sodium cyanide (strength equivalent to 0.002% KCN), sodium thiocyanate (0.002% KCN), and sodium-zinc cyanide (0.002% KCN) respectively. The first three solutions were considerably affected by the permanganate, but the reaction was still incomplete after four days. The sodium-zinc cyanide, which is present in large proportion in working solutions, appeared to be only slightly, if at all, affected by the permanganate after four days contact.—T. St.

Cyanide mud; Critical investigation of the methods for the determination of Prussian blue in — G. Anderson. Z. angew. Chem., 1914, 27, 532—535.

THE methods of Bueb (Bunte, "Zum Gaskursus," 1912), Drehschmidt (J. Gasbeleucht., 1892, 225)

and Feld-Witzcek (this J., 1904, 728) were investigated. The chief disadvantage of the first method is the lack of a sharp end-point in the titration of ferrocyanide with zinc sulphate. Dilution or the addition of sulphuric acid causes differences in the titration results. The Drehschmidt method proved to be the least accurate of the three. The use of mercurous nitrate to remove chlorine is not satisfactory. The Feld-Witzcek method is rapid and reliable; the author has used it for two years and found it satisfactory. The Bueb method gives rather lower results than the others.

—F. C. T.

Limestone; Production and uses of—in U.S.A. E. C. Eckel. Eng. and Min. J., 1914, 98, 899.

The consumption of limestone in the United States in 1912 and 1913 was:—

Used for	Million short tons.	
	1912.	1913.
Road metal, ballast, concrete	33.1	35.2
Blast-furnace flux	22.6	25.3
Portland cement manufacture	18.5	20.7
Lime-burning	6.3	6.4
Building and paving stones	3.7	3.3
Sold crude, chiefly for lime-burning	2.0	2.0
Natural cement manufacture	0.15	0.13
Total output	86.4	93.1

—O. E. M.

Barium cyanide; Action of steam on—, L. Rolla. *Annali Chim. Appl.*, 1914, 2, 301—304.

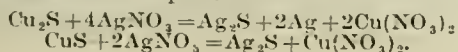
ONE of the processes suggested for the fixation of atmospheric nitrogen consists in passing air over a mixture of barium oxide and carbon heated to above 1000° C., and decomposing the resulting mixture of barium cyanide and cyanamide with steam to obtain ammonia. To ascertain the character of the combustible gases produced in the second stage of the process, pure barium cyanide was heated in nitrogen to various temperatures and then treated with steam, and the products analysed. In the following tables the quantities of the different gases are given in c.c. per grm. of ammonia produced:—

Temperature.	CO	H ₂	CH ₄	CO ₂
°C.				
100	306.2	—	—	—
150	341.4	—	—	—
200	459.2	—	—	—
250	271.5	903.6	—	58.9
300	289.4	1118.5	—	74.7
350	200.1	398.9	211.1	59.4
370	165.0	701.6	400.8	65.4
400	179.7	994.3	—	88.8
450	214.0	1084.6	—	86.1
500	221.5	1153.6	—	94.2

Gas of the maximum calorific value is thus produced between 300° and 400° C. Probably barium formate is formed as intermediate product of the reaction and is decomposed in various ways according to the conditions.—A. S.

Cuprous and cupric sulphides; Determination of—in mixtures of one another. E. Posnjak. J. Amer. Chem. Soc., 1914, 36, 2475—2479.

The substance (0.4—0.5 grm.) ground to pass a 200-mesh sieve is heated with 50 c.c. of 5% silver nitrate solution for about 3 hrs. on the steam bath with frequent vigorous stirring. The following reactions take place:—



The resulting mixture of silver and silver sulphide is filtered off, washed free from silver nitrate, and metallic silver extracted by treating two or three times with 40—50 c.c. of 5% solution of ferric nitrate (anhydrous) at about 70° C., and the silver in the solution and in the residue determined. The amount of cuprous sulphide can then be calculated from the amount of silver formed, and the cupric sulphide from the difference between the silver as sulphide and metallic silver. The method is accurate in mixtures of all proportions to within 1.5%.—R. G. P.

Tungstic acid; Modifications of the reduction test for—, G. Torossian. *Amer. J. Sci.*, 1914, 38, 537—538.

THE tests for tungstic acid in solutions with zinc, tin, or aluminium in presence of hydrochloric acid, are made more sensitive by using the substance to be tested in solid form. If the dry or moistened substance be rubbed with a piece of iron or aluminium, a blue coating appears on the metal if no strong oxidising agents are present. The test fails in the presence of chromates, chlorates, or nitrates. Several modifications of the acid test are described, the following being recommended: (a) The powdered substance is placed on aluminium foil, moistened with water and a drop of hydrochloric acid added. The blue colour is developed even in the presence of oxidising agents. (b) A globule of water is placed on aluminium foil, the powdered substance is sprinkled upon it, and a small drop of hydrochloric acid added. The production of the blue colour is not prevented by carbonaceous matter, metallic oxides, sulphur, or calcium fluoride.—W. F. F.

Sodium nitrate. Shipments and consumption from 1912 to 1914. W. Montgomery and Co. Dec. 31, 1914.

12 months ending Dec. 31st.	1912.	1913.	1914.
	Tons.	Tons.	Tons.
Shipments from South American Ports to all parts	2,456,000	2,647,000	2,660,000
Consumption in U.K.	132,000	125,000	122,000
Consumption in Continent ..	*1,711,000	*1,689,000	*1,568,000
Consumption in United States	503,000	583,000	553,000
Consumption in other Countries	*114,000	*86,000	*90,000
Consumption in the world ..	2,460,000	2,451,000	2,633,000

* Egypt, which has hitherto been included in "Other Countries" is now included in figures for the Continent.

Ammonium chloride as a by-product of coke-ovens, gas-works, etc. Strommenger. See IIA.

PATENTS.

Ammonia from its elements; Catalytic manufacture of—, Badische Anilin und Soda Fabrik. Ger. Pat. 276,133, Nov. 30, 1912. Addition to Ger. Pat. 249,117.

IN processes for the catalytic production of ammonia, in which the catalyst consists of a contact metal and an "activator," one of which absorbs hydrogen and the other nitrogen, it is possible to minimise, or even to eliminate the influence of contact poisons by working at a comparatively low temperature. Thus, when a mixture of reduced iron with 5% of aluminium borate is used as catalyst, satisfactory yields of ammonia are obtained at about 500° C., whilst with aluminium phosphate about 450° C. is suitable; in this latter case, the "poisonous" effect of the phosphorus is not apparent much below 600° C.—T. F. B.

Ammonia obtained from cyanamide; Catalytic oxidation of—by means of air or other gas containing oxygen. Oesterr. Verein f. Chem. u. Metall. Produktion. Ger. Pat. 276,720, Nov. 8, 1913.

THE crude ammonia obtained from cyanamide is washed with an alkali or alkaline-earth hydroxide. This removes from it the silicious dust and also the hydrides of silicon and phosphorus and acetylene, which are decomposed during the catalytic oxidation and thus act as contact poisons.—T. P. R.

Cyanides and other useful products [calcium cyanamide]; Manufacture of—. C. White, London. Eng. Pat. 17,937. Aug. 6, 1913.

A MIXTURE of calcium carbide with not less than 25% of sodium or potassium chloride or carbonate, or of a mixture of these, is heated in a current of nitrogen, and the reaction mass, containing alkali cyanide and calcium cyanamide, is lixiviated, the residual cyanamide being pressed and dried, preferably at a low temperature, or heated in a current of steam to produce ammonia. For example, nitrogen is passed for 12–24 hours, at 10 lb. above atmospheric pressure, over a mixture of carbide (14 parts) and dry sodium chloride (20 parts), heated to 750°–900° C.—F. SODX.

Sulphurous anhydride and carbonic anhydride; Apparatus for the purification of gases rich in—. L. P. Basset. Montmorency, France. Eng. Pat. 20,667, Sept. 12, 1913.

THE gases pass successively through a dust chamber, the tubes of a boiler, a washer, and a scrubber in which the sulphur dioxide or carbon dioxide is absorbed by sprayed water or other liquid and from which the liquor passes into the boiler, where it serves to cool the gases passing through the boiler-tubes, whilst at the same time the dissolved gas is expelled. A heat-exchange apparatus heats the liquor on its way to the boiler and cools the returning liquor before this passes to the reservoir to be pumped back to the top of the scrubber. A separate small quantity of water is circulated repeatedly through the washer, so that little gas is absorbed at this stage. A coiled tube in the dust chamber may serve to heat air, which is then used to regulate the atmosphere of the furnace in which the gases are produced.—F. SODX.

Sulphur; Process and apparatus for the commercial extraction of— from gases rich in sulphurous anhydride. L. P. Basset, Montmorency, France. Eng. Pat. 20,716, Sept. 13, 1913.

THE gases, previously purified and freed from dust, are passed into a column containing incandescent coke, and the resulting mixture of carbon bisulphide, oxysulphide, and monoxide is then oxidised to sulphur and carbon dioxide in a second chamber, contiguous to and heated by the first, by treatment with an excess of sulphur dioxide admitted through a separate conduit. The second chamber is fitted with baffles, and the desired temperature is maintained in both chambers by lagging the sides and, if necessary, preheating the gases.—F. SODX.

Molybdenum trioxide from ores and concentrates; Process for recovering—. F. D. S. Robertson. Glasgow. Eng. Pat. 28,069, Dec. 5, 1913.

THE crushed material is heated, e.g., in a rotary furnace, in a highly oxidising atmosphere, preferably of air and steam, so as to produce molybdenum trioxide which is collected as a crystalline sublimate. The process may be accelerated in some cases by mixing crushed quartz or sand with the charge or, especially with pyritic ores, by adding

lime which also combines with the sulphur separated; it may be repeated if further purification be desired.—F. SODX.

Rare earths, together with thorium, cerium, and zirconium; Method of separating—, by electrolysis. L. M. Dennis, Ithaca, N.Y. U.S. Pat. 1,115,513, Nov. 3, 1914. Date of appl., Sept. 18, 1913.

RARE-EARTH metals are separated as insoluble compounds, from solutions containing them, by electrolytic precipitation under conditions which tend to prevent the formation of an adherent deposit of electropositive products on the cathode. Fractional separation is effected by adjusting the voltage.—F. SODX.

Zeolites; Process of producing reactive—. T. R. Duggan. Assignor to The Permutit Co., New York. U.S. Pat. 1,116,038. Nov. 3, 1914. Date of appl., July 12, 1913.

A FUSED vitreous melt comprising alumina, silica, potash, and soda (the last two approximately in the ratio 1:5) is granulated, preferably to a size between 1.5 and 9 mm. diameter, treated with water to extract alkalis, and crushed to material of about a 2 mm. mesh. Or, the melt is crushed to the first size given, treated with hot water to destroy its vitreous character, and then re-crushed, washed, and dried.—F. SODX.

Algae; Process for utilising marine—. Norsk Tangsyndikat. Fr. Pat. 469,190. Feb. 27, 1914. Under Int. Conv., March 1, 1913.

MARINE algae are lixiviated with water on the counter-current principle, and the solution is evaporated under reduced pressure, yielding a residue containing iodine and magnesium compounds, mannitol, mucous substances, and "kretine."—F. C. T.

Iodine and by-products or fertilisers; Treatment of seaweed to obtain—. H. E. J. Roussel and L. J. C. C. Thévenin. Fr. Pat. 469,324. May 16, 1913.

THE seaweed is burnt in a pit or furnace provided with a channel, covered with metal plates on which wet weed is dried, and volatile compounds deposited in the channel are recovered. The ash or kelp obtained is systematically extracted with hot water, from which salts are deposited on cooling, and the mother liquors are treated with sulphuric acid saturated with nitrous acid, and the mixture agitated until all the iodine is precipitated.—W. C. H.

Hydrogen or gaseous mixtures containing it; Process for promoting the reaction of— under pressure and at high temperatures. Centralstelle für wissenschaftlich-technische Untersuchungen G. m. b. H. Fr. Pat. 469,391 and First Addition thereto. March 7, 1914. Under Int. Conv., April 18 and Nov. 12, 1913.

REACTIONS in which hydrogen is involved under pressure and at high temperatures are carried out in an apparatus comprising an exterior (metallic) receiver, capable of supporting the pressure, and an interior receiver (e.g., of glazed porcelain, glass, quartz, etc.), capable of resisting the chemical action and the diffusion of the hydrogen. Or, the reaction is allowed to take place in an inner metallic or non-metallic porous receiver which is separated from the outer wall, supporting the pressure, by an alloy or composition capable of resisting the chemical action and diffusion of the hydrogen. The process is applicable to the synthesis of ammonia.—W. C. H.

Air into oxygen and nitrogen; Process for decomposing——. H. Runge. Fr. Pat. 469,793. Feb. 19, 1914.

To obtain an increased yield of oxygen, the air is dialysed, by aspiration through a suitable membrane, before being brought into the liquefying and rectifying plant.—W. C. H.

Ammonia-soda process. A. Clemm, Mannheim, Germany. U.S. Pat. 1,118,332, Nov. 24, 1914. Date of appl., July 24, 1913.

SEE Eng. Pat. 16,470 of 1913; this J., 1913, 1066.—T. F. B.

Ammonia; Producing——. C. Bosch and A. Mittasch, Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 1,118,628, Nov. 24, 1914. Date of appl., Aug. 16, 1912.

SEE Addition of May 21, 1912, to Fr. Pat. 425,099; this J., 1912, 1125.—T. F. B.

Ammonia; Method for the preparation of—— from the elements. M. Pier, Zehlendorf-Berlin, Assignor to Dynamit A.-G., Hamburg, Germany. U.S. Pat. 1,119,534, Dec. 1, 1914. Date of appl., Oct. 5, 1912.

SEE Ger. Pat. 252,997 of 1912; this J., 1912, 1178.—T. F. B.

Ammoniacal liquor from gas works; Process for treating——. Berlin-Anhaltische Maschinenbau-A.-G. Fr. Pat. 470,117, Feb. 28, 1914. Under Int. Conv., May 9, 1913.

SEE Ger. Pat. 269,658 of 1913; this J., 1914, 685.—T. F. B.

Molybdenum [as trioxide]; Process for recovering—— from its ores and concentrates. F. D. S. Robertson, Toronto, Assignor to M. J. O'Brien, Renfrew, Ont. U.S. Pat. 1,118,150, Nov. 24, 1914. Date of appl., Nov. 14, 1913.

SEE Eng. Pat. 28,069 of 1913; preceding.—T. F. B.

Zinc oxide; Process of producing pure——. H. W. de Stucklé, Paris. U.S. Pat. 1,118,894, Nov. 24, 1914. Date of appl., Feb. 18, 1914.

SEE Fr. Pat. 465,816 of 1913; this J., 1914, 599.—T. F. B.

Alumino-silicates; Process of producing——. R. Gans, Grünewald, Assignor to Permutit-Akt-Ges., Berlin. U.S. Pat. 1,121,490, Dec. 15, 1914. Date of Appl., Oct. 16, 1913.

SEE Fr. Pat. 467,038 of 1914; this J., 1914, 865.—T. F. B.

Liquids which contain colloidal silicic acid as an impurity; Process for purifying——. H. W. de Stucklé, Paris. U.S. Pat. 1,118,895, Nov. 24, 1914. Date of appl., Feb. 18, 1914.

SEE Fr. Pat. 465,817 of 1913; this J., 1914, 645.—T. F. B.

Oxide of tin; Process of making pure——. G. Spitz, Brünn, Austria-Hungary, Assignor to Goldschmidt Detinning Co., New York. U.S. Pat. 1,119,547, Dec. 1, 1914. Date of appl., Nov. 6, 1909.

SEE Eng. Pat. 28,565 of 1908; this J., 1910, 352.—T. F. B.

Radiothorium; Process for extracting——. O. Knöfler und Co. Fr. Pat. 469,561, May 24, 1913. SEE U.S. Pat. 1,076,141 of 1913; this J., 1913, 1116.—T. F. B.

Electrolysis and treatment of sulphate solutions; Process for the——. Chance and Hunt, Ltd. Fr. Pat. 469,730, March 17, 1914. Under Int. Conv., May 19, 1913.

SEE Eng. Pats. 11,634 of 1913 and 2952 of 1914; this J., 1914, 692.—T. F. B.

Hydrogen; Process of producing——. B. Spitzer, Berlin-Wilmersdorf, Assignor to Berlin-Anhaltische Maschinenbau A.-G., Berlin. U.S. Pat. 1,118,595, Nov. 24, 1914. Date of appl., March 12, 1914.

SEE Eng. Pat. 6155 of 1914; this J., 1914, 920.—T. F. B.

Hydrogen; Process for making——. L'Hydrogène Soc. Anon. Fr. Pat. 469,489, March 11, 1914. Under Int. Conv., March 12, 1913.

SEE Eng. Pat. 6155 of 1911; this J., 1914, 920.—T. F. B.

Hydrogen; Process of producing the materials for generating——. S. Uyeno, Tokyo. U.S. Pat. 1,120,768, Dec. 15, 1914. Date of appl., June 4, 1912.

SEE Eng. Pat. 11,838 of 1912; this J., 1913, 289.—T. F. B.

Hydrogen; Manufacture of—— by partial liquefaction of water-gas. L'Air Liquide (Soc. Anon. pour l'Etude et l'Exploit. des Proc. G. Claude). Fr. Pat. 469,854, May 29, 1913.

SEE Eng. Pat. 13,160 of 1914; this J., 1914, 1149.—T. F. B.

Oxygen; Separation of—— from the air. L. Bergfeld, Durlach, Germany. U.S. Pat. 1,120,436, Dec. 8, 1914. Date of appl., Sept. 30, 1913.

SEE Eng. Pat. 21,211 of 1913; this J., 1914, 831.—T. F. B.

Nitrogen; Process for fixing—— by means of ferro-aluminium. Soc. Générale des Nitrures. Fr. Pat. 470,099, June 7, 1913.

SEE Eng. Pat. 27,030 of 1913; this J., 1914, 519.—T. F. B.

VIII.—GLASS; CERAMICS.

Ceramic industry; New technical methods in the——. R. Dietz. Z. angew. Chem., 1914, 27, 494—497.

A BRIEF survey of recent improvements. Amongst raw materials, geyserite and quartzspar have been found in large quantities in Germany, and are being worked in order to replace the supplies from New Zealand and Yellowstone Park (U.S.A.) in the first case, and from Norway in the second. Geyserite, pearl-sinter, or sand-sinter, from Taunus contains 99.25% SiO_2 . Quartzspar from Zobten consists of felspar 66.96, quartz 25.28, and clay-substance 7.76%. Mined from a biotite-granite, it contains some iron which is, however, not deleterious in an oxidising fire. Another substance used as a flux is artificial sodium silicofluoride. In the preparation of raw materials, grading is effected by pneumatic separators. Clay is purified from iron by treatment with small quantities of cold hydrosulphurous acid, instead of by larger quantities of hot hydrochloric or sulphurous acid. Electro-osmosis is also employed for the purification of clay. The casting process has been so improved that it can be used for the thinnest porcelain or

the thickest lavatory basins. By the use of gas-firing a stoneware kiln capable of holding goods to the value of £400 may be fired for less than £10. The Faugeron and Dressler tunnel-kilns are noticed. Serapis faience is an underglaze treatment of stoneware and similar bodies. Gold and platinum are being increasingly used for lilac and red colours. In connection with factory hygiene, Eckstein's radiators for heating and ventilating are described (Ger. Pat. 202,846 of 1907).

—H. H. S.

PATENTS.

Ceramic substances : Process to lower the vitrifying-point of —. B. Schwerin, Assignor to Ges. f. Elektro-Osmose m. b. H., Frankfort, Germany. U.S. Pat. 1,121,408, Dec. 15, 1914. Date of appl., Feb. 29, 1913.

SEE Addition of June 22, 1912, to Fr. Pat. 426,072 of 1911; this J., 1912, 1180.—T. F. B.

Fittering medium [tile]. U.S. Pat. 1,117,601. See I.

IX.—BUILDING MATERIALS.

Lime mortar : Strength of —. W. E. Emley and S. E. Young. Amer. Soc. Testing Materials, June 30—July 3, 1914. [Advance proof] pp. 21.

A LARGE number of cubes, briquettes, and bars were made from different sand-lime mortars under conditions as uniform as possible, and the effect of the following factors on the compressive and tensile strengths of the specimens were observed : age ; size and shape of specimens ; proportion of sand ; consistence of mortars ; condition of atmosphere as regards temperature, CO₂-content, and humidity ; and chemical composition of the lime. The shearing strengths were compared by the use of a special instrument, adapted to grip a bar at both ends, whilst the part of the bar between the supports was sheared out by an equally distributed load. The results indicated that the strength of lime mortar was affected by too many variables to be capable of accurate measurement, and that no definite relation between the strength as measured in the laboratory, and that which might be expected in practice, could be established.—O. R.

Cement : Errors in the methods of determining the time of setting of —. G. M. Williams. Amer. Soc. Testing Materials, 1914, 14. [Reprint.] pp. 22.

IN tests made according to both Vicat's and Gillmore's methods, the results were found to be affected very considerably by the amount of work done on the material in the process of gauging, the humidity, and the temperature of the atmosphere during the setting period. Neither method yielded results which were sufficiently consistent and accurate for use as standards, except in the case of slow-setting cements.—O. R.

Portland cement : Results obtained with the autoclave test for —. H. J. Force. Amer. Soc. Testing Mats., 1914. 6 pp. [Advance proof.]

NEAT cement even after exposure to the atmosphere for 18 months did not, in many cases, become sufficiently seasoned to pass the autoclave test, although showing considerable improvement in tensile strength. Most [American] cements, however, now show a tensile strength of 200—300 lb. per sq. in. with the autoclave test, whereas 2 or 3 years ago the majority exhibited little or no

cohesion, many disintegrating entirely. An initially good tensile strength is always maintained. Results of tests are given in tables and curves. —F. SODN.

Portland cement concrete : Proportioning aggregates for —. A. Moyer. Proc. Amer. Soc. Testing Mats., 1914, 14. 12 pp. [Reprint.]

THE ingredients are mixed in proportion to give maximum density, which the author considers necessary for securing maximum strength in the concrete. Thus, sand and cement mortar is made so that the voids in the sand (determined directly by mixing sand and water in known volumes) are completely filled with cement paste, every cubic foot of which requires 110 lb. of cement, and when stones of two sizes are used for the coarser aggregate, they are mixed in such proportion that a minimum volume is produced for a given combined volume before mixing. A table is given showing the percentage of voids in crushed stone (from material of 9 specific gravities, from 2.70 to 3.25) for a series of weights per cu. ft. ranging, in each case, from 80 to 124 lb., and another table showing the proportions of stone and mortar, for 11 different sand : cement ratios, necessary to give the densest concrete, when the coarse aggregate contains 27—54% of voids.—F. SODN.

Concrete aggregates : Testing —. C. M. Chapman. Amer. Soc. Testing Materials, 1914. 6 pp. [Advance proof.]

SPECIMENS (6 in. cylinders or 2 in. cubes) are built up from the coarse aggregate previously coated with a cement grout, a sufficiently fluid standardised grout is poured in to fill completely the voids in the skeleton structure, and, after ageing, the specimens are tested by crushing. Results are given showing that one stone may produce concrete 50—100% stronger than another, with the same proportion of the same sand and cement, the strongest concrete recorded being made from a light, porous material having a comparatively low crushing strength and a high percentage of voids. —F. SODN.

Rock asphalts of Oklahoma and their use in paving. L. C. Snider. Petroleum, 1914, 9, 974—976.

THE rock asphalts of Oklahoma contain 3—12% of bitumen and occur in deposits which are estimated, in some cases, to be capable of yielding 2.25—13.5 million tons of material suitable for paving. The proportion of bitumen is smaller than in "sheet-pavement" (an artificial mixture of sand, stone-dust, and bitumen), but the bitumen in the rock asphalt is not inferior in quality, and paving produced by rolling the heated material has proved superior to sheet-pavement in resisting penetration by traffic in hot weather.—F. SODN.

Bituminous binders : Cementing value of —. L. Kirschbraun. J. Ind. Eng. Chem., 1914, 6, 976—985.

THE cementing value of a binder is directly proportional to the work done in producing fracture or failure of a given unit of material. An apparatus is described by means of which strain is applied to a test-briquette of the material by a dynamometer travelling at an uniform speed, and the strain and elongation are measured. The briquette is drawn out until finally it either breaks, or the rate of elongation becomes higher than the rate of travel of the dynamometer, so that the values recorded by the latter pass through a maximum and then return to zero. Results obtained by the method with different materials are given in tables and diagrams. The cementing value is represented by the area enclosed by a curve plotted with

amounts of elongation as abscissæ and the values for the strain as ordinates; but the values for the elongation and the maximum strain must also be taken into account separately in estimating the value of a given material. In the case of bitumen for sheet asphalt pavements, it is recommended that when tested by the author's method, the minimum cementing value should be 0.08 kilogram-metre for light and 0.24 kilogram-metre for heavy traffic, with elongations of 8—14 cm. and 4—6 cm. respectively.—A. S.

Production and uses of limestone in U.S.A. Eckel. See VII.

PATENTS.

Magnesium chloride composition and process of making the same; Dry—. L. H. Reuter, Berkeley, Cal. U.S. Pat. 1,117,443, Nov. 17, 1914. Date of appl., July 7, 1908.

MAGNESIUM sulphate (5 parts) is added to a dehydrated composition containing magnesium chloride and carbonate (preferably 100 and 20 parts respectively), the mixture is heated, calcined magnesite (over 250 parts) added, and the heating continued at a higher temperature. Or, a mixture of magnesium chloride and ground magnesite is evaporated practically to dryness, dry magnesium sulphate added (in amount at least sufficient to convert calcium hydroxide or oxide contained in the magnesite into sulphate), and the mixture is dehydrated by heating to a higher temperature and incorporated with calcined magnesite. The product is packed in air-tight containers.—F. SODN.

Lime mortars, cements, etc., glazed or fire-enamelled, and their process of manufacture. A. Bigot. Fr. Pat. 469,397, May 19, 1913.

MIXTURES of ground sand, quartz, granite, felspar, earthenware debris, etc., suitably selected, and bound together by fat lime, hydraulic lime, or by cements, either pure or mixed with magnesia, alumina, aluminates, and iron oxide, are enamelled or glazed, like ordinary ceramic products, either after a preliminary (biscuit) firing or in the raw state after the application in that case of coarse grains of a suitable engobe.—W. C. H.

Wood; Bleaching—. A. Franck-Philipson. Fr. Pat. 469,296, Feb. 14, 1914. Under Int. Conv., Feb. 17, 1913.

SEE U.S. Pat. 1,068,580 of 1913; this J., 1913, 978.—T. F. B.

Wood or like fibrous material; Treatment of—. F. W. Golby, London. From L. S. Bache, Bound Brook, N.J., U.S.A. Eng. Pat. 21,417, Oct. 28, 1913.

SEE Fr. Pat. 464,791 of 1913; this J., 1914, 551.—T. F. B.

Cement; Process for lowering the temperature of burning and of manufacture of—. Brück, Kretschel und Co. Fr. Pat. 469,657, March 14, 1914. Under Int. Conv., March 16, 1913.

SEE Ger. Pat. 272,174 of 1913; this J., 1914, 551.—T. F. B.

Bricks from the incombustible constituents of house refuse; Process for making red—. G. Hildoux and J. Bernheim. Fr. Pat. 469,771, March 19, 1914. Under Int. Conv., March 22, 1913.

SEE Eng. Pat. 7002 of 1913; this J., 1914, 82.—T. F. B.

Process for utilising leather waste. Fr. Pat. 469,779. See XV.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Cast-iron car wheels; Standard specifications for—. Amer. Soc. Testing Materials. Year-book, 1914, 242—247.

As an example of suitable metal the following analysis is given:—C (graphitic) 2.90, C (combined) 0.60, Si 0.70, Mn 0.40, P 0.50, S 0.08%; some of the constituents may vary within considerable limits. The data as to weight and tests are:—

Wheel.	33 in. diam. Freight and Passenger cars.			36 in. diameter.	
	60,000 lb. capacity and less.	70,000 lb. capacity.	100,000 lb. capacity.	Passenger cars.	Locomotive tenders.
Kind of service					
Number	1	2	3	4	5
Weight (lb.) { Desired	600	650	700	700	750
{ Variation	2% either way.				
Height of drop (ft.) ..	9	12	12	12	12
Number of blows	10	10	12	12	14

For any single inspection and test, only wheels having three consecutive shrinkage numbers (submitted by the manufacturer) will be considered. Wheels tested must show soft, clean grey iron free from defects such as holes, containing slag or dirt, more than $\frac{1}{4}$ in. in diameter, honeycombing of iron in the hub, white iron in the plates or hub, or clear white iron around the anchors of chaplets at a greater distance than $\frac{1}{4}$ in. in any direction. The depth of the clear white iron must not be greater than $\frac{3}{8}$ in. at the throat and 1 in. at the middle of the tread, or less than $\frac{3}{8}$ in. at the throat or any part of the tread. The blending of the white iron with the grey iron behind must be without any distinct line of demarcation, and the iron must not have a mottled appearance in any part of the wheel at a greater distance than $1\frac{1}{2}$ in. from the tread or throat. The depth of chill, as regards each lot of 103 wheels, will be determined by inspection of three test wheels (all of which shall be broken for the purpose if necessary), and if one fails, all of the same shrinkage number in the lot shall be rejected, but the remainder may be re-offered in a subsequent lot. One of the test wheels, placed horizontally, flange downwards, on an anvil block (weighing not less than 1700 lb. and set on rubble masonry 2 ft. deep) having three supports not more than 5 in. wide for the flange to rest upon, shall be struck centrally upon the hub by a flat-bottomed weight of 200 lb. falling from the height indicated in the table; should the wheel be broken by a smaller number of blows than that shown in the table, the whole lot will be rejected. Each of the remaining test wheels shall be subjected to the following thermal test:—A channel, 4 in. deep and $1\frac{1}{2}$ in. wide at the centre of the tread shall be moulded with green sand around the wheel placed (at ordinary temperature) flange downwards in the sand, the clean tread

forming one side of the channel and the clean flange part of the bottom. The channel shall then be filled to the top with molten cast-iron, the latter being poured from one ladle without previous cooling or stirring and at such temperature as to form, when cold, a ring of solid metal, free from wrinkles or layers, around the wheel. Two minutes after the pouring has ceased, each wheel shall be examined, failure as regards this test being indicated by fracture or by the extension, through or into the tread, of any crack in the plates. The lot will be accepted only if both wheels pass the test; but if one fails, only those of the same shrinkage number in the lot will be rejected, and the remainder may be re-offered in a subsequent lot.—W. E. F. P.

Foundry pig iron: Standard specifications for —. Amer. Soc. Testing Materials. Year-book, 1914, 225—227.

To promote uniformity in grading, when any one or all of the constituents of pig iron are specified, the following percentages shall be used:—Si 1.00, 1.50, 2.00, 2.50, 3.00, 3.50 (0.25 allowed either way); S (max.), 0.04, 0.05, 0.06, 0.07, 0.08, 0.09, 0.10; total C (min.), 3.00, 3.20, 3.40, 3.60, 3.80; Mn, 0.20, 0.40, 0.60, 0.80, 1.00, 1.25, 1.50 (0.20 allowed either way); P, 0.20, 0.40, 0.60, 0.80, 1.00, 1.25, 1.50 (0.15 allowed either way). The standard methods of the American Foundrymen's Association shall be used for analysis, sulphur being determined gravimetrically unless otherwise specified. For market quotations a pig iron containing Si 2.00 (± 0.25) and S 0.05% (max.) shall be taken as the basis; and a table is suggested to be used for adjusting disputes between buyer and seller, based upon the agreed price for the basis metal and a constant differential to be determined at the time the contract is made.—W. E. F. P.

[Iron] locomotive cylinders: Standard specifications for —. Amer. Soc. Testing Materials. Year-book, 1914, 238—241.

THE cylinders shall be made from good quality close-grained grey iron cast in a dry mould. Drillings taken from the fractured ends of the transverse test bars shall contain P not more than 0.90 and S not more than 0.12%. Two arbitration test bars and one chill test shall be poured (in moulds of specified forms and dimensions) from each ladle of metal used for one or more cylinders. The arbitration test bars ($\frac{1}{8}$ in. smaller in diameter at the bottom than at the top), allowed to cool in the mould, shall have an average strength and deflection of not less than 3200 lb. and 0.09 in., respectively, when placed horizontally upon supports 12 in. apart and tested under a load applied centrally. The chill test bar, allowed to cool in the mould to a dark red (almost black) heat, then removed and quenched in water, shall, on being broken, show a fracture of close-grained, grey iron with a well defined border of white iron at the bottom; the depth of the latter shall not be less than $\frac{1}{16}$ in. as measured at the centre line.

—W. E. F. P.

Steel: Standard specifications for methods of chemical analysis for plain carbon —. Amer. Soc. Testing Materials. Year-book, 1914, 169—176 and 181—192.

Carbon is determined by direct combustion in oxygen at 950°—1100° C., the boat or container for the metal being lined with alundum (90-mesh or finer). The oxygen employed (of not less than 97% purity) is passed over a heated catalyst (e.g. CuO) and through a purifying train before use. The carbon dioxide produced is absorbed in potassium hydroxide or soda lime and weighed as

usual, or in a solution of barium hydroxide contained in a Meyer tube, the precipitated barium carbonate filtered off out of contact with the atmosphere, washed, dissolved in standard acid, and the excess of acid titrated with standard alkali; in the latter case no precautions are necessary to prevent access of water vapour or sulphur trioxide to the absorption tube.

Phosphorus. For routine work the steel is dissolved in nitric acid, potassium permanganate is added, then ammonium bisulphite to dissolve precipitated manganese oxide, the solution (at 80° C.) agitated with molybdate solution for 3—4 mins., the precipitate filtered off, dissolved in standard sodium hydroxide and titrated with standard nitric acid (see this J., 1912, 927).

Sulphur. In the oxidation method, the steel is dissolved in *aqua regia* and silica separated by two evaporations to dryness; the barium sulphate, precipitated by the addition of barium chloride to the cold hydrochloric acid solution, is allowed to stand for at least 24 hours, then filtered off, washed first with a hot solution containing 10 c.c. HCl and 1 grm. BaCl₂ per litre, until free from iron, and then with hot water. The washings are collected separately and evaporated to recover any dissolved barium sulphate. A blank determination is made on all the reagents used. In the evolution-titration method, 5 grms. of the steel are dissolved in 80 c.c. of hydrochloric acid (1:1) in a flask (480 c.c.) fitted with a stopper and thistle-funnel and having a straight side-tube with which is connected a vertical delivery tube extending to the bottom of a tall beaker containing 150 c.c. of water and 10 c.c. of ammoniacal cadmium chloride solution (CdCl₂, 10 grms., water 400 c.c., ammonia, sp. gr. 0.90, 600 c.c.). The flask and contents are heated until solution of the steel is complete, extremely slow or rapid evolution of gas being avoided, after which the solution is boiled for $\frac{1}{2}$ min.; the contents of the beaker are then acidified with 40 c.c. of hydrochloric acid (1:1), starch solution is added and the liquid titrated with a solution of potassium iodate (KIO₃, 1.116 grm., KI 12 grms., water 1000 c.c.) previously standardised against a steel of known sulphur content.

Silicon. The steel is dissolved in a mixture of nitric and sulphuric acids, or in the latter alone, the solution evaporated till sulphur trioxide is evolved and the operation concluded as usual, the silica obtained being evaporated with hydrofluoric acid. A blank determination is made on the reagents employed.

Copper. Solution is effected in sulphuric acid (1:4), the liquid diluted, heated, saturated with hydrogen sulphide, filtered, and the precipitate washed with 1% sulphuric acid containing hydrogen sulphide until free from iron; the filter and contents are incinerated, the residue fused with sodium bisulphate, the melt dissolved in hot water and the solution filtered, the copper being then determined colorimetrically (with ammonia or potassium ferrocyanide) or by electrolysis.

Nickel. The dimethylglyoxime method is employed, precipitation from the ferrous solution being effected in the presence of tartaric acid. The precipitate is either dried at 110°—120° C. and weighed as such; or dissolved in nitric acid, the solution boiled with ammonium persulphate, cooled, made distinctly ammoniacal, silver nitrate and potassium iodide added, and the liquid titrated to a faint turbidity with a solution of potassium cyanide (2.29 grms. per litre) previously standardised against a steel of known nickel content.

Chromium. 5 grms. of the steel are dissolved in 50 c.c. of hydrochloric acid (1:1), the solution nearly neutralised with a saturated solution of

sodium carbonate and then completely with barium carbonate (10 grms. suspended in 100 c.c. of water) of which about 1 grm. excess is used. The precipitate, obtained by boiling the liquid in a covered flask for 10–15 mins., is filtered off, washed, the filter and contents incinerated, the residue fused for 10 mins. with a mixture of sodium carbonate (5 grms.) and potassium nitrate (0.25 grm.), the melt dissolved in water, 2 c.c. of hydrogen peroxide (3% solution) added, the liquid boiled and filtered. Chromium is determined in the filtrate (if strong yellow) by boiling thoroughly, acidifying with sulphuric acid, adding excess of standard ferrous sulphate and titrating the excess with standard potassium permanganate; or (if pale yellow) by colour comparison with a standard solution of sodium chromate.—W. E. F. P.

Case-hardened carbon-steel objects; Recommended practice for the heat treatment of—. Amer. Soc. Testing Materials. Year-book, 1914, 207–208.

WHEN hardness of case is the only important consideration, the carburised objects may be quenched either from the carburising temperature direct or, to minimise distortion and cracking, from slightly above the critical range of the case (800°–825° C.); both core and case remain coarsely crystalline as the result of either treatment. To refine and increase the toughness of the case, the carburised objects should be cooled slowly to 650° C. or below, then reheated to slightly above the lower critical point (generally between 775° and 825° C., according to the carbon content and thickness of the case) and quenched in water or oil but removed from the bath while still just above 100° C.; this treatment is most beneficial when the carburising temperature has not exceeded 900° C. To refine and increase the toughness of both core and case, the objects, slowly cooled to 650° C. or below, should be reheated to above the critical temperature of the core (generally 900°–950° C.), quenched, and, before they have cooled to below 100° C., reheated to slightly above the lower critical point of the case and again quenched in water or oil. As a final treatment the objects may be tempered by reheating to 200° C.

—W. E. F. P.

Metals [iron and steel]; Standard methods for metallographic tests of—. Amer. Soc. Testing Materials. Year-book, 1914, 364–366.

Microscopic examination. Unhardened iron and steel, after polishing, should be examined under a magnification of 50 to 150 diameters, wrought iron for slag or cinder, steel for MnS, etc., and cast iron for size and shape of graphite. By etching for 15 secs. with a saturated solution of picric acid in alcohol, pearlite becomes darker than accompanying ferrite or cementite, and, in the case of wrought iron, the general appearance will sometimes show the origin of the material. Ferrite grains may be made visible by a rapid etching with nitric acid (1 vol.) diluted with water (9 to 3 vols.) or amyl alcohol (24 vols.). To distinguish between thin envelopes of ferrite and cementite near the eutectoid point (C 0.6–1.0%), the specimen should be etched at 100° C. with a solution of sodium picrate (picric acid 2, 25% caustic soda solution 98 parts) by which cementite becomes dark brown or black, other constituents being unaffected. The results should be compared with standard etched specimens. The indications for hardened and tempered steel are less decisive than the above; the 4% solution of nitric acid in amyl alcohol is recommended for etching, the time of which must be found by trial in each case. *Macroscopic examination.* For ascertaining the presence of defects due to segregation, blowholes, piping, etc.,

a polished section, washed with a strong solution of potassium hydroxide and rinsed, should be etched with (a) iodine solution (I 20, KI 30, water 1000 grms.), (b) dilute hydrochloric or sulphuric acid (up to 30% acid), (c) dilute nitric acid (from 1:9 to 3:7), (d) concentrated hydrochloric acid, or (e) copper ammonium chloride (10 or 12 parts of the double salt in 90 or 88 of water). The structure of wrought iron is “developed” rapidly by (d) and more slowly by (c) or (b); the segregation of carbon in steel is well shown by etching with (a) (5 secs. is enough for some materials), the impurities, segregation of MnS, slag, etc., being rapidly indicated by (d) although more accurately by (b). By etching very deeply, e.g., for several hours with (b), the segregation of the carbon, and the impurities like slag and MnS are shown simultaneously, and a picture of the object may be obtained by inking and printing with the specimen.—W. E. F. P.

Spelter; Standard specifications for [and analysis of]—. Amer. Soc. Testing Materials. Year-book, 1914, 284–287.

VIRGIN spelter (not re-worked metal) is considered in 4 grades, the maximum allowable impurities in which are:—

Grade.	Maximum impurities per cent.				
	Pb	Fe	Cd	Al	Pb + Fe + Cd
A. High grade ..	0.07	0.03	0.05	none	0.10
B. Intermediate ..	0.20	0.03	0.50	none	0.50
C. Brass Special ..	0.75	0.04	0.75	none	1.20
D. Prime Western	1.50	0.08	—	—	—

To obtain the sample for analysis, at least 10 slabs from each car-load shall be sawn completely across and the sawdust collected, or the slabs drilled through and the drillings cut into short lengths; particles of iron are removed from the sample by means of a magnet before analysis:—*Lead.* Sufficient to be taken to contain at least 0.01 grm. of this impurity. *Iron.* At least 10 grms. of Prime Western, or 25 grms. of any other grade, to be completely dissolved in acid, the iron precipitated as ferric hydroxide, re-dissolved and determined volumetrically, as usual. *Cadmium.* 25 grms. to be treated with 330 c.c. of hydrochloric acid (1:5), allowed to stand over night and filtered (filtrate discarded); the insoluble residue (containing about 5% of the zinc) dissolved in nitric acid, 10 c.c. of sulphuric acid added, the liquid evaporated till sulphur trioxide is evolved, diluted and the lead sulphate removed by filtration; the filtrate is diluted to 500 c.c., 5 grms. of ammonium chloride is added, a slow stream of hydrogen sulphide passed through for 1 hour, the liquid allowed to stand for 5 hours and filtered; the precipitate washed with hot water, re-dissolved in 60 c.c. of boiling dilute sulphuric acid (1:5 by vol.), the solution filtered, diluted to 400 c.c. and saturated with hydrogen sulphide as before, the precipitated cadmium sulphide to be weighed as such or dissolved in hydrochloric acid and titrated with potassium ferrocyanide.—W. E. F. P.

Manganese-bronze ingots for sand castings; Standard specifications for—. Amer. Soc. Testing Materials. Year-book, 1914, 288–289.

COMPOSITION to be Cu 53–62, Zn 36–45, Al 0.05–0.5, and Pb not more than 0.15%; ultimate tensile strength, not less than 70,000 lb. per sq. in. and elongation not less than 20%, as determined on a standard, turned specimen 0.5 in. in diameter and 2 in. gauge length.—W. E. F. P.

Aluminium by electro-metallurgic methods. J. Blanquier. Min. and Eng. World, 1914, 41, 909—911.

THE bauxite used should contain less than 3% SiO_2 . It is fused with sodium carbonate, or sodium sulphate and carbon, or heated in an autoclave under pressure with caustic soda, so as to form sodium aluminate, from which purified alumina is prepared by the action of carbon dioxide, or by agitating with freshly precipitated alumina. In the Serpek process, aluminium nitride is formed in an electric furnace, and decomposed with an alkaline solution to form sodium aluminate. In the Hall (American) process, the calcined bauxite is heated with carbon in an electric furnace, so as to form an alloy of iron with silicon, titanium, and aluminium, which is very dense and fluid, the purified alumina floating on it. In the furnaces for electrolysis of the alumina, carbon electrodes are used, the cathode forming the base in conductor furnaces, with 8 to 12 anodes, or both electrodes may dip into the electrolyte, some 30 to 40 electrodes being employed in four files, two of which are cathodes. Nearly pure cryolite may be used, or fluorides and sodium chloride may be added, so as to obtain a homogeneous electrolyte, fluid at 800°C ., which will dissolve the maximum amount of alumina. The potential difference is usually 8 volts; it should not rise to 15 volts, the decomposition point of the cryolite. The current may vary between 8000 and 20,000 amps.—B. N.

Uranium ores in Madagascar. C. Grossmann. Comptes rend., 1914, 159, 777.

A MINERAL has been discovered at Fiadanana, Madagascar, externally resembling euxenite and containing 12—40% U_3O_8 . Its radioactivity, tested by an aluminium foil electroscope, is about double that of the pure oxide, thus suggesting an important source of radium.—W. F. F.

Production and uses of limestone in U.S.A. Eckel. See VII.

Use of potassium permanganate as cyanicide in sand-filling solutions. Cooper. See VII.

Volumetric determination of copper in its salts and many of its alloys. Zuccari. See XXIII.

PATENTS.

Steel castings; Method of making sound —. L. B. Lindemuth, Steelton, Pa. U.S. Pat. 1,116,899, Nov. 10, 1914. Date of appl., April 11, 1914.

AN air-blast and ferrosilicon are applied to the surface of the molten casting until the latter has cooled sufficiently to prevent piping.—W. E. F. P.

Manganese steel from scrap; Manufacture of —. H. M. Howe, Bedford Station, N.Y., Assignor to Taylor-Wharton Iron and Steel Co., High Bridge, N.J. U.S. Pat. 1,117,384, Nov. 17, 1914. Date of appl., May 16, 1912.

A MIXTURE of the scrap with ferro-manganese is melted, mixed with molten iron, and the product treated in an open-hearth furnace with manganese oxide or a slag in which the latter predominates over iron oxide.—W. E. F. P.

Alloy steels; Process of producing —. B. D. Saklatwalla, Crafton, Pa. U.S. Pat. 1,119,643, Dec. 1, 1914. Date of appl., April 30, 1913.

A COMPOUND of the metal to be alloyed with the steel is reduced by ferrosilicon in presence of the molten steel.—O. E. M.

[Iron ore, etc.] Briquettes; Method of making —. F. A. Jordan, Assignor to Moose Mountain, Ltd., Sellwood, Ont., Canada. U.S. Pat. 1,117,853, Nov. 17, 1914. Date of appl., April 30, 1914.

WET "ore-containing material" is charged into moulds formed by a framework resting upon a heated car. The car is placed in a drying chamber, until the briquettes have shrunk sufficiently to allow the frame to be removed, and the car is then transferred to a kiln in which the briquettes are hardened.—W. E. F. P.

Electrolytically cleaning [metal] articles; Apparatus for —. E. Le Roy Couch, Hartford, Conn., U.S.A. Eng. Pat. 23,454, Oct. 16, 1913. Under Int. Conv., Jan. 31, 1913.

THE apparatus comprises a number of zones in each of which a liquid is contained and partly confined by steam jets arranged between the zones, the articles being passed continually through the zones, so that they are in contact during their passage with the metal of the apparatus. The articles are given a preliminary cleansing with brushes, and the further cleansing process in the apparatus is effected by the electrolytic action produced by contact of the liquid with the articles and a movable metallic belt which conveys them through the zones. A receptacle, adapted to contain liquid, is provided close to each of the zones, the liquid being pumped from the receptacles and heated, before being again discharged into the apparatus.—B. N.

Flexible objects of organic origin; [Electrically] coating — with metal. R. Rafn, Nuremberg, Germany. U.S. Pat. 1,118,878, Nov. 24, 1914. Date of appl., Oct. 17, 1914.

METAL is disintegrated electrically in *vacuo* and deposited on the flexible base of organic origin, and the adherence of the coating is improved by superficially hardening a film of drying oil in intimate association with the base and the metal, any unchanged oil being afterwards removed.—B. N.

Metal-melting apparatus. W. I. Burch, London. Eng. Pat. 23,521, Oct. 17, 1913.

THE melting pot is provided with a perforated tray or dish and also with one or more stirring blades. The tray and the blades are moved up and down together and either or both are rotated. For example the blades may be fixed to, and the tray mounted loosely on, a sleeve having projections which engage with a spiral groove on a central pillar, so that when the sleeve is moved up and down, it and the blades are rotated relatively to the dish. (See also Eng. Pat. 15,323 of 1913; this J., 1914, 835.)—A. S.

Melting of metal; Apparatus for regulating and controlling temperatures in the —. I. Hall, Birmingham. Eng. Pat. 26,583, Nov. 19, 1913, and 5198, Feb. 28, 1914.

IN apparatus of the type in which the temperature is controlled by means of a thermostat or differential expansion device connected with the gas-admission valve, the valve seating has an external screw thread which engages with a thread in the support for the seating. By turning the support the vertical position of the valve seating can be adjusted so that the gas-admission valve closes at any desired temperature within a definite range.—A. S.

Fusion-furnaces; Process of generating heat in—.
B. Stoughton, New York. U.S. Pat. 1,117,274.
Nov. 17, 1914. Date of appl., April 8, 1912.

A BED of solid fuel is ignited in the furnace and atomised liquid fuel is then injected with only sufficient air to consume the latter completely and maintain a very slow combustion of the former.—W. E. F. P.

Furnace; Heating and melting—. W. N. Best, New York. U.S. Pat. 1,119,227, Dec. 1, 1914.
Date of appl., June 21, 1914.

THE furnace is fired by liquid fuel blown by an air blast through a laterally flaring jet extending along one side of the combustion-chamber.—O. E. M.

Furnace; Electric—. W. H. Hampton, New York, Assignor to The Conley Electric Furnace Co., Inc., Wilmington, Del. U.S. Pat. 1,116,884, Nov. 10, 1914. Date of appl., Feb. 17, 1913.

THE reduction furnace comprises a shaft, which increases in width towards its base, and terminates in substantially vertical walls enclosing a space which forms a fusing and reducing zone above the hearth. Non-metallic heating bars of low conductivity are embedded in the vertical walls out of contact with the charge, and are arranged one above the other so that a differential heating effect may be produced. One or more substantially vertical walls, containing non-metallic heating conductors insulated from the charge, and spaced so as to permit free passage of the material, traverse the heating zone, with wide non-bridging spaces between the conductors.—B. N.

Martin furnace. Eickworth u. Sturm G. m. b. H. Fr. Pat. 469,859, March 19, 1914. Under Int. Conv., April 16, 1913, Jan. 24, and Feb. 19, 1914.

THE air enters obliquely on each side by a port narrowed at the exit, and mixes with the gas in a space in front of the hearth. The air conduits are also provided with outlets of smaller section which allow a portion of the air to pass directly to the roof of the furnace, thereby forcing the combustible gases downwards towards the metal.—T. ST.

Furnace; Regenerative—. A. Pothmann. Fr. Pat. 470,068, March 26, 1914. Under Int. Conv., April 9, 1913.

THE furnace is designed to use blast-furnace gas which is burnt alternately at an end-on burner, and at one or more roof-burners situated nearer to the hearth. The burnt gases pass partly through the regenerators of the other burners, and partly through the furnace, exhausting direct to the chimney at the inlet end for the material to be heated. The flames thus pass alternately in opposite directions between the differently situated burners, and always in the same direction in the rest of the furnace.—T. ST.

Concentrating tables for the treatment of ores and similar materials. E. W. Wetherell, London. Eng. Pat. 27,149, Nov. 25, 1913.

THE table consists of long narrow parallel sections, alternating with troughs for tailings, so that dead space, with consequent waste of power in jiggling, is avoided.—O. E. M.

Ores; Concentrating—. H. L. Sulman and Minerals Separation, Ltd., London. Eng. Pat. 27,749, Dec. 2, 1913.

AQUEOUS extracts of nearly insoluble substances, such as tar-oils, are used as froth-producing agents in the agitation froth process for removing minerals from gangue.—O. E. M.

[Sulphide] ores; Method of concentrating—. W. S. Stevens, Magdalena, N. Mex., Assignor to The Ozark Smelting and Mining Co., Cleveland, Ohio. U.S. Pat. 1,116,642, Nov. 10, 1914. Date of appl., Dec. 10, 1912.

THE crushed ore is mixed with water, sulphuric acid (5% or less of the weight of ore) and petroleum oil of high b. pt. (1% or less), at not below 60° C., and the mixture is first "presented to the air" and then to the surface of a liquid, whereby flotation of the oiled sulphide particles is effected by surface tension.—W. E. F. P.

Sulphide ores; Concentration of—. Minerals Separation, Ltd. Fr. Pat. 469,677, March 14, 1914. Under Int. Conv., April 3, 1913.

ORES, slimes, etc., containing blende and galena are concentrated by a flotation process in which the water is rendered slightly alkaline with sodium carbonate. The mixture is agitated and aerated, preferably at 48° to 55° C., and a frothing agent such as eucalyptus oil may be added. The concentrate rises in the froth, the gangue sinking to the bottom.—T. ST.

Slime separator. C. Allen, El Paso, Tex. U.S. Pat. 1,118,614, Nov. 24, 1914. Date of appl., Aug. 3, 1910. Renewed May 27, 1914.

THE sludge runs continuously into a conical tank with a float-controlled valve at the bottom to retain a constant quantity of sediment in the tank. The discharged sediment is carried off by a stream of water proportional to the quantity of solid matter.—O. E. M.

Alloy. C. R. Denton, Sheffield. Eng. Pat. 17,157, July 20, 1914.

NICKEL (7.5 lb.), vanadium (0.5 lb.) and copper (25 lb.) are melted together, and a further quantity (18 lb.) of copper is added. Then, in presence of a suitable flux, spelter (6 lb.), tin (3.5 lb.), and aluminium (0.5 lb.) are added successively, the melt being heated to about 2000° F. (about 1100° C.) after each addition. The alloy can be brazed, stamped, cast, rolled, hammered, etc., without losing its ductility, is not tarnished under ordinary conditions, and resists corrosion by sea-water and most acids.—A. S.

Alloy and its manufacture. V. E. Maillard. Fr. Pat. 469,743, May 27, 1913.

AN alloy containing 2 to 20% Ni is made by adding finely-divided nickel, in small portions, to silver heated at least to the melting point of nickel, and agitated. The silver may be partially replaced by copper. The alloy is suitable as the basis metal for gold-plated articles of jewellery, etc.—T. ST.

Bronze; Method of manufacturing a new—. A. Schwob et Cie. Fr. Pat. 469,784, May 28, 1913.

ALLOYS of Cu-Pb, and Cu-Pb-Sn, in all proportions, are made by adding the lead, or the lead and tin, in small portions to a bath of molten copper, agitated and heated to such a temperature that it will not adhere to an iron rod dipped into it.—T. ST.

Zinc from zinc-bearing refuse; Process for the extraction of—. R. R. Parish, Assignor to Chase Rolling Mill Co., Waterbury, Conn. U.S. Pat. 1,104,922, July 28, 1914. Date of appl., May 7, 1914.

THE refuse is gradually introduced into dilute sulphuric acid, which is agitated with compressed air and maintained at its original strength by the

addition of strong acid, so that a concentrated solution of zinc sulphate is ultimately produced. This is neutralised by refuse containing zinc oxide, and the solution is agitated with compressed, ozonised air to precipitate manganese and iron, filtered, and further purified by contact or agitation with metallic zinc.—W. E. F. P.

Zinc ores; Process of smelting——. J. M. Hyde, Berkeley, Cal. U.S. Pat. 1,118,012, Nov. 24, 1914. Date of appl., Feb. 13, 1911.

THE ore is fed continuously, with a flux and a reducing-agent, into an externally-fired retort. The zinc distils off, and the waste products are continuously removed from below in a fused state.—O. E. M.

Metals [zinc, etc.]; Process for the distillation of——from fused slags, ores, etc. W. Troeller, Fr. Pat. 469,862, March 19, 1914. Under Int. Conv., April 1, 1913.

REDUCING gases such as producer gas, are passed through the fused slags, etc., to which, if necessary, fluxes have been added. Volatile metals such as Bi, Sb, Sn, Zn, etc., distil over and are recovered as metals or oxides. Other metals which become reduced may be tapped off from under the slag. Where the heating gases come into contact with the charge it is protected from oxidation by a layer of coke.—T. St.

Metals; Apparatus for treating——. S. T. Wellman, Cleveland, Ohio. U.S. Pat. 1,116,772, Nov. 10, 1914. Date of appl., Aug. 18, 1911.

A MIXTURE of ore and flux, reduced and melted by electrical means in a chamber having a removable closure at the bottom, is transferred while molten to an adjacent chamber in which the treatment is completed by similar means.—W. E. F. P.

Mercury; Process for extracting——from its ores and other materials. E. B. Thornhill, Gray Summit, Mo. U.S. Pat. 1,119,377, Dec. 1, 1914. Date of appl., Jan. 12, 1914.

THE mercury is precipitated by means of a metal such as aluminium from a solution made by treating the ore with a solution of an alkali sulphide and hydroxide.—O. E. M.

Copper; Method of extracting——from ores. G. D. Van Arsdale, East Orange, N.J. U.S. Pat. 1,119,477, Dec. 1, 1914. Date of appl., May 16, 1912.

THE ore is leached with dilute sulphuric acid to yield a solution containing 10% Cu: sulphur dioxide is added to prevent polarisation, and the solution is electrolysed. To avoid precipitation of sulphides, only 80% of the copper is deposited. The spent solution is used for leaching fresh ore.—O. E. M.

Copper; Process of extracting——from ores. G. D. Van Arsdale, East Orange, N.J. U.S. Pat. 1,119,478, Dec. 1, 1914. Date of appl., Sept. 20, 1912.

THE ore is roasted with a sulphur compound before treatment as described in U.S. Pat. 1,119,477 (see preceding abstract).—O. E. M.

Copper; Furnace for melting and refining——. W. S. Rockey, West New Brighton, H. Eldridge, Stapleton, and C. D. Clark, New York. Assignors to Metallurgical Research Co., New York. U.S. Pat. 1,119,540, Dec. 1, 1914. Date of appl., Dec. 26, 1913.

THE metal is melted in a chamber heated by the combustion gases from fluid fuel burnt in a separate

chamber, and is protected from oxidation, while being poured, by a current of burnt gases.—O. E. M.

Metallic [tungsten] wires and strips; Manufacture of——. J. Pintsch Akt.-Ges. Fr. Pat. 469,212, March 3, 1914. Under Int. Conv., Oct. 15, 1913.

TUNGSTEN or other wire, for incandescence filaments, etc., heated electrically to a temperature below that at which measurable recrystallisation takes place, is passed through a short spiral of wire heated to a bright white heat, at such a speed (determined experimentally) that the small crystals constituting the wire as first produced are all absorbed into one big crystal across the section surrounded by the spiral. An inert atmosphere is maintained around the heated portion of the wire.—T. St.

Ores and solid salts; Treatment of——by electrolysis. A. A. M. Haunriot, Fr. Pat. 469,516, May 22, 1913.

THE ore or salt is placed in a suitable electrolyte in contact with the cathode, and a current is passed. The substance is reduced and the metal takes the place of the original substance without passing into solution.—B. N.

Tin oxide ores and roasted tin sulphide ores; Method of removing iron from——by treatment with acid. M. Chiapponi, R. Hesse, and G. von Rauschenplat, Fr. Pat. 469,928, March 21, 1914. Under Int. Conv., March 27, 1913.

THE ores are treated with reducing gases at 300° to 500° C. to reduce the iron compounds present as far as possible to ferrous oxide, whilst leaving the tin oxide unaffected. The mass is then leached with hydrochloric or sulphuric acid to dissolve the ferrous oxide, or the iron may be removed as chloride by heating to 400°–500° C. in a current of hydrochloric acid gas.—T. St.

Thomas steel or other analogous manganese steels; Process for making——. H. Naegeli, Fr. Pat. 469,665, March 11, 1914.

SEE Ger. Pat. 265,813 of 1912; this J., 1913, 1159.—T. F. B.

Melting and alloying metals in vacuo; Furnace for——. W. S. Simpson, London. U.S. Pat. 1,118,820, Nov. 21, 1914. Date of appl., March 26, 1913.

SEE Eng. Pat. 12,067 of 1912; this J., 1913, 755.—T. F. B.

Metallurgical furnace. H. Davison and L. C. Harvey, Battersea, Assignors to Morgan Crucible Co., Ltd., London. U.S. Pat. 1,118,534, Nov. 24, 1914. Date of appl., March 14, 1913.

SEE Eng. Pat. 6808 of 1912; this J., 1913, 192.—T. F. B.

Melting and mixing metals in vacuo; Apparatus for——. W. S. Simpson, London. Reissue No. 13,819, Dec. 15, 1914, of U.S. Pat. 1,015,091, Jan. 16, 1912. Date of appl., Sept. 16, 1913.

SEE Eng. Pat. 11,832 of 1910; this J., 1911, 1020.—T. F. B.

Metallic body; Process for coating a——. G. Cooper, Birmingham. U.S. Pat. 1,121,169, Dec. 15, 1914. Date of appl., May 12, 1913.

SEE Eng. Pat. 11,380 of 1912; this J., 1913, 664.—T. F. B.

Ores : Dry treatment of —. W. Buddeus, Charlottenburg, Germany. U.S. Pat. 1,121,226, Dec. 15, 1914. Date of appl. Feb. 5, 1914.

SEE Fr. Pat. 466,397 of 1913; this J., 1914, 599.
—T. F. B.

Zinc-lyes : Treatment of —. W. Buddeus, Charlottenburg, Germany. U.S. Pat. 1,120,683, Dec. 15, 1914. Date of appl. Nov. 26, 1913.

SEE Eng. Pat. 25,967 of 1913; this J., 1914, 644.
—T. F. B.

Roasting furnaces : Feeding apparatus for —. Nichols Copper Co. Fr. Pat. 469,272, March 6, 1911. Under Int. Conv., March 7, 1913.

SEE Eng. Pat. 3581 of 1911; this J., 1914, 926.
—T. F. B.

Furnace for roasting ores : Mechanical —. E. Dohet, Fr. Pat. 469,820, March 13, 1914.

SEE Eng. Pat. 7892 of 1913; this J., 1913, 1017.
—T. F. B.

Roasting furnaces : Rabbling shaft for —. Nichols Copper Co. Fr. Pat. 469,990, March 23, 1914. Under Int. Conv., March 21, 1913.

SEE Eng. Pat. 7171 of 1914; this J., 1914, 926.
—T. F. B.

Furnaces or cupolas : Electric —. W. N. Crafts, Fr. Pat. 469,520, Aug. 8, 1913.

SEE U.S. Pat. 1,070,017 of 1913; this J., 1913, 915.—T. F. B.

Muffle furnaces. E. Curran, Fr. Pat. 469,814, March 11, 1911. Under Int. Conv., March 12, 1913.

SEE Eng. Pat. 6165 of 1913; this J., 1914, 320.
—T. F. B.

Oxidising, reducing, or otherwise treating ores and other materials : Mechanism for —. F. von Schlippenbach, Stolberg, Germany, Assignor to Dwight and Lloyd Sintering Co., Inc., New York. U.S. Pat. 1,119,459, Dec. 1, 1914. Date of appl., Jan. 21, 1910.

SEE Eng. Pat. 29,779 of 1909; this J., 1910, 1392.
—T. F. B.

Sodium and other metals : Production of — from compounds thereof by electrolysis. R. J. McNitt, Perth Amboy, N.J., U.S.A. Eng. Pat. 29,987, Dec. 30, 1913. Under Int. Conv., Jan. 2, 1913.

SEE Fr. Pat. 466,205 of 1913; this J., 1914, 600.
—T. F. B.

XI.—ELECTRO-CHEMISTRY.

Working up of the materials obtained by the electrolysis of the residual liquors from the manufacture of potash salts. Dietz. See VII.

PATENTS.

Ozoniser [for sterilising, etc.], B. R. B. von Tagueeff, Berlin. Eng. Pat. 27,258, Nov. 26, 1913. Under Int. Conv., Sept. 12, 1913.

THE object to be treated is placed between two condensers charged with an alternating current, so that it is subjected to the direct action of ozone and ionised air.—B. N.

Condensers : Electrical —. G. Giles, Fribourg, Switzerland. Eng. Pat. 10,868, May 2, 1914. Under Int. Conv., July 3, 1913.

A PART or the whole of the armature of a condenser is formed of a layer of lead, projected on to a non-conducting glass surface by one of the usual processes for pulverising metals.—B. N.

Gases : Electrical apparatus for effecting the chemical combination of —. C. C. Meigs, Charleston, S.C. U.S. Pat. 1,116,606, Nov. 10, 1914. Date of appl., Jan. 23, 1914.

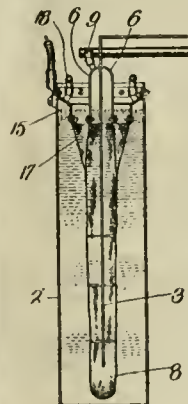
A STATIONARY outer shell is arranged within a vertical support, having a thrust-bearing element attached to its upper end. Contact brushes are connected with the outer shell, and extend towards the interior, where they engage with tubular contacts on an inner, closed rotating shell, so as to provide wide sparks. Several spaced hollow cooling members are arranged between the shells. A spindle connected with the upper end of the inner shell and passing through the outer shell and the thrust-bearing element, is provided with means for rotating it. A tubular spindle, connected with the lower end of the inner shell, rests at its lower end in a guide-bearing element, and gases are supplied through the latter to the inner shell.—B. N.

Electrical separation : Process of —. H. M. Sutton, W. L. and E. G. Steele, Dallas, Tex. U.S. Pat. 1,116,951, Nov. 10, 1914. Date of appl., Jan. 11, 1908.

FINELY-DIVIDED material is separated by subjecting it to a convectively delivered electrical charge in the path of convection, thus causing some of the particles to adhere to an opposing electrode. The charge is varied in polarity and duration during delivery, according to the characteristics and susceptibilities of different particles of the material, and the separated particles are collected separately.—B. N.

Electrolytic cell. A. M. Griffin, Assignor to M. O. Hackett, Kansas City, Mo. U.S. Pat. 1,117,185, Nov. 17, 1914. Date of appl., April 27, 1914.

THE cell, 2, is made of conducting material, and is insulated from an inverted trough-shaped vessel, 6, supported within it, with its lower end submerged in the liquid. A sack, 8, insulated from and enclosing the anode, 3, is attached at its upper end to the lower end of the vessel, 6, and is provided with an inverted skirt, 17, which is flared outwards in an upward direction and attached to a frame, 15, secured to the cell around the vessel, 6. Pipes, 9, 18, which lead away the gases, communicate respectively with the interior of the vessel, 6, and with the space between the cell and the frame, 15. A series of cells may be used, the anode in each case being connected with the adjacent cell.—B. N.



Electrolytic cell. F. McDonald, Roaring Spring, Pa. U.S. Pat. 1,117,879, Nov. 17, 1914. Date of appl., April 20, 1914.

THE anode is enclosed in a perforated partition, closely surrounded by a porous diaphragm. A graphite cathode, the inner face of which is bevelled

at its upper end, is adjacent to but spaced from the diaphragm, and a column of mercury is interposed between and supported by the diaphragm and cathode. A decomposing element is arranged above the mercury column, between the upper ends of the cathode and the diaphragm, and means are provided for maintaining the solution in the cell at a constant level.—B. N.

Insulating compounds. J. F. Menning, West Allis, Wis., Assignor to Allis-Chalmers Manufacturing Co. U.S. Pats. (A) 1,119,441 and (B) 1,119,442. Dec. 1, 1914. Date of appl., March 12, 1909.

(A) A MIXTURE of 5 parts of sand and hydraulic cement, 3 parts of asbestos, and 4 parts of shellac. (B) The sand in the above mixture is omitted, and a colouring matter is added.—B. N.

Insulating electric conductors; Composition particularly suitable for——. T. J. Hadley, Winnipeg, Manitoba, Canada. Eng. Pat. 8138. March 31, 1914.

A MIXTURE of 8 galls. of coal tar, 2 galls. of kerosene oil, 2 galls. of Portland cement, and 1 gall. of japan drier.—B. N.

Galvanic battery; Secondary——. H. P. R. L. Pörsche and J. A. E. Achenbach, Hamburg, Germany. U.S. Pat. 1,119,313, Dec. 1, 1914. Date of appl., April 22, 1911.

SEE Fr. Pat. 427,415 of 1911; this J., 1911, 1070.—T. F. B.

Furnaces; Electric——. F. T. Snyder, Oak Park, Ill. U.S.A. Eng. Pat. 25,171, Nov. 4, 1913.

SEE Fr. Pat. 465,188 of 1913; this J., 1914, 491.—T. F. B.

Removing liquid from organic and inorganic substances; [Electro-osmotic] process for——. B. Schwerin, Assignor to Elektro-Osmose Akt.-Ges. (Graf Schwerin Ges.), Frankfurt, Germany. U.S. Pat. 1,121,409, Dec. 15, 1914. Date of appl., April 6, 1911.

SEE Eng. Pats. 6993 and 6995 of 1914; this J., 1914, 871.—T. F. B.

Dehydration of organic and inorganic substances [by electro-osmosis]. Elektro-Osmose Akt.-Ges. (Graf Schwerin Ges.). Fr. Pat. 469,991, March 23, 1914. Under Int. Conv., June 21 and July 21, 1913.

SEE Eng. Pats. 6993 and 6995 of 1914; this J., 1914, 871.—T. F. B.

Producing a bleaching, disinfecting, deodorising, or preserving agent. Eng. Pat. 26,726. See VI.

Separating the rare earths, together with thorium, cerium, and zirconium, by electrolysis. U.S. Pat. 1,115,513. See VII.

Treatment of ores and solid salts by electrolysis. Fr. Pat. 469,516. See X.

Composition particularly suitable for insulating electric conductors. Eng. Pat. 8138. See XIII.

XII.—FATS; OILS; WAXES.

Raw linseed oil from North American seed; Standard specifications for the purity of——. Amer. Soc. Testing Materials. Year-book, 1914, 335–337.

THE oil shall have sp. gr. 0.936–0.932 at 15.5° C., or 0.931–0.927 at 25° C.; acid value 6.00 (maxi-

mum); saponification value 195–189; unsaponifiable matter 1.50% (maximum); n_D 25° C., 1.4805–1.4790; iodine value (Hanus) 178. All tests should be made on the sample filtered through paper, at 60°–80° F. (15.5°–26.7° C.), immediately before weighing out; methods given in Bull. No. 107 (revised 1908) of the U.S. Dept. of Agriculture, Bureau of Chemistry, should be used for determining the acid, saponification, and iodine values, and Bömer's method for the unsaponifiable matter.—W. E. F. P.

Linseed and petroleum oils; Iodine value of——. W. H. Smith and J. B. Tuttle. J. Ind. Eng. Chem., 1914, 6, 991–998.

A DETAILED account of the experiments the chief results of which have been published previously (see this J., 1914, 700).—A. S.

Grape-seed oil. G. Dell'Acqua. Amali Chim. Appl., 1914, 2, 295–301.

A SPECIMEN of grape-seed oil of undoubted purity had the following characters: Sp. gr. 0.9226 at 15° C.; Valenta test (critical temperature of solution in glacial acetic acid), 83° C.; refractometer reading (Zeiss-Wollny), 78.8 at 15° C., 62.9 at 40° C.; unsaponifiable matter, 0.325%; iodine value (Hübl), 140.25; thermal number (mixture of equal parts of sample and mineral oil in Tortelli's thermoleometer), 118° C.; acetyl value, 17.84; refractometer reading of acetylated oil, 76.7 at 19.5° C., 65 at 40° C. Fatty acids: sp. gr. 0.8988 at 25° C.; m. pt., 25–28.5° C.; solidif. pt., 21–18° C.; critical temperature of solution (5 c.c. of fatty acids, 10 c.c. of 70% alcohol), 75° C.; refractometer reading, 62.2 at 20.5° C., 50.8 at 12° C.; iodine value (Hübl), 111. The oil is very similar in properties to maize and soya bean oils, but the three oils may be distinguished by means of uranium nitrate (Settimi, Ann. del Lab. chim. centr. delle Gabelle, Roma, 1912, 6, 461): 5 c.c. of the oil are shaken with 2 c.c. of chloroform and 3 c.c. of a 2% aqueous solution of uranium nitrate: maize oil gives a white emulsion; soya bean and grape-seed oils give an intense lemon-yellow colour. If 10 c.c. of the oil be heated on the water-bath with 3 c.c. of an ethereal solution of uranium nitrate, soya bean oil gives a yellow colour changing to olive green and red; grape-seed oil remains yellow for a longer time and then becomes orange-yellow. When heated for 10 mins. at 60° C. with nitric acid (Hauchecorne's reaction), soya bean oil gives a brownish-orange colour changing to chocolate brown, whilst grape seed oil gives a brownish to reddish orange colour.—A. S.

Fats; Hardening [hydrogenation] of——. F. Bergius. Z. angew. Chem., 1914, 27, 522–525.

DE HEMPTINNE has effected a partial conversion of oleic into stearic acid in an atmosphere of hydrogen in the absence of catalysts by passing the oil over plates charged at a high potential and between which there was a sparking discharge (see this J., 1905, 448). This process is more suitable for the polymerisation of mineral oils. Experiments by Kalnin in the author's laboratory have shown that hydrogenation is effected by heating oleic acid with alkali lye at 300° C. in hydrogen under a pressure of about 30 atmos. The process is independent of the purity of the oil or the hydrogen. The defective lathering properties of soaps from hydrogenated fats are now improved by the addition of liquid fats before saponification, whilst the proportion of nickel (which produces specks in the soap) is being continually reduced. Simultaneous hydrogenation and saponification, in the absence of catalytic agents, as described above, will probably prove a much cheaper process than

that in use, even after the expiry of the patent for the nickel process of hydrogenation in 1917.

—C. A. M.

Fatty acids: Calcium and magnesium compounds of higher —. W. Haupt. Z. angew. Chem., 1914, 27, 535—536.

THE magnesium salts of the higher fatty acids (palmitic, stearic, and oleic) are considerably more soluble in 0.025—0.1% solutions of sodium and potassium chlorides than in pure water. Hence the view that the introduction into rivers of magnesium chloride from potassium chloride works causes a very large waste of soap in towns where such water is used, is unjustified. Figures are given showing also that, per 100 grms. of metal, calcium chloride causes the precipitation of a much larger quantity of insoluble soap than does magnesium chloride.—F. C. T.

Rapid determination of water in crude petroleum, oil fuel and similar substances. Shrewsbury. See 11A.

Revivification of bone-black. Nagel. See XVII

PATENTS.

Cottonseed: Process for sterilising and preserving —. E. R. Barrow, Assignor to Barrow Cottonseed Preserver Co., Memphis, Tenn. U.S. Pat. 1,119,672. Dec. 1, 1914. Date of appl., Nov. 18, 1913.

COTTONSEED is mixed with about 5% of finely divided sodium chloride and the mixture dried. —C. A. M.

Catalytic reactions; Process for carrying out —. [Hydrogenation of oils.] O. C. Hagemann and C. Baskerville. Fr. Pat. 469,172. Feb. 5, 1914. Under Int. Conv., Feb. 8, 1913.

SEE U.S. Pat. 1,083,930 of 1914; this J., 1914, 207. The catalyst may be in the form of very thin sheets of metal, the surface of which is partially oxidised. After the reaction, the catalyst is regenerated by treatment with air or other oxidising gas at a high temperature followed by treatment with hydrogen.—T. F. B.

Lubricant; Electrically-conducting —. G. Pommerhantz, Belvedere, Austria, Assignor to Standard Chemical Co., Bayonne, N.J. U.S. Pat. 1,118,148. Nov. 24, 1914. Date of appl., Nov. 21, 1913.

A METALLIC salt of a fatty or other organic acid is emulsified with a water-soluble oil and a solid thickening agent, with or without the addition of water, to obtain a lubricant of high electrical conductivity.—C. A. M.

Oils; Process and apparatus for extracting — by pressure. H. Zander. Fr. Pat. 469,273. March 6, 1914. Under Int. Conv., March 8, 1913.

SEE Eng. Pat. 5706 of 1914; this J., 1914, 798. —T. F. B.

Fatty substances; Process for treating —. W. T. Powling, Prittlewell. U.S. Pat. 1,121,598. Dec. 15, 1914. Date of appl., March 29, 1913.

SEE Eng. Pat. 8397 of 1912; this J., 1913, 543. —T. F. B.

Rust-preventing greases and oils; Process for manufacturing —. B. Zschokke, Zürich, Switzerland. Eng. Pat. 28,283. Dec. 8, 1913. Under Int. Conv., Dec. 7, 1912.

SEE Ger. Pat. 276,122 of 1912; this J., 1914, 876. —T. F. B.

Oil-refiner. U.S. Pat. 1,119,453. See 11A.

Regeneration of impure benzene. Fr. Pat. 469,490. See 11A.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Pigments; Testing — for permanence of colour. W. de W. Abney. J. Roy. Soc. Arts, 1914, 63, 85—91.

PIGMENTS fade very rapidly (in from 10 mins. to about 4 hrs.) when exposed to moist ozonised oxygen, but not in dry ozonised oxygen. The relative stability of pigments tested in this way is similar to their stability in light under atmospheric conditions. The stability of pigments, wall papers, dyed fabrics, etc., may therefore be rapidly tested by exposure in tubes to a current of moist ozonised oxygen, but oil paints have not given satisfactory results up to the present. Hydrogen peroxide was found to have no effect. Lists of stable and fugitive pigments are given. (See also this J., 1908, 1121; 1910, 705.)—R. G. P.

Iodine value of linseed and petroleum oils. Smith and Tuttle. See XII.

Collodion enamels for leather. Callan. See XV.

PATENTS.

Metallic paint; Manufacture of —. The British Patent Surbrite Co., and E. G. Meadway, London. Eng. Pat. 24,125. Oct. 24, 1913.

A WATERPROOF elastic paint is obtained by mixing an india-rubber solution with a metallic powder which has been rendered impervious to the rubber solution by being treated with a suitable substance such as a solution of shellac and gum mastic in methylated spirits and naphtha.—C. A. M.

Lead; Process of oxidising —. C. D. Holley, Assignor to Acme White Lead and Color Works, Detroit, Mich. U.S. Pat. 1,116,702. Nov. 10, 1914. Date of appl., Feb. 11, 1911.

FINELY divided lead is exposed to the simultaneous action of alkali nitrate solution (e.g., chromate waste liquor containing sodium nitrate) and air, and the resulting mass of "oxidised lead" and alkali nitrate is separated into its components. —F. SODN.

Basic carbonates of lead [white lead]; Process of making —. E. Euston, Assignor to Euston Lead Co., St. Louis, Mo. U.S. Pat. 1,117,358. Nov. 17, 1914. Date of appl., Nov. 2, 1911.

BASIC lead acetate solution is treated with carbon dioxide so as partially to precipitate the "basic portion," and, the greater part of the mother liquor having been removed, an acid lead acetate solution is added, and the mixture is treated with carbon dioxide until the proper density is acquired by the precipitate, which is then separated and finished. (See also this J., 1914, 363, 603.) —F. SODN.

Paint mixture. Z. Bessette, Montreal, Canada. U.S. Pat. 1,116,977. Nov. 10, 1914. Date of appl., July 20, 1912.

A MIXTURE of oil and pigment forming a paint, to which is added an almost equal volume of lime-

water or an equal quantity of a mixture of benzene (2%), lime-water (97%), and colouring matter (1%).—F. SODN.

Zinc oxide: Separation of lead from—. I. Tenenbaum. Ger. Pat. 276,776, Dec. 28, 1913.

IMPURE zinc oxide is freed from lead by treatment with 10% caustic alkali lye, and the solution thus produced is evaporated to a syrup, whereupon the greater part of the lead separates; on addition of water a solution of caustic alkali is obtained, together with a solid residue of oxygen compounds of lead.—T. F. B.

Composition of matter [artificial amber] and process of producing the same. L. V. Redman, Lawrence, Kans., Assignor to Amberoid Chemical Products Co., Chicago, Ill. U.S. Pat. 1,107,703, Aug. 18, 1914. Date of appl., Feb. 17, 1911.

A MIXTURE of phenol or a homologue, hexamethylenetetramine (preferably 1 mol. to more than 5 mols. of phenol), an "initial product" solvent (which acts also as a controlling agent), such as denatured alcohol, acetone, or amyl acetate, and a small proportion of glycerin or the like, to give pliability to the product, is heated for a predetermined period at a comparatively low temperature, and the "initial product," thus obtained, is then heated more strongly under pressure. For example, 90 grms. of phenol is mixed with 3 grms. of glycerin, and 23 grms. of hexamethylenetetramine, 80 grms. of alcohol is added, and the mixture is heated at about 80° C. for 5 hours, after which it may be further heated at 130°—190° C., under 80—120 lb. per sq. in. pressure. Ammonia is evolved during the whole heating process. The final product, which is infusible, insoluble, and very inert, may be used as an artificial amber, insulating material, etc. The initial product may be used, without further treatment, as a varnish or adhesive. Dyestuffs may be added after the first heating.—F. SODN.

Plastic condensation product. L. H. Friedburg, Assignor to General Electric Co., New York. U.S. Pat. 1,119,592, Dec. 1, 1914. Date of appl., Sept. 12, 1912.

A FLEXIBLE insoluble, resinous, saponifiable product is obtained by heating a mixture of a polyhydric alcohol (glycerin), phthalic anhydride, and butyric acid until combination takes place, and distilling off the uncombined ingredients.—C. A. M.

Rosin: Treating—. F. E. Mariner, Assignor to The Pensacola Tar and Turpentine Co., Gulf Point, Fla. U.S. Pat. 1,117,584, Nov. 17, 1914. Date of appl., April 1, 1914.

ROSIN, from which the turpentine has been separated, is distilled under reduced pressure (preferably of 22 inches, and at 290°—310° C.) until substantially all has passed over. A "grease-set" rich in abietic acid is obtained.—F. SODN.

Paint: Process for preparing a metallic—. A. Finkler and Co. Fr. Pat. 469,872, March 20, 1914.

SEE Eng. Pat. 8126 of 1914; this J., 1914, 1215.—T. F. B.

Condensation products from phenol and formaldehyde or other substances: Process for making—. K. Tarassoff. Fr. Pat. 469,832, March 14, 1914.

SEE Eng. Pat. 528 of 1914; this J., 1914, 557.—T. F. B.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Rubber used in nursing nipples and toys: Chemical composition of—. E. B. Phelps and A. F. Stevenson. U.S. Hygienic Lab., Bull. No. 96, Aug., 1914, 55—62.

QUALITATIVE analyses were made of several varieties of nipples of black and red rubber, teething rings of red rubber, and toys of white rubber. The articles were decomposed by means of fuming nitric acid and ammonium persulphate. All the specimens contained iron and aluminium in considerable quantities, showing that clay had been used as a filling material. In the red rubbers ZnO and MgO were also present, and in the black rubbers ZnO and BaO. Antimony was found in several of the black and red rubbers. The white rubbers contained clay and ZnO. The samples containing antimony were digested in 0.5% solutions of lactic and hydrochloric acids for 5 days at 37° C. The amount of antimony dissolved from 6 grms. of the material varied from nil to 0.6 mgrm. Two of the red rubbers, which yielded most antimony to the acid solutions, were gently rubbed up in a mortar with fresh saliva acidified with lactic acid for 1½ hrs.: 0.2 and 0.6 mgrm. Sb respectively were dissolved. The use of rubber containing antimony in articles for infants is thus undesirable.—J. H. J.

Rubber coagulant; Coconut water as a—. Chem. Trade J., Jan. 2, 1915.

THE U.S. Consul at Colombo reports the successful use of coconut water as a rubber coagulant. Millions of gallons of coconut water now run to waste on estates in copra drying and desiccation mills. The "water" is allowed to ferment for four or five days, after which it can be used immediately for coagulating latex. One to two ounces of the fermented liquid will coagulate one pint of pure latex. It is said to produce a better rubber than that procured by using crude acetic acid, especially as regards colour.

PATENTS.

[Rubber] latex; Apparatus for treating—. H. A. Wickham, London. Eng. Pat. 2627, Jan. 31, 1914.

APPARATUS for curing rubber by exposing successive films of latex to a treating agent such as smoke (especially that described in Eng. Pat. 7371 of 1907; this J., 1907, 1021) is furnished with a casing which more or less completely encloses the rotating member and which may be surrounded by a heating jacket. The casing is divided by a partition into two compartments, one of which communicates with a smoke furnace, whilst the other is largely isolated from the smoke and provided with an opening permitting access to the rotating member from without. The discharge end of the conduit, by which latex is conveyed from a reservoir to the rotating member, is given a reciprocating movement, so as to distribute the latex uniformly. The rotating cylinder is preferably vertical, but a modified form with flanged plate rotating in a horizontal plane is also described.

—F. SODN.

Caoutchouc substitute: Process of making—. O. Röhm, Darmstadt, Germany. U.S. Pat. 1,121,134, Dec. 15, 1914. Date of appl., Jan. 28, 1913.

SEE Eng. Pat. 613 of 1913; this J., 1913, 545.—T. F. B.

Rubber-covered [metal] article and method of making the same. L. Daft, Rutherford, N.J., Assignor to Electro-Chemical Rubber and Manufacturing Co. U.S. Pat. 1,120,794, Dec. 15, 1914. Date of appl. June 3, 1910.

SEE Eng. Pat. 2306 of 1912; this J., 1912, 595.
—T. F. B.

XV.—LEATHER; BONE; HORN; GLUE.

[Chestnut oak and white] oak. Detection of — in tannin extracts and leathers. J. S. Rogers, J. Amer. Leather Chemists' Assoc., 1914, 9, 525—537.

AQUEOUS extracts of chestnut oak when treated with a slight excess of ammonia show a decided blue fluorescence; the reaction may be used as a test for the presence of chestnut oak or white oak in other extracts, 10% of these oaks in a solution of any other tannin being easily detected.
—F. C. T.

Moellon analysis; Report of Committee on —. T. A. Faust, J. Amer. Leather Chemists' Assoc., 1914, 9, 548—562.

For moisture determination the method of direct heating in a wide platinum dish is quite accurate and distinctly better than the sand method. There was great diversity of opinion as to the determination of unsaponifiable matter; the following method is suggested for further discussion: 5 grms. of sample and 2.5 grms. of potassium hydroxide are dissolved in a little water, mixed with 25 c.c. of alcohol and heated under a reflux condenser for 1 hour. The soap is dissolved in 50 c.c. of hot water, the solution cooled, extracted three times with petroleum ether, and the extract washed three times with water. Two members of the Committee preferred to use ether instead of petroleum ether. The majority of the Committee preferred the method of Eachus (J. Amer. Leather Chemists' Assoc., 1913, 8, 240) for the determination of oxidised fatty acids. One member preferred Lewkowitsch's method as easier of manipulation. The following method was suggested for the determination of free fatty acids and was found fairly satisfactory: 2 grms. of moellon are dissolved in a mixture of 20 c.c. of alcohol and 20 c.c. of ether which has been made neutral to phenolphthalein, and the free acids titrated with aqueous N/10 sodium hydroxide using phenolphthalein as indicator.

In the examination of hard greases, e.g. hard paraffin wax, and scale wax, the English and Saybolt methods proved equally reliable for the determination of melting point. For the estimation of free oil, the press method (Lewkowitsch, Vol. III., 215) proved the best. For other hard greases, the present method of carrying out the titer test (see Amer. Leather Chemists' Assoc. Official Methods) is regarded as satisfactory, as is the present method of determining the acid value, with the substitution of N/10 aqueous sodium hydroxide for alcoholic potash. A method of determining unsaponifiable matter similar to that used for moellon, is regarded as best.—F. C. T.

Collodion enamels for leather. T. Callan, Leather World, 1914, 6, 523—524.

COLLODION enamels for leather usually contain nitrocellulose; solvents, b. pt. 55° to 80° C., such as acetone, ethyl acetate and camphor dissolved in alcohol; solvents, b. pt. 110° to 160° C., such as amyl acetate and amyl formate; diluting agents such as petroleum hydrocarbons, benzene,

and methylated spirit; softening agents such as castor or linseed oils; colouring matters. Enamels prepared with low-boiling solvents only will not give a coherent film on evaporation except in a warm dry atmosphere, as the rapid evaporation of the solvent cools the enamel, moisture is condensed from the air, and the nitrocellulose is precipitated as a white powder. The addition of a high-boiling solvent reduces the rate of evaporation, thus preventing surface cooling, and gives a brilliant film. With a nitrocellulose soluble in a mixture of camphor, alcohol, and benzene (90%), these solvents can be used as cheap diluting agents. The addition of castor or linseed oil makes the enamel more flexible but also softer and less durable, hence most of the oil should be in the lower coats. The colouring matters are usually pigments, but occasionally spirit-soluble dyes are employed.—T. C.

Tannery waste; Disposal of —. A. Roth, J. Amer. Leather Chemists' Assoc., 1914, 9, 512—522.

THE waste is first submitted to a sedimentation process, usually in a continuous flow tank, large enough to allow ample time for sedimentation, even with a maximum supply of liquor three or four times the average. The waste should enter the tank well below the surface and along the entire width, and should be drawn off over a weir and not through a single outlet pipe. Ample sludge storage should be provided, and deep tanks are preferable. Sedimentation may be made more efficient by the use of chemical precipitants such as lime or aluminium sulphate, or by utilising lime waste for the precipitation of tannins; the sludge after chemical treatment of the waste is sometimes very thin. The sludge is dried sufficiently by spreading it on well under-drained sand. For further treatment of the liquor some form of filtration is nearly always necessary, as sewage farming methods require too much land. Contact filters are inefficient and splinkling filters costly. Intermittent sand filtration has proved satisfactory, when sufficient time is periodically allowed for the aeration of the bed.—F. C. T.

Tannery wastes; Sewage disposal and use of —. C. C. Smoot, J. Amer. Leather Chemists' Assoc., 1914, 9, 523—525.

HAIR is washed and dried and in this form may be sold. Fleshings will yield 30% of grease; when they are limed for dispatch to glue factories about 8% will be found unsuitable, but may be treated for the recovery of grease. One half of the lime used in a tannery is taken up by the hide, 25% of the remainder goes into the sewage, and the remaining spent lime is useful in agriculture. Spent tanning materials are used as fuel, and the ash contains about 3% of potash. The sediment from waste liquors, spent lime, and ash from the tanning materials, form a useful fertiliser when used together.—F. C. T.

Preparation and dyeing of skins. König. See VI.

PATENTS.

Skins; Process for treating —. La Peausserie Française. First Addition, dated Feb. 12, 1914, to Fr. Pat. 442,062, March, 1912 (this J., 1912, 890).

AFTER coating the skins with an adhesive solution as described in the chief patent, coloured fleshings, linen, silk, or metallic powders are applied.

—F. C. T.

Skins; Process for puering—L. Krall. Fr. Pat. 469,758, March 18, 1914.

As a substitute for dog-puer, a mixture is used containing lipolytic and proteolytic enzymes, substances capable of emulsifying the fats of the skin, and amino-acids.—F. C. T.

Tanning materials; Process for producing—Badische Anilin und Soda Fabrik. Fr. Pat. 469,359, March 6, 1914. Under Int. Conv., June 26, 1913.

AROMATIC hydroxy-compounds or their derivatives or salts of these compounds are treated under pressure above 100° C., with sulphites and formaldehyde, or with substances capable of generating these.—F. C. T.

Leather-fibre board; Process for the production of—A. L. Clapp, Braintree, Mass., Assignor to Hide-It Leather Co., Boston, Mass. U.S. Pat. 1,119,345, Dec. 1, 1914. Date of appl., Dec. 26, 1911.

TANNED leather waste is softened by treatment with chemicals that will produce chromic acid (e.g., potassium bichromate and hydrochloric acid), and then beaten out in presence of a reducing agent (e.g., sodium thiosulphate and hydrochloric acid) to reduce the chromic acid to chromic oxide.—C. A. M.

Leather waste; Process for utilising—in the manufacture of "reconstructed" leather. F. M. Loup. Fr. Pat. 469,779, May 28, 1913.

THE material is disintegrated by successive baths of warm sodium bicarbonate solution, acetic acid, and ammonia, followed by mechanical treatment. The product is compressed by hydraulic pressure, and may be used as a substitute for American fibre, wood for paving blocks, etc. The fibrous structure of the original leather is retained.—F. C. T.

Leather; Waterproofing of chrome-tanned—E. W. Terry, Hawthorn, Victoria. U.S. Pat. 1,121,418, Dec. 15, 1914. Date of appl., July 17, 1912.

SEE Eng. Pat. 16,060 of 1912; this J., 1913, 706.—T. F. B.

XVI.—SOILS; FERTILISERS.

Phosphoric acid in soils; Strength of nitric acid, period of extraction, and ignition as affecting the gravimetric determination of—O. L. Brauer. J. Ind. Eng. Chem., 1914, 6, 1004—1005.

FOR the determination of the soluble phosphoric acid by extraction with nitric acid, the best results were obtained by digesting with 2N acid for 2 hours on the steam bath. The content of phosphoric acid soluble in nitric acid was diminished by igniting the soils.—A. S.

PATENTS.

Vinasse; Utilisation of—as a fertiliser. Melasseschempe G. m. b. H. First Addition, dated Feb. 23, 1914, to Fr. Pat. 459,872, June 5, 1913 (this J., 1913, 1165). Under Int. Conv., May 30, 1913.

A NON-HYGROSCOPIC fertiliser is prepared by heating vinasse with superphosphate, e.g., at 106°—108° C., until the free bases present have

combined with the phosphoric acid, and the organic acids and water have been expelled.—J. H. L.

Treatment of seaweed for obtaining iodine and chemical by-products or fertilisers. Fr. Pat. 469,324. See VII.

XVII.—SUGARS; STARCHES; GUMS.

Cane sugar factories; Advantages of the electrification of—G. Lobo. Intern. Sugar J., 1911, 16, 564—566.

NO cane sugar factory having a complete electric power plant has yet been erected, but in the Amistad Central factory, Cuba, steam power has been gradually replaced by electric power, and the advantages derived from the electrification of the grinding mills (each one driven independently by its own motor) are given as follows: The speed of each set of rolls may be varied in accordance with the percentage of fibre in the cane and the quantity of maceration water. Any one of the units may be stopped in the event of blockage without affecting the operation of the others. Neither the inertia of the moving parts (no heavy flywheel being necessary) nor the power of the motor is enough to cause breakage should a sudden resistance be encountered. The motors require little attention, and there is a considerable saving of labour; the cane is handled more quickly; the consumption of oil is decreased; the exhaust steam is free from oil, which is of importance in keeping the multiple-effect calandrias clean; and there is easier control of the plant and more complete centralisation of responsibility. Other parts of the factory than the milling plant have also been electrified, and the advantages that have ensued are:—The wages of engineers, attendants, and cleaners are more than 50% less and the total cost of manufacture about 15% less than with the steam drive. During the inter-campaign, the expense of the dismantling and preservation of the installation has been about half of what it was previously, the plant being furnished with a damp-proof insulation, which keeps it in good condition. On account of the longer life, the reduced cost of repairs, and the lower initial cost, depreciation and interest amount to about 15—20% less than those of a steam-driven factory of the same capacity. The total saving compared with a steam-driven factory of the most modern type is estimated as 20—25%.—J. P. O.

Sugar solutions; Study of the efficiency of various methods for the filtration of—A. E. Roberts. J. Ind. Eng. Chem., 1914, 6, 986—989.

LABORATORY tests were made with cloth of varying degrees of fineness of texture, alundum, various kinds of filter paper, 40-mesh sand, asbestos, fullers' earth, infusorial earth, and sawdust. In all cases it was found necessary to defecate the sugar solution. Increasing the hydrostatic pressure proved a better means of accelerating filtration than the use of suction, increasing the filtering surface, or inverting the filter to keep it free from a deposit of solid matter. Rapid and clear filtration was most readily obtained with sawdust, and the use of this material or some form of wood waste is recommended for laboratory work and also in refineries, where its chief disadvantage would be the cost of evaporating the increased volume of sweet water produced in washing the sawdust, whilst its advantages are that it is cheap, easily washed, needs no filter-presses, and yields clear bright liquors in a minimum of time.—A. S.

PATENTS.

Sugar; Treatment or preparation of — and apparatus for use therein. E. Shaw, G. S. and G. R. Baker, London. Eng. Pat. 27,185, Nov. 25, 1913.

To prepare fine powdery sugar (so-called "aerated" or "amorphous" sugar) such as is referred to in Eng. Pats. 28,297 of 1903 and 4112 of 1904 (this J., 1905, 144, 245), the treated syrup is delivered on to a plate or surface the temperature of which can be controlled, and the layer of sugar so formed is removed and delivered into and through a chamber or trough wherein the heat is controlled so that the syrupy mass crystallises uniformly. From this chamber the sugar, air, and vapour are withdrawn by a fan at high speed, so that the sugar is subjected to an air blast of large volume which cools, dries, and delivers it for further treatment. Sugar dust remaining suspended in the air is recovered by moistening with a steam jet and water spray. —J. F. B.

Locust beans; Process for obtaining — in the form of a pure and dry powder from which gum can be made. A. Pinel, Houlme, France. Eng. Pat. 13,508, June 3, 1914. Under Int. Conv., June 26, 1913.

LOCUST beans, previously decorticated, are crushed in the moist state, and the moist powder is dried and again crushed. —J. F. B.

Adhesive substance from seaweed; Process for producing a light coloured —. Norsk Tangsyndikat. Fr. Pat. 469,191, Feb. 27, 1914. Under Int. Conv., March 1, 1913.

SEE U.S. Pat. 1,099,382 of 1914; this J., 1914, 840. —T. F. B.

Process for the utilisation of marine algæ. Fr. Pat. 469,190. See VII.

XVIII.—FERMENTATION INDUSTRIES.

Barley; Proteins of — in the grain itself and during the brewing processes. H. Schjerning, Comptes rend. Trav. Lab. Carlsberg, 1914, 11, 45—105.

THE results of the author's previous work on this subject (see this J., 1906, 1109; 1910, 583; 1913, 985) are summarised and full details are given of the method of precipitation by solutions of metallic salts employed in determining different classes of proteins and their products of hydrolysis. The principle of this method is as follows:—Under the conditions described albumin I (leucosin) is salted out by stannous chloride; albumin I., albumin II. (edestin), and denuclein by mercuric chloride; albumins I. and II., denuclein, and proteases (albumoses) by ferric acetate; albumins I. and II., denuclein, proteoses, and peptone (real peptone) by uranium acetate; albumins I. and II. and proteases by magnesium sulphate. From the values thus obtained and the quantities of nitrogen, insoluble, soluble, and present as ammonia, the amounts of the various classes of nitrogenous compounds present in a liquid can be calculated. The probable course of protein degradation (and conversely of protein condensation) is represented by the following stages, taken in order:—Insoluble protein, albumin II, albumin I., peptic products (denuclein, proteose, peptone) and tryptic products (amides, amines, and ammonia).—J. H. L.

Barleys; Ammoniacal nitrogen in —. H. Leberle and H. Lüers. Z. ges. Brauw., 1914, 37, 321—324.

By distillation with calcined magnesia at atmospheric pressure ammonium salts are completely decomposed, acid-amides (asparagin) only slightly, and amino-acids (glycine) not at all. The quantities of ammoniacal nitrogen determined by this method and calculated as protein, in 40 samples of barley from various localities, ranged from 0.24 to 0.42%, and lower values were obtained by distillation with magnesia *in vacuo*. No general relation was observed between the amount of ammoniacal nitrogen and the place of growth of a barley, the fertilisers employed, or the manner of storage of the grain. Determinations of the protein in barley by Barnstein's method gave values only 0.19—0.36% lower than those calculated from the total nitrogen-content of the grain (factor 6.25), so that the nitrogenous matters of barley consist almost exclusively of proteins of high molecular weight.—J. H. L.

Hops; Investigations on —. IV. Determination of resins in hops. J. Schmidt, O. Winge and J. P. H. Jensen. Comptes rend. Trav. Lab. Carlsberg, 1914, 11, 116—147.

VARIOUS methods for determining the bitter substances of hops (Briant and Meacham, this J., 1897, 702; Tartar and Bradley, this J., 1912, 403) have been based on the separation of the soft α - and β -resins from the hard γ -resin, in the belief that the latter is not bitter and is therefore of no value in brewing. The γ -resin, however, assists in clarifying the wort by precipitation of albumins, and it also possesses a bitter flavour readily recognisable in solutions, e.g., in dilute alcohol. Water in which the solid γ -resin has been boiled for some hours is distinctly bitter, and however often the operation may be repeated with fresh water the residue retains its bitter flavour when dissolved in dilute alcohol. The relative bitterness conferred on wort by boiling with the separate resins for the period usually employed in brewing, is approximately 10:7:4 for the α -, β - and γ -resins respectively and all three promote clarification of the wort. The average proportions in which the three resins are present in hops are approximately 6%, 8%, and 2%, and the quantities of each corresponding to 1 c.c. of N/1 potassium hydroxide on titration are 0.32, 0.40 and 0.6 gm. respectively. From these data it is calculated that, as regards bitterness and titre towards alkali, the total resins in hops behave as if they consisted wholly of β -resin, and therefore in the following method the assumption that 1 c.c. of N/1 potassium hydroxide corresponds to 0.40 gm. of total resins (cp. Lintner, this J., 1899, 178) permits an approximately accurate determination of the "bitterness value" of hops. The method is as follows:—30 grms. of hops are disintegrated in a meat mincing machine. The first 5 grms. are discarded and the remainder, amounting to about 15 grms. (some remaining in the machine), is mixed, and 5 grms. weighed out into a tared flask and dried in a vacuum at 35° C. for 24 hours to determine the moisture. The material is next treated with 150 c.c. of ether free from water and alcohol, shaken frequently during 1 hour, and filtered. The residue is washed thoroughly with about 100 c.c. of ether, using a wash-bottle with a fine jet, and the extract is titrated with N/20 potassium hydroxide solution in 93% alcohol, in presence of 6—8 drops of a 1% solution of phenolphthalein in 93% alcohol, until a red colour is produced which further addition of alkali does not intensify. One c.c. of N/1 potassium hydroxide corresponds to 0.40 gm. of resins. If the hops and the ether are not free from water high results are obtained owing to solution of hop tannic acids

The presence of 4.5% of moisture in the hops may increase the apparent content of resins by more than 1%. To recover the ether it is transferred after titration to a large bottle half filled with saturated brine, and passed through 5 such bottles in the course of 5 days, each being shaken twice daily. It is next distilled from a bath at 40° C., then dried for some days with calcium chloride, and for at least 10 days with sodium, and finally distilled from a bath at 35° C. The materials used by the authors for 1000 analyses were: 74 litres of ether, 35 litres of alcohol, 600 grms. of sodium, and 12 kilos. of commercial calcium chloride. A bibliography of the subject is appended to the paper.—J. H. L.

Hop boiling; Transformations during—G. Jakob. *Spezialmonatschr. ges. Brau- und Malz-Betriebeskontrolle*, 1913, 1, 2, 21, 27. *Z. ges. Brauw.*, 1914, 37, 21.

A loss of bitter substances occurs during the ageing of hops or their storage in a warm place; drying at higher temperatures results in a still greater loss and also a darkening of colour. If hops are boiled with a protein solution, the latter becomes after a time less bitter and more deeply coloured the longer boiling is continued. The oxidation of certain constituents of the hops is also influenced by the protein. The intensity of the oxidation processes is much increased by predigestion of the hops in the protein solution at 75° C., and is also influenced by the concentration of the solution and the final temperature. The loss of bitter substances during the boiling of worts with hops may be diminished by coagulating the proteins, as far as possible before the hops are added, but Wiegmann found that a similar result is attained by intense agitation of the boiling wort. The author distinguishes between readily soluble "primary" bitter substances which are readily decomposed, and the less soluble "secondary" bitter substances of harsher flavour which are more stable. The satisfactory flavour of a beer depends on the presence of both kinds in certain relative amounts, and no system of hop extraction should be adopted which allows the proper balance to be disturbed by excessive decomposition of the less stable but more aromatic bitter substances.

—J. H. L.

Hop boiling; Jakob's views concerning transformations during—D. Wiegmann. *Allgem. Brauer- und Hopfenzeit.*, 1913, 53, 2917. *Z. ges. Brauw.*, 1914, 37, 22.

The darkening of protein solutions on boiling with hops, observed by Jakob (see preceding abstract), is due not to bitter principles but to hop tannins. A deeper colour is produced by hops free from bitter substances than by normal hops. Jakob's solutions of "primary" bitter substances are only solutions of tannins containing small quantities of bitter principles. Non-coagulable proteins are entirely or almost indifferent towards the bitter substances during the boiling of worts. The process suggested by Jakob, of agitating the hops with water at 70°–80° C. in a Halut extractor for half an hour and then adding the lupulin extract to the wort separately, is attended with great loss of bitter substances. Jakob's work shows the importance for the brewery of hop tannins in a concentrated form.—J. H. L.

Yeast; Autofermentation of—M. W. Beijerinck. *Livre Jubilaire Van Laer*. *Z. ges. Brauw.*, 1914, 37, 223–224.

THE autofermentation of yeast is accompanied by the conversion of the glycogen in the cells into dextrose by the enzyme glycogenase. *Schizosaccharomyces Pombe*, which contains no glycogen,

does not undergo autofermentation. All influences which injure yeast without killing it induce autofermentation; such influences are desiccation and subsequent moistening, high temperatures, soluble matters of the most diverse kinds which raise the osmotic pressure, and poisons and disinfectants. Pressed yeast undergoes slow autofermentation even at 30° C., but most rapidly at 48°–49° C., the whole of the cell glycogen disappearing in 3–5 hours at this temperature. The corresponding temperature for beer yeast is lower, and this difference provides a means of distinguishing the two kinds of yeast. Sodium chloride exerts its maximum acceleration on autofermentation in solutions of about 5% concentration and isosmotic solutions of the most diverse non-poisonous substances have approximately the same effect. Mannitol exerts its maximum action at concentrations of 13–15%. The proportion of glycogen in pressed yeast, calculated from the amounts of alcohol and carbon dioxide formed during autofermentation, is usually smaller than in the better top-fermentation yeasts. In presence of poisonous substances the quantity of carbon dioxide formed is always much less than corresponds to the glycogen present.—J. H. L.

Yeast juice; Reduction of acetaldehyde by—S. Kostytschew and E. Hübner. *Z. physiol. Chem.*, 1913, 85, 408. *Z. ges. Brauw.*, 1914, 37, 260.

THE reduction of acetaldehyde observed by Lebedew and Griaznow with yeast maceration juice, in absence of sugar, is confirmed when freshly prepared yeast juice is employed. Previous negative results are attributed to the use of juice which had been kept for 42 hours at the ordinary temperature. The fact that not only living yeast, but also all forms of permanent yeast ("Dauerhefe") and yeast juice hitherto prepared, are capable of reducing acetaldehyde, is in accordance with the theory propounded by Kostytschew for the fermentation of sugar. (See also this J., 1912, 553, 741, 1195; 1913, 207; 1914, 328.)—J. F. B.

Yeast organism; The chemical fixation of substances in killing the—by various chemical reagents. *Disappearance of the substance from the solution*. T. Bokorny. *Allg. Brau. u. Hopfenzeit.*, 1914, 54, 541. *Z. ges. Brauw.*, 1914, 37, 243.

IN studying the killing of yeast cells by various bases, acids and dyestuffs, it was frequently found that the reagent was fixed by the cell substance. The combination leads to the death of the cell, an alteration of the constituent groups of the protein complex being produced which prevents the exercise of vital functions. The poisonous action of dyestuffs is doubtless due to their property of being absorbed by the protoplasm. Dyestuffs which are still capable of staining at extreme dilutions are also poisonous to micro-organisms at extreme dilutions. Some aniline dyestuffs are fatal at dilutions of 1 part per 100,000 or more. It is also possible that the dyestuff is absorbed without chemical combination, apart from the protoplasm, by the cellulose or cell walls.—J. F. B.

Alcoholic fermentation. V. Proteolysis by permanent yeast ("Dauerhefe") in presence of zinc chloride. S. Kostytschew and W. Brilliant. *Z. physiol. Chem.*, 1913, 85, 507. *Z. ges. Brauw.*, 1914, 37, 260. (See this J., 1914, 706.)

EXPERIMENTS were made at the ordinary temperature with dry permanent yeast prepared according

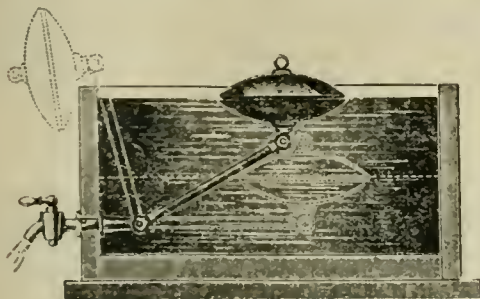
to Lebedew's method, containing total N 9.48% and protein N 7.62%. In absence of sugar, the addition of zinc chloride caused a slight increase of the proteolysis, which was apparently due simply to the acid reaction of the salt; in sugar solutions, on the other hand, there was a decided retardation. The inhibition increased with the concentration of the sugar, but was uninfluenced by increase in the quantity of zinc chloride, fermentative proteolysis being generally retarded by large proportions of sugar. The experiments proved that the powerful inhibition of zymase fermentation which is caused by zinc chloride is not due to the rapid destruction of the zymase by proteolysis, but is the direct effect of the zinc chloride on the activity of the fermentation enzyme.—J. P. B.

Brewing practice; Sarcina-infection in — and the degree of attenuation. F. Stockhausen. Jahrb. Versuchs. Labranst. für Brau., 1912, 15, 305. Z. ges. Brauw., 1914, 37, 270—271.

Two forms of malady in beers, due to sarcina, should be distinguished. In one the organisms, without any apparent change in the external conditions, multiply within a short time to such an extent as to render the beer turbid. In the other the beer assumes a light haze which may become more intense without forming any deposit, and as no sarcina, or only a few, are detected under the microscope the cause of the trouble may be overlooked. Incompletely saccharified worts are very subject to this malady, a great safeguard against which is a high degree of attenuation in the vat. It may sometimes be prevented by acidification of the mash, although in one case where this was successful the beer became cloudy with wild yeasts within a few days. Moreover the sarcina themselves produce acids and they readily become accustomed to high acidity and also to the use of large quantities of hops. Sarcina infection was exceptionally prevalent in the summer of 1911, and particularly in breweries with open surface coolers. Multiplication of the organism was favoured by the low attenuation of the beers of that year, which in turn was a consequence of overworking of the yeast owing to the highly nitrogenous malts employed. The chief safeguards against sarcina infection are pure yeast, rapid fermentation, and high attenuation.—J. H. L.

Yeast; Automatic apparatus for drawing off wash waters from —. G. Fries. Z. ges. Brauw., 1914, 37, 69—70.

The yeast is suspended in water in the vessel shown (see figure) and strongly aerated, the float mean-



while resting against the side of the vessel. When the yeast has subsided the float is lowered on to the

surface of the liquid, which enters the slot in the side of the float and is drawn off until the layer of yeast is reached, when the tap is closed. The apparatus can be taken to pieces for cleaning.

—J. H. L.

Beer; New legislation respecting —. Finance Act, 1914 (Session 2) [5 Geo. 5, Ch., 7].

AN additional Customs duty is payable, from Nov. 18, 1914, on imported mum, spruce, or black beer and on Berlin white beer and other preparations of a similar character, at the rate of £1 0s. 10d. or £3 9s. 0d. per 36 galls. according as the original gravity does or does not exceed 1215. On other beers an additional duty of 17s. 3d. per 36 galls. of original gravity 1055 is imposed, with a rebate of 2s. until March 31, 1916, and afterwards of 1s. until March 31, 1917. A proportional rebate is also allowed off the additional Customs duty on the special kinds of beer mentioned above. Beer brewed for exportation may be placed in bond without payment of Excise duty, or if the latter has already been paid the brewer may obtain drawback on placing the beer in bond. For the determination of original gravity of beer worts a revised Table (see below) is substituted for the one hitherto used, and in calculating the duty a deduction of $\frac{1}{3}$ of a degree is allowed from the original gravities as shown by the Table. Samples of beer are to be filtered before distillation. Liquors made elsewhere than on licensed premises of a brewer shall not be regarded as beer unless their original wort gravity exceeds 1016 and they contain more than 2% of proof spirit.

Table for determining the original gravity of worts of beer.

Spirit Indication.	Degrees of Original Specific Gravity.	Spirit Indication.	Degrees of Original Specific Gravity.	Spirit Indication.	Degrees of Original Specific Gravity.	Spirit Indication.	Degrees of Original Specific Gravity.
0	00	4.1	17.75	8.2	36.58	12.3	56.38
1	02	4.2	18.21	8.3	37.04	12.4	56.80
2	05	4.3	18.66	8.4	37.51	12.5	57.40
3	1.27	4.4	19.12	8.5	37.97	12.6	57.91
4	1.70	4.5	19.57	8.6	38.44	12.7	58.42
5	2.12	4.6	20.03	8.7	38.90	12.8	58.93
6	2.55	4.7	20.48	8.8	39.37	12.9	59.44
7	2.97	4.8	20.94	8.9	39.83	13.0	59.95
8	3.40	4.9	21.39	9.0	40.30	13.1	60.46
9	3.82	5.0	21.85	9.1	40.77	13.2	60.97
10	4.25	5.1	22.30	9.2	41.24	13.3	61.48
1.1	4.67	5.2	22.76	9.3	41.71	13.4	61.99
1.2	5.10	5.3	23.21	9.4	42.18	13.5	62.51
1.3	5.52	5.4	23.67	9.5	42.65	13.6	63.01
1.4	5.95	5.5	24.12	9.6	43.12	13.7	63.52
1.5	6.37	5.6	24.58	9.7	43.59	13.8	64.03
1.6	6.80	5.7	25.03	9.8	44.06	13.9	64.54
1.7	7.22	5.8	25.49	9.9	44.53	14.0	65.05
1.8	7.65	5.9	25.94	10.0	45.00	14.1	65.62
1.9	8.07	6.0	26.40	10.1	45.48	14.2	66.14
2.0	8.50	6.1	26.86	10.2	45.97	14.3	66.66
2.1	8.94	6.2	27.32	10.3	46.45	14.4	67.18
2.2	9.38	6.3	27.78	10.4	46.94	14.5	67.70
2.3	9.82	6.4	28.24	10.5	47.42	14.6	68.22
2.4	10.26	6.5	28.70	10.6	47.91	14.7	68.74
2.5	10.70	6.6	29.16	10.7	48.39	14.8	69.26
2.6	11.14	6.7	29.62	10.8	48.88	14.9	69.78
2.7	11.58	6.8	30.08	10.9	49.36	15.0	70.30
2.8	12.02	6.9	30.54	11.0	49.85	15.1	70.83
2.9	12.46	7.0	31.00	11.1	50.35	15.2	71.36
3.0	12.90	7.1	31.46	11.2	50.85	15.3	71.89
3.1	13.34	7.2	31.93	11.3	51.35	15.4	72.42
3.2	13.78	7.3	32.39	11.4	51.85	15.5	72.95
3.3	14.22	7.4	32.86	11.5	52.35	15.6	73.48
3.4	14.66	7.5	33.32	11.6	52.85	15.7	74.01
3.5	15.10	7.6	33.79	11.7	53.35	15.8	74.54
3.6	15.54	7.7	34.25	11.8	53.85	15.9	75.07
3.7	15.98	7.8	34.72	11.9	54.35	16.0	75.60
3.8	16.42	7.9	35.18	12.0	54.85		
3.9	16.86	8.0	35.65	12.1	55.36		
4.0	17.30	8.1	36.11	12.2	55.87		

—J. H. L.

Lactic acid: Production of—by acetic bacteria. A. Osterwalder. *Centralbl. Bakt.*, 1913, II., 37, 353. *Z. ges. Brauw.*, 1914, 37, 35.

CERTAIN acetic bacteria (*Bact. o* and *r*) often produce appreciable amounts of lactic acid during the acetic fermentation, but only in presence of alcohol and probably from the latter either directly or secondarily from acetic acid. Malic acid is attacked by these bacteria but without formation of lactic acid.—J. H. L.

Pyknometer spindle: The—, a new instrument for alcohol determination. H. Wüstenfeld and T. Foehr. *Deut. Essigind.*, 1914, 18, 114, 125. *Z. ges. Brauw.*, 1914, 37, 245.

For the rapid estimation of alcohol in vinegar factories by determination of the specific gravity, the ordinary hydrometer spindle is difficult to read accurately owing to the deformation of the meniscus by dirt on the surface of the liquid. In the new instrument the hollow portion of the hydrometer itself is filled with the distillate to be tested, after the manner of a pycnometer, and the instrument is floated in a liquid, *e.g.* toluene, which is unaffected by a greasy surface. In this way all the accuracy of a pycnometer is attained without the use of an analytical balance, and an observation may be made with a smaller quantity of distillate than is required to float a hydrometer spindle. The filling of the instrument is simpler than that of the pycnometer and adjustment to normal temperature is unnecessary if correction tables be used. The range of one spindle is from 0 to 12% of alcohol.—J. F. B.

Denatured alcohol in Australia.

A COMMONWEALTH Customs Order of Sept. 9, 1914, states that, owing to the difficulty of procuring spirit denaturants conforming to the prescribed standards, various General Orders hitherto issued are suspended until further notice. The denaturing of spirits for industrial purposes may be permitted by the use of denaturants of quality and quantity approved by the Collector of Customs; samples of the denaturants used will be tested periodically to ensure protecting the Revenue.

Alcohol as a substitute for benzine for driving motor cars. Hempel. *See* IIa.

Substitutes for petrol and benzine in motor engines. Dieterich. *See* IIa.

Alcohol as a motor car spirit. Mohr. *See* IIa.

PATENTS.

Liquid [fermenting wort]: Apparatus for aerating and agitating—. H. J. Worssam. London. Eng. Pat. 26,591. Nov. 19, 1913.

Air or other gas is led under pressure from a reservoir to nozzles attached to one or more arms submerged below the level of the fermenting liquid, the escaping gas being directed downwards and backwards so as to rotate the arms and at the same time agitate the substance (yeast) at the bottom of the containing vessel. A portable form of the apparatus with flexible hose connection to the agitator arms may be used.—J. F. B.

Beer: Manufacture of temperance—. R. Wahl. Chicago, Ill. U.S. Pat. 1,117,613. Nov. 17, 1914. Date of appl., June 4, 1914.

BEER containing a low percentage of alcohol is prepared by adding to the wort an acid extract of the soluble matters of malt containing the peptase and the albuminoids dissolved by its action,

together with the acid used for the extraction of the malt; adding yeast to obtain the fermentation flavour: cooling to near 0° C. to arrest alcoholic fermentation so that the alcohol does not exceed 0.5—1%, and causing the lactic acid to change the neutral phosphates of the wort to primary phosphates with sufficient additional acid to bring the amount of free lactic acid up to that contained in normal alcoholic beer.—J. F. B.

Brewing [mashing]: Art of—. H. H. Freund, Weehawken Heights, N.J. U.S. Pat. 1,119,504. Dec. 1, 1914. Date of appl., April 3, 1913.

THE hulls are separated from the remainder of the malt body, treated with water to extract the deleterious ingredients, separated from this extract, and then added to the remainder of the malt body in the mash-tub.—J. F. B.

Fermentation: Process of—utilising the catalytic influences of stabilised electro-metallic colloids in combination with vegetable extracts. R. Bhun. Fr. Pat. 169,667. March 14, 1914. Under Int. Conv., April 1, 1913.

To stimulate the yeast and suppress fermentation by foreign organisms, the fermenting liquid is subjected to "radio-dynamic emanations" from an inert porous body, *e.g.* clay, impregnated with known electro-metallic colloids and with vegetable extracts to confer the desired flavour and aroma on the product.—J. H. L.

Wine: Manufacture of sparkling—. [Treatment of bottles.] H. Ebert. Fr. Pat. 469,674, March 14, 1914.

To enable bottles once used to be employed a second time without risk of breakage, they are heated to the softening point and cooled slowly.—J. H. L.

Fusel-oil: Process of manufacturing—. J. Scheckenbach, Munich, Germany. U.S. Pat. 1,118,238, Nov. 24, 1914. Date of appl., Sept. 17, 1913.

SEE Fr. Pat. 462,472 of 1913; this J., 1914, 329.—T. F. B.

Alcoholic fermentation: Process of—. R. de Fazi. Fr. Pat. 469,283, Jan. 19, 1914. Under Int. Conv., Jan. 28, 1913.

SEE Eng. Pat. 1335 of 1914; this J., 1914, 936.—T. F. B.

Treatment [alcoholic fermentation] of sulphite cellulose waste lye. Eng. Pat. 24,738. *See* V.

Utilisation of vinasse as a fertiliser. Addition to Fr. Pat. 459,872. *See* XVI.

Manufacture of fatty acids. Fr. Pat. 469,552. *See* XX.

XIXA.—FOODS.

Flour: Acidity of—. Natural and artificial bleaching of flour, and sulphates and lime in flour. R. T. Thomson. *Analyst*, 1914, 39, 519—527.

ORDINARY wheaten flour is neutral to litmus and methyl red, alkaline to methyl orange, and acid to phenolphthalein. The acidity as measured by titration, using phenolphthalein as indicator, is not due to lactic acid since this is also acid towards methyl red and litmus. When flour becomes

"sour" it is acid towards the two latter indicators, but it is doubtful whether, even in this case, the acidity is due to lactic acid.

During the process of milling, flour absorbs a certain quantity of nitrite from the atmosphere, the quantity being about 0.35 part (as NaNO_2) per million in the case of first-grade flour and decreasing as the product becomes coarser. The absorption of nitrites from the atmosphere by flour stored in glazed paper bags is very small, but the surface layer may absorb up to 3.12 parts per million, a quantity also found in flour which has been exposed for 30 mins. in a practically closed chamber containing lighted gas jets, or in that which has been artificially bleached with 5 c.c. of nitric peroxide per kilo. The percentage of colour destroyed, however, is entirely different, being only 6% in the case of the flour stored in the bag or exposed to the special atmosphere, whereas by the artificial bleaching 21% of the colour is removed. A specimen of flour bleached with 2 c.c. of nitric peroxide per kilo. contained 1.10 parts of nitrite per million and 7% of the colour was destroyed, whilst another specimen exposed to the air for 10 days and then found to contain 1.1 parts of nitrite, had 27% of its colour removed. The bleaching effect in the latter instance must be attributed to other causes than nitrous acid, probably oxidation assisted by moisture and light. Nitrites as such do not bleach flour, and the amount of acid required to bring flour into a condition capable of liberating nitrous acid from added nitrites is practically equivalent to the alkalinity of the mineral matter of the flour towards methyl orange; it is improbable that such a quantity of acid is present in the volume of air which could come into contact with the flour, and the author dismisses as impossible the theory that nitrous acid is the active agent in bleaching flour exposed to the atmosphere.

To determine sulphates in flour, 20 grms. is mixed with 250 c.c. of water containing about 15 c.c. of hydrochloric acid (sp. gr. 1.16), the mixture is heated on a boiling water-bath until the starch is liquefied, then boiled for a few minutes, cooled, filtered, and the insoluble portion washed with dilute hydrochloric acid. The sulphates in the filtrate are precipitated by barium chloride. First-grade flour was found to contain from 0.010 to 0.013% SO_3 , and 0.015% CaO , whilst "common flours" contained 0.061% SO_3 and 0.102% CaO (see also this J., 1911, 1069).—W. P. S.

Iron in tomatoes. C. A. Brantleight and G. Crawford. J. Ind. Eng. Chem., 1911, 6, 1001—1002.

TOMATOES grown in ten different counties of Florida, U.S.A., on soils containing 1.06—1.3% Fe, were found to contain 0.012—0.037% Fe (average 0.023). The water content of the tomatoes ranged from 89.3 to 95.3 (average 93.1) and the yield of ash from 0.38 to 0.61% (average 0.53). No relation between the water and ash, or iron and ash, could be detected, and the content of water and of iron appeared to be independent of the geographical position of the plot on which the tomatoes were grown.—A. S.

PATENTS.

Margarine; Manufacture of —. E. V. Schou, Copenhagen. Eng. Pat. 23,167, Oct. 16, 1913.

THE aqueous liquid and the fat are sterilised, and the former is then passed into a fermenting vessel where micro-organisms are developed under constant conditions throughout the entire liquid (see Eng. Pat. 4504 of 1912; this J., 1913, 444). The fermented liquid and the fat are passed into an emulsifier in the proportions it is desired to have in the finished product, and the emulsified

mass is delivered between cooling drums and is instantly spread out into a layer sufficiently thin to secure uniform cooling throughout the entire thickness of the layer (see Eng. Pat. 12,561 of 1907). The whole process may be conducted out of contact with the outside air (see Eng. Pat. 4508 of 1912; this J., 1913, 416).—J. H. J.

Flour; Dry-shortening —. A. W. Estabrook and H. E. Weaver, Kansas City, Mo., Assignors to The Larabee Flour Mills Co., Hutchinson, Kans. U.S. Pat. 1,119,260, Dec. 1, 1914. Date of appl., Nov. 6, 1913.

Dry flour is mixed with "a shortening amount" of powdered sodium stearate and gas-producing materials.—J. H. J.

Tomato preserve; Manufacture of —. G. Frerichs. Fr. Pat. 469,255, March 5, 1911. Under Int. Conv., Mar. 23, 1913.

THE skins and seeds in tomato pulp are separated from the juice which is then fermented with yeast. After the fermentation is completed, the yeast is filtered off, and the filtrate is added again to the pulp. The mixture is evaporated to the desired consistence or to dryness.—J. H. J.

Fodder; Manufacture of — from waste sulphite-cellulose lyes. J. König. Fr. Pat. 469,768, March 19, 1914. Under Int. Conv., Feb. 2, 1914.

WASTE sulphite lye is mixed with the residual liquid obtained in the treatment of wood with dilute alkalis and acids, with the aid of heat and pressure (see Ger. Pat. 265,183; this J., 1913, 1063), and the mixture is evaporated, neutralised, and freed from sulphurous acid; the product can be used as a cattle food. The sulphite lyes may be submitted to a preliminary treatment with acid or alkali, which enables them, after neutralisation and separation of sulphurous acid, to be evaporated separately; this product also can be used as a food by itself. The residual liquid obtained from the acid and alkali treatment of cellulose may be treated for the extraction of resins, tannin, sugar, etc., before being mixed with the sulphite liquor.—J. H. J.

Food product; Manufactured — and process of producing the same. G. von Rigler, Kolozsvár, Austria-Hungary. U.S. Pat. 1,118,317, Nov. 21, 1914. Date of appl., May 22, 1913.

SEE Fr. Pat. 461,131 of 1913; this J., 1914, 215. —T. F. B.

Tomato preserves, and process of making the same. G. Frerichs, Bonn, Germany. U.S. Pat. 1,119,263, Dec. 1, 1914. Date of appl., March 19, 1911.

SEE Fr. Pat. 469,255 of 1911; preceding.—T. F. B.

Vegetable extract similar to meat extract; Process for preparing a —. G. Frerichs. Fr. Pat. 469,373, March 7, 1911. Under Int. Conv., March 23, 1913.

SEE Ger. Pat. 269,813 of 1913; this J., 1914, 330. —T. F. B.

Beverage extracts; Manufacture of —. J. L. Kellogg, Battle Creek, Mich. Reissue No. 13,817, Dec. 15, 1911, of U.S. Pat. 1,097,720, May 26, 1914. Date of appl., Oct. 22, 1914.

SEE this J., 1911, 803.—T. F. B.

Desiccating organic matter. U.S. Pat. 1,118,841. See 1.

XIXB.—WATER PURIFICATION; SANITATION.

Oxygen in waters in presence of nitrite; Comparison of methods for the determination of —. E. Elvove. U.S. Public Health Service. Hygienic Lab., Bull. No. 96, 15—35, Aug., 1914.

THE Levy method, in which the amount of ferrous oxide oxidised is determined, gives low results even if nitrites are absent. The acetate modification of Winkler's method, in which potassium acetate is added before titration, affords more accurate results owing to depression of the dissociation of the nitrous acid (compare Hale and Melia, this J., 1914, 39). Excess of potassium acetate should be used, and 15 min. contact allowed. The permanganate modification of the Winkler method (Rideal and Stewart, this J., 1901, 841) gave very consistent results. When solutions of oxalic acid stronger than $N/50$ were used low results were obtained, but this could be counteracted by the use of more potassium iodide than usual. It is recommended that 0.45 gm. of potassium iodide be added, and that the excess of potassium oxalate should not exceed 1 c.c. of a 1% solution. The use of the permanganate method has the further advantage of oxidising the organic matter in the sample before the iodine is liberated.—J. H. J.

Ultra-violet rays and their application for the sterilisation of water. M. von Recklinghausen. J. Franklin Inst., 1914, 178, 681—704.

THE only source of ultra-violet rays suitable for industrial purposes is the quartz mercury vapour lamp. With rays from such a source, a fraction of a second's exposure close to the lamp is sufficient to sterilise water. At a distance of 200 mm. from a lamp burning at 66 volts and 3.5 amps., many pathogenic and non-pathogenic bacteria in suspension in clean water were killed in 10—50 seconds; *Paramoecia* required 180 seconds and yeast 300 seconds. Spores were 1.5—5 times as resistant as vegetative forms. The sterilising action diminished as the square of the distance from the lamp, and was independent of temperature between 0° and 55° C. The power of the rays was determined by placing a drop of water containing *Paramoecia* at a definite distance from the lamp and observing the number of seconds required to kill them. A photochemical method was also used, the time taken to blacken silver citrate paper at different voltages being noted. The results by the two methods agreed very closely. Several forms of lamp are described, the one finally adopted to secure proper contact of the water with the rays being the closed U-shape, two of these being placed as radii in a circular tank. Ultra-violet rays not only kill bacteria, but also destroy toxins.—J. H. J.

Shell fish; Investigation of coastal waters with special reference to the pollution of —. R. H. Creel. U.S. Hygienic Lab., Bull. No. 96, Aug., 1914, 5—11.

THE sewage of Gulfport, Miss., U.S.A., population 7000, is discharged into Mississippi Sound one mile from the shore. Between that point and the shore are oyster beds, and in most cases *B. coli* could be detected in 0.01 c.c. of the shell liquor. *B. coli* was invariably present in 0.01—1.00 c.c. of the sea water around the beds. The drainage from the cesspools of the town of Biloxi percolates into an arm of Mississippi Sound. The oyster beds are situated near the shore, and in nearly all instances *B. coli* was present in 0.01 c.c. of the shell liquor and in a few cases in 0.1—1.0 c.c. of the sea water.—J. H. J.

Arsenic solutions [dipping baths]; Blood charcoal as a purifying agent for — previous to titration. R. M. Chapin. J. Ind. Eng. Chem., 1914, 6, 1002—1003.

ARSENICAL dipping baths may be satisfactorily purified and decolorised previous to titration by digesting the acid solution with a small quantity of blood charcoal (not more than 0.25 gm. per 25 c.c.). In tests it was found that arsenious oxide was slightly adsorbed and oxidised by the charcoal but was again taken into solution on thorough washing. If total arsenious oxide is to be determined, the amount of arsenious oxide oxidised must be ascertained by a control determination with the charcoal used.—A. S.

Calcium and magnesium compounds of higher fatty acids. Haupt. See XII.

Disposal of tannery waste. Roth. See XV.

Sewage disposal and use of tannery wastes. Smoot. See XV.

PATENTS.

Disinfectants and other chemicals; Appliance for mixing water with liquid —. W. S. Watson, East Sheen, Surrey. Eng. Pat. 26,918, Nov. 22, 1913.

Two pistons mounted on the same shaft work in the two compartments of a horizontal cylinder. One compartment communicates with the inlet for the chemical or disinfectant solution, and also with an outlet leading to a mixing chamber to which the water supply is also admitted. The other compartment communicates with a valve-chest and slide-valve, worked by the pressure of the water supply and admitting water to the two sides of the piston alternately; the pressure of the water entering behind the piston causes it to travel forward, and simultaneously causes the piston in the other compartment to move forward and eject the disinfectant into the mixing chamber. As the piston worked by the water pressure reaches the forward end, it engages a tappet rod connected with a lever, the movement of which reverses the water-supply valve.—J. H. J.

Insecticide. I. F. Peck, Auburn, R.I., Assignor to The Veldop Co., Wilmington, Del. U.S. Pat. 1,119,036, Dec. 1, 1914. Date of appl., March 7, 1914.

(COMMERCIAL arsenic (one mol.) and slaked lime (2 mols.) are mixed together, a little free lime is added, and enough water to form a pasty mass. The product is capable of being mixed with larger quantities of water in which it remains in suspension so that it can be sprayed.—J. H. J.

Refuse; Incineration of —. Müllverbrennungs-ges. m. b. H. "Vesuvio." Fr. Pat. 470,034, March 24, 1914.

THE refuse is fed into a hopper, at the bottom of which is a screw conveyor to feed it continuously on to the grate of the furnace. The furnace gases pass behind the grate, carrying the light cinders with them, whilst the heavy cinders fall into a bucket below the grate. The heat from the grate partially dries the refuse at the bottom of the hopper.—J. H. J.

Soya beans; Process for making a soluble nitrogenous substance [decolorising agent] from —. E. Dammer. Fr. Pat. 469,787, Jan. 26, 1914.

SEE Ger. Pat. 274,974 of 1913; this J., 1914, 840. The product may also be used for treating boiler-feed water to prevent or remove incrustation.—T. F. B.

Pasteurising liquids; Process of——. C. Krug. Frankfort on Maine, Germany. U.S. Pat. 1,119,520, Dec. 1, 1914. Date of appl., Dec. 12, 1913.

SEE Eng. Pat. 27,904 of 1913; this J., 1914, 710.
—T. F. B.

Purification of liquids; Process of and apparatus for the——. C. P. Landreth, Philadelphia. Eng. Pat. 2626, Jan. 31, 1914.

SEE Fr. Pat. 468,242 of 1911; this J., 1914, 971.
—T. F. B.

Filtering water and other liquids; Process and apparatus for——. L. Ländeu. Fr. Pat. 469,658, March 14, 1914. Under Int. Conv., Nov. 25, 1913.

SEE Eng. Pat. 1266 of 1911; this J., 1914, 938.
—T. F. B.

Household refuse; Process for separating into combustible fibrous matter and incombustible mineral matter. G. Hidoux and J. Bernheim. Fr. Pat. 469,772, March 19, 1914. Under Int. Conv., March 22, 1913.

SEE Eng. Pat. 6998 of 1913; this J., 1914, 39.
—T. F. B.

Apparatus for indicating the presence and estimating the proportion of a gas [firedamp] admixed with air or other gases. Eng. Pat. 26,001. See IIA.

Producing a bleaching, disinfecting, deodorising or preserving agent. Eng. Pat. 26,726. See VI.

Ozoniser [for sterilising, etc.]. Eng. Pat. 27,258. See XI.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Bayweed; Bitter principle of common——. B. E. Nelson and G. W. Crawford. J. Amer. Chem. Soc., 1914, 36, 2536—2538.

PLANTS of *Ambrosia artemisiifolia*, Linn. (N.O. *Compositae*), yielded a white crystalline substance, m. pt. 208° C., which appeared to be physiologically inactive, and a bitter amorphous substance, probably identical with absinthin derived from *A. absinthium*.—R. G. P.

Solidago nemoralis; Volatile oil of——. E. R. Miller and M. H. Eskew. J. Amer. Chem. Soc., 1914, 36, 2538—2541.

TEN samples of the plant yielded from 0.24 to 0.43%, mean 0.32%, of an olive green oil; optical rotation in 100 mm. tube, -14.82° to -17.73° . The chief constituent of the oil is α -pinene (mixed dextro- and levo-modifications); acetic and salicylic acids, an alcohol existing free and combined as acetate, and, probably, borneol are also present (cf. Schimmel's Rept., April-May, 1906, 63).
—R. G. P.

Saccharin and sodium saccharinate [sodium sulphaminobenzoate]; Determination of——. U. Pazienti. Annali Chim. Appl., 1914, 2, 290—294.

THE purity of saccharin extracted in analytical work may be determined by titration with $N/10$ sodium hydroxide, using phenolphthalein as indicator. To control the purity of sodium saccharinate (sodium *o*-sulphaminobenzoate, $\text{NH}_2\cdot\text{SO}_2\cdot\text{C}_6\text{H}_4\cdot\text{CO}_2\text{Na}$), the sodium may be

determined as chloride; or saccharin may be precipitated from an aqueous solution of the salt by means of 6% hydrochloric acid, a correction being applied to allow for the slight solubility of saccharin (0.0403 gm. per 100 c.c.) in acid of this concentration; or a solution of the salt may be titrated with $N/10$ silver nitrate in presence of potassium chromate.—A. S.

Addition compounds of sulphuric acid with organic substances. Kendall and Carpenter. See III.

PATENTS.

Fatty acids, especially butyric acid; Process for manufacturing——. Soc. d'Étude du Carburx. Fr. Pat. 469,552, March 9, 1914.

BUTYRIC fermentation is effected by suitable ferments (*Amylobacter*, *Clostridium*, etc.) which have been selected methodically, by successive cultures, to adapt their specific properties to the material to be treated. Two distinct types of ferment are used, to act on the one hand on the sugars, cellulose, amines, proteins, etc., and on the other hand on the amylaceous materials; these are chosen according to the materials to be fermented. In the treatment of sugar beets, the roots are made into a pulp with water, calcium or magnesium carbonate is added, and the mass is sterilised at 100° C. at least. When cool it is sown with about 10% of its volume of liquid from an operation already in progress; fermentation commences after a few hours at 38°—39° C., and this temperature is maintained during the entire process, which occupies from 8 to 15 days. The liquid is then filtered and concentrated in a multiple-effect apparatus until a saturated solution of calcium butyrate is obtained, at which stage the salt becomes insoluble at the boiling point; the calcium salts are separated from the liquid and decomposed by mineral acid, and the mixed fatty acids are fractionated to separate the butyric acid from the other acids formed. Sugar beets containing 18% of sugar will yield up to 12% of butyric acid by this process, indicating that the amino compounds and the cellulose have also undergone fermentation. From beet or cane molasses the yield of butyric acid amounts to 40—48% of the convertible substances.—T. F. B.

Acetaldehyde from acetylene; Process for making——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 469,497, March 11, 1914. Under Int. Conv., March 15, 1913.

ACETYLENE is passed into a solution or suspension of an organic sulphonic acid and a mercury compound, or of a mercury salt of a sulphonic acid. In either case a free mineral acid may be added. For example, 21.6 parts of mercuric oxide is heated with 417 parts of *o*-chlorophenolsulphonic acid and 583 parts of water, and acetylene is passed into this solution at 30°—35° C.; when the absorption of the gas has diminished considerably, the aldehyde is removed by heating or by means of steam. The yield is about 300 parts. The solutions of sulphonic acids have a high power of hydration, considerably greater than that of solutions of mineral acids of the same acidity.—T. F. B.

Acetaldehyde from gases obtained by dry distillation of coal, lignite, peat, wood, etc.; Preparation of——. J. Behrens. Ger. Pat. 276,764, March 16, 1913.

THE distillation gases are mixed with carbon dioxide and heated, whereby the ethylene is

converted into acetaldehyde; the aldehyde is removed as soon as it is formed, *e.g.*, by absorption with potassium bisulphite, since the reaction is reversible. Four to five vols. of carbon dioxide should be used to each volume of ethylene in the gases; greater excess results in the formation of carbon monoxide and water only. The yields amount to about 50% of the theoretical.—T. F. B.

Liquid [acetic ester] which is an energetic solvent for many substances: Process for making a—A. Helbronner and G. E. Criquebeuf. First Addition, dated May 30, 1913, to Fr. Pat. 464,646, Jan. 18, 1913 (see this J., 1911, 502).

THE acetic acid present in dilute solutions is recovered in the form of an ester of low boiling point, by treatment with a suitable alcohol. This process may be applied to waste waters of paper works or vinegar factories, waste liquors from the manufacture of alcohol from cellulose, distillery vinasses, etc.—T. F. B.

Derivatives of diaminodi[hydr]oxyarsenobenzene and process of making same. G. Korndörfer and B. Reuter, Assignors to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. Reissue No. 13,818, Dec. 15, 1914, of U.S. Pat. 1,053,300, Feb. 18, 1913. Date of appl., Aug. 26, 1914.

SEE Ger. Pat. 245,756 of 1911; this J., 1912, 604.—T. F. B.

Arseno-azo compounds and process of making same. P. Ehrlich and P. Karrer, Assignors to Farbwerke vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. U.S. Pat. 1,120,700, Dec. 15, 1914. Date of appl., Feb. 2, 1914.

SEE Ger. Pat. 271,271 of 1913; this J., 1914, 502.—T. F. B.

Aliphatic aldehydes from gases obtained by the dry distillation of coal, lignite, peat, wood, etc.: Preparation of—J. Behrens, and Norddeutsche Hütte Akt.-Ges. Fr. Pat. 469,582, March 12, 1914. Under Int. Conv., March 15, 1913.

SEE Ger. Pat. 276,761 of 1913; preceding.—T. F. B.

Cocaine isovalerianate. M. Overlach, Charlottenberg, and M. Körner, Berlin, Assignors to T. Teichgraber, Berlin, and Saccharinfabrik A.-G. vorm. Fahlberg, List und Co., Sallke-Westerhüsen, Germany. U.S. Pat. 1,120,233, Dec. 8, 1914. Date of appl., Sept. 6, 1912.

SEE Eng. Pat. 10,750 of 1912; this J., 1912, 844.—T. F. B.

Water or other liquid: Method of rendering—radio-active. J. Landin, Stockholm. Eng. Pat. 2629, Jan. 31, 1914. Under Int. Conv., Feb. 10, 1913.

SEE Fr. Pat. 466,850 of 1913; this J., 1914, 864.—T. F. B.

Condensation and analogous processes. E. I. du Pont de Nemours Powder Co. Fr. Pat. 469,405, March 9, 1914.

SEE Eng. Pat. 5408 of 1914; this J., 1914, 984.—T. F. B.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

PATENTS.

Photographic plates and cinematograph films; Anti-halo backings for—S. Cocanari. Fr. Pat. 469,218, March 3, 1914. Under Int. Conv., Dec. 3, 1913.

ANTI-HALO backings for plates or films are made of an insoluble, indelible substance, of "actinic" colour, preferably deep blue or deep violet. It may be applied to the back of the support of the emulsion or interposed between the support and the emulsion. If it is undesirable to use a separate backing, the support itself may be coloured blue or violet.—T. F. B.

Radiographic plates; Fluorescent—and process of making them. E. C. Saleil. First Addition, dated May 17, 1913, to Fr. Pat. 468,806, May 3, 1913 (see this J., 1914, 986).

THE fluorescent film is detached from its support of glass or metal and coated on one side with a sensitive silver salt emulsion.—T. F. B.

Photometry: Process of—especially applicable to photography. H. Goetz. Fr. Pat. 469,356, March 6, 1914. Under Int. Conv., March 8, 1913.

THIS process consists in measuring the diameter of the pupil of the eye when it is looking at the object in such a manner that at least half of the pupil receives directly the light from the object. In one form of the process, the observer sees in a mirror the image of his eye and also of a measuring scale, whilst in another form, a second observer measures the size of the pupil from its image in a mirror.—T. F. B.

Photographic-printing process. F. E. Ives, Woodcliffe-on-Hudson, N.J. U.S. Pat. 1,121,187, Dec. 15, 1914. Date of appl., July 12, 1912.

SEE Fr. Pat. 463,737 of 1913; this J., 1914, 441.—T. F. B.

Photography and cinematography in colours. F. W. Donisthorpe. Fr. Pat. 470,176, March 27, 1914. Under Int. Conv., March 28, 1913.

SEE Eng. Pat. 7368 of 1913; this J., 1914, 503.—T. F. B.

Sensitive photographic paper and process of making the same. Process for the production of photographic prints. W. Willis, Brasted Chart, Kent. U.S. Pats. 1,120,429 and 1,120,580, Dec. 8, 1914. Dates of appl., Sept. 22, 1913, and June 2, 1914.

SEE Eng. Pat. 20,022 of 1913; this J., 1914, 986.—T. F. B.

XXII.—EXPLOSIVES; MATCHES.

Matches: Detection of white phosphorus in—E. B. Phelps. U.S. Hygienic Lab., Bull. No. 96, Aug., 1914, 51—54.

ABOUT ten match heads are placed in a test-tube which is half filled with water and fitted with a rubber stopper holding inlet and exit tubes. The test-tube is placed in boiling water and a current of hydrogen, purified by passing through alkaline pyrogallol, is led through it for a few moments at a time. The exit tube is drawn out to a fine capillary, and is electrically heated by a coil of

wire to prevent condensation of moisture. The capillary end enters a dark chamber and is placed in the focus of a microscope of about 12 cm. focal length. A luminous jet at the tip of the capillary is evidence of the presence of yellow phosphorus. About 0.1 mgrm. of phosphorus in the quantity of match heads taken, can be detected. The presence of nitrates, chlorates, hydrogen sulphide, and carbon bisulphide does not interfere with the test.—J. H. J.

PATENTS.

Explosive. A. E. Charbonneaux. Fr. Pat. 469,752, March 18, 1914.

SEE U.S. Pat. 1,093,767 of 1914; this J., 1914, 569.—T. F. B.

Explosives; Gelatinised propellant——. Nobel's Explosives Co., Ltd. Fr. Pats. 470,041 and 470,042, March 25, 1914.

SEE Eng. Pats. 4940 and 4941 of 1913; this J., 1914, 712.—T. F. B.

Nitro derivatives of toluene; Process for making complex liquid——especially applicable to the manufacture of explosives. A. E. Vergé. Fr. Pat. 469,898, May 31, 1913.

SEE Eng. Pat. 17,128 of 1913; this J., 1914, 890.—T. F. B.

Pyroxylin solvent. U.S. Pat. 1,118,498. See V.

XXIII.—ANALYTICAL PROCESSES.

Methyl red as an indicator. R. T. Thomson. Analyst, 1914, 39, 518—519.

METHYL red gives a sharper end-point than methyl orange when the two indicators are tested in water with acid or alkali, and its sensitiveness, unlike that of methyl orange, is not greatly affected by the presence of neutral salts, such as sodium chloride or sulphate. When methyl red is used as the indicator in the titration of carbonates with acids, the solution must be boiled after each addition of the acid in order to expel free carbon dioxide. In general, methyl red most closely resembles litmus in its indications, but is to be preferred to the latter owing to its more decided change in colour with alkalis and acids.

—W. P. S.

Copper; Volumetric determination of——in its salts and many of its alloys. G. Zuccari. Annali Chim. Appl., 1914, 2, 287—290.

THE solution of the copper salt is titrated with a solution of sodium nitroprusside (46.866 grms. $\text{Na}_2\text{Fe}(\text{CN})_5\text{NO}\cdot 2\text{H}_2\text{O}$ per litre: 1 c.c. = 0.01 grm. Cu), the end point being ascertained by a spot test on filter paper with ammonium sulphide solution. The results are not affected by the presence of free acids or salts of Fe^{+++} , Zn (unless in high concentration), Sn, Al, Pb, Mn, etc., and hence the method may be applied directly to solutions prepared from copper alloys not containing nickel or cadmium; any ferrous iron must be oxidised with nitric acid. The concentration of the solution should not be higher than 2—3%.

—A. S.

Water; Qualitative test for——by the acetylenecuprous chloride reaction. E. R. Weaver. J. Amer. Chem. Soc., 1914, 36, 2462—2468.

THE substance to be tested is brought into contact with calcium carbide in presence of a solvent

of acetylene: the solvent is then decanted or distilled and tested for acetylene with ammoniacal cuprous chloride, a flocculent red precipitate of cuprous carbide indicating water. Nearly all the common organic solvents are suitable after careful desiccation; the calcium carbide is first freed from occluded acetylene by evaporating to dryness once or twice with a little anhydrous solvent. Two or three minutes contact of the carbide with the substance and solvent are sufficient, and it is preferable to employ a solvent which dissolves the substance tested. Cuprous chloride solutions prepared as described by Hovsøy (this J., 1899, 1158) are recommended. The only substances which interfere are the stronger acids and substances which react with cuprous salts, e.g., hydrogen sulphide. The method is specially useful for detecting water in volatile organic liquids and is sensitive to less than 0.1 mgrm. —R. G. P.

Determination of hydrogen in gas mixtures by means of colloidal palladium. Burrell and Oberfell. See IIa.

Determination of the viscosity of gas oils. Hendrickson. See IIa.

Rapid determination of water in crude petroleum, oil-fuel and similar substances. Shrewsbury. See IIa.

Test for toluene in benzol. See III.

Determination of the degree of bleaching of cellulose. Schwalbe. See V.

Determination of Prussian blue in cyanide mud. Anderson. See VII.

Determination of cuprous and cupric sulphides in mixtures of one another. Posnjak. See VII.

Modifications of the reduction test for tungstic acid. Torossian. See VII.

Standard specifications for methods of chemical analysis for plain carbon steels. See X.

Standard methods for metallographic tests of metals [iron and steel]. See X.

Standard specifications for [and analysis of] speller. See X.

Detection of oak in tannin extracts and leathers. Rogers. See XV.

Report of Committee on moellon analysis. Faust. See XV.

Strength of nitric acid, period of extraction, and ignition as affecting the gravimetric determination of phosphoric acid in soils. Brauer. See XVI.

Determination of resins in hops. Schmidt and others. See XVIII.

The pycnometer spindle, a new instrument for alcohol determination. Wüstenfeld and Foehr. See XVIII.

[Determination of] sulphates in flour. Thomson. See XIXa.

Determination of oxygen in waters in presence of nitrite. Elvove. See XIXb.

Blood charcoal as a purifying agent for arsenic solutions [dipping baths] previous to titration. Chapin. See XIXb.

Determination of saccharin and sodium saccharinate. Paziènti. See XX.

Detection of white phosphorus in matches. Phelps. See XXII.

PATENTS.

Pyrometer; Absorption —. G. A. Alder and A. O. Cochrane, Middlesbrough, Yorks. Eng. Pat. 27,633. Dec. 1, 1913.

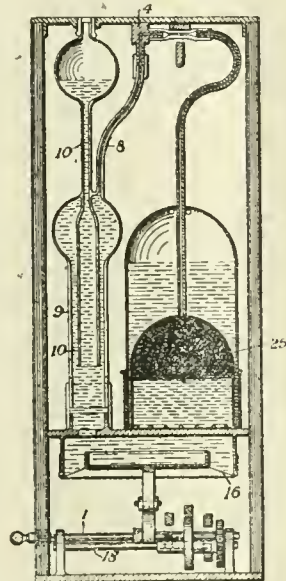
THE luminous rays from the hot body are focussed by a telescope separated into two parts by a box containing the light-absorbing element. This may consist of a wedge-shaped glass container filled with a solution of one or more aniline dyes, or of a wedge of "neutral" glass. A compensating wedge of plain glass eliminates refraction. The absorption wedge is moved by a rack and pinion until the light is just cut off, a quadrant diaphragm assisting in the determination of this point. The position of the wedge as indicated on a scale is a measure of the temperature of the hot body. —W. F. F.

Pyrometer; Optical —. A. C. Burleigh, Sewickley, Pa. U.S. Pat. 1,119,571, Dec. 1, 1914. Date of appl., Sept. 3, 1914.

A STRIP of metal through which an electric current passes, is surrounded by a glass cylinder, and a shield is provided within the cylinder having an opening through which the central part of the strip is exposed, and through which the heat tints produced on the strip can be seen.—W. F. F.

Gas analysis; Apparatus for automatic —. H. J. Westover, New York. U.S. Pat. 1,111,815, Sept. 29, 1914. Date of appl., July 16, 1909.

THE apparatus (see fig.) is particularly adapted for the determination of carbon dioxide in furnace gases. The various parts are operated automatically by a system of levers and cams connected with the shafts, 1. and 18, the latter being geared to the shaft, 1, so that it turns once for every two turns of the latter. As the flexible diaphragm, 16, descends, the gas is drawn from a storage vessel through the distributing header, 4, and rubber tube, 8, into the measuring chamber, 9, any excess being expelled to the atmosphere through the tube, 10. The diaphragm, 16, then rises and when the liquid reaches the tube, 10, the gas-inlet tube is closed, and a measured quantity of the gas is trapped in the vessel, 9. Further rise of the diaphragm, 16, expels the gas into the reagent chamber, 25, containing some steel sponge to increase the effective surface of the absorbing liquid. The diaphragm, 16, now descends and



the unabsorbed gas is drawn back into 9 and measured. The diaphragm on again rising expels the residual gas through the tube, 8, to a liquid seal (not shown) of such depth that the gas pressure is sufficient to displace also the spent reagent from the absorption chamber.—W. F. F.

Apparatus for indicating the presence and estimating the proportion of a gas [firedamp] admixed with air or other gases. Eng. Pat. 26,001. See 11a.

Process of photometry. Fr. Pat. 469,356. See XXI.

* New Books.

[The Roman numerals in thick type refer to the similar classification of abstracts under "Journal and Patent Literature" and in the "List of Patent Applications."]

I. *Smith, R. H.*: Boilers, economisers and superheaters: their heating power and efficiency. Royal 8vo, pp. 136. C. Lockwood, London. 1914. Net 7s. 6d.

Wells, G. J. and Tayler, A. J. W.: The Diesel or slow-combustion oil engine. 2nd ed., revised. 8vo. pp. 320. Lockwood. 1914. Net 7s. 6d.

IIA. *Cooper-Key*: A primer on the storage of petroleum spirit and carbide of calcium. Phil. Lippincott. c. 128 pp. 12mo. 1914. \$1 net.

X. *Gowland, W.*: The metallurgy of the non-ferrous metals. Phil. Lippincott. 296 pp. ill. pls. 8vo. 1914. \$5 net.

Heat-treatment of steel: A comprehensive treatise on the hardening, tempering, annealing and case-hardening of various kinds of steel, together with chapters on heat-treating furnaces and on hardness testing. N.Y., Industrial Press. c. 10+278 p. Diagrams. 8vo. 1914. \$2.50.

Wagner, F. H.: Cleaning of blast-furnace gases. 164 pp. ill. diagrs. (1 fold.). 8vo. McGraw Hill, N.Y. 1914. \$2.

XI. *Watts, O. P.*: Laboratory course in electrochemistry. 148 pp. ill. 16mo. McGraw Hill, N.Y. 1914. \$1.

XIXA. *Ernst, De W.*: Text-book of milk hygiene. Royal 8vo. Baillière. London. 1914. Net 15s.

Sherman, H. C.: Food products. 9+594 pp. ill. Macmillan, N.Y. 1914. \$2.25.

XIXB. *Hubbard, C. L.*: Heating and ventilating plants. 2nd ed. 300 pp. 8vo. McGraw Hill, N.Y. 1914. \$2.50.

Price, G. M.: The modern factory: safety, sanitation and welfare. 8vo. Chapman & Hall. London. 1914. Net 17s.

XXI. *Namias, R.*: La fotografia a luce lampo, Casalmoferrato. 16° fig., p. viii, 136, con 16 tav. 1914. Lire 2.50.

Namias, R.: Teoria e pratica della coloritura delle fotografie ed ingrandimenti di ritratto e paesaggio. Casalmoferrato, 16°. p. vii, 112. 1914. Lire 2.50.

XXIV. *Fowle, F. E., jr.* comp.: Smithsonian physical tables. 6th rev. ed. Wash., D.C. Smithsonian Inst. 36+355 p. O. 1914. \$2.

Moore, E. J.: Outlines of organic chemistry. 2nd ed. Cr. 8vo. Chapman & Hall, London. 1914. Net. 5s. 6d.

* Compiled by H. Grevel and Co., 33, King Street, Covent Garden, London, W.C., from whom all the works in the preceding list can be obtained.

Official Notice.

ALCOHOL FOR INDUSTRIAL PURPOSES.

In a letter dated March 4, 1914, addressed to Mr. C. T. Needham, M.P. (Hon. Secretary of the Association of Chambers of Commerce of the U.K.), the Commissioners of Customs and Excise have supplied the following information on the subject of alcohol for industrial purposes:—

ALCOHOL is allowed to be used duty-free for industrial purposes on the following conditions:—

1. *Methylated spirit*.—This is spirit which has been denatured by licensed or authorised makers under the supervision of the Revenue officials.

It is of two kinds:—

(a) "Industrial methylated spirit" which is a mixture of strong spirits with 1/19th of its bulk of wood naphtha or other substance or combination of substances approved for the purpose by the Commissioners. The mixture can only be supplied by the makers to persons who have the authority of the Commissioners to receive it for use for specified purposes in any art or manufacture carried on by them.

Except when the quantity to be received is very small the user is required to enter into bond for the proper use of the spirit, and under any circumstances the premises are visited from time to time by the revenue officers.

(b) "Mineralised methylated spirit" which is a similar mixture to (a) except that the proportion wood naphtha or other approved denaturant is 1/9th of the bulk of the ordinary spirit, and that in addition it contains not less than 3/8th of one per cent. by volume of approved mineral naphtha or petroleum oil. This mixture is used in those arts and manufactures for which it is suitable and in connection with which there may be some objection to sanction the use of industrial methylated spirit. With the authority of the Commissioners it may be received in the quantities required in such cases. The risk of using it for potable purposes is not so serious as in the case of the less impure mixture (industrial methylated spirit), and consequently the manufacturer who employs it on the large scale is not in ordinary circumstances required to enter into bond, but notwithstanding this, his premises are subject to a certain amount of revenue supervision. This mixture may be sold by licensed retailers to any person in quantities not exceeding 4 gallons at one time, and in fact the great bulk of this description of the spirit is disposed of in this way. The spirit thus sold is used for heating purposes and for making french polish in comparatively small quantities.

2. *Duty free alcohol other than methylated spirit*.—Under Section 8 of the Finance Act 1902, the Commissioners may, subject to such regulations as they may make, authorise the receipt of pure spirit for use duty free, in any art or manufacture in which the use of spirits is required, and where it is proved to their satisfaction that methylated spirit is unsuitable or detrimental. The conditions which have been imposed are, as far as possible, adapted to the circumstances of each case; but the manufacturer must give bond that he will use the spirit on his premises for the authorised purpose; an account of the spirit on receipt at the manufactory must be taken by a revenue officer, and before use it must be mixed in his presence with such denaturants as may have been approved by the Commissioners

in connection with the particular manufactory. The use of the denatured spirit is also subject to supervision of a more or less stringent character according to the extent to which it has been rendered unfit for consumption, the facilities which may exist for purifying or redistilling it, and other circumstances.

Petrol tax.—The tax on petrol is levied only on spirit used to supply motive power for motor cars. The amount of the tax is:—

For private motor cars	.. 3d. per gallon.
For motor cars standing or plying for hire (omnibuses, taxicabs, etc.), trade motor vans, and motor cars used by medical men in their professional duties	.. .. 1½d. per gallon.

As a matter of convenience in collecting the revenue from spirit used in motor cars, the full duty of 3d. is, as a rule, paid on the spirit on delivery from the manufactory, refinery, or warehouse, but if it is ultimately used for a purpose for which the half duty spirit is applicable, half the duty paid is allowed as a rebate to the actual user. In the case, however, of persons who use over 500 gallons per annum for generating power for driving taxi-cabs, omnibuses, and trade vans, arrangements are made to allow them to receive the spirit from bond on payment of half the full duty.

No tax is levied on any spirit used for the generation of power, or for motor purposes, other than that on petrol used for motor cars, but it may be observed that duty-free alcohol, except in the form of mineralised methylated spirit, is not allowed to be used for those purposes.

Liverpool Section.

Meeting held at the University, on Wednesday, November 25th. 1914.

PROF. E. C. C. BALY IN THE CHAIR.

THE FUTURE POSITION AND PROSPECTS OF THE BRITISH CHEMICAL TRADE, AND THE QUESTION OF CONCERTED ACTION BY MANUFACTURERS.

The CHAIRMAN said that it was obvious that a situation which had been growing up for the past 40 years could not be reorganised to meet entirely new conditions at a moment's notice. One of the essential reasons for the paramount position of Germany was the intelligent co-operation between University and manufacturer, a co-operation which was conspicuous by its absence in this country. The success of the great German chemical manufacturing firms was very largely, if not entirely, due to a progressive policy, rendered possible by the possession of a research laboratory, fully equipped and manned by a very efficient and large staff of University-trained chemists. In Great Britain each University turned out every year a number of fully trained chemists, the average product of the English University being quite equal to the average product of the German;

the best product of the English University was superior to the best product of the German University. The opening for research chemists, fully trained in the most modern developments of chemistry—an opening in which they could make good use of their knowledge—had been practically non-existent. Even supposing that the training of these men were modified on the lines which had been suggested on many occasions, what would happen? The man would be expected to carry out routine analyses or to watch a process, which in all probability was as stereotyped as the analytical methods themselves. That was not the ideal for which they in the Universities trained their men. Their best men, after a year or two of research, were worthy of higher things. There was in this country the raw material in plenty, and we possessed in full the men and material for entering the new field of progressive manufacture and for its successful tillage.

The great difficulty to his mind lay in the individuality of manufacturers. They had to learn that the establishment of a fully manned and equipped research laboratory was an essential preliminary to the erection of new works. The duty of the research staff, at first, would be to devise methods for the production of such compounds as were urgently needed. After that, they could carry out work with the view to discovering new dyestuffs, for example, for a second factor contributing to Germany's success had been the continuous introduction of new products. One point he urged, namely, directly a particular process had been proved to be successful and economically sound, it passed out of the experimental stage and needed no further control by the research staff. That research staff should be well paid and should not be expected to be responsible for any process after it had become stereotyped.

One essential factor was the financial factor. The demand for drugs and dyestuffs was urgent, and the manufacturer who undertook that work should not be expected to invest large sums of money in the establishment of a research laboratory and the erection of plant, if at the end of the war the Germans were able to undersell him at every turn. Yet the drugs and dyestuffs must be produced. Surely if the nation demanded those products, it must guard those manufacturers against financial loss. He suggested that any substances produced under the new scheme, should be protected by a tariff to be terminable after a limited number of years. The tariff should continue in force for sufficient time to enable the manufacturers to arrive at the best economic conditions of work, and, in short, firmly to establish themselves.

Mr. J. W. PATON stated that he was a manufacturer of metal polishes, boot polishes, and cardboard boxes of all descriptions. In addition his firm were printers and enamellers of tin plate, and manufacturers of all kinds of tin boxes and canisters. They also made certain lines in toys which were protected by patents and copyright designs. At the present time they were not dependant on the Continent for anything they used. They had their own silica mines in America. Where they held patents and special designs they had been able to maintain their trade, but for lines which were not in any way protected they had found it impossible to compete with Germany, the latter country having flooded the market with goods which appeared to be sold practically at cost price. The exceptional facilities which German manufacturers had always received from their Government and from their Banks had made it impossible for English manufacturers to stand against them. Since the war broke out, many mechanical toys and tin goods had been unobtainable in this country, and in several cases

large buyers had asked them to make certain articles which would necessitate a considerable increase in their plant and premises. The buyers were at present willing to pay a fair price, but none of them would give contracts for a lengthy period, or guarantee to continue their business when the war was over. Until an adequate measure of protection was afforded, there would be no whole-hearted response by English manufacturers to the appeal to compete with Germany.

Dr. E. F. ARMSTRONG thought the war had given the younger members of the Society a great opportunity to assert themselves. He deprecated the prevailing custom of appointing committees akin to Royal Commissions as leading to very little constructive progress, and urged that the Society should make greater use of its young and active members.

He emphasized the need of research in industrial chemistry, and drew attention to such recent achievements in applied chemistry as the production of artificial silk and of synthetic ammonia as illustrating, firstly, the practical value of such research, and secondly, that English chemists were quite able to take their part in it. He claimed that the industries in which Britain was still pre-eminent were those in which the best procurable technical staff was employed, and which kept their knowledge up to date. On the other hand instances could be cited, particularly in Lancashire, where the technical staff had been neglected and the industry ruined by German competition. The large German firms had gone very far in writing off part of their profits and putting this money into research, and this policy had paid them many times over.

Manufacturers of all kinds should be made to realise what they stood to gain by employing fully trained chemists. Half-trained men by themselves were of very little value, and the Universities must give the industry their best men. They would lose the confidence of manufacturers if they turned out a mediocre product, and they had suffered in the past because they had done this. There was a great chance, particularly for the Northern Universities, to produce the really practical, well-informed, diligent, and modest type of chemical engineer.

Mr. W. P. THOMPSON mentioned some cases he had come across lately illustrating the loss many English firms incurred from never employing an expert chemist. In one case a firm had been paying for years to have a waste product removed from the works, but careful examination had resulted in its being sold recently at £5 per ton. In another case the manufacturer had declared that everything to be known about their product was known.

Dr. ALLMAND agreed with the Chairman that the question was, in its broadest sense, bound up with the type of technical chemist produced by the Universities. Whilst the English Universities produced men as well trained in every way as did the German Universities, little or no attempt was made to turn out men similar to those produced by the German Technical High Schools—namely, chemical engineers. He thought the newer English universities should teach technical chemistry on the broadest possible lines without too much specialisation—general chemical engineering should be the basis of the course. Such a method would be more suitable to English conditions than the way adopted at Leeds (specialisation under experts in one or two branches) or at the Massachusetts Institute of Technology at Boston (short courses on a large number of special subjects). He was convinced that chemists of that type were just as much wanted as men with a more purely theoretical training, and would be welcomed by chemical manufacturers.

Mr. H. E. POTTS said that an important factor in determining the supremacy of Germany in the fine chemical industry was the extraordinarily close network of patents; he had found in some cases as many as twenty patents dealing with one or two drugs alone. Possibly that was not the cause of German success but only a symptom of it; still British manufacturers would not have much chance till they adopted similar measures. It was true that the working clauses of the 1907 Patents Act had attacked the problem, but after all, in the case of fine chemicals, did it matter very much where they were made? In any case the labour employed was practically negligible compared to the cost of the materials and expert supervision and research. Further, the various steps in the manufacture of a complicated drug might be covered by separate patents, and possibly only the final stage worked in this country. For example, salvarsan was manufactured in this country only so far as the final stage was concerned, i.e. the reduction of the *p*-hydroxyaminophenylarsinic acid to dihydroxydiamino-arsenobenzene. The intermediate product was imported from Germany. The remedy appeared to be rather in the direction of easy compulsory licenses, to enable British manufacturers to obtain a share of the business, than in the direction of compulsory working by the patentee. This latter often merely meant that a works was established here to carry out an illusory working sufficient to satisfy the law. A step had already been taken in the former direction by the present Government in their Temporary Act to deal with patents held by alien enemies. Mr. Potts then proceeded to explain the provisions of this Act in some detail, giving actual examples from his own experience before the Comptroller of Patents (see this Journal, 1914, pp. 813, 847, 899, 1037, 1118.)

Mr. G. CARRUTHERS THOMSON said that, looking back on his own experience in engineering, it seemed to him that what was wanted was a little more enterprise and foresight among the manufacturers. Unless they had a good head draughtsman with a good staff in the drawing office, they would not do well in the works. Likewise in the chemical industry, unless the manufacturers had a good head chemist in their scientific department, they were not likely to do well in their factories and could not do much in the way of improvement. More education of the manufacturers was wanted. A great many had the means but not the will to employ and pay for the brains; but that was often caused by ignorance of the value of men with brains and skill to the business. Again in the chemical industry, the engineer with a knowledge of chemistry was not appreciated as he ought to be, to assist the works manager and chemist in bringing to a successful issue the processes required to make profitable the discoveries and improvement made by the scientific department. The engineer should be one with a knowledge of chemistry and not a chemist with a knowledge of engineering.

Prof. BALY felt that it was too much to expect a chemist also to be an engineering expert. High efficiency in both sciences appeared to be too high an ideal to look for in any one man. He suggested that what was really needed was that the two types should be attached to the staff of the works, the research chemist and the engineer. Each of these men should know a little of the other's subject so that they would be able to meet and discuss problems without either of them being entirely ignorant of the other's field. The modern training of both types of men was very severe, and it was not possible that any one individual could become proficient in both. The right method to adopt was to give both men a sympathetic understanding of each other's work and

that both should be attached to the staff of every progressive manufacturer.

New York Section.

Meeting held at Rumford Hall, Chemists' Building, on Friday, November 20th, 1914.

MR. G. W. THOMPSON IN THE CHAIR.

TITANIUM AND ITS EFFECTS ON STEEL.

BY GEORGE F. COMSTOCK.

(Abstract.)

Titanium is widely distributed in the earth's crust in small quantities and is always found as an oxide, its principal ores being rutile, the fairly pure dioxide, and ilmenite, a mixture of iron and titanium oxides. One of its chief peculiarities is the readiness with which it combines with nitrogen. It is one of the very few elements which will "burn" in an atmosphere of nitrogen. Its dioxide is one of the most stable compounds known, and great energy is required to decompose it. Thus it follows that when titanium is separated from its oxygen, it will readily re-combine with it, with evolution of heat. The value of titanium in the steel industry is due largely to the fact that its dioxide is so much more stable than iron oxide that its action in "deoxidising" melted steel is very powerful.

The reduction of the natural oxides is effected either by reduction with carbon by means of the electric arc, or by an aluminothermic reaction. The former process delivers the titanium in the form of a carbide, while the latter produces an alloy of titanium, aluminium, and iron. The carbide is the form most generally used.

Metallic titanium when heated to redness in nitrogen forms titanium nitride, but when heated in air only the oxide is formed. The nitride is slowly converted to the oxide when heated to redness in air, but the carbide burns vigorously in air, forming dioxide. The reverse reaction takes place only at very high temperatures. Even at the temperature of the blast furnace titaniferous ores do not give more than 1% of titanium in the pig iron. This is probably present partly as carbide and partly as cyanonitride. Although in the blast furnace titanium nitride is sometimes formed, it is not present in the titanium-carbide alloy used in treating steel, for at the temperature of the electric arc furnace, in which this alloy is made, with a reducing atmosphere and excess carbon, the nitride is dissociated in favour of the carbide.

For general effectiveness titanium is the best of the various deoxidisers for steel. The carbide gives results quite as good as the pure metal and is much cheaper. A material is sold at 8 cents per lb. containing 15 to 20% Ti, and known as "Ferro Carbon-Titanium." It consists of microscopic particles of titanium carbide held in a matrix similar to grey cast iron. When added to melted steel the matrix dissolves quickly, and the particles of titanium carbide are rapidly diffused through the bath, where they react vigorously on the oxygen.

The aluminothermic alloy, which contains very little carbon, is an alloy of aluminium and titanium in iron, and hence its use involves the production of the effects of both these elements. The chief

objection to its use is the harmful effect of aluminium in hindering the removal of oxide and slag enclosures.

Titanium oxide acts as a flux for silicates and other slags that may be in the steel. The best cleansing action is obtained when the titanium is added without aluminium, or in the form of the carbide rather than as the aluminothermic alloy. The latter should only be used in the few rare cases where the addition of the carbon of the alloy would be undesirable. In soft steels the increase in carbon from this addition would not be more than about 0.01%, so that the cases where this would make any material difference are very few indeed. Practically all the titanium used in steel in America at the present time is in the form of ferro carbon-titanium, a large percentage being used for rail steel, although its use in other steels is growing steadily.

"Titanium steel," properly speaking, is not made commercially at present. Such a title naturally implies a steel whose properties are dependent to an appreciable extent on a certain content of titanium. The advantages of the titanium-treated steels as made to-day are due to greater soundness, cleanness, and less segregation, and not, as far as is known at present, to the small amount of titanium left in the metal. In no case has over 0.025% of titanium been found in any sample of titanium-treated steel analysed at our laboratories. It is very difficult to make steel absorb more than 0.025% titanium under the usual conditions of manufacture, and no use has yet been found for steel containing larger quantities that would warrant the attempt to produce commercially a real "titanium steel."

Steels made by the Bessemer, open-hearth, or crucible processes are treated with titanium, but most of this element is used in open-hearth steel. The alloy is furnished in various sizes, from lumps of about 1 in. diameter to powder, according to the quantity of steel to be treated at one time, and for the best results it must be added to the melted steel as it flows from the furnace to the ladle. After the addition the steel must be kept in the ladle for from 3 to 10 minutes, depending on the size of alloy used and the mass of steel treated. Then the steel is teemed as usual into the moulds where no further additions should be made. The amount of alloy recommended for use in rail steel is 13 lb. per ton, which means an addition of 0.1% of metallic titanium. A higher grade alloy is not used because its rate of solution in the melted steel is slower. The price of rails treated in this way is increased about 5%. For castings and soft steels a smaller amount of alloy may be added. Low-carbon steels always contain blowholes even if treated with titanium, but the steel being normally cleansed by the titanic oxide, they are free from slag and are closed up when the ingots are worked. If they become oxidised, however, or contain slag, they will open up as seams or remain as slag inclusions in the metal. It is well known that if steel is completely deoxidised and no blowholes are formed, a large shrinkage cavity, or "pipe," will form in the centre of the upper part of the ingot. Titanium may cause piping, as well as other deoxidisers, but by properly designing the moulds piping may be controlled so as not to give much trouble.

The dependence of segregation on deoxidation is less obvious than that of soundness. Primarily, segregation is due to selective freezing. The freezing-point diagram of the iron-carbon alloys shows that with ordinary steel the first metal to freeze is of lower carbon content than the remaining liquid, and the last liquid to freeze is of higher carbon content than the already frozen solid. But with well-deoxidised steel this selective freezing takes place in a quiet mass of pasty

material, and the higher-carbon liquid is so intricately entangled in the lower-carbon solid that it does not have chance to gather in the centre of the ingot to any great extent, and is finally frozen together with the lower-carbon material. If this steel is not well deoxidised, but gives off gas during solidification, the gas rises and opens up passages through the steel, taking with it a little of the higher-carbon liquid towards the top and centre of the ingot and leaving the solid lower-carbon material behind. This action will result in the formation of a large body of higher-carbon material in the upper part of the ingot, or, in other words, there will be excessive segregation. Phosphorus is subject to this action in the same way as carbon, and sulphur, existing in the steel as small non-metallic globules composed of a mixture of iron and manganese sulphides with a freezing point not much, if any, higher than that of the metal, is even more affected. For this explanation of the relation between segregation and oxides in steel the writer is indebted to Mr. N. Petinot, Metallurgist of the Titanium Alloy Manufacturing Co.

Aluminium and probably also vanadium and silicon have an effect on segregation similar to that of titanium, but with vanadium the cost would be higher, and with silicon and aluminium impurities would be added to the steel. In most rail steel that has been properly treated with titanium, very small, hard, angular pink inclusions can be found with the microscope. These are titanium nitride, possibly contaminated with carbide. An average of many nitrogen determinations on titanium-treated rails shows a distinctly lower amount present in solution in the metal than in untreated rails. If it is assumed that nitrogen has an injurious effect on steel, the lower amount must be an advantage, for even if the whole amount removed from the metal itself is still present in the pink inclusions, it could have no more ill effects in this form than any other non-metallic inclusions of the same size. As the titanium nitride inclusions are never found segregated in groups or streaks, like alumina and silicates, but are always very small and thinly scattered, their weakening effect on the metal is practically negligible. They have been found in titanium-treated steel axles as well as rails, but not in steel castings or soft steels, where smaller amounts of titanium have been used.

Some so-called "titanium-treated" steels have not been any better in regard to segregation than the average untreated steel. These have constituted, however, an insignificant percentage of the total number examined in these laboratories. In every case these segregated "treated" rails have not shown a titanium content of over 0.005% (while the average treated rails are well above that figure), and the pink nitride inclusions have also been absent. These facts indicate that not enough titanium was added to produce the usual effects. In the case of deoxidation of steel with titanium an excess of probably at least 0.005% is necessary.

Forty-two samples of plain and treated open-hearth steel rails have been exhaustively tested, physically and chemically, in these laboratories. The samples have all been taken from the "A rails" or first rails rolled from the ingots, after the usual discards from their tops, thus representing in each case metal from the top part of an ingot, which would show the greatest amount of segregation and impurities. The samples were always taken in pairs, one treated and one untreated from each rolling, so that in the final comparison the influence of the conditions of manufacture could be as far as possible eliminated. The final averages of the results are here tabulated.

Chemical analyses were made at four places on each rail—at top of head, centre of head, web, and flange. The lowest and highest figures for each rail were averaged together, giving the average low and high results:—

	Untreated rails.		Treated rails.	
	Low.	High.	Low.	High.
Carbon	0.58	0.82	0.63	0.76
Manganese	0.71	0.78	0.75	0.79
Phosphorus.....	0.016	0.026	0.018	0.023
Sulphur	0.032	0.053	0.031	0.040
Silicon	0.117	0.131	0.090	0.099

The following figures relate to tests on the head of the rails:—

	Untreated rails.	Treated rails.
Elastic limit	56,071	59,738
Ultimate strength	118,138	124,857
Elongation	12.8%	13.1%
Reduction of area	14.3%	15.4%
Brinell hardness.....	220	226
Impact resistance (Fremont machine)	1.47	1.58
Endurance (A)	1312	1280
Endurance (B)	16,550,920	23,923,623

(A) By Landgraf-Turner machine. Alternate bendings endured before fracture.

(B) By White-Souther machine. Revolutions before fracture.

The improvement in other rails, from lower positions in the ingots, would be much less marked, but the rails that give most of the trouble in service are the segregated "A" rails, and these are rendered practically as uniform and homogeneous as the other rails by treatment with titanium. Titanium-treated rails are not better, probably, than the best possible untreated rail; but by this treatment the general standard of quality is unquestionably raised, uniformity is more nearly attained, and the bad heats of dangerously segregated or dirty steel are avoided.

To acquire still more positive data on the effect of titanium on segregation in rails, 79 "A" rails from different untreated heats and 31 similar rails from different treated heats were examined recently by means of sulphur prints and chemical analyses for carbon made on each at an upper corner of the head and at the junction of head and web. The average difference between these two points was 17% for the untreated rails and the worst rail showed 40, while only 29 of these 79 rails showed less than 12%. For the treated rails the average difference was 3.1%, and the worst one gave 11.5%, none of the 31 showing over this amount.

The railroads have been acquiring data for some time in regard to the wear of titanium-treated rails in track, as compared with that of ordinary open-hearth rails. The results have been uniformly favourable to the treated rails, in some cases very decidedly so. For instance, on a sharp curve on the Boston Elevated Railway, titanium-treated rails laid alternately with plain rails of practically the same composition showed 41% less wear after 214 days' service. In a test made by the Rock Island Railroad, titanium-treated rails in 17 months had 0.014 sq. in. abraded from their sections, on the average, while electric steel rails showed under the same conditions a loss of 0.058 sq. in., and ordinary rails 0.075 sq. in.

In axle steel it has been found similarly advantageous to use titanium for purifying the metal and preventing segregation. In steel castings the use of titanium as a deoxidiser has usually been successful and satisfactory, and in soft steel for

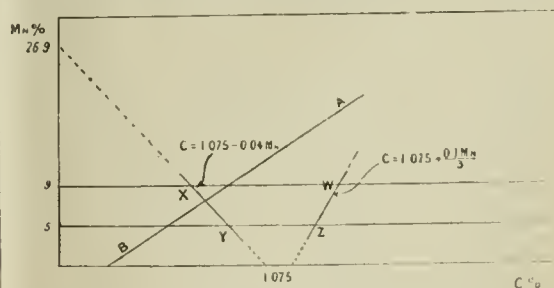
plates and thin sheets much titanium is used. This element is preferred to any other deoxidiser because it does not leave any product of its oxidation in the steel as aluminium and silicon do, and the ingots therefore roll out smoother and the finished sheets have a better surface. Small defects on the surface of a sheet are very serious in galvanizing, so that the smoother surface of titanium-treated sheets, due to cleaner ingots, is much appreciated.

MANGANESE STEEL.

BY JOHN H. HALL.

Composition and characteristics.—Manganese steel was discovered in the early eighties, and was originally made by mixing molten ferro-manganese and carbonless Bessemer blown metal in such amounts as to give various proportions of manganese in the finished product; consequently the ratio of manganese to carbon was practically fixed. With less than a certain amount of manganese, the metal proved to be extremely brittle, and in practice the manganese was seldom less than 9%, the steel generally containing 10 to 14% of manganese and 1 to 1.5% of carbon. The silicon is generally from 0.2 to 0.5%, the sulphur is always very low, about 0.001%, and the phosphorus averages from 0.08 to 0.1%. Small variations in the silicon and phosphorus have little effect on the properties of the steel. The sulphur is invariably low, because the manganese of the steel eliminates it by flotation as MnS. By heating this steel to between 1000° and 1100° C. it can be made, if not of too heavy a section, to consist entirely of austenite.

More recent researches, in some of which the author has participated, have shown that if the carbon content of the metal is maintained at about 1%, the steel will be austenitic after quenching, even if the manganese content is as low as 5% or even a little less; the range of carbon content



within which pure austenite can be obtained is narrow with low manganese content, and widens as the manganese increases. This can be more readily understood by reference to the accompanying diagram, showing part of the manganese steel series, in which the carbon content is plotted as ordinate and the manganese content as abscissa. Within the area WXYZ the steel consists of pure austenite when quenched. Steels immediately to the left of the line $C = 1.075 - 0.04 \text{ Mn}$ are more or less martensitic when quenched; those immediately to the right of the line $C = 1.075 - \frac{0.1 \text{ Mn}}{3}$ contain free cementite when quenched, the amount of cementite increasing as the carbon content rises. This is true also of the prolongations of the lines for a certain distance. These lines were plotted as the result of a careful research, having for its object the determination of the useful range of manganese content in these steels. The line AB represents roughly the contents of carbon and of

manganese of the steels forming the basis of the original discovery and patent. The reason why the steel was found to be martensitic and brittle when the manganese was still comparatively high is apparent at a glance. The well-known diagram of Guillet, showing the micro-structure of the steels of the non-carbon manganese series, is not parallel to this diagram, as Guillet's figure represents the steel in the normalised condition; whereas in this figure, the structures are that of the steel in the quenched state.

Properties of the steel.—Manganese steel has a very low conductivity for both heat and electric current, a low melting point (about 1360° C.), a very high coefficient of expansion (making necessary a shrinkage allowance of 5/16 in. to the foot in foundry work), and is practically non-magnetic in all ordinary conditions. When cast it is very brittle. The cast material after heating to about 1080° C. and quenching has only a moderately high tensile strength, about 60,000 to 80,000 lb. per sq. inch, a rather low elastic limit in both tension and compression, and a rather high ductility; its shearing strength is remarkably high. When rolled or forged and treated, the tensile strength is increased very greatly, sometimes reaching 150,000 lb. per sq. inch, and the ductility much improved; the other properties are not much altered. The rolled material, if untreated, is quite brittle.

The chief characteristic, to which the metal owes its usefulness, is its hardness. In the treated state in which the steel has to be used, this hardness is of a peculiar kind, since, owing to its low elastic limit, the metal can be made to pean or flow when cold under the blows of a hammer to a considerable extent. In a way, therefore, the steel is soft; and hardness tests, which depend upon indenting the material, do not give high figures. Unless specially heat-treated, however, it cannot be cut with tools to a sufficient extent to make machining practicable, and its resistance to most kinds of wear is extraordinary.

As the manganese content is reduced, if the carbon be kept at the proper figure, the properties change much less than was originally supposed. The strength falls off a little, the toughness diminishes progressively, and the magnetism increases a little. The resistance to wear is very little altered as long as the manganese is kept above about 5 or 6%, and the tendency to pean or flow decreases as the manganese content diminishes. The usefulness of these low manganese steels is, however, rather limited by their comparative lack of toughness; they are not very brittle, like the martensitic steels of the same manganese content, but they are not nearly so tough as the steels containing over 10% of manganese.

Uses.—Manganese steel is very widely used for the wearing parts of stone crushers and rolls working on hard rock, for the lips and teeth of steam shovels and ladder dredges handling rock or gravel, for centrifugal pump cases and flyers, handling gritty water, for stone screens, coal cracking rolls, drive chains exposed to grit, and other service of a similar nature. For railroad and trolley frogs, switch points, crossings, etc., the cast material is very widely used, and for rails laid on sharp curves manganese steel is almost indispensable. These rails were formerly all of cast material, but are now very generally rolled from ingots. Its tendency to flow or pean under heavy loads prevented its being used for railway car wheels. Under light loads in mine and quarry cars, blast-furnace charging barrows, etc., it is widely used. The tendency to flow or pean has limited the usefulness of the metal also for tyres in such grinding mills as the Fuller and Griffin, and for the lining plates of the various forms of ball mills. It has long been widely used for lining plates in ball mills used in the manufacture of cement, but in many other cases it has proved to pean too much to make its

use possible. In some cases, as for instance for certain sorts of grinding mill tyres, the use of a steel of lower manganese content, which peans less, overcomes the difficulty; the general application of these low manganese steels to this field is, however, prevented by their lack of toughness.

Manufacture of the steel.—The simplest and cheapest way to produce manganese steel is to mix together molten 80% ferromanganese and molten soft steel containing from 0.10 to 0.25% of carbon. The carbon content of the ferromanganese is such that the steel produced is of the correct composition for most purposes. The steel is seldom made by the crucible process, on account of the cost and of the difficulty of obtaining low-carbon steel by that method.

The open-hearth furnace can be used to produce the soft steel required, but the small Bessemer converter has many advantages and is more widely used. It makes cheap metal, though not quite as cheap as the basic open-hearth furnace; it provides small lots of metal distributed over the day; it does not have to be run double turn, and the cost of shutting the plant down for several days in the week is not nearly so high as with the open-hearth furnace. The Bessemer metal is not as good as open-hearth, because it is more highly oxidised, but the enormous addition of manganese will deoxidise it almost completely, and most manganese steel castings do not require better metal than can be made in the Bessemer converter.

The scrap produced, which amounts in most small foundries to 40 or 50% of the fluid metal, must for complete economy be remelted. This can be done in the open-hearth furnace, although if but a single furnace is available, and the chief product is manganese steel, metal containing a great deal of manganese produces a slag which cuts into the bottom of the furnace severely. In the small bottom-blown Bessemer vessel, most of the scrap produced can be used by melting it with the pig iron in the cupola. The resulting high-manganese metal can be successfully blown by taking proper precautions, the practice being similar to that in the Swedish Bessemer shops, where pig iron containing a high proportion of manganese is frequently blown. In the side-blown converter it has so far been practically impossible to blow these high-manganese mixtures. Within the last year or two the author has conducted some experiments bearing on this problem with some success, and he hopes and expects that the problem will be solved satisfactorily within the next few years.

If the scrap is remelted in the open-hearth furnace, or remelted in the cupola and blown in the Bessemer converter, all the manganese is oxidised and lost in the slag. The yearly loss represented by this oxidised manganese amounts to a considerable sum. The most obvious solution of this problem is to melt the scrap in the electric furnace, which can be done almost without loss of manganese. In practice, however, the saving, as compared with remelting and blowing, is not very great, especially in shops already provided with a Bessemer equipment sufficient for their needs, because if an electric furnace is added to remelt the scrap, the output of the Bessemer equipment is cut down, and hence the cost of the steel made in it is raised. For this reason the electric furnace has not so far proved so useful in the manufacture of manganese steel as its inventors hoped. To make electric steel cheaply, moreover, it is necessary to use a furnace of considerable size and to keep it running continuously. This is a condition not well suited to the average manufacturer of manganese steel castings.

Melting the ferro-manganese.—As the total weight of ferro-manganese needed for the production of manganese steel is roughly one-fifth of the weight of the blown metal, it is essential that the ferro-manganese be melted. For many years crucibles

have been used for the purpose, in spite of the fact that this method is more expensive than any other. The great advantage of crucible melting is that the melting losses are relatively slight.

Efforts have been made with more or less success to melt ferro-manganese in the cupola furnace. The use of this very cheap melting method has, however, not become general, because the melting losses are very high even when special precautions are taken, and these precautions necessarily complicate the operation of the cupola. The air furnace and even the small open-hearth furnace have been used to a certain extent for melting ferro-manganese, but have not been generally adopted because the melting losses are high, and, in the case of the open-hearth furnace, because night work is not commonly desirable.

The electric furnace has often been suggested as the best method of melting ferromanganese, and is being used to an increasing extent in foreign steel works making ordinary steels. It has certain disadvantages for the maker of manganese steel in large quantities. The first is that the total melting capacity of the furnace must be high, and this necessitates the installation of one or two large furnaces. The first cost of the furnaces is high, and to keep them idle at night involves a very considerable loss. The second disadvantage is that a large bath of metal has to be melted down and drawn off a little at a time, since the furnace will not melt the metal as fast as it is needed; hence a considerable expense has to be incurred for current. In many cases, therefore, it does not pay to instal an electric furnace for melting ferro-manganese, unless it is used at night for melting manganese steel scrap; this necessitates pouring at night, which does not suit the ordinary small foundry; and in some cases the electric furnace will be found profitable in an existing shop only when the existing melting capacity must be increased, as it would not pay to use it if the output of the original equipment was correspondingly reduced.

Moulding methods.—The differences between manganese steel foundry practice and ordinary steel practice are due to the greater shrinkage of manganese steel and its low melting point and great fluidity. The latter properties enable the maker to obtain sound castings in many cases with less waste of metal in sink-heads than would be possible with ordinary steel. Chills are very extensively used to assist the action of the sink-heads, and the heads themselves are often almost completely drained, leaving a mere shell of metal. The great shrinkage and the brittleness of the steel in the cast condition, greatly increase the tendency of the castings to crack in cooling in the moulds. The moulds and cores often have to be broken up while the casting is still hot, and the castings often have to be cooled slowly, either by burying them in sand or by placing them when hot in a hot furnace, where they are allowed to cool slowly and evenly. Many of the castings also have to be freed from sand and placed in the treating furnace whilst still hot, to prevent cracking. The great tendency to crack also necessitates the utmost care in the design of the casting to avoid great variations in section between different parts.

Heat treatment.—Manganese steel is heat-treated by heating it to between 1000° and 1100° C. and cooling rapidly in cold water. Naturally this very drastic treatment frequently results in the cracking of the casting, so that unevenness of section must be avoided as far as possible. Moreover, the low heat conductivity of the metal and its high coefficient of expansion make the heating of the castings in the treating furnace a delicate matter. If they are heated too rapidly, the outside of the heavy portions and the whole of the lighter parts outstrip the interior of the heavy sections very

greatly, much more so than in the case of ordinary steel. The great expansion of the steel gives rise under these conditions to very heavy stresses, and as the steel in the cast condition is extremely brittle, these stresses are almost certain to result in the cracking of the casting. Hence heavy and complicated castings of this steel have to be heated up extremely slowly.

Rolling and forging.—For many years the problem of the rolling and forging of manganese steel was only partly solved, and many rolled shapes were made, not from an ingot, but from a cast blank which approximated the shape of the finished product. To-day, however, large ingots are successfully rolled into rails and other shapes. It is generally essential that the ingot be rolled or hammered at first very lightly all over and returned to the heating furnace before much reduction of size is attempted. The ingots are successfully brought to rolling temperatures which it was formerly thought could not be attained without risk of the ingots crumpling under the hammer or in the mill. The range of temperature within which the steel may readily be rolled is not very wide, since if it is heated too highly it will crumple, and if it is too cool it will burst the housings of the rolling mill. The heat treatment of the rolled steel is the same as that of the cast material. Frequently, however, the shape is finished slightly above the proper temperature for quenching, and is introduced into the tanks of water without reheating. Very even sections, whether cast or rolled, can be made quite tough by cooling in the air, since the toughness is roughly a function of the rate of cooling.

Metallography.—In the cast condition manganese steel consists of a ground-mass of austenite, containing manganiferous cementite in a net-work, and many needles and small lakes within the austenite grains. These cementite lakes and net-works are bounded by a zone in which the austenite is more or less transformed to troostite or sorbite. There are also places where the cementite and partly transformed austenite form an eutectic. The higher the carbon the greater the quantity of this eutectic.

On heating to the treatment temperatures, the cementite is absorbed in the austenite, and is not liberated on cooling if the cooling be sufficiently rapid. In a thin bar cooled in the air there will be but little cementite liberated. In a heavy section there will be a considerable formation of cementite in the interior even after quenching, because the interior cools too slowly to restrain the separation of cementite. Hence, heavy sections cannot be made as tough as light sections, and there is a distinct limit to the thickness of manganese steel castings which it is practicable to manufacture.

If the steel is cooled slowly from the treatment temperature, the cementite is liberated in a structure more or less resembling that of the cast material. The temperature at which cementite begins to be liberated, however, is several hundred degrees lower than that at which the last traces of it are absorbed in heating. Hence the castings may be allowed to cool considerably in the furnace or in the air on the way to the tank, and yet will be quite tough after quenching; but if they are very heavy, more cementite will be liberated in their interior portions than if they had struck the water at the maximum temperature. Hence the larger the casting the more care must be taken to prevent its cooling off before quenching.

If the quenched steel be reheated to a comparatively low temperature, its toughness is almost completely removed. This is largely due to the liberation of cementite from the austenite at about 500° C., in a very fine net-work, and in countless little needles distributed broadcast through the austenite. These needles break up the continuity

of the austenite, which is no doubt also partially transformed, so that the steel becomes very brittle. This brittleness, in fact, is greater than that due to cooling in the air from the treatment temperature, so that if a bar of the toughened steel be reheated at one end to a white heat and cooled in the air, it will generally break when struck with a hammer at the point where it was at or slightly below red heat. The maker of manganese steel is much troubled by claims for castings which have broken when the users heated the metal in order to bend or work it. Frequently the casting breaks quite a distance from the spot where it was heated, and it is then difficult to convince the customer that it was the heating which caused the damage, but microscopical examination will prove the case beyond doubt.

If heated for 24 hours or more to 500°–600° C. the steel becomes very brittle, strongly magnetic, and very much softer as tested by the drill than in the cast or treated condition, although its Brinell hardness figure is raised. This treatment results in the transformation of the austenite to sorbite, and if the heating were sufficiently prolonged transformation to pearlite would no doubt occur. If the steel is immersed in liquid air, its magnetism is increased. On reheating this magnetic material, a critical point is found at about 730° C., accompanied by loss of magnetism. If reheated to the quenching temperature and quenched the metal is austenitic and tough, but if cooled slowly it will be brittle and will show the same micro-structure as if it had never been made magnetic.

The controversy which is now raging as to the existence of β -iron has involved manganese steel, and much new data has been published on the behaviour of manganese steel in heat treatment. It has long been claimed by some that there are features in the behaviour of manganese steel which the allotropic theory will not explain. I personally have not yet found a treatment of the metallography of manganese steel which the allotropic theory fails to explain. In fact, when I first investigated the metallography of manganese steel I was able to save myself a great deal of labour by using the carbon-iron diagram and the allotropic theory as a guide.

Nottingham Section.

PRESENTATION TO DR. H. J. S. SAND.

At a meeting held at University College, Nottingham, on Dec. 9th, 1914, Dr. H. J. S. Sand, late Secretary of the Section, was presented by the members of the Section with a handsome clock, in appreciation of his services during his tenure of office. The chair was occupied by Mr. L. Archbutt, in the unavoidable absence of Mr. John White, Chairman of the Section.

Mr. ARCHBUTT, in making the presentation, tendered to Dr. Sand the very hearty thanks of the Section for all the work he had done for them during the four years of his Secretaryship, particularly mentioning his successful efforts on the occasion of the Annual Meeting of the Society in July, 1914. He thought that it was a great credit to the Section and to its officials that they had been able to keep together for so many years, in spite of having only about 70 members, amongst whom there was an unusual diversity of interest. The association of the Sections with University Colleges was most valuable.

Mr. J. T. Wood endorsed the Chairman's remarks, and said he knew from experience how arduous were the labours of a Secretary in obtaining suitable papers for the meetings.

Dr. SAND very warmly thanked the Chairman and the Section for their expressions of appreciation and for their very handsome gift to him. The Society, through its Sections, was doing a very good work in bringing together those connected with widely differing branches of chemical industry, and he valued very highly the friendships which he had made during the time he had been connected with the Section.

Scottish Section.

Meeting held at Glasgow on Tuesday, 24th November 1914.

MR. ROBERT HAMILTON IN THE CHAIR.

NOTE ON THE MELTING POINT OF 1.2.4.6-TRINITROTOLUENE.

BY WILLIAM RINTOUL.

Considerable discrepancies exist between the observations of different workers with regard to the melting point of trinitrotoluene. The following are some of the determinations which have been published from time to time:—

Pure Trinitrotoluene.

Observer.	Reference.	Melting point. °C.
Wilbrand	Annalen, 1863, 123 , 178	82
Mills	Phil. Mag., 1875, [4] 50 , 17	78.85
Brunswig	"Explosivstoffe," 1909, 149	{ 80.54 81.5
Comey	J. Ind. Eng. Chem., 1910, 103	80.5—80.6
Vasquez	Mem. d'Artillerie, Sept. 1910	80.6
Milani	"Explosifs en Italie," 1913, 170	80.4
Molinari and Gina	"Explosifs en Italie" 1913, 170	80.65

In view of the differences recorded above, it was considered desirable to carry out some experiments in order to determine the true melting point of this substance.

A full-sized manufacturing charge of the highest grade of commercial toluene, having a distillation range of less than 0.5° C. was nitrated with well-settled commercial acids. The resulting product was fractionated by distillation *in vacuo* and by re-crystallisation. In this way, a quantity of *p*-nitrotoluene of a high degree of purity was obtained, which showed a melting point of 50.8 to 51.6° C.

A quantity of this material was re-crystallised repeatedly from pure absolute alcohol until no difference in melting point could be detected between the crystals separated from the last crystallisation and the residue obtained on evaporating the mother liquor of that crystallisation to dryness, one additional crystallisation being carried out after this point had been reached. The following results were obtained:—

Crystallisation.	Melting point of crystals.	Melting point of residue from mother liquor.
	°C.	°C.
1	51.6—51.9	50.1—51.2
2	51.6—51.9	51.6—51.8
3	51.6—51.9	51.6—51.9
4	51.6—51.9	51.6—51.9

From these figures it would appear that the true melting point of *p*-nitrotoluene is $51.6-51.9^{\circ}\text{C}$.

The following figures for this constant are to be found in literature :—

Melting point of p-nitrotoluene.

Observer.	Reference.	Melting point.
Jaworsky	Zeit. f. Chemie, 1865, 223	$^{\circ}\text{C}$. 54
Rosenstiehl	Beilstein (11), 1896, 92	52
Beilstein u. Kuhlberg	Comptes Rend., 70, 260	54
Neubeck	Annalen, 155, 1	
Auwers	Z. physik. Chemie, 1887, 1, 659	54
Holleman-Walker	Z. physik. Chemie, 1899, 30, 310	$50.5-52$
	"Org-Chem." 1903, 360	51

The pure *p*-nitrotoluene obtained from the fourth crystallisation referred to above was nitrated to dinitrotoluene with a mixed acid prepared from chemically pure sulphuric and nitric acids. The resulting product was purified by boiling with water and careful neutralisation. The dinitrotoluene obtained had a melting point of 69.5 to 70.0°C . This material was purified in exactly the same way as in the case of the *p*-nitrotoluene described above with the following results :—

Crystallisation.	Melting point of crystals.	Melting point of residue from mother liquor.
	$^{\circ}\text{C}$.	$^{\circ}\text{C}$.
1	$69.6-70.0$	$62.3-65.4$
2	$69.7-70.0$	$68.1-70.0$
3	$69.9-70.2$	$69.4-69.9$
4	$69.9-70.2$	$69.9-70.2$
5	$69.9-70.2$	$69.9-70.2$

The melting point of 1,2,4-dinitrotoluene is therefore $69.9-70.2^{\circ}\text{C}$.

From the pure 1,2,4-dinitrotoluene prepared above, trinitrotoluene was prepared by nitration in the usual manner, chemically pure nitric acid and oleum of as high a degree of purity as could be obtained being used. The product from nitration was purified by washing with distilled water and careful neutralisation. The melting point of this trinitrotoluene as prepared was $79.5-80.0^{\circ}\text{C}$., and constituted the final raw material from which the preparation of the pure trinitrotoluene was carried out.

The separation of chemically pure trinitrotoluene from the crude material was attempted in several ways, namely, by crystallisation from sulphuric acid, by crystallisation from pure alcohol, by crystallisation from pure benzene, and by fractional precipitation from acetone.

These preliminary experiments showed that the most efficient means of purifying the commercial material was by crystallisation from alcohol or from benzene. It was decided therefore to employ crystallisation from both these solvents as a means of obtaining the trinitrotoluene in a pure form.

The purest material which had been obtained from the alcohol crystallisation was fractionated, by a further re-crystallisation from alcohol, into a number of fractions, and these fractions were continuously fractionated three times, the second and succeeding fractions being dissolved in the mother liquor of the preceding fractions. The material giving the highest constant melting

point after the third continuous fractionation was then fractionated into several portions from benzene solution, and these portions were in turn continuously fractionated three times.

In the same way, the trinitrotoluene which had been prepared from the crude material by four crystallisations from benzene was continuously fractionated from benzene and then from alcohol.

With the pure materials obtained as described above, accurate melting point determinations were carried out. The apparatus used for these determinations was similar to the thermometer standardising apparatus used at the National Physical Laboratory and described in their Annual Report for 1908. The thermometer used was graduated in tenths of a degree, and had been recently standardised by the Reichsanstalt. The melting point tubes used were from 40—50 cm. long and about 1 mm. or less in internal diameter.

The trinitrotoluene to be tested was carefully dried by gently warming for one or two hours. The tubes containing the material were introduced into the bath at a temperature of about 80°C . and the temperature was gradually raised to 80.4° and kept as nearly as possible at that temperature for 20 to 40 minutes. The temperature was then raised 0.05° at a time, and maintained as constant as possible for a definite interval of time, usually about 30 minutes. Observations were taken at the end of each interval of any changes which had taken place during that particular period. This procedure was continued until every particle of the material under test had been completely melted.

Five of the samples of purified trinitrotoluene resulting from the third continuous fractionation from benzene were submitted to this accurate method for the determination of the melting point, the first fractionation being omitted owing to the small quantity obtained. The following results were obtained :—

No. of fraction.	First indication of softening.	First indication of melting.	Completely melted at
	$^{\circ}\text{C}$.	$^{\circ}\text{C}$.	$^{\circ}\text{C}$.
2	$80.55-80.60$	$80.70-80.75$	$80.75-80.85$
3	$80.45-80.50$	$80.55-80.60$	80.70
4	$80.65-80.70$	—	$80.75-80.85$
5	$80.55-80.60$	$80.70-80.75$	$80.75-80.85$
6	$80.65-80.70$	—	$80.75-80.85$

In the same way, the first four samples resulting from the third continuous fractionation from alcohol were also tested and gave the following results :—

No. of fraction.	First indication of softening.	First indication of melting.	Completely melted at
	$^{\circ}\text{C}$.	$^{\circ}\text{C}$.	$^{\circ}\text{C}$.
1	$80.40-80.50$	$80.55-80.60$	$80.65-80.70$
2	$80.40-80.50$	$80.60-80.65$	$80.70-80.80$
3	$80.40-80.50$	80.55	$80.65-80.70$
4	$80.40-80.50$	$80.50-80.55$	$80.60-80.65$

From the above experiments it would appear that the purest 1,2,4,6-trinitrotoluene will liquefy if maintained at a temperature of 80.85°C . for a sufficiently long period of time, and that the true melting point of this substance lies somewhere between 80.80 and 80.85°C .

The practical work in connection with this investigation was carried out by Mr. J. H. O'Connor and Mr. W. C. Evans in the Research Laboratories of Messrs. Nobel's Explosives Co., Ardeer.

Yorkshire Section.

Meeting held at Queen's Hotel, Leeds, on Monday, November 30th, 1914.

MR. F. W. RICHARDSON IN THE CHAIR.

THE OXIDATION OF OILS AND OF FATTY ACIDS.

BY J. HYLAND AND L. L. LLOYD.

Owing to the production of partially hydrogenated oils, having chemical and physical values practically identical with those of olive oil, which are being placed on the market as a substitute for olive oil for use in the worsted trade, etc., an attempt has been made to discover some test by means of which these oils could be valued. Some hydrogenated oils have been placed on the market that have an iodine value practically the same as that of olive oil, but which, unlike olive oil, gradually become tacky when exposed in thin films to moist air, such as oiled tops, etc.

From the communication by Hird and one of us, on the action of sulphur dioxide upon oils (see this J., 1912, 317), it appeared possible to obtain a quantitative production of sulphuric acid by the action of sulphur dioxide and oxygen upon oils for a definite time at constant temperature. We have been able to obtain a constant yield of sulphuric acid from certain oils when diluted with several inert solvents. With many oils, however, particularly those that readily char with sulphuric acid, a constant production of sulphuric acid could not be obtained. With genuine pure oils fairly characteristic colour reactions may be observed during the action of sulphur dioxide and oxygen upon them. The colour reactions of the commercial oils vary so much, probably due to other oils having been in the same vessels for transport, etc., that it is of little value tabulating these results.

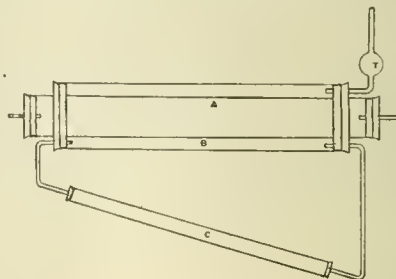
The yield of sulphuric acid by the action of sulphur dioxide and oxygen upon oils is greatly increased in the presence of a drier, the increase varying with the amount and nature of the drier. The order of activity, calculated from the production of sulphuric acid, of the metals which have been tested when dissolved as resinsates in the oils, is as follows:—Copper, cobalt, manganese, nickel, chromium, and iron. Lead did not assist the formation of sulphuric acid.

It has also been observed that the addition of small amounts of oxidisable oils to the "non-drying oils" greatly increases the rate at which these oils absorb oxygen, thicken, and become tacky. Similarly the addition of oxidisable oils to the "non-drying oils" affects the amount of sulphuric acid formed by action of sulphur dioxide and oxygen. In each of these cases the oxidisable oils apparently act as oxygen carriers or catalytic agents.

Ingle (this J., 1913, 639—641) has shown that with drying oils the amount of oxygen absorbed in dry air is in the ratio $21 = 20$ or $I_2 = O_2$, but if the air be moist the peroxides thus formed are decomposed with production of volatile compounds—aldehydes and acids; also that the free acids of linseed and other oils only absorb half the amount of that absorbed by their glycerides. The same remarks also apply to their ethyl esters, these only absorbing one atom of oxygen for every two atoms of iodine absorbed. Ingle also showed that the maximum absorption of oxygen by the oils took place in dry air; moisture tends to lower it, and after maximum absorption, loss begins to take place.

We have made similar experiments with the so-called "non-drying oils" that are used in the textile trade for combing, spinning, etc., using both dry and moist air, to find whether they were oxidised to any great extent, and also to see whether the absorption of oxygen at any given temperature is quantitative. From a practical point of view more importance has been attached to the action of moist air, as better representing the conditions under which these oils are used.

Pure oleic acid was prepared from olive oil by means of the lead and barium soaps. Some of this acid, after having dissolved in it 5% of manganese resinate, was exposed in a very thin layer to the ordinary atmosphere. The acid increased in weight very slowly, the maximum being reached in three months. The iodine value was taken before exposure and after the maximum gain in weight. The results are given in the table. The acid although still liquid was very viscous. Attempts were then made to increase the rate of oxidation, using the apparatus illustrated. It



consists of a wide glass tube, A, surrounded by a water jacket, B. The water jacket is connected by glass tubing to the copper tube, C, for heating purposes and is also fitted with a water trap, T. The boats containing the oil, etc., were supported on a strip of plate glass inside the tube, A. A thermometer was also placed in the bottom of this tube. When the water is rapidly boiling in the copper tube, the temperature in the tube, A, remains extremely constant at 97° — 98° C.

A weighed quantity of oil, about one gram, was exposed for oxidation on purified quartz contained in broad platinum boats, the boats containing about 10 grms. of finely powdered quartz which had been purified by repeated extraction with hydrochloric acid, washed, and dried. A piece of thick platinum wire was also weighed with the boat, this being used for stirring the mixture. Air was drawn slowly through the tube, A, by means of an aspirator, about 1.5 litres passing per hour. When dry air was used, it was first passed through a wash bottle containing sulphuric acid and then through two calcium chloride tubes. A calcium chloride tube was also placed between the exit of the tube and the aspirator to prevent diffusion of moisture into the tube. When moist air was used it was drawn through a wash bottle containing water and then through a tube containing cotton wool. The weighed boats and contents, etc., were exposed to oxygenation and were taken out at intervals, dried in a desiccator and weighed. When the maximum had been reached or just as loss began to take place, the contents of the boats were extracted with ether, the ether driven off, and the iodine value taken.

The treatment was at first carried out at 97° — 98° C., but it was soon observed that the products of oxidation were far too unstable at that temperature, and that loss in weight began to take place long before a theoretical increase had been reached.

Other temperatures were then tried, and 50° C. was found to be the highest temperature at which

constant results could be obtained, the oxidation at this temperature being far quicker than at the ordinary temperature. This temperature was consequently used for the experimental work.

the oxidation products of these bodies than those of the free acids. It will be observed from the table that the oils are nothing like saturated when the maximum gain in weight is obtained, the

TABLE I.

Oil and additions.	Conditions of experiment.	Maximum gain in weight. %	Time.	Calculated iodine equivalent of gain.		Iodine values by determination.		Actual decrease in iodine value.
				O=I ₂	O ₂ =I ₂	Before.	After.	
Oleic acid + 5% manganese resinate..	Ordinary air, cold	5.8	3 months	92.0	46.0	90.8	51.6	39.2
Oleic acid + 5% manganese resinate .	Dry air, 50° C.	4.3	90 hrs.	68.2	34.1	90.8	36.6	54.2
Oleic acid + 5% manganese resinate .	Moist air, 50° C.	4.1	30 hrs.	65.0	32.5	90.8	52.7	38.1
Oleic acid alone	do.	4.0	250 hrs.	77.7	38.8	90.0	40.4	49.6
Ethyl oleate alone	do.	4.5	270 hrs.	71.4	35.7	75.6	40.2	35.4
Ethyl oleate + 5% manganese resinate	do.	4.4	45 hrs.	69.8	34.9	76.5	38.1	38.4
Olive oil alone	do.	5.8	114 hrs.	92.0	46.0	87.9	46.5	41.4
Olive oil + 5% manganese resinate...	do.	5.6	47 hrs.	89.2	44.6	88.9	40.2	48.7

The numbers in columns 5 and 7, and also the numbers in columns 6 and 9, should agree for each separate experiment.

From the above table it will be observed that the increase in weight corresponds in almost every case to $O=I_2$. With oleic acid, however, a theoretical increase in weight is not obtained, which is doubtless due to the fact that the oxidation products are so unstable at this temperature that they decompose and volatilise some time before complete oxidation has taken place, and it is this decomposition which no doubt accounts for the slight irregularity in the results for the oleic acid. The volatility of oleic acid and of ethyl oleate was tested at 100° C. in a current of carbon dioxide; in 15 hours about 0.5% was lost in either case, but at 50° C. no loss was obtained.

The effect of moisture is apparent from the difference in the iodine values of oleic acid and resinate in dry air and the same mixture in moist air. In dry air the reduction in iodine value is 54.2, in moist only 38.1, whereas the difference in the increase in weight would only account for a difference in the iodine value of 3.1, the actual difference being 16.1. The greater reduction in iodine value in dry air than in moist, with approximately the same increase in weight, is probably due to polymerisation taking place more readily in dry than in moist air or to the formation, by addition of water, of dihydroxy compounds, etc. But with the esters, ethyl oleate or olive oil, figures much nearer the theoretical value have been obtained, showing the greater stability of

actual decrease in iodine value being approximately only half the original iodine value, so that the ratio between the increase in weight and the reduction in iodine value is really $O_2=I_2$, and not $O=I_2$. It is highly probable that condensation or polymerisation takes place, the double bonds being thus shielded from oxidation, or that the oxidation products combine with some of the unoxidised compound during resinification.

The experiments in dry air tend to show that complete oxidation is possible, but the present communication only deals with the absorption of oxygen until a maximum gain in weight is obtained; further oxidation is no doubt possible, but is accompanied by loss in weight.

Moist air appears to prevent the complete oxidation of glycerides, the oxidation products having approximately half the original iodine value, whereas with fatty acids moisture actually aids oxidation.

From the knowledge obtained in the above experiments it seemed desirable to compare the liability to firing of oils of different iodine values. The iodine values of a number of oils were determined and these oils were then tested by the Mackey Cloth-Oil Tester; 14 grms. of oil were distributed on the usual amount of cotton wool and allowed to remain in the tester until a dangerous temperature had been reached or until the temperature remained practically constant. The oily "wool" was removed, extracted with

TABLE II.

Oil.	Maximum temperature.	Time.	Iodine value before.	Iodine value after.	Decrease.	Effect on cotton wool.	Remarks.
	°C.						
Cottonseed oil	217	1 h. 25 m.	111.0	75.1	35.9	Charred	Test stopped to prevent firing, etc.
Malaga olive oil	210	4 h. 38 m.	87.9	52.9	35.0	Charred	do.
Sperm oil	102	5 h.	75.6	65.1	10.5	No effect	Temperature was rising extremely slowly.
50% oleine (dark) contd. 41% free fatty acids	106	3½ h.	88.6	67.1	21.5	do.	This was a maximum temperature and remained constant for a considerable time.
Unsataponifiable matter from the 50% oleine	97.2	3 h.	92.9	76.2	16.7	do.	do.
Fatty acids from the 50% oleine...	93.5	5 h.	80.9	67.0	13.9	do.	Still rising, but extremely slowly.
70% oleine contd. 61% free fatty acids	98.5	3 h.	71.8	65.4	6.4	do.	Constant at this temperature for a considerable time.
Unsataponifiable matter from the 70% oleine	96	3 h.	62.1	60.3	1.8	do.	do.
Fatty acids from 70% oleine	99.5	5 h.	77.8	72.1	5.7	do.	Still rising, but extremely slowly.
Oleic acid	200	1 h. 45 m.	90.0	62.5	27.5	Charred	Stopped to prevent firing.
Ethyl oleate	213	5½ h.	75.6	44.8	30.8	Charred	do.

ether, and the iodine values of the extracted oils determined. In those tests where a dangerous temperature was reached the inlet and exit tubes were tightly corked and the vessel cooled as quickly as possible. The results are given in the Table II.

It will be observed that with all of the oils where any considerable degree of heat was produced, it was accompanied by a considerable decrease in the iodine value, while in practically every case the extracted oil was much thicker and darker.

It is well known that an olive oil containing free fatty acids is much more dangerous than one which is neutral. The time for oleic acid to attain a dangerous temperature in the Mackey Tester is short compared with ethyl oleate or Malaga olive oil. Comparing the iodine values of these substances it does not appear that the liability to fire is governed entirely by the unsaturated nature of the oil but also by the constitution of the substances.

The experiments with distilled oleines, with the fatty acids, and with the unsaponifiable matter separated from these oleines, indicate that the iodine value is of little value as a guide to liability to firing. Although firing is due primarily to oxidation, this alone is not the only cause; if it were, then the 50% oleine which gave a decrease in iodine value of 21.5% should have shown a considerable rise in temperature. It is evident that firing is due to some reaction other than oxidation.

Although a high acid content in olive oil aids firing, it appears not so much the mere acidity, as the constitution of the fatty acids, which governs their behaviour. Also it is not simply the oxidisability of the fatty acids, since the 50% oleine oxidises almost as much as the oleic acid and is yet so much safer. It therefore appears probable that the decomposition of the oxidation products plays an important part.

The experiments with ethyl oleate show it to be far safer than the free acid. The previous experiments (those in the tube) show that it oxidises almost as rapidly as the acid; but with the ester an almost theoretical increase in weight is obtained, whereas with the acid decomposition occurs some time before the theoretical increase in weight is reached. This shows that the oxidation products of ethyl oleate are much more stable than those of oleic acid, and this fact, coupled with the results obtained in the Mackey Tester, upholds the view that the production of heat is due to the decomposition of the oxidation products, and that the more dangerous oils are those whose oxidation products are more easily decomposed or polymerised.

Oleic acid is oxidised more readily in moist air than in dry, as is shown in the first table. This no doubt accounts for the fact that moisture increases the tendency of the oils to fire, when on the fibre, and especially those rich in oleic acid.

By comparison of the results obtained with oleic acid from olive oil and with oleic acid obtained from distilled oleine, it appears that the constitution of the oil or acid is of most importance from a firing aspect, and that the change in the properties is due to change of constitution probably brought about during distillation. It appears that with regard to stability not only unsaturation but also the position of double bonds and the influence of steric groups must be considered.

Further work is being carried out upon the oxidation of oleic acid.

DISCUSSION

The CHAIRMAN stated that the Bradford Wool-combers' Association had tried the use of arachis

oil on "tops" and at first with apparent success, only to discover later that the tops became very sticky. The trial referred to was a small laboratory experiment only, and the result amply proved that arachis oil was a drying oil and was quite unsuitable to replace olive oil as a lubricant for tops. As a result of this laboratory test, arachis oil was never tried on a larger scale.

Prof. H. R. PROCTER quoted several papers published from his laboratory on this subject. One of them (this J., 1898, 1021), on the relation of the constitution of oils to refractive index and specific gravity, showed that both were raised by the presence of double bonds, and also by oxidation, but that the refractive constant, whether calculated by Gladstone and Dale's formula or by that of Lorenz and Lorentz, was lowered by oxidation. The former formula gave a value near 0.5 for all oils, but it was the apparently small differences from this figure which were significant. In their experiments on oxidation (this J., 1905, 1287) the oils were blown in test tubes instead of being exposed in thin films. While such experiments had a technical importance, the only way to obtain precise information was by further study of the chemical constitution of the different oils.

Mr. W. MCD. MACKEY agreed with Dr. Lloyd that the iodine value did not give a reliable criterion as to whether or not an oil was safe from the insurance point of view. One point to be borne in mind when considering the indications given by such an instrument as the Cloth-Oil Tester was that one was dealing not with an oil alone but with the oil in very intimate contact with cotton wool, and there was little doubt that the action between the oil and the cotton had something to do with the result. Thus, if wool were used instead of cotton wool, the action was slower, and it might be useful to make some experiments of the same nature as those of Dr. Lloyd, spreading the oil on an inert substance such as, say, glass wool.

Mr. T. FAIRLEY considered that the very different results obtained by the authors when using dry air, from those obtained when moist air was used, were due to the presence of moisture, which gave scope for bacteria to start the heating process. In every case where a cargo of wool from Australia had been shipped in a wet condition, a case of spontaneous combustion had arisen. The raw wool contained about 33% of fatty matter. The same applied to cotton shipped in a wet state. He had made experiments with both cotton wool and wool, and as might be expected there were great differences. Raw wool was also different from scoured wool. Scoured wool was used when an insurance company wished to know what might happen in a factory. The last investigation which he had carried out was in connection with rape oil. In the Leicester district rape oil was used extensively, and he found that pure oil was perfectly safe, in fact, almost as safe as olive oil.

Prof. J. W. COBE thought that the investigation of the connection between rise in temperatures and chemical changes carried out on oxygen absorbing substances of established composition could not fail to be of service, not only as regards those substances, but also as forming a basis for the understanding of more complicated phenomena of the same order, such as the spontaneous combustion of coal. Dr. Lloyd had expressed the opinion that the evolution of heat was often due, not to the primary oxidation, but to after-decomposition of the compounds so formed, and experimental evidence in support of that view would be interesting to consider. Mr. Winnill and his collaborators had decided that, so far as coal was concerned, it was advisable to

commence an experiment at a low temperature if a deduction was to be drawn as to the liability of the coal to spontaneous combustion. Were the same considerations not applicable in this case?

Mr. RUSBY stated that there had been several cases of serious fires in the district caused by the spontaneous combustion of oiled wool. It would be very helpful if in such cases the insurance companies would have the oil used tested and the results published. In his opinion the presence of moisture was a chief predisposing cause. In regard to the objection to the presence of fatty acids in olive oil used in Bradford, it was not that the acids in themselves were objectionable, but that their action on the copper and iron in the combing machines formed minute quantities of salts which catalytically caused gumming of the oiled tops. He deprecated the use of resins by the authors as not imitating anything actually used by woollen or worsted manufacturers.

Dr. LLOYD, in reply, said that there fractive index was governed by the iodine value, and since two sources of oleic acids having approximately the same iodine value had been found to absorb oxygen at such different rates and had different properties, they did not include those readings. The oxidation of oils at the ordinary temperature took place so slowly that, although the iodine value was decreased, a rise in temperature was not observed. Most cases of spontaneous combustion in mills, etc., were probably due to initial oxidation being caused by steam leakages, radiators, or some other source of heat aided by the moisture in the wool, waste, etc. It seemed most probable that the evolution of heat was due to a number of reactions taking place at the same time, such as the absorption of oxygen, and the action of moisture upon the oxidised compounds, this being accompanied by polymerisation and also decomposition of the resulting bodies. The time required for pure oleic acid to be oxidised in air at 50° C., until maximum gain in weight was obtained, was so long that the experiments were carried out with addition of manganese resinate, the assumption being that the rate of oxidation of other acids would be in a similar ratio to that of oleic acid and oleic acid *plus* resinate. Some (distillation) oleines were much safer than oleic acid, and he thought the constitution accounted for the differences. The unsaponifiable matter increased the value of the oil as regards safety. Oleines were generally bought containing not less than 50% saponifiable; in some cases the saponifiable matter was increased by addition of cottonseed oil, which was one of the worst that could be employed. No doubt that was the cause of several cases of firing.

Communication.

GERMAN CHEMICAL INDUSTRY THIRTY YEARS AGO.

BY THE RIGHT HON. SIR HENRY ROSCOE, F.R.S.

The following short report, written by myself for the Royal Commission on Technical Instruction, of which I was a member, was printed in 1882. This shows that even in those early years the Germans had seized upon the methods which have made their chemical industries so successful; and that money cannot secure success unless it is accompanied by perfect scientific method, and above all by the recognition of the importance of original investigation.

ON THE INFLUENCE OF TECHNICAL EDUCATION ON CERTAIN BRANCHES OF CHEMICAL INDUSTRY.

We have here collected our notes on certain special industries, viz., 1. chemical colours; 2. beet-sugar; and 3. the alkali trade, upon which the influence of technical education is plainly observable.

1.—Influence of Technical Training on the Chemical Colour Industry of Germany and Switzerland.

Among the coal-tar colour works visited by the Commissioners, were those erected on the banks of the Rhine at Basle by Messrs. Bindschedler and Busch. These works, though far less extensive than those of Messrs. Meister, Lucius, und Brüning, at Höchst, or of the Baden Aniline and Soda Works at Ludwigshafen, are carried on in a no less scientific spirit, and the general method of working adopted in all these establishments is identical.

The first principle which guides the commercial heads of all the Continental colour works, is the absolute necessity of having highly trained scientific chemists, not only at the head of the works, but at the head of every department of the works where a special manufacture is being carried on. In this respect this method of working stands in absolute contrast to that too often adopted in chemical works in this country, where the control of the processes is left in the hands of men whose only rule is that of the thumb, and whose only knowledge is that bequeathed to them by their fathers.

On entering the works of Messrs. Bindschedler and Busch one is struck, in the first place, with the adaptation of means to ends, with the substantially-built, well-lighted, well-ventilated workshops, and, above all, with the all-pervading cleanliness and neatness. But it is not of these things that we now desire to speak, but rather of the method by which their business is conducted. In the first place, then, the scientific director (Dr. Bindschedler) is a thoroughly educated chemist, cognisant of, and able to make use of the discoveries emanating from the various scientific laboratories of the world. Under him are three scientific chemists, to each of whom is entrusted one of the three main departments into which the works are divided. Each of these head chemists, who have in this instance enjoyed a thorough training in the Zürich Polytechnic, has several assistant chemists placed under him, and all these are gentlemen who have had a theoretical education in either a German University or in a Polytechnic School. An important part of the system has now to be noticed, viz., that directly under these scientific assistants come the common workmen, who have, of course, no knowledge whatever of scientific principles, and who are, in fact, simple machines, acting under the will of a superior intelligence. The many and great advantages of this arrangement are patent to all; and the fact of having men of education and refinement in positions of this kind, renders the foreign manufacturer who adopts this system less liable to annoyance and loss (from sources which we need not more nearly specify) than his English competitor, who works on a different plan.

So much for the *personnel* of the works. Now for the mode in which they carry on their work. To begin at the beginning, we find no less than ten well-equipped, airy, experimental laboratories in these works, perfectly distinct from the workshops where the manufacturing processes are carried on. In these ten laboratories, the chief departmental chemists and their assistants work out their investigations respecting the production of new colouring matters, or the more economic manufacture of old ones. To assist them in their work, a complete scientific library is at hand containing all the newest researches, for these, as

we have said, form the material out of which the colour-chemist builds up his manufacture, and no sooner do the results appear of a perhaps purely scientific research which may possibly yield practical issues, than the works-chemist seizes on them and repeats these experiments, modifying and altering them so as at last to bring them within the charmed circle of financial success.

Thanks to Dr. Bindschedler, we are able to quote a specially representative case, and a clear description of one such case is worth a host of generalities. Through the original investigations of Messrs. Emil and Otto Fischer, the attention of the manufacturer was drawn to the leuco or colourless base obtained by the action of benzaldehyde on dimethylaniline, inasmuch as they stated that the salts of these colourless bases become green on exposure to air. Founded on these observations, an endeavour was made to effect the practical manufacture of a green colouring matter by oxidation of these colourless bodies. In order to attain the desired end, the following investigations had to be made by the chemist and his assistants who were to conduct the operations:—

(1) A cheap method had to be found for manufacturing benzaldehyde.

(2) A profitable mode of making the leuco-base had to be worked out.

(3) The proper oxidising agents and their best method of application had to be determined.

(4) The best method of purifying and of crystallising the green colouring matter had to be discovered.

The laboratory experiments on the above points having proved so far successful as to give prospects of good results, operations on a somewhat larger scale were started, and these yielding a satisfactory issue, the manufacture proper of the colouring matter, now well known as malachite green, on the technical scale was commenced; all the operations being watched by, and constantly being under the control of the chemists. But even now their scientific work is by no means ended. Continuous laboratory experiments go on for the purpose of finding improvements in the mode of manufacture. Thus, for example, the improved yield, both as to quality and quantity, of the benzaldehyde is a matter of investigation. Again, the synthetic production of the pure leuco-base by a more direct process is sought for, so as to get rid of loss in working, and to obtain a yield as close as possible to that pointed out by theory. In the same way improvements in the materials used for oxidation, and in their application, are made, so as to effect the oxidation quantitatively, without the formation of by-products. Lastly, the action of various solvents is examined, so as to obtain the best form of the crystallised colouring matter. As indicating the value of these improvements made after the colour became a marketable article, it is only necessary to state that the price of the crystallised oxalate has been reduced from £2 to £1 4s. per kilo.

The foregoing may serve to give a picture of a really scientifically-conducted works, where each step in advance is made systematically, as the result of a well-devised plan of operations. This is, indeed, the only means of progress, and this fact is so well recognised in Germany that each of the much larger colour works at Höchst and Ludwigshafen possesses a staff of from 30 to 40 well paid and thoroughly trained chemists to conduct their operations.

But we are, of course, far from believing that because the methods adopted in these foreign colour works are scientific and productive of good, those made use of in all English works must therefore be unscientific and bad. Taking the whole applications of chemical science we may, no doubt, with truth say that the English industrial chemists

have been at least as successful commercially and certainly as productive in new and important discoveries, as their Continental rivals. The Germans and Swiss, however, have been and still are distinctly before us, not only in the facilities which they possess of obtaining the highest technical training in their numerous Universities and Polytechnic Schools, but what is even more to the point before us, is the general recognition of the value and importance of such training for the successful prosecution of any branch of applied science.

The following statistics give some idea of the magnitude of the colour works of Messrs. Meister, Lucius, und Brüning, at Höchst, near Frankfurt, referred to above, and founded in 1862.

The establishments occupy an area of 150 acres, of which 20 are covered with buildings. The staff includes 51 scientific chemists, 50 foremen, 15 managers and engineers, and 77 clerks and commercial men with 1,400 workpeople. The works possesses its own railways, 41 boilers, with a heating surface of 4,000 square yards, and 71 motors, either steam, water or gas engines. The workmen and officials are domiciled in houses belonging to the company, and restaurants, baths, sick clubs and pension funds have been established for the good of the employés. There is also a fire-brigade with 5 hand engines, and one steam fire-engine. The total supply of water, from 145 fire-cocks, amounts to 30,000 cubic feet per hour.

In 1882 the products of these works amounted to:—

- (1) 6,600,000 lb. weight of alizarin.
- (2) 2,200,000 lb. weight of aniline oil.
- (3) 1,540,000 lb. weight of aniline, resorcin, and naphthol.

Colours.

The following are the separate products classed together under the last head:—

Aniline and aniline salts.
Fuchsine (no arsenic used in its preparation).
Methyl violet.
Green and blue colours.
Eosin colours.
Naphthol colours.
Alizarin and artificial indigo.
Quinolin derivative (kairin a new substitute for quinine).

Acids.

The most important raw materials employed in manufacturing the foregoing products are as follows:—

40,000	tons coal.
3,000	„ tar products.
2,400	„ caustic soda.
400	„ potash salts.
2,900	„ carbonate of soda.
17,400	„ sulphuric acid.
10,100	„ various other acids.
1,500	„ iron borings and filings.
250	„ wood spirit and spirits of wine.
1,000	„ various chemicals.
6,800	„ common salt.
2,050	„ carbonate of lime.

The whole of the sulphuric, hydrochloric, and nitric acids used, is made on the works.

From about 70 to 80% of all the aniline colours manufactured are exported, the remainder used in Germany.

About 90% of the total make of alizarin is exported chiefly to England, but considerable quantities find their way to America, Russia, France, Holland, Spain, and Italy.

One of the most recent and most interesting additions to the above list of products is a derivative of quinolin, termed kairin, lately discovered by Emil Fischer. This substance, which is now being made at Höchst at the rate of about 22 lb.

daily, has been shown to possess important febrifuge properties, even exceeding quinine in activity, and it is not impossible that this artificial product obtained from coal-tar may be the means of supplanting altogether the natural alkaloid. The importance of this discovery, should it serve the above purpose, can of course hardly be overrated, and it will then add another and most striking example to the numerous ones which already exist of the immense importance to the human race of researches in purely scientific organic chemistry, which at one time appeared to have no practical value or possible application. It may, therefore, serve again to point the moral, which cannot be too strongly insisted upon, that it is only by the highest and most elaborate achievements of pure scientific investigation that the greatest practical advantages to mankind can be secured.

II.—Influence of Technical Training on the Beet-sugar Manufacture.

Probably no more striking illustration of the rise of a successful and most important industry depending upon the application of the scientific principles of engineering and chemistry can be found than in the Continental beetroot sugar manufacture. The increase in the consumption of sugar in this country has been very great. In 1843 it amounted to 200,000 tons; this figure was doubled in 1854; in 1874 it reached 850,000 tons, and in 1882 1,000,000 tons of sugar were consumed in the United Kingdom. Of these quantities in 1870, 165,000 tons consisted of beetroot sugar, whilst in 1882 the total was over 400,000 tons valued at £10,000,000. The whole of this amount is imported from Belgium, France, and Germany, as no beetroot sugar is manufactured in this country.

To show the extent and growth of the Continental industry in a small country, we may cite the case of Belgium, with a population of 5,600,000. In 1816 the area under cultivation for beetroot was only 5,421 acres; in 1806 this was increased to 44,480 acres, and in 1882 to 86,490 acres. The quantities of raw beet-sugar manufactured in Belgium were in 1880–81, 68,000 tons; in 1881–82, 73,000; and in 1883 probably 80,000 tons were manufactured in 156 works; that is, about one ton of sugar is obtained from one acre of beetroot crop. In France and Germany the area of beet crop and the consequent production of sugar is very much larger. The processes of extraction and purification of sugar from beet are complicated and delicate, requiring both scientific knowledge and capital, as the plant necessary for working up the juice into refined sugar is of a very costly character, and the operations require careful and scientific handling in order to ensure success. The juice contains not only sugar crystallisable and uncrystallisable, but also a considerable quantity of inorganic salts and organic substances other than sugar, and the presence of these latter ingredients prevents a large portion of the sugar from crystallising, and therefore they must be removed. This removal of the injurious constituents can only be effected when an exact analysis of the juice and of the sugar has been made, and this must be done at each stage of the operation, so that the mode of working shall be properly regulated, and such an investigation is a somewhat complicated process, needing skilled chemical knowledge. The quantity of sugar which is rendered uncrystallisable by the presence of inorganic salts or ash is about five times the weight of the ash.

In order to obtain the sugar which would otherwise be thus lost, many processes have been adopted, and of these that involving the strontia is the most recent. This method was secretly worked for some years in certain works in Germany, but it has now been generally adopted under

the patent of Dr. Scheibler, chemist to the Beetroot Sugar Institution. By the use of the strontia process large profits have been made, and the plan has been successfully introduced into France and Belgium. The Continental beetroot sugar manufacture, partly of course in consequence of the Government bounties, has been a very profitable one, annual dividends as high as 100% having been paid by some sugar-mills. It would seem, however, that owing to the great increase in the number of these establishments the trade has seen its best days.

The question of the cultivation of sugar beet in the United Kingdom, and especially in Ireland, though it has received a certain amount of attention in various quarters, has not come to any practical issue. About 1850 Lord Clarendon, then the Lord Lieutenant of Ireland, ordered an official inquiry on the subject of the growth of beetroot in that country, and the results of that inquiry, presented to Parliament in 1852, showed that 78% of beets grown in Ireland were rich enough in sugar to be worked, whilst the corresponding amounts for England and Belgium were 75% and 70% respectively. At that time the West India sugar had the command of the market; the sugar trade has, however, since that date been revolutionised, but no step has yet been taken by agriculturists and capitalists to commence the growth of sugar beet and the manufacture of beet sugar in this country. To produce the 400,000 tons of beet sugar now imported from the Continent we should need as many acres, but as the beet crop is taken only every three years the total acreage required would be 1,200,000. A large proportion of this, if not the whole of it, could be found in Ireland, and there can be no doubt that the introduction of such an industry would do much to improve the general agriculture of that country.*

III.—Influence of Technical Training on the Alkali Manufacture.

The beneficial action of high scientific and technical training upon the chemical colour and beet sugar industries having thus been shown, it becomes of interest to examine the effects of such education on another no less important branch of chemical manufacture, viz., the alkali trade, and in this instance the comparison of the relative position of the Continental and English works is by no means in favour of the former. In the first place, as regards the workmen themselves, it may be truly said that in no country does any real amount of scientific education reach the ordinary workman in alkali works, who are rather labourers than artisans. Moreover, the foremen, both in this country and abroad, are almost invariably men who entered the works either as laboratory boys or as ordinary workmen, and who have risen by virtue of industry and native intelligence, but who have had no scientific training beyond that afforded by the occupation in which they have been engaged. So far, therefore, as the education of the workmen employed in alkali works is concerned, the foreigner has no advantage over us, nor have we any over the foreigner. In the case of the managers and proprietors the matter is, of course, different. On the Continent nearly every manager of a soda works is a man of a very high degree of scientific attainment, a highly trained engineer, and a highly trained chemist. An English manager, one at least of the older school, on the other hand, is scarcely ever a man who has had a similar training to that of Continental managers before they enter upon the duties of

* The sugar factory of Mr. Duncan, established some years ago at Lavenham, and which was not successful, is about to be reopened. The use of strontia and other improvements in the manufacture, together with lower railway charges on the roots, encourage the new proprietors to anticipate better results.

management. The Continental alkali makers are men of wider knowledge and of more extended scientific attainments than their English brethren. Thus, whilst probably none of our English alkali makers could discuss the chemistry of the latest organic colouring matter, nearly all the Continental masters are able to do so. But in the opinion of those best qualified to judge, and speaking of course of the managers of the first-class works in each case, there is no doubt that the English alkali makers are just as well acquainted with the scientific bearings and relations of their own manufacture as their Continental rivals. Nor is the foreigner a better alkali maker than the Englishman, for even in cases in which the former obtains better results than are usual in this country, as regards economy of fuel and raw material, the cause is to be sought rather in the fact that his cheaper labour permits him, and his dearer fuel and raw material compels him, to do what dear labour and cheap fuel and material absolutely forbid to the English alkali maker, than in any superiority in scientific training of the one over the other. It certainly cannot be said that the English soda industry suffers, in comparison with that of the Continent, owing to the want of scientific knowledge on the part of those who conduct it. Men of the highest talent and most eminent for their scientific knowledge are found in all our large alkali works, and it is a remarkable fact that with one or two exceptions everything in the way of

important improvements in the alkali manufacture by the Leblanc process has originated in England. Hydrochloric acid condensing towers, revolving black-ash furnaces, Glover-towers, mechanical calcining furnaces, mechanical salt-cake furnaces, plus-press furnaces, and last, but not least, the Weldon plant; each one of these English improvements marks an era in the alkali manufacture, and has been at once adopted as a necessity by all manufacturers. Even the well-known ammonia soda process, first successfully worked in Belgium, is chemically an English invention (Dyer and Hemming), though made industrial by a Belgian (Solvay). No less remarkable is it that, certainly often in England, and in some cases abroad, those men who have made the most important improvements or discoveries in the alkali manufacture have been self-taught, proving the truth of the axiom that a scientific education cannot stand in place of natural sagacity and workshop training.

It is the opinion of those intimately acquainted with the present condition and future prospects of the alkali trade, both at home and abroad, that such differences as exist between the results obtained on the Continent and at home are due to differences of national character and local circumstances rather than to a superiority of scientific education, and it may be questioned whether many Continental alkali works could survive in face of English competition, if the import duties by which they are at present protected were abolished.

Journal and Patent Literature.

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I.—GENERAL PLANT; MACHINERY.

PATENTS.

Refrigerating; Processes for —. W. R. Ormandy, Warrington, J. Walker, Mirfield, and F. Holroyd, Elland. Eng. Pat. 27,985, Dec. 5, 1913.

A SATURATED or supersaturated solution of calcium chloride or other alkaline-earth halide is used to absorb the ammonia in a refrigerating apparatus. (See also Eng. Pat. 25,806 of 1907; this J., 1908, 740.)—W. H. C.

Distillation of liquids. O. Söderlund, T. Boberg and Techno-Chemical Laboratories, Ltd., London. Eng. Pat. 28,537, Dec. 10, 1913.

THE apparatus is of the type in which the vapour given off is slightly compressed and used as a heating medium in the evaporator (see Eng. Pats. 12,462 and 22,670 of 1911; this J., 1911, 971; 1912, 183). To prevent rise of boiling point of the solution undergoing evaporation, due to concentration, and also to prevent formation of scale, only a small proportion of the liquid is evaporated and the heat contained in the concentrate as well as that in the condensed liquid is recovered. A pair of evaporators or a single evaporator divided into compartments is used, with a pair of recuperators. Part of the feed solution is heated in one of the recuperators by the condensed liquid and the remainder is heated in the other recuperator by the concentrate.

—W. H. C.

Solids suspended in gases; Apparatus for collecting —. W. E. Playter, Collinsville, Ill. U.S. Pat. 1,118,045, Nov. 24, 1914. Date of appl., Feb. 19, 1914.

THE gas is forced through bags of pervious material suspended within a chamber. From time to time the current of gas is shut off, and compressed air is forced into flexible pipes suspended within the bags, causing these to oscillate, strike the bags and shake down the dust.—W. H. C.

Suspended matter; Means for removing particles of — from bodies of gas or fluid. W. W. Strong, Pittsburgh, and A. F. Nesbit, Wilkinsburg, Assignors to R. B. Melton, Pittsburgh, Pa. U.S. Pat. 1,119,469, Dec. 1, 1914. Date of appl., Feb. 11, 1913.

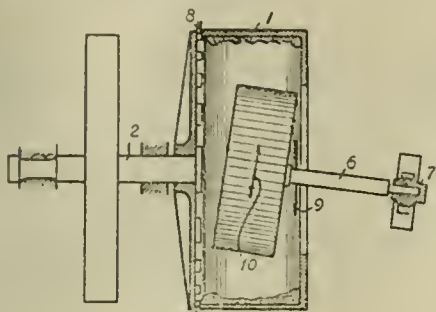
THE gas is passed through a series of cells formed by enlargements in a conduit which acts as an earthed electrode. Active electrodes are suspended within the conduit and a wide difference of potential is maintained between the electrodes.

—W. H. C.

Grinding or crushing machine. J. S. Fasting, Frederiksberg, Denmark. Eng. Pat. 14,784, June 19, 1914. Under Int. Conv., June 19, 1913.

THE material is fed through the opening, 9, into the drum, 1, which is carried on, and rotated by, the shaft, 2. A grinding member, 10, supported from the bracket, 7, by the shaft, 6, which is inclined to, but does not intersect, the shaft, 2, is rotated within the drum and is capable of a

limited lateral movement. The material is ground between the grinding member and the drum and



is pushed forward and discharged through the openings, 8.—W. H. C.

Desiccating machine. L. P. Mick, Chicago, Ill. U.S. Pat. 1,118,304, Nov. 24, 1914. Date of appl., Nov. 1, 1913.

The material is sprayed into a rotating horizontal cylinder, and the deposited powder is removed by a vacuum device fixed within the cylinder and almost touching it at its lowest part.—W. H. C.

Drying-kiln [for wood]. E. A. Hallam, Portland, Oreg. U.S. Pat. 1,119,595, Dec. 1, 1914. Date of appl., Feb. 25, 1914.

JETS of steam are delivered downwards from pipes fixed in "walk-ways" at the sides of the stack of timber in the drying kiln. The steam mixed with air passes down through skeleton floors at the base of the "walk-ways" to a heater and then rises through the stack of timber.

—W. H. C.

Drying apparatus. F. Zorn, Fienstedt, Germany. U.S. Pat. 1,120,879, Dec. 15, 1914. Date of appl., May 19, 1913.

VERTICAL cylinders mounted in a brickwork heating chamber, so that they can be revolved, are divided into compartments by transverse steam heating plates and sieve plates. Each cylinder is provided with a hollow vertical shaft and with flame tubes. The steam plates are heated by steam introduced through the hollow shaft. The material is fed into the upper ends of the cylinders by screw conveyors from a common feed trough, and its descent is facilitated by rakes moving over the upper surface of the sieve plates. Adherence of the material to the flame tubes is prevented by brushes.—W. H. C.

Filtering medium. J. E. Porter, Syracuse, N.Y., Assignor to General Filtration Co., Inc., Rochester, N.Y. U.S. Pat. 1,118,441, Nov. 24, 1914. Date of appl., April 9, 1914.

A RAPID filtering medium having strata of different densities, the stratum of one density being formed solely of a quantity of sand mixed with a very small proportion of infusorial earth and fused together with less than half the quantity of powdered glass.—W. H. C.

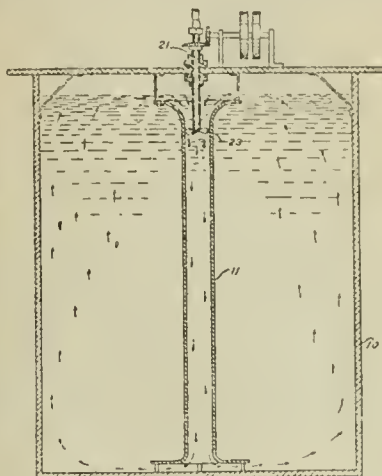
Filter-press and filtering apparatus. O. J. Salisbury, Salt Lake City, Utah. U.S. Pat. (A) 1,120,628 and (B) 1,120,629, Dec. 8, 1914. Dates of appl., Sept. 30 and Jan. 2, 1914; (B) renewed Nov. 2, 1914.

THE filtering elements are enclosed in a casing which consists of: (A) a horizontal cylindrical

shell, split longitudinally and hinged at the top so that each half can be removed simultaneously; or (B) a rectangular casing, the opposite sides of which can be removed.—W. H. C.

Mixing device. G. Crerar, Spokane, Wash. U.S. Pat. 1,119,405, Dec. 1, 1914. Date of appl., April 8, 1913.

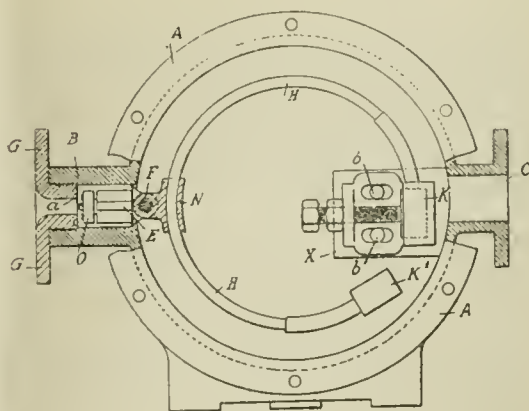
A FLANGED cylinder, 11, is fixed centrally within a tank, 10. A short shaft, 21, driven by gearing



from above, projects into the upper part of the cylinder, and carries at its lower end a propeller, 23, which sets up a circulation in the direction indicated by the arrows.—W. H. C.

Hydro-extractor [steam trap]; Automatic — which allows water to pass but retains the useful steam. V. A. Prost. Fr. Pat. 469,381, March 7, 1914.

A TUBE, H, of flattened oval section, filled with petroleum spirit and having one end, K', free, is



fixed by the other end, K, to the block, X, within the casing, A, provided with an inlet, B, and an outlet, C. The tube, H, carries a rider, N, which is attached by the pin, F, and the winged rod, E, to the valve, O. The apparatus is connected by the flange, G, with the steam apparatus. So long as water only passes through the orifice, a, the tube, H, retains its shape, but as soon as steam enters, the liquid in the tube, H, expands,

whereupon the tube acts as a spring and presses the valve, O, on to the seat, a, thus shutting off the escape of steam. The lift of the valve is regulated by the adjusting screws, b, b.—W. H. C.

Heating, evaporating, volatilising, or distilling liquids by electricity; Apparatus for—T. McClelland, jun., Cathcart, Scotland. U.S. Pat., 1,121,743, Dec. 22, 1914. Date of appl., Nov. 30, 1912.

SEE Eng. Pat. 27,422 of 1911; this J., 1912, 1112.

Producer gas and [steam] power plant. Eng. Pat. 27,922. See IIA.

IIA.—FUEL; GAS; MINERAL OILS AND WAXES.

Corrosion of refractories by salts in coal. A. B. Searle. J. Gas Lighting, 1914, 128, 535–536.

THE speed of reaction between the salts in coal or coke and the fireclay or silica of retorts or bricks has been found to depend more on the physical state of the refractory material than on chemical differences, it being possible to control the fusibility by mixing fine and coarse material, so that either a silica mixture or clay mixture will melt the more easily. Corrosion is least marked when the retort material has a close surface or, in a porous material, when the grains are coarse and hard-fired. If the retorts be made of clay, a large proportion of it should have been burned and made into coarse "grog" before being mixed with the remainder. Water in the retort acts injuriously by causing intimate contact between the retort and the salts, and by facilitating reaction. The introduction of wet materials into the retort should therefore be abandoned, or, if this be impossible, a basic retort material (preferably sintered magnesia brick) should be employed, or the retort lined with chromite or graphite wash.—F. SODN.

Coke-oven gas; Supply of—for town lighting in Middlesbrough. J. Gas Lighting, 1914, 128, 726.

COKE-OVEN gas is supplied for town lighting in Middlesbrough from the Newport Iron Works. A suitable quality of gas is obtained by providing a separate main for the "rich" gas produced in the early stages of carbonisation, the "lean" gas obtained later being used for heating the ovens (cf. Douglas, this J., 1912, 762). A battery of 46 regenerative ovens supplies up to 1,600,000 cub. ft. per day. A separate by-product plant of the direct recovery type is used for each of the two mains. The gas is cooled to its dew-point in air-coolers, treated with tar-sprays to remove tar, and passed into saturators to recover the ammonia as sulphate. The gas leaving the saturators, is freed from water in surface coolers and cooled to normal temperature by spray coolers. Naphthalene is recovered from the effluent water. The "rich" gas at 8–10 inches water pressure then passes through a rotary washer fed with benzolised creosote oil to remove any remaining naphthalene, to the gas works for distribution. The "lean" gas is kept at a lower pressure and any excess of "rich" gas not required by the town is mixed with it. Benzol is recovered from the mixed gases, but that in the "rich" gas is retained for illuminating purposes. The gas supplied averages 600 B.Th.U. net, slight variations occurring when the gas from a newly charged oven is introduced. —W. F. F.

Gas leaks; Effects of—on bituminous pavements. G. C. Warren. Amer. Soc. Municipal Improvements. J. Gas Lighting, 1914, 128, 740.

COAL gas was passed through two tubes, one containing sand, and the other a sand-asphaltum mixture. The gas from the latter gave a flame of considerably diminished luminosity as compared with that from the former. Liquid asphaltum through which coal gas was passed for twelve days gained 2.98% in weight and 4% in volume, and its viscosity was considerably diminished. Coal gas will attack any form of bituminous pavement, sometimes at a considerable distance from the leak, due to penetration through stratified material. The "plugging" test for gas leaks is not reliable. —W. F. F.

PATENTS.

Coal briquettes; Manufacture of—H. J. Phillips, London, and A. Phillips, Tredegar, Mon. Eng. Pat. 29,009, Dec. 16, 1913.

100 PARTS of coal are ground to a pulp with 45 to 60 parts of water and the mixture is subjected to a pressure of 3 to 5 tons per sq. in. in a mould having oppositely acting plungers to eliminate the greater part of the moisture. The partly formed briquettes are passed through a tunnel chamber heated to 80° C. at the inlet and 250° to 500° C. at the outlet, and are then again subjected to a pressure of from 5 to 15 tons per sq. in. in another press.—W. H. C.

Fuel briquettes; Manufacture of—J. B. Cann, Boston, Mass. U.S. Pat. 1,121,325, Dec. 15, 1914. Date of appl., Jan. 13, 1913.

SMALL particles of fuel are mixed with a binder which is then rendered adhesive by treatment with steam saturated with an oleaginous substance. The mixture is then pressed into briquettes which are subsequently heated. —W. H. C.

Coke-ovens. L. L. Summers, Chicago. Eng. Pat. 10,284, Apr. 25, 1914.

IN ovens of the type described in Eng. Pats. 6504 and 7049 of 1910 (this J., 1911, 274, 202), the horizontal retort is divided into sections by light longitudinal walls, these and the retort side walls and roof being provided with longitudinal heating ducts. Each section has a reciprocating floor, on which the carbonaceous material is fed at one end, the coke being discharged at the other. All the floors are connected to a common cross-head and reciprocated in unison by a single hydraulic ram. The restraining action of the wall of the charging hopper upon the layer of material when it is reciprocated, causes uniform compression in all the retort sections. Each of the heating ducts in the walls and roof is formed with more than one tile section to avoid cracking due to unequal expansion.—W. F. F.

Coke-ovens; Recuperators for retort—C. H. Hughes, Syracuse, N.Y., Assignor to Semet-Solvay Co., Solvay, N.Y. U.S. Pats. (A) 1,120,146 and (B) 1,120,147, Dec. 8, 1914. Dates of appl., June 19, 1912, and Jan. 7, 1910. (B) renewed Sept. 14, 1912.

(A) THE air supply is preheated by hot waste gas passing between two horizontal plates connected by tubes through which the air passes. (B) The gas passes in series through the two spaces formed between three horizontal plates, the air heating tubes passing across both spaces. In each case expansion of the tubes is provided for.—W. F. F.

Coke-ovens or gas-retorts; Heating of —. H. W. Woodall, Poole, Dorset. Eng. Pat. 3363, Feb. 9, 1914.

THE oven or retort gas is mixed with waste flue gases to make it suitable for use with burners and flues constructed for heating by producer gas.—W. F. F.

Gas-retorts; Charging and discharging apparatus for —. F. J. Bancroft and J. B. Hansford, New Barnet, Herts. Eng. Pat. 13,218, May 29, 1914.

A TROUGH, similar in shape to the retort and having a plate lying along the bottom and a charging head at the outer end, is filled with fuel, and the plate and head are moved forward with the fuel into the retort, after which the plate is withdrawn and then the head. To discharge the retort the head is fixed at the forward end of the plate and the two are pushed bodily into the retort.—W. F. F.

Producer-gas and [steam] power plant. A. H. Lynn, Westminster. Eng. Pat. 27,922, Dec. 4, 1913.

STEAM is withdrawn from the engine or turbine at a point where its pressure is about 30 lb. abs., and used for driving the blowers and other auxiliary machinery, being then exhausted into the gas producers.—W. F. F.

Gas-generator. J. C. Walton, Fort Worth, Tex., Assignor to J. A. Wisherd, Stanton, Nebr. U.S. Pat. 1,118,319, Nov. 24, 1914. Date of appl., May 1, 1913.

THE generator, containing metal scraps, is provided at the bottom with perforated pipes open to the atmosphere at both ends for the supply of air, and means for drawing in air automatically and intermittently. Acid and oil, contained in separate tanks, are forced by pneumatic pressure into a mixing pipe which communicates with a perforated pipe in the upper part of the generator tank, and a baffle is provided whereby the acid and oil are distributed throughout the tank. A service pipe, provided with a back-check, is connected with other perforated pipes which extend from the upper part of the tank to the exterior.—W. C. H.

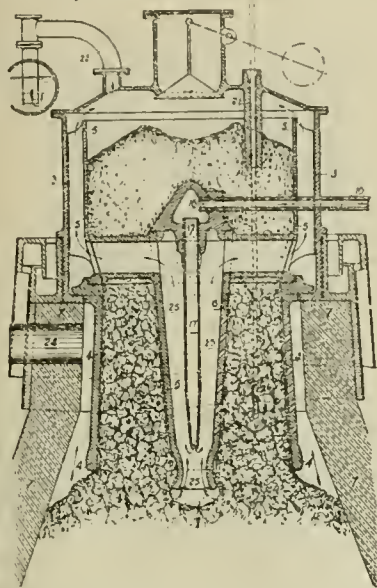
Gas; Process and apparatus for making —. H. Burgi, Springfield, Mass. U.S. Pat. 1,120,273, Dec. 8, 1914. Date of appl., May 13, 1912.

COAL is fed continuously downwards through a heated vertical retort, the coke being withdrawn at the bottom. Suitable enriching hydrocarbons are supplied through a jacketed pipe extending downwards inside the retort to a zone where a "cracking" temperature prevails, and the resulting gas mixes with the coal gas, and is withdrawn from the top of the retort.—W. F. F.

Gas producers; Retort for distilling, at very high temperatures, the fuel to be supplied to —. H. Mastaing and L. Monnier. Fr. Pat. 469,967, March 23, 1914. Under Int. Conv., Jan. 10, 1914.

THE retort, which serves also as a feed-hopper for the gas producer, consists of four separate, easily replaceable parts, 3, 4, 5, 6. The producer, 7, is charged with coke and set in operation, the gas being exhausted through 24 and 22, or through 22 alone. To attain the high temperature (1000°—1300° C.) necessary for the complete coking of the raw fuel fed into the chamber, 5, a portion of the producer gas is burnt in the chamber, 25, by air introduced under pressure through the pipes, 16,

17. The coked fuel falls readily from the chamber, 4, into the producer, but if necessary a poker may be introduced through the opening, 21. The gas



drawn off through the pipe, 22, is a mixture of coal gas and producer gas with a calorific value about double that of ordinary producer gas.—A. S.

Tar or other liquids; Centrifugal apparatus for separating — from gases. Soc. Générale de Matériel à Gaz. Fr. Pat. 469,302, Feb. 20, 1914. Under Int. Conv., Feb. 28, 1913.

A SEPARATOR for removing tar, oil, or other suspended matter from gases, consists of a horizontal cylinder divided into two compartments by a transverse partition having an opening at its centre. The gas is introduced tangentially through an inlet at the periphery of one compartment, travels with increasing velocity to the centre, and passes through the opening into the other compartment, wherein its velocity decreases from the centre to a tangential outlet at the periphery. Two or more of such cylinders may be used in series. Each compartment is provided with a drain pipe for discharging the separated tar or the like.—W. F. B.

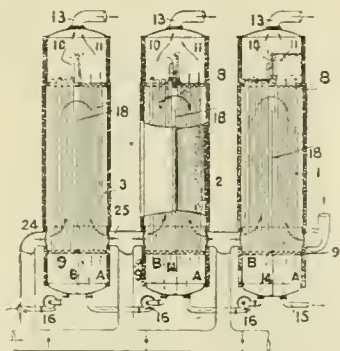
Oils; Process for cracking —. O. H. Valpy and O. D. Lucas, London. Eng. Pats. 20,470, Sept. 10, 1913, and 2838, Feb. 3, 1914.

STEAM superheated to a temperature slightly below the cracking point is sprayed into the oil in a still, and the mixture of oil vapour and steam is passed through heated catalysing tubes of nickel, which may be packed with catalysing material, and thence to a coil in the oil still where the heat of the cracked vapour is utilised for heating the oil. The catalysing tubes may be heated electrically, or by an oil burner.—W. F. F.

[Oil] Distilling apparatus. R. C. Dundas, Los Angeles, Cal. U.S. Pat. 1,120,039, Dec. 8, 1914. Date of appl., Jan. 23, 1913.

THE liquid is pumped through a series of vessels, 1, 2, 3, each consisting of a vertical cylinder divided into three superposed chambers by the tube-plates, 8, 9. The lowest chamber is divided

into two compartments, A, and B, by the vertical partition, 14, the middle chamber by the vertical partition, 18, into two compartments communicating at the top, and the upper chamber into two



communicating compartments by the partition, 10, the compartment, 11, on the right serving as a reservoir. The top and bottom chambers are connected by means of tubes expanded into the tube-plates, the tubes on the left of the partition, 18, being of larger diameter than those on the right. The oil enters through the pipe, 15, into the compartment, A, of the cylinder, 1, rises through the smaller tubes into the reservoir, 11, overflows and passes down the larger tubes into B, and is withdrawn by the pump, 16, and forced into the second cylinder, and so on. The heating medium enters the last cylinder, 3, by the pipe, 24, passes upwards round the larger tubes and downwards round the smaller tubes to the exit, 25, and so on through the series. The vapour given off escapes through the pipes, 13.—W. H. C.

Oils and the like: Adhesive test for—C. B. Osborne, Sacramento, Cal. U.S. Pat. 1,120,624, Dec. 8, 1914. Date of appl., March 12, 1913.

A FILM of the oil is interposed between a hollow stationary cylinder and a loosely fitting ring surrounding it, a heating or cooling agent is circulated through the cylinder, and the ring is rotated by means of a weight and cord.—W. H. C.

Gasolene: Process of and apparatus for recovering and grading—R. D. Bassett, Kinzua, Pa., Assignor to K. A. Krantz, Kinzua, and H. H. Bassett, Grand Valley, Pa. U.S. Pats. (A) 1,120,669 and (B) 1,120,670, Dec. 15, 1914. Dates of appl., March 11, 1914 and April 30, 1912.

(A) HEAVY low-grade gasolene is added to liquid high-grade gasolene, or gas rich in gasolene, under pressure, and the mixture cooled. (B) The apparatus consists of two long casings having chambers at the ends connected by pipes, the middle portions of the casings forming jackets for the pipes. A mixture of low-grade gasolene and liquid and gasified high-grade gasolene is forced through the two sets of pipes in series, and the liquid portion finally separated from the lean gas. This gas at high pressure and temperature is passed through the jacket of the first set of pipes, and then through a reducing valve at a greatly reduced pressure and temperature to the second jacket.—W. F. F.

Manufacture of carburetted (methyl) alcohol. Fr. Pat. 469,903. See IIB.

Utilisation of gas producers for the manufacture of ammonia by synthesis. Fr. Pat. 469,331. See VII.

[*Electrical*] purification of [combustible] gases. U.S. Pat. 1,120,475. See XI.

Gas analysis apparatus. U.S. Pat. 1,121,244. See XXIII.

IIB.—DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Flame standards in photometry. E. B. Rosa and E. C. Crittenden. Bull. Bureau of Standards (U.S.A.), 1914, 10, 557—595.

As a result of a large amount of experimental work it is concluded that the Harecourt pentane lamp is the most practical flame standard available, but that, as made at present, it cannot be considered as a reproducible primary standard, being decidedly inferior to the Hefner lamp in this respect. For use as a primary standard one or more lamps should be constructed to very exact specifications, and operated within very narrow limits of temperature and humidity, with much more rigorous requirements as to the density and boiling point of the pentane, and in an atmosphere of constant oxygen content. In a very large number of tests with the present standard type of pentane lamp, the correction to be applied for water vapour (percentage decrease of candle-power caused by an increase of 1 litre of water vapour per cb. metre of air) as determined at the Bureau of Standards was found to be 0.567, a value appreciably lower than that found in the National Physical Laboratory (Paterson, this J., 1908, 553) and by Butterfield, Haldane, and Trotter (this J., 1911, 1005). The equations given for the Hefner and pentane lamps respectively are:

$$I = I_n[1 \div 0.0055(8.8 - h) - 0.00011(760 - b)]; \text{ and} \\ I = I_n[1 \div 0.0057(8.0 - h) - 0.0008(760 - b)],$$

where I is the observed candle-power; I_n is the normal value of the lamp at an atmospheric humidity of 8.8, or of 8 litres of water vapour per cb. metre of air, and a barometric pressure of 760 mm. of mercury; h is the actual humidity as found by the Assmann psychrometer, and b is the barometric pressure.—A. S.

PATENT.

[*Methyl*] alcohol; *Manufacture of carburetted*—C. Henry. Fr. Pat. 469,903, June 2, 1913.

THE oily and aqueous liquors obtained by the destructive distillation of peat, are distilled together in an apparatus furnished with an agitator, the products (methyl alcohol, acetone, light hydrocarbons, water, and acetic acid) passing over below 90° C. being collected. The distillate is treated with quicklime to remove water and acetic acid, and the products of b. pt. below 65° C. are separated by rectification, leaving carburetted methyl alcohol suitable for use as a motor fuel.—A. S.

III.—TAR AND TAR PRODUCTS.

Nitro-groups; Influence of—on the reactivity of substituents in the benzene nucleus. J. Kenner. Chem. Soc. Trans., 1914, 105, 2717—2738.

A META-DIRECTIVE grouping, especially the nitro-group, confers a certain degree of mobility on substituents in ortho- or para-positions, and in some cases ortho-para-directive substituents, notably chlorine, produce a corresponding effect on meta-substituents. An explanation is offered in terms of Flürscheim's views, namely, that the

attachment of the substituent is loosened. The mobile substituent can take part in reactions, be displaced by other groups, etc., in spite of the steric influences to which it is exposed, and the phenomenon is correlated with the property of nitro- and other meta-directive groups of forming additive compounds. In connection with the above views, the action of hydrazine on methyl 2-chloro-3,5-dinitrobenzoate was shown to yield directly 5,7-dinitro-3-keto-1,3-dihydroindazole. The nitro-groups of this compound were displaced by chlorine atoms when it was treated with phosphoryl chloride at 180° C.—G. F. M.

Acetyl-nitro-substitution. Substitution in aromatic hydroxy-compounds. Part II. V. J. Harding. Chem. Soc. Trans., 1914, 105, 2790—2800.

In the presence of methoxyl groups the acetyl group substituted in certain positions in the benzene nucleus can be directly displaced by the nitro-group. Thus 3,4-dimethoxyacetophenone yields 1,6-dinitro-3,4-dimethoxybenzene, and 3,4,5-trimethoxyacetophenone is converted into 3,4,5-trimethoxynitrobenzene. On the other hand, if the acetyl group occupies a position which, in the phenol ether, is inactive to nitric acid a nitro-ketone is produced. 2,3,4-trimethoxyacetophenone, giving, for example, 6-nitro-2,3,4-trimethoxyacetophenone.—G. F. M.

IV.—COLOURING MATTERS AND DYES.

Manufacture of aniline dyestuffs in Great Britain.

THE Government scheme for the establishment of a national dyestuff industry (see this J., 1914, 1199, 1200; 1915, 22) has not, up to the present, received the enthusiastic support of those most interested. A meeting of the Consultative Committee was held at the Board of Trade on January 13th to consider the position, but it adjourned for a week without making a report. After the meeting on Jan. 20th it was announced that Mr. L. B. Lee (Calico Printers' Assoc.) and Mr. M. S. Sharp (Bradford Dyers' Assoc.) had withdrawn from the Committee in view of the attitude of their respective companies. The Committee will be enlarged and will proceed immediately to prepare a scheme on a modified financial scale, which, while not departing from the general lines originally laid down, will be more advantageous to the subscribers of the proposed company.

The fact that adequate support has not been forthcoming is hardly surprising, in view of the diversity of opinion on the subject and the large number of objections that have been urged against the scheme, both as a whole and on points of detail. Under the circumstances, a *résumé* of some of the points raised may be of interest.

In October last, the Leeds Chamber of Commerce suggested to the Government Committee (which was appointed in August to consider the question) that their action should take the form of protection by means of import duties on the products in question, either without limitation of time or for such a period as would encourage the investment by traders of the necessary capital, and they further called attention to the need of duty-free alcohol.

The Derby Chamber made the following recommendations: That the Government be requested to take steps to encourage the manufacture of aniline dyes in the country; that private enterprise is to be preferred to a Government undertaking; that it is very necessary that a supply of duty-free alcohol for the manufacture of chemicals should be permitted. Small undertakings to manufacture quite a limited number of

colours at first will be more successful than one large concern, and the movement will be considerably assisted by a combination between gas works, tar distillers, alkali works, etc., for the purpose of advancing their crude products a further stage.

The Manchester Chamber passed a resolution declaring that they were unable to support the Government scheme, but later this resolution was rescinded. On December 5th, the Leeds Chamber passed a resolution expressing the opinion that the proposed scheme would not meet the difficulties of the situation, but would stifle competition and establish a monopoly. The Chamber repeated its demand for a substantial import duty on coal-tar colours to be imposed for some years after the close of war.

The Executive Council of the Association of Chambers of Commerce passed a resolution in terms similar to that of the Leeds Chamber of Dec. 5th, and the Council of the London Chamber of Commerce on Jan. 14th passed a resolution declaring that adequate tariff protection should be guaranteed for at least ten years after the end of the war, but such protection should be considered as a means of meeting a national emergency, and in no way as a precedent for future action on the same lines. The Board of Directors of the Manchester Chamber of Commerce, however, dissociate themselves entirely from the policy of even temporary protective duties on dyestuffs, but consider that, in the exceptional circumstances, some adequate measure of financial assistance from the State is warranted.

Among the objections raised in other quarters to the scheme, there has been the feeling that the Government was not doing enough to help the industry. It has been suggested that a better course would have been for the Government to find the whole of the capital or to guarantee the interest to those who did so; alternatively the Government might have taken the same risks on ordinary shares that the shareholders were asked to take, instead of securing their capital on debentures. Again, many people hesitated to bind themselves under the contracting clause, which compelled them to buy only from the new company, owing to their doubt as to its ability to produce dyes of the requisite quality at a suitable price.

In a letter to the "Morning Post" on January 7th, Mr. C. Diamond, a member of the committee of textile manufacturers appointed to confer with the Board of Trade on the subject (see this J., 1914, 1200), has enumerated and answered some of the other objections that have been raised: the following are extracts from this letter:—

"Conservative estimates go to show that in order to produce two million pounds' worth of dyes per annum the capital proposed is ample to purchase existing concerns, to erect new works, and to leave perhaps 2½ million pounds or more for working capital or as a fighting fund. The German capitalisations and output bear out these estimates. The money put in, if wisely used, will be ample to build up a great British industry, and if at the end of ten years it has been found that it was necessary to expend £250,000 a year for this purpose, there should be then an earning power and a goodwill in the company equal to the outlay.

"The Government has been forced by the pressure of the trades to endeavour to organise this great national effort. If those concerned will do it themselves no doubt the Government will be glad to stand aside. There is, however, no evidence of this. Hence the Government offer of £1,500,000 as a loan, at low interest, for twenty-five years, the interest and sinking fund being payable only out of earnings. The Government requires that those whose vital interests are involved should do

their share in the matter. On an annual trade of £200,000,000 the £3,000,000 to be raised is only $1\frac{1}{2}\%$. The first amounts called up are very small. The remaining amounts are also in very small instalments at very long dates.

"To do nothing, to wait till the war is over, and then go back to Germany for our dyes, and to confess failure and helplessness, would be shameful. But more, it would mean that later the Germans could and would charge such prices for their dyes as would soon eat up all the capital proposed to be raised for this scheme, and still leave British industries in a state of dependence. The monopoly of the synthetic dye industry by Germany compels us to believe that there are those amongst us who are willing to accept such a conclusion.

"The Germans can, if they like, when the war is over, offer their dyes for nothing, but under the co-operative scheme now proposed their competition cannot touch the proposed concern or injure the new industry. If the users and the allied trades resolve that never again shall they be placed in such jeopardy, the Germans will be powerless and the British company unassailable.

"The very biggest users of dyes are on the Committee, and agreed to support the Government scheme in principle. Of course any concern that has plans of its own is free to stand out of this national effort, but the bigger the concern the graver the responsibilities imposed upon it in this national crisis. The country is doing a great deal for such concerns in protecting them and enabling them to carry on their businesses and to earn their profits. They have a corresponding duty to the country.

"The new company will start with the control of certain good concerns. It hopes to get others. It will extend its operations in every direction in order best to meet the emergency. It will have ramifications of a character that should enable it to do this with success.

"If the whole scheme falls through, the users of dyes and those trades dependent on dyes will be in grave straits. A national effort such as this, with substantial Government aid and the co-operation of those concerned, is bound to succeed. A confession of impotence now would indeed be a national humiliation. The Germans may resolve to keep their best dyes, and by their aid endeavour to build up their textile and other trades in foreign markets, or they may decide to charge double or quadruple prices here for such dyes as they may be willing to sell to us when the war is over. The risks involved in putting up some capital now in this co-operative scheme are absolutely negligible when such risks are duly considered, and when the assured benefits of the scheme are taken into account."

Writing to the "Morning Post" on Jan. 19th, Prof. H. E. Armstrong suggests that a general meeting of the Royal Society be called forthwith to organise the body corporate in the service of the State. It will be impossible, he says, to re-establish the dyestuff or the glass industry, for example, unless such protection be granted as is necessary to place the industry permanently on a footing to meet outside competition unaided. Also, our system of education must be so rearranged that our commercial men are trained to work with scientific assistants and to appreciate their co-operation. Our present position should not be attributed to any failure on the part of science. The re-establishment of the industry must be gradual; to train the necessary army of workers will be very difficult, especially as the number who can give the training is so limited. Some of the most distinguished and successful German workers have been taken into the factory directly from academic positions, and this must be our policy also. But it will be useless to

attempt to train men until a Government guarantee is given to support the industry.

Prof. R. Meldola, President of the Institute of Chemistry, in a letter in the "Times" of Jan. 20th, points out that the Board of Trade Advisory Committee has had nothing to do with the formulation of the Government scheme, and that the Sub-Committee, appointed to deal with this special branch of manufacture, is equally irresponsible. He considers that the weakness of the scheme was in the subordination of science to business in an industry in which science should govern the Directorate. The development of this great industry in Germany has been the result of spending many years and large amounts of capital in research work, and it is to be hoped that we shall not continue to ignore this; if we do, all such schemes are doomed to failure. Scientific control is of primary importance to the industries of this country.

(Further information on this subject will appear in subsequent issues of the Journal.)

Alizarin; Some homologues of —. H. Bradbury and C. Weizmann. Chem. Soc. Trans., 1914, 105, 2748—2751.

HEMPINIC anhydride condenses with *o*-xylene, under the influence of aluminium chloride, to form a dihydroxy-2-xylylbenzoic acid, which on dehydration with sulphuric and boric acids gave a mixture of two dimethylalizarins. That melting at 276° C. gave on oxidation pyromellitic acid and is therefore $\alpha\beta$ -dihydroxy- $\beta'\beta'$ -dimethyl-anthraquinone. The other melted at 198° C., and the position of its methyl groups has not yet been determined. Both form orange-yellow needles, dissolve in sodium hydroxide to a purple solution, and dye mordanted cotton. The condensation of 4-methoxyphthalic anhydride with *o*-xylene proceeds in a similar way, giving two hydroxy-xylylbenzoic acids, one of which, m. pt. 228° C., was converted by dehydration into a mono-hydroxydimethylantraquinone crystallising in pale green needles, and melting at 210° C.—G. F. M.

Glucosides of chalkones. G. Bargellini. Gaz. Chim. Ital., 1914, 44, II., 520—528.

MANY chalkones, among them naringenin (4,2',4',6'-tetrahydroxychalkone) and hesperitin (4-methoxy-3,2',4',6'-tetrahydroxychalkone), exist as colouring matters in plants in the form of glucosides. The author succeeded in synthesising glucosides of chalkones by condensing helicin (the glucoside of salicylic aldehyde) with hydroxy-derivatives of acetophenone in alcoholic solution, at the ordinary temperature in presence of a 40% solution of sodium hydroxide, or by heating in presence of piperidine. In this way the glucoside of 2,4'-dihydroxychalkone (minute yellow needles, m. pt. 257°—259° C. with decomposition) was obtained from *p*-hydroxyacetophenone; 2,2'-dihydroxy-4'-methoxychalkone-glucoside (canary-yellow needles, m. pt. 213°—215° C.) from 2-hydroxy-4-methoxyacetophenone; 2,2'-dihydroxy-5'-methoxychalkone-glucoside (orange-yellow needles, m. pt. 225°—227° C.) from 2-hydroxy-5-methoxyacetophenone; 2,2'-dihydroxy-3',4'-dimethoxychalkone-glucoside (bright yellow crystals, m. pt. 195°—196° C. with decomposition) from 2-hydroxy-3,4-dimethoxyacetophenone; and 2-hydroxy-2'-benzalaceto-1'-naphthol-glucoside (minute reddish orange needles, m. pt. 244°—246° C.) from acetanaphthol (m. pt. 100°—101° C.). In a similar manner tetra-acetylglucovanillin when condensed with paeonol yielded the glucoside of 2',4'-dihydroxy-4',3'-dimethoxychalkone, canary yellow crystals, m. pt. 220°—225° C.—A. S.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Cellulose acetate; Varnishes and coatings of —. L. Clément and C. Rivière. Bull. Soc. d'Encouragement, 1914, 121, 187—206.

THE most suitable solvent for cellulose acetate is tetrachloroethane, but this gives viscous solutions, often opalescent owing to moisture present in the cellulose acetate. For practical purposes a mixture of tetrachloroethane with 10% of strong methyl or ethyl alcohol is suitable, but as such mixtures are slightly inflammable and the alcohol evaporates more readily than the tetrachloroethane, the use of amyl alcohol in place of the lighter alcohols has been suggested (Fr. Pat. 461,058; this J., 1914, 20). The cellulose acetate is dissolved in mixing machines with moving blades, and the viscous liquid may be filtered under pressure in a filter-press; for the preparation of highly viscous solutions or pastes heated mixing machines are necessary. Artificial silk made from cellulose acetate is said to withstand water better than other kinds, but the cost, and the artificial silk "trust," have prevented its manufacture. Varnishes composed of solutions of cellulose acetates are now being used for rendering aeroplane fabrics impermeable. Suitable mixtures are: (1) tetrachloroethane, 900; denatured 95% alcohol, 100, and cellulose acetate 75 grms.; and (2) tetrachloroethane, 800; denatured 95% alcohol, 80; acetone, 120; and cellulose acetate 65 grms. Two or three coats of about 500 grms. per sq. metre are applied to the fabric stretched on the chassis. The fabric so treated is said to possess advantages over rubbered fabrics in regard to impermeability to water and resistance to oil and motor spirit. It is suggested that cellulose acetate solutions might be used in the textile printing industry as thickening agents instead of gum or starch, and as resists in dyeing.—R. G. P.

PATENTS.

Sulphite fibre; Process of making — and reclaiming sulphur dioxide. H. K. Moore and R. B. Wolf, Berlin, N.H. U.S. Pat. 1,119,977, Dec. 8, 1914. Date of appl., Feb. 1, 1910.

THE raw material and aqueous liquor are charged into a digester, which is then closed, and sulphur dioxide is injected to provide an excess of sulphurous acid, the air being allowed to escape. The charge is allowed to stand, without heating, while the acid permeates the material, and steam is injected until the cooking is completed, sulphur dioxide being again passed in to compensate for the weakening of the solution by condensed water. The liquor and gases are discharged and separated, the sulphur dioxide being removed from the other gases by liquefaction.—B. N.

Viscose solution from wood-cellulose; Method of manufacturing a —. A. Bernstein, Chemnitz, Germany. U.S. Pat. 1,121,605, Dec. 22, 1914. Date of appl., Aug. 22, 1913.

SEE Fr. Pat. 462,147 of 1913; this J., 1914, 196.

Artificial lustrous threads, etc.; Process of manufacturing —. F. E. Dietler, Assignor to Verein. Kunstseidefabriken A.-G., Kelsterbach on Maine, Germany. U.S. Pat. 1,121,903, Dec. 22, 1914. Date of appl., June 18, 1912.

SEE Fr. Pat. 443,621 of 1912; this J., 1912, 1027.

Composition [from sulphite-cellulose waste lye] for laying road-dust. U.S. Pat. 1,119,500. See IX.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

PATENTS.

Washing machines; Rotary cylinder —. I. Braithwaite and Son, and R. J. W. Cousins, Kendal, Westmoreland. Eng. Pat. 28,565, Dec. 11, 1913.

THE washing machine comprises a rotary cylinder with a conical base ending in a trunnion serving as the discharge outlet, through which the clear liquid and steam are supplied. The axis of the cylinder is slightly inclined to the vertical. When the liquid reaches a given level the vessel is emptied through a siphon discharging into a chamber provided with two movable buckets counter-balanced by a weight. The movement of the buckets opens and closes the outlet and inlet valves, so that the action of the machine is continuous.—B. N.

Bleaching textile materials and other substances. J. E. Macilwaine, Belfast. Eng. Pats. 28,911, Dec. 15, 1913, and 6317, March 12, 1914.

THE material is impregnated with a solution of sodium bicarbonate, and then with the hypochlorite bleaching liquor, or the order of impregnation may be reversed, the active bleaching agent in either case being liberated in the body of the fibre. Mechanical or other pressure may be applied to intensify the process of impregnation.—B. N.

Dyeing yarns and slubbings; Machines for —. S. S. Partridge, Kidderminster, Worcester. Eng. Pat. 3114, Feb. 6, 1914.

A HANK-CARRYING frame is given a vertical reciprocating movement in a vat by means of mechanism, as described in Eng. Pat. 8570 of 1904 (this J., 1905, 543), and at one end of the vat is arranged a compartment provided with an agitator for the liquid. The liquid is circulated between this compartment and the vat, whilst the yarn is prevented from entering the compartment and becoming entangled with the agitator.—B. N.

Dyeing-spool. J. G. Masson, Woonsocket, R.I. U.S. Pat. 1,120,398, Dec. 8, 1914. Date of appl., July 18, 1913.

A TUBULAR spool is provided with a series of perforated walls, with deep annular grooves, between which the goods are wound in comparatively thin separated rows, so that the dyeing liquid may be forced through each row from either side. A jacket of perforated material encloses the spool when charged.—B. N.

Dyeing machine. J. Benesch, Assignor to Klander-Weldon Dyeing Machine Co., Amsterdam, N.Y. (A) to (E). U.S. Pats. 1,120,643 to 1,120,647, Dec. 8, 1914. Dates of appl., (A)—(C) Dec. 13, 1913, (D) March 9, 1914, (E) March 10, 1914.

(A) A FRAME is formed of central and outside spiders, with two sets of yarn sticks carried on them by means of a pair of adjacent sockets opening in opposite directions, and the frame is mounted so as to turn within an outer casing. Intermittent rotation of the yarn sticks is produced by mechanism connected with one of the spiders. (B) The yarn sticks are carried by a pair of rotary members, one end of each stick resting in one of the members, whilst the second member is provided with slides which lock and release the sticks in groups. (C) The yarn sticks are

supported between a pair of rotary carrying members, sockets upon one of the members being adapted to receive one end of each stick, whilst the other member is flanged and has sockets, each of which has its outer side open. A slide, beneath the flange, is provided with a number of projections passing through slots in the carrying member, the slots being of such a length that the projections may be moved into and out of register with the sockets and the sticks held in position. The slide is locked in position by a screw passing through the flange. (D) The rotary frame, supporting the yarn sticks, is provided with mechanism so arranged that the sticks are rotated as they pass a trip member, but in one direction only. The member may be set, however, to move the sticks when the frame is moved in the opposite direction. (E) The sticks are supported in non-circular sockets, and means are provided for rotating the sticks intermittently in one direction only, independent of the movement of the frame.—B. N.

Dyeing machine. W. W. Brown, Assignor to Klauder-Weldon Dyeing Machine Co., Amsterdam, N.Y. U.S. Pat. 1,120,899, Dec. 15, 1914. Date of appl., April 28, 1914.

THE yarn sticks are carried in a support and rotated by mechanism engaging with a trip member, which is operated by a weighted lever arranged so that it yields on the application of unusual pressure, whereby movement of the trip member is resisted to cause tripping. Means are also provided for regulating the pressure.—B. N.

Dyeing machine. J. Benosch, Assignor to Klauder-Weldon Dyeing Machine Co., Amsterdam, N.Y. U.S. Pat. 1,121,061, Dec. 15, 1914. Date of appl., March 9, 1914.

A NUMBER of cups are supported on a rotary carrier; each cup opens away from the axis of the carrier, and is adapted to receive the end of a yarn stick. The sticks are forced into the cups, and are retained in position by a sliding member on the carrier actuated by a spring.—B. N.

Dyeing straw and the like: Vat for—. A. Kluge, Brooklyn, N.Y. U.S. Pat. 1,121,023, Dec. 15, 1914. Date of appl., Oct. 4, 1913.

A PERFORATED support is fixed a little above the bottom of the vat, and a "puffer" is connected to the centre of the support. A perforated pipe is fixed parallel and adjacent to the edge of the bottom of the vat, the perforations being directed towards the bottom of the vat and the lower end of the vertical pipe.—B. N.

Dyeings: Producing stable—. A. Schlegel, Mannheim, and K. Pfister, Philadelphia, Pa., Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen on the Rhine, Germany. U.S. Pat. 1,121,295, Dec. 15, 1914. Date of appl., Dec. 4, 1913.

THE material is passed through a paste of a vat colouring matter of the anthracene series, and the colouring matter is fixed on the fibre by a single short passage through a warm solution containing about 3 or 4 parts of sodium hydrosulphite in 100 parts of water.—B. N.

Dyeing process. J. A. Domínguez, Buenos Aires. U.S. Pat. 1,121,720, Dec. 22, 1914. Date of appl., Oct. 9, 1911.

SEE Addition of Dec. 13, 1911, to Fr. Pat. 437,020 of 1911; this J., 1912, 637.

Cotton fabrics: Process for the production of pattern effects upon—. Heberlein et Cie., Wattwil, Switzerland. Eng. Pat. 13,129, May 28, 1914. Date of appl., Nov. 20, 1913.

SEE Fr. Pat. 468,642 of 1914; this J., 1914, 960.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Carbonic acid: Detection of—, especially in mixtures of carbonate and sulphite. J. Petersen. Z. anorg. Chem., 1914, 88, 234—236.

To the mixture of carbonate with sulphite, etc., hydrochloric acid and a few strips of zinc are added, and the gases evolved are passed at the rate of 2 to 3 bubbles per second through a wash-bottle containing 3% hydrogen peroxide and then into a fairly large volume of lime-water; the solubility of calcium sulphite in water being 1 in 800, the small quantity formed from the traces of sulphur dioxide remaining in the gas will be dissolved, and any precipitate will be due to the presence of carbon dioxide. If chlorine is evolved the dilute hydrogen peroxide is replaced by potassium iodide solution.—J. R.

Acid sodium borates. J. Ponomareff. Z. anorg. Chem., 1914, 89, 383—392.

FUSED mixtures of borax with varying proportions of boron trioxide were made to crystallise by placing in a platinum boat in a definite temperature gradient, so that for at least one layer favourable conditions for crystal formation were produced (see Tammann, this J., 1914, 691). Three definite maxima were observed at 732°, 694°, and 783° C., indicating the existence of definite acid borates of the formulae, $\text{Na}_2\text{O} \cdot 2\text{B}_2\text{O}_3$, $\text{Na}_2\text{O} \cdot 3\text{B}_2\text{O}_3$, and $\text{Na}_2\text{O} \cdot 4\text{B}_2\text{O}_3$, respectively. These three compounds form mixed crystals with each other, and the most acid of them can take up still more boric anhydride, so that it is possible to obtain crystals containing only 3% Na_2O , the nearest approximation to crystallised boric anhydride so far obtainable.—G. F. M.

Cathode rays: Salts coloured by—. E. Goldstein. Brit. Assoc., Australia, 1914. Chem. News, 1915, 111, 27—29.

THE incidence of cathode rays on certain salts produces immediately vivid colours on the salts which in the dark and at low temperatures may persist in some cases for many years (Wiedemann, Ann., 54, 371; 60, 491; Phys. Zeits., 3, 149; Sitzungsber. Berl. Akad. Wiss., 1901, 222; see this J., 1901, 1240). Thus, sodium chloride becomes amber-coloured, potassium chloride violet, potassium bromide deep blue, sodium fluoride rose, lithium chloride bright yellow, and potassium carbonate reddish. The colours are sensitive to heat in very different degrees: for instance, that of sodium chloride is comparatively stable, but those of potassium chloride and bromide disappear even at tropical temperatures. The disappearance of colour in daylight is generally accompanied by the appearance of marked fluorescence. Similarly solid solutions of these salts even in extreme dilution, in substances such as potassium or sodium sulphate, which are not themselves affected by cathode rays, also acquire characteristic colours, generally different from the colour given by the pure substance. Thus, one part of potassium carbonate in 25,000 parts or more of the sulphate produces a green colour, whilst in some cases quantities of an admixture estimated at one part in one million, may produce

a perceptible tint. These reactions afford a very sensitive method for detecting impurities in salts, even when more than one impurity is present, since the colours produced by different impurities generally disappear at different rates in daylight or on increasing the temperature. Potassium sulphate, for example, generally turns dark grey at first, owing to the presence of a trace of sodium chloride, but this colour disappears in a short time in daylight, leaving only a vivid green due to the carbonate. Potassium sulphate may be obtained so pure by repeated fractional crystallisation, that it is no longer coloured by cathode rays; on the other hand, it has not been possible to separate from sodium sulphate by this method the last traces of carbonate, as indicated by the persistent grey shade produced by the rays. There is thus a marked difference between these so-called "first-class colours" and the Giesel colours which are produced by heating the substance in the vapour of one of its components, sodium chloride in sodium vapour, for example (see Ber., 30, 156). In this latter case the decomposition is permanent, the salts have a strong alkaline reaction, and the colour is not at once destroyed by daylight. However, by submitting salts to the action of cathode rays for a somewhat prolonged time, until the salts are strongly heated, products identical in every respect with the Giesel salts are obtained. Since the colorations produced by different salts of the same metal vary so much, it is probable that they are due, primarily to the acidic radical. This assumption is strengthened by the fact that the halogen derivatives of acetic acid are coloured by the cathode rays, whilst acetic acid itself remains colourless. These phenomena are probably accounted for by a decomposition, not, however, of the ordinary kind in which the components are entirely set free, but merely a "distention," the components remaining at a short distance from one another, and if the absorptive power is weakened by heating, or the chemical affinity strengthened by the energy of daylight, recombination again ensues. The effects of cathode rays and β -rays are really the effects of the ultraviolet light produced by the stopping of those rays, and hence ultra-violet light also produces similar colour effects on salts. The therapeutic effect of X-rays, radium, etc., according to this view, would be merely the effect of the ultra-violet light produced on any surface whereon the rays are stopped.

Radium. Report presented to the House of Representatives, U.S.A. Chem. News, 1914, 110, 264—266, 276—278, 284—286, 301—302, 310—312. (See also this J., 1913, 1066, 1107.)

THE Committee on Mines and Mining report, with the recommendation that it be passed, "a Bill to provide for and encourage the prospecting, mining, and treatment of radium-bearing ores in lands belonging to the United States for the purpose of securing an adequate supply of radium for government and other hospitals in the United States, and for other purposes." The general scope of the bill is to provide the Government with a preferential right to purchase radium-bearing ores from lands now owned by the Government, at prices to be fixed semi-annually by the Secretary of the Interior, under such conditions as will ensure and encourage prospecting and mining. It does not reserve to the United States the ownership of radium-carrying ores, but furnishes the actual prospector with a steady market for his ores. The bill further authorises an appropriation to cover the cost of the mining of the radium-bearing ores on the public lands, and the extraction of the radium. The Secretary may sell to American

hospitals, at cost of production, a part or all of the radium produced.

During the last two or three years the U.S. production of the raw radium material was from two to three times as much as that of the rest of the world together, but up to Jan. 1st, 1914, only 2 grms. of radium had been actually isolated in the States, and such was the foreign demand for raw material that it was practically impossible to procure radium for immediate delivery. Since some of the pure radium salt had also been exported there is probably less than 2 grms. in America to meet the entire demand of some 200,000 cancer cases. About 1000 claims, many of them by foreign interests, have already been staked out in the carnotite deposits of Colorado and Utah, the most extensive radium-bearing deposits in the world. The deposits have been very wastefully exploited, four tons of low-grade ore having been thrown away for every ton marketed. The testimony presented to the Committee as to the future supplies was contradictory, and prompt action by the Government to secure the deposits already located is therefore necessary in view of this uncertainty, and the fact that, although the carnotite region covers over 480,000 acres, the individual pockets are small, unconnected by veins, and have produced in the most favourable cases less than 500 tons of ore suitable for export. From the ores exported in 1912, 11.43 grms. of anhydrous radium bromide could, and probably have been prepared, and, in 1913, 7.5 grms. The report concludes with a statement of the requirement of radium in America for cancer treatment, and of the impossibility of obtaining it at a reasonable price other than by government operation.

Appendix I. U.S. radium resources. C. L. Parsons, U.S. Bureau of Mines. American carnotite from Montrose and San Miguel counties, Colorado, including the Paradox valley deposits, and from Green River and other places of lesser importance in Utah, are at the present time the principal sources of radium in the world. Apart from the deposits at Joachimsthal, Bohemia, pitchblende is of quite secondary importance, the only other deposits of any size being in Gilpin County, Colorado, where small quantities have been mined. Since 1896 carnotite has been spasmodically worked by various companies for uranium and vanadium, and first in 1903 for radium but without success. In 1910 the Standard Chemical Co. and the International Vanadium Co. successfully engaged in mining carnotite, but most of the high-grade ores have been exported to Europe for radium extraction, and the low-grade ores wasted. Mechanical concentration of the latter would save half of the material now thrown away. An estimate placing the amount of radium in the Colorado carnotite deposits at 900 grms. is five times as large as that made by the Bureau of Mines. (See also this J., 1913, 616, 1107.)

Appendix II. National Radium Institute (see this J., 1913, 1066).—G. F. M.

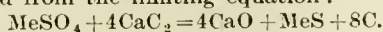
Carnotite near Mauch Chunk, Pennsylvania. E. T. Wherry, Bulletin 580-II., U.S. Geol. Survey, Washington, 1914.

THE occurrence of carnotite near Mauch Chunk, Pa., was first noted in 1908; the mineral occurs in a 40-foot layer of coarse-grained conglomerate lying near the base of the Pottsville formation, the rock consisting chiefly of white quartz, but also of gneiss, crystalline limestone, and serpentine. A sample of the carnotite separated from gangue contained V_2O_5 9.80%; UO_3 31.11%; K_2O 3.55%. Analysis of a small specimen of the rock showed 4.4% UO_3 , but it is doubtful whether much of the material contains more than 1%. However, as

the cost of transport to consumers would be far less than for the Colorado ores, a profit of £5 per ton is possible even on 1% ore, and further prospecting of the deposit is recommended.

Radium; Preparation of — from "crude sulphate" by means of calcium carbide and mixtures of calcium carbide and calcium hydride. E. Ebler and W. Bender. Z. anorg. Chem., 1914, 88, 255—264.

"CRUDE sulphate" mixtures containing radium could not be satisfactorily reduced with carbon, silicious and other impurities preventing reduction of the radium. The "crude sulphate" from torbernite, autunite, carnotite, and other important sources containing very little radium and much silicious matter, was satisfactorily reduced with calcium carbide by maintaining at a bright red heat for 4 hours, the amount of carbide being estimated from the limiting equation:



The greyish-black product was powdered and freed from sulphide as rapidly as possible by boiling with dilute hydrochloric acid, whereby the radium was obtained in the filtrate in company with Ba, Ca, Fe, and Pb (if present). The autogenous reduction of the "crude sulphate" with calcium hydride (see this J., 1913, 976) may become extremely vigorous in presence of certain impurities; the process was conveniently moderated by the addition of calcium carbide, the amount of calcium hydride being chosen so as to render the reaction just autogenous. With very pure "crude sulphate" up to 75% of the hydride could be replaced by carbide. The reduction was complete in a few minutes. The percentage yields of radium increased with the total charge up to 50 kilos. The reduction is attributed to the action of calcium vapour.—J. R.

Calcium carbide; Note on the preparation of pure —. M. D. Thompson, L. R. Gonzalez, and K. B. Blake. Met. and Chem. Eng., 1914, 12, 779—780.

PURE calcium carbide, in quantities large enough for experimental purposes, was prepared by the action of acetylene on calcium dissolved in anhydrous liquid ammonia. The carbide made in this way is acted upon by atmospheric moisture with such intensity that the acetylene produced is ignited. A stable product may be obtained by allowing it to stand in an atmosphere of acetylene.—W. E. F. P.

Peroxides of the alkaline earths. E. H. Riesenfeld and W. Nottebohm. Z. anorg. Chem., 1914, 89, 405—412.

THE peroxides of barium, strontium, and calcium can be obtained either anhydrous, or as octohydrates, or as diperoxyhydrates, according to the temperature and concentration of the solutions from which they are precipitated. The anhydrous peroxides of calcium and strontium are precipitated by hydrogen peroxide from concentrated solutions at high temperatures. All three anhydrous peroxides are also obtained by the careful drying of any of the hydrates. The octohydrates are in general produced when cold fairly dilute salt solutions containing hydrogen peroxide are rendered alkaline. If excess of peroxide is present a diperoxyhydrate is precipitated from cold solutions of barium salts, but the corresponding strontium and calcium peroxide diperoxyhydrates are only obtained by the action of concentrated hydrogen peroxide on the octohydrates at low temperatures. Barium peroxide also forms a monoperoxyhydrate, obtained by precipitating between 30° and 60° C., and calcium peroxide can be obtained as a dihydrate.—G. F. M.

Copper sulphates; Basic —. Fonzes-Diacon. Bull. Soc. Chim., 1914, 15, 723-727.

WHEN a solution of sodium carbonate is poured slowly into a solution of copper sulphate, the latter being vigorously agitated, a basic copper sulphate, $\text{CuSO}_4 \cdot 3\text{CuO} \cdot 4\text{H}_2\text{O}$, is first formed. As the concentration of the copper sulphate decreases, a hydrate of the type, $\text{CuSO}_4 \cdot 4\text{CuO} \cdot n\text{H}_2\text{O}$, is produced. Excess of sodium carbonate decomposes these basic sulphates with the formation of copper hydrocarbonate. When the supernatant liquor containing excess of copper sulphate is exposed to the air a blue compound, $\text{CuSO}_4 \cdot 3\text{CuO} \cdot 5\text{H}_2\text{O}$, or a green compound, $\text{CuSO}_4 \cdot 3\text{CuO} \cdot 4\text{H}_2\text{O}$, is deposited. (See also Ermen, this J., 1912, 312; Fowles, 1913, 9.)—F. SHDN.

Oxides of lead; The higher — and their dissociation. W. Reinders and L. Hamburger. Z. anorg. Chem., 1914, 89, 71—96.

THE dissociation pressure of Pb_3O_4 was determined at temperatures between 440° and 610° C., and it was found that the results could be represented satisfactorily by either of the equations:

$$(1) \log p = -\frac{35926}{4.571T} + 11.8976, \text{ or}$$

$$(2) \log p = -\frac{32406}{4.571T} + 1.75 \log T + 0.000216T + 2.8.$$

The heat of formation of Pb_3O_4 from PbO and O_2 was calculated to be 35,926 and 35,954 cal. at 550° C. by equations (1) and (2) respectively and 33,504 cal. at 17° C. by equation (2). When lead dioxide is heated there are formed not definite chemical compounds but solid solutions of oxides, of composition ranging from PbO_2 to $\text{PbO}_{1.33}$ at 361° C. (or to $\text{PbO}_{1.33}$ at 381° C.). The dissociation pressure varies considerably with the composition of the products. These oxides are metastable in comparison with Pb_3O_4 , and the latter is formed when PbO_2 or an oxide PbO_x ($x > 1.33$) is heated to 420° or higher in oxygen under pressure. Pure Pb_3O_4 can be obtained by heating PbO_2 at 440° C. under an oxygen pressure of 2 atmospheres. Lead oxides containing active oxygen, prepared by wet methods, change colour when heated, and show the same behaviour as the products of dissociation of PbO_2 . (See also Milbauer, this J., 1909, 612, 1049; 1910, 282; 1911, 37; 1912, 193; 1913, 97, 151.)—A. S.

Hydrosols; Influence of the quantity of peptising agent on the properties of —. Hydrosol of stannic acid. R. Zsigmondy. Z. anorg. Chem., 1914, 89, 210—223.

HYDROSOLS of stannic acid (0.5% SnO_2) were prepared by treating stannic acid gel with varying quantities of potassium hydroxide free from carbonate, in the proportions corresponding to 200, 100, 50, 25, 10, and 2 mols. SnO_2 respectively per mol. KOH . With increasing quantity of alkali, the size of the colloidal particles, the amount of colloidal stannic acid transferred under the influence of the electric current, the gold number (this J., 1902, 192), and the viscosity of the sol decreased; the stability on boiling, the osmotic pressure, the electric conductivity, and the quantity of electrolyte required to effect precipitation increased, and the surface tension remained unaltered or diminished slightly. The differences observed are explained by the author's theory of peptisation, according to which the added alkali forms alkali stannate and peptisation is produced by adsorption of the stannate ions by the colloidal ultramicros of the stannic acid gel, whereby they become electrically charged. It is suggested that sols prepared from gels by peptisation with alkalis or acids, and of which

the properties change gradually and continuously from those of a colloidal to those of a true solution, as the quantity of peptising agent is increased, should be grouped as a separate class of colloids, for which the name "electrolyte-colloids" is proposed.—A. S.

Potash; Felspar as a possible source of American —. A. S. Cushman and G. W. Coggeshall. Amer. Inst. Chem. Eng., Dec. 2, 1914. Oil, Paint, and Drug Rep., Dec. 14, 1914, 32A—32B.

IN 1914 the U.S.A. imported potassium salts to the value of \$15,000,000, including chloride of the value of \$8,000,000. Most of this, including 85% of the chloride, was utilised in the fertilising industry; and the remainder of the chloride was converted chiefly into hydroxide, carbonate, chlorate, and bichromate. Most of the American sources of potash, namely, the kelps, saline lakes and wells, and alunite deposits, are situated in the West, whereas the demand exists east of the Allegheny mountains; and it is considered unlikely that the Panama Canal will enable Western potashes to compete with the European product. On the other hand, the great Appalachian felspar dykes are close to the centres of demand. In the process described, a mixture of ground felspar (10% K_2O) and burnt limestone is formed into "clumps" by treatment with calcium chloride solution and heated in a rotary kiln, the fuel being oil or powdered coal. The red-hot product falls into lixiviating vats. The weaker vat-liquors are used in a further operation, while the stronger ones are concentrated by spraying through the waste hot gases, whereby loss of potassium chloride by volatilisation is also prevented. The product, after drying in a rotary dryer which utilises the hot waste gases of the lime-kiln, contains 70—80% KCl , 14 to 16% $NaCl$, and small amounts of calcium salts and moisture, as against 70 to 80% KCl in the imported "80% muriate." A high-grade product can be obtained by fractional crystallisation. The general plant, in the main, resembles a Portland cement mill. The total cost of a plant to handle 300 tons of felspar per 24 hours is given as \$100,000 for the general plant, with an additional \$70,000 for the special equipment. The estimated total expenditure per day of \$1488.90 is composed of \$800 for raw materials, \$554.60 for manufacturing operations, and \$64.30 for charges, including interest and depreciation. Calculating on the basis of an 80% conversion of K_2O to KCl , the cost of the product amounts to \$31.32 per ton, as against \$37.50 for the normal price of the imported "80% muriate," which latter, however, is probably artificially controlled. No account is taken in these estimates of possible valuable by-products. Since all the requisite materials are available in the country, the authors consider that the U.S.A. might be rendered independent of foreign supplies.—J. R.

Ammonia; Determination of —, by the boric acid method. L. W. Winkler. Z. angew. Chem., 1914, 27, 630—632.

IN applying the boric acid method (this J., 1913, 485) to the determination of nitrogen by the Kjeldahl process, the distillate (200 to 300 c.c.) from the ammoniacal liquid is passed into a cooled receiver containing boric acid (10 grms.) in distilled water (100 c.c.). A narrow-necked receiver, e.g., a Soxhlet flask, is preferable, and the mouth should be closed with a wad. The distillate is titrated with $N/10$ or $N/5$ hydrochloric acid, using either Congo-red (1 in 1000) or methyl-orange (1 in 1000). For great accuracy water free from carbonic acid is employed, a boric acid solution containing the same amount of indicator is used as a colour standard, and the hydrochloric acid is standardised by distilling a weighed quantity

of pure ammonium chloride with alkali under similar conditions. The method, which is recommended for general use, gave results of high accuracy (e.g., 0.1790 grm. NH_3 instead of 0.17846 grm.) when the above precautions were observed. —J. R.

Ammonia production in the United Kingdom in 1914. Bradbury and Hirsch, Liverpool. Jan., 1915.

PRODUCTION of ammonia, calculated into sulphate (including that used in the manufacture of ammonia soda and for other chemical purposes), from all sources in the United Kingdom during 1914, is estimated at 421,000 tons, viz.:—

	1913.	1914.
	tons	tons
Gas works	182,000	177,000
Iron works	20,000	19,000
Shale works	63,000	62,000
Coke and carbonising works and producer gas	167,000	163,000
	432,000	421,000

Of this quantity it is estimated that England contributed 295,000 tons, Scotland 123,000 tons, and Ireland 3,000 tons. Exports during 1914 amounted to 314,000 tons and home consumption to 106,000 tons, leaving a stock of 25,000 tons to carry forward to 1915.

Strontia in the beet sugar industry. Meyer. See XVII.

PATENTS.

Ammonia by synthesis; Process for utilising gas producers for the manufacture of —. A. Bambach. Fr. Pat. 469,331, Feb. 28, 1914.

A GAS producer is operated in the normal manner with atmospheric air, but with a charge of fuel which has been treated with metallic salts, oxides, hydroxides, or carbides. Metallic nitrogen compounds (cyanides, cyanamide, nitrides, etc.) are thus formed, and these are decomposed *in situ* by steam or atomised water, so as to produce ammonia, which is carried forward by the gaseous current, and oxides or salts which are recovered from the ash. The air is preferably preheated, and the gases containing ammonia are suddenly chilled by a cooling coil in the centre of the producer, surrounded by a perforated iron drum connected with an exhaust. Supplementary substances, such as small proportions of magnesium chloride, calcium fluoride, etc., may be added to the charge, to increase the yield of ammonia and the speed of the reaction.—F. SODN.

Salt; Process of purifying and sterilising [common] —. E. D. F. Barrey. Fr. Pat. 469,241, May 14, 1913.

THE salt is crystallised from water and brought in contact with heated air in a drying stove, being preferably introduced into the upper part of the stove and allowed to fall through air at not less than 140° C. The product is packed under aseptic conditions, for example, in an ozonised atmosphere.—F. SODN.

Aluminium nitride; Process of making —. Soc. Générale des Nitrures. Second Addition, dated May 13, 1913, to Fr. Pat. 427,109, May 19, 1910 (see Eng. Pat. 13,086 of 1910 and 22,435 of 1912; this J., 1911, 421; 1913, 233).

THE preliminary heating is effected in an extension of the main reaction tube, which is supplied with

air and serves for the combustion of the reaction gases. The bauxite may be calcined by direct contact with the flame, whilst the carbon is heated in a coil surrounding the tube and introduced at a point behind the flame. Or the mixture of bauxite and carbon may be heated together, out of contact with the flame, by passing through an axial tube in the combustion zone, or by traversing a coil, preferably of increasing section, built in the lining of the furnace, so as to deliver behind the flame; in the latter case, steam evolved from the material is carried forward into the flame, rendering the temperature more uniform.—F. SODX.

Nitrides [especially aluminium nitride]: Electric furnace principally for the manufacture of—and its mode of utilisation. G. Coutagne. Fr. Pat. 169,551, May 23, 1913.

A PAIR of vertical electrodes is disposed axially in a gas-tight metallic envelope, the upper one being movable, whilst the lower is fixed and consists of a thick-walled tube of agglomerated carbon, filled with coke. Producer gas or other nitrogenous gas is introduced into the lower electrode under pressure from below. The envelope is provided with an exit pipe for residual gas and air-tight charging doors, and the space between it and the lower electrode is packed with refractory material, the upper part of the envelope being protected only by the peripheral portion of the charge (e.g., a mixture of bauxite and carbon) which escapes reaction. The furnace is started by lowering the upper electrode, and the charge is then introduced intermittently, until the furnace is full, when it is allowed to cool and the product withdrawn by removing certain readily dismantled sections from the upper part of the envelope. The cake of nitride is detached from unagglomerated material, and particles of included metal are separated by crushing and treating with a magnet or exposing to steam or water, which cause such particles to fall into powder.—F. SODX.

Nitrous gases; Process for the gradual absorption of dilute—by means of water. F. Häusser. Fr. Pat. 469,649, March 14, 1914.

ABSORPTION vessels of relatively small size are made to alternate with oxidation chambers, so that the gases pass through each in succession, whilst the absorbing liquid gravitates from one absorption vessel to the next.—F. SODX.

Perborates [of magnesium and zinc]; Process for making—. Henkel und Co. (A) First and (B) Second Additions, dated Feb. 11 and 12, 1914, to Fr. Pat. 468,293, Feb. 10, 1914 (this J., 1914, 962). Under Int. Conv., Feb. 21 and 27, 1913.

(A) A MAGNESIUM salt or (B) a zinc salt of an acid which forms an alkali salt containing water of crystallisation, is mixed with an alkali peroxide, borax, and a substance reacting with the excess of alkali (e.g., boric acid), the mixture is allowed to absorb about 25% of water, and is then melted by heating for some time, with stirring, preferably at about 65° C., and the solidified product is crushed, dried, and powdered.—F. SODX.

Elements; Process of obtaining—from their volatile compounds. Ehrlich und Graetz, and E. Podszus. Fr. Pat. 469,355, March 5, 1914. Under Int. Conv., March 19, 1913.

VOLATILE compounds (e.g., chlorides of V, Ti, B, etc.) are brought into contact with an excess of strongly heated metallic vapour produced in a metallic vapour arc, and the products are rapidly cooled and subsequently separated by distillation, preferably *in vacuo*, to obtain the reduced element

in the pure state. The vapour to be treated may be introduced into a horizontal tube, in which are one or more mercury vapour arcs (perpendicular to the tube or at an angle), rendered stable as described in Ger. Pat. 227,270 of 1908, an adjustable mercury cathode functioning within a "stabilising tube" which is fitted detachably to the main tube.—F. SODX.

Liquid air; Process of, and apparatus for separating—into its constituents. G. Hildebrandt, Berlin. Assignor to American Industrial Gas Co., New York. U.S. Pats. 1,119,158 and 1,119,159, Dec. 1, 1914. Dates of appl., Oct. 16, 1912, and Sept. 26, 1913.

Air is liquefied by cooling, compressing, and expanding, and the liquid air is separated into its constituents by fractionation whilst passing in thin streams through a long conduit. Nitrogen is collected at the head and liquid oxygen at the base of the conduit: the former is used to cool the unexpanded compressed air, and evaporation of the liquid oxygen serves to heat the rectifying conduit.—W. C. H.

Furnace; Electric—particularly adapted for the manufacture of nitrides. G. Coutagne, Lyons, France. Eng. Pat. 12,057, May 15, 1914. Under Int. Conv., May 23, 1913.

SEE Fr. Pat. 469,554 of 1913; preceding.—T. F. B.

Perborate of zinc; Process of manufacturing—. W. Weber, Assignor to Henkel und Co., Düsseldorf, Germany. U.S. Pat. 1,121,428, Dec. 15, 1914. Date of appl., Feb. 9, 1914.

SEE Addition to Fr. Pat. 468,293 of 1914; preceding.—T. F. B.

Improving the quality of inorganic solid materials [minerals coloured by iron compounds]. Fr. Pat. 469,271. See VIII.

VIII.—GLASS ; CERAMICS.

Optical glass and scientific instruments. United Kingdom imports and German exports. Nature, Jan. 7, 1915.

IMPORTS of scientific instruments and apparatus (other than electrical) complete into the United Kingdom in 1913 amounted to £710,341 in value, of which Germany contributed £362,891, France £108,010, Belgium £28,939, and the United States £182,203. Parts of scientific instruments (including cinematograph films and photographic plates, films, and paper) were imported to the value of £2,373,426, including £310,229 from Germany, £522,682 from France, £126,725 from Belgium, and £1,256,311 from the United States. The exports from Germany to the United Kingdom in 1912 included the following:—Optical measuring instruments (polariscopes, etc.), nautical, astronomical, and geodetical instruments, £15,615; precision balances, instruments for metrology and gauging, barometric, calorimetric, thermometric, and like apparatus, £19,800. Exports of terrestrial telescopes and opera glasses of all kinds from Germany in 1912 were valued at £350,000, Russia receiving these goods to the value of £83,050, Austria £50,930, and the United Kingdom £31,430. Other optical glass, ground and mounted (telescope objectives), stereoscopes, microscopes, and unmounted lenses were exported to the value of £229,500, including £31,430 to the United Kingdom, £30,000 to Russia, and

£23,740 to the United States. Photographic apparatus, including lenses, amounted to £370,000, including £65,000 to the United Kingdom, £51,000 to Russia, and £51,000 to Austria. Glass thermometers, combined or not with other materials, represented £122,000, of which Russia took £18,000, Austria £12,700, and the United Kingdom £12,600. Exports from Germany of apparatus and instruments of glass (including glass tubes), combined or not with other materials, totalled £290,000, including £50,000 to the United States, £40,000 to the United Kingdom, and £17,600 to Russia.

PATENTS.

Glass sheets; Manufacture of—F. L. O. Wadsworth, Sewickley, Pa. U.S. Pat. 1,119,328, Dec. 1, 1914. Date of appl., March 12, 1908.

A PAIR of co-operating rolls is rotated so that a portion of the surface of each roll is in contact with a mass of molten glass. A vacuum is created between the molten glass and the portions of the roll surfaces in contact with it, and maintained between the glass and successive portions of the roll surfaces as they move away from the mass of glass. A layer of glass is thus continuously drawn from the mass in contact with each moving roll surface and the vacuum is gradually relieved as the layers are compressed between the rolls.

—W. C. H.

[Reinforced] *sheet-glass; Manufacture of*—F. L. O. Wadsworth, Sewickley, Pa. U.S. Pat. 1,119,329, Dec. 1, 1914. Date of appl., April 13, 1909.

A ROLL is immersed in a mass of molten glass to a point above its axis, and means are provided, with a suitable tension device, for guiding the layer of reinforcing material, to be embedded in the sheet, on to one side of the roll and withdrawing it, when embedded, from the main mass of the glass on the opposite side. A free body of glass is maintained on substantially the same level as the glass in the receptacle between the roll and the outwardly moving layer of reinforcing material, and above the plane where the latter passes out of contact with the roll. Between the guide and the drawing mechanism, means are provided for embedding the reinforcing layer in the glass, such means being vertically movable by variations in the tension and rate of drawing of the layer.—W. C. H.

Inorganic solid materials [e.g., sand for glass making, coloured by iron compounds]; Process for improving the quality of—F. Schulz, Jun. Akt.-Ges., and H. Gruber, Fr. Pat. 469,271, March 6, 1911.

THE material is treated with hydrosulphurous acid or its derivatives, or with aldehyde- or ketone-sulphoxylic acids or their derivatives in the presence of an acid. For example, 500 grms. of concentrated sulphuric acid (previously diluted) are stirred into a mixture of 100 kilos. of sand (for glass making) and 100—200 litres of water, to which have been added 100—200 grms. of hydrosulphite, and the mixture is allowed to stand for 1—2 hours: the sand is then separated and washed.—F. SODX.

Ovens and driers suitable for use in the manufacture of tiles, bricks, pottery, and analogous ware, for annealing and for other purposes. C. Dressler, London. Eng. Pat. 18,821, Aug. 19, 1913.

IN an oven or dryer of the type described in Eng. Pats. 18,114 of 1910, 8228 and 23,863 of 1912, and 8505 of 1913 (this J., 1911, 1254; 1912, 752;

1913, 1094; and 1914, 540), a longitudinal wall or screen is fixed between each combustion chamber and the adjacent space containing the articles to be fired, forming, with the chamber, a separate air-heating passage and preventing or retarding the passage of radiant heat into the firing space, whilst forcing the heated air to circulate continuously over the screen, and down amongst the goods. The cooling zone is provided with a similar screen or screens, and an air passage is also provided between each combustion chamber or cooling conduit and the adjacent side wall of the oven, to allow air to flow under and on either side of the chamber or conduit. The walls of the combustion chamber are supported by rigid outward extensions, which may be connected at their outer sides to a longitudinal plate, so as to form a series of passages open only at the bottom and top; these prevent collapse of the walls in the event of softening by heat.—F. SODX.

Enamel composition. P. Eyer, Frankfort-on-the-Maine, Germany. U.S. Pat. 1,118,898, Nov. 24, 1914. Date of appl., Aug. 25, 1914.

A MIXTURE of boracite, 34.3 parts, sodium silicofluoride 8.8, quartz 10, felspar 33, soda 12, saltpetre 7.5, and cobalt oxide 0.3 part.—W. C. H.

Glass; Manufacture of illuminating—[for lamp globes, etc.]. G. A. Macbeth, Pittsburgh, Eng. Pat. 11,214, May 6, 1914. Under Int. Conv., May 9, 1913.

SEE U.S. Pat. 1,097,600 of 1914; this J., 1914, 693.

IX.—BUILDING MATERIALS.

Portland cement clinker; The compound, $8\text{CaO} \cdot \text{Al}_2\text{O}_3 \cdot 2\text{SiO}_2$ (alite), the chief constituent of—E. Jänecke, Z. anorg. Chem., 1914, 89, 355—369.

THE mixture of composition, $8\text{CaO} \cdot \text{Al}_2\text{O}_3 \cdot 2\text{SiO}_2$, was found to possess a maximum melting point, 1385°C ., in the ternary system, $\text{CaO} - \text{Al}_2\text{O}_3 - \text{SiO}_2$, and it therefore probably represents a definite compound. It has a sp. gr. 3.035, refractive index 1.63, and hardness 7 (Mohs' scale). The substance known as alite, which crystallises from cement clinker, exhibits all the properties of the above compound, and it is maintained, mainly on optical grounds, that the substances are identical.—G.F.M.

Cement; Standard specifications for—Year-Book of Amer. Soc. Testing Materials, 1914, 290—317.

General conditions. All cement shall be inspected and at least 12 days allowed for inspection and testing. A bag of cement shall contain 94 lb. of cement net; and each barrel of Portland cement shall contain 4 and of natural cement 3 bags of above net weight. Cement failing to meet the 7-day requirements may be held pending the results of the 28-day tests before rejection. All tests shall be made in accordance with the methods of the American Society of Civil Engineers (see this J., 1911, 190; 1912, 337). Acceptance or rejection shall be based on the following requirements:

Natural cement is defined as the finely-pulverised product resulting from the calcination of an argillaceous limestone at a temperature only sufficient to expel the carbonic acid gas. *Fineness*. Not more than 10% by weight to be left on a No. 100 and not more than 30% on a No. 200 sieve. *Time of setting*. At least 10 mins. for initial set and from 30 mins. to 3 hours for hard set. *Tensile strength*. The minimum requirements for briquettes 1 sq. in. in cross-section are given in the table: no retrogression in strength

must be shown within the periods specified. *Constancy of volume.* Pats of neat cement about 3 ins. diam., 0.5 in. thick at the centre, and tapering to a thin edge, shall be kept in moist air for 24 hours, and subsequently shall remain firm and hard and show no signs of distortion, checking, cracking, or disintegration when kept in air at normal temperature or in water at about 70° F. (21° C.) for at least 28 days.

Portland cement is defined as the finely pulverised product resulting from the calcination to incipient fusion of an intimate mixture of properly proportioned argillaceous and calcareous materials, and to which no addition greater than 3% has been made subsequent to calcination. *Specific gravity.* Not less than 3.10. If a sample fails to pass, a second test may be made on a sample ignited at a low red heat: the loss in weight on ignition shall not exceed 4%. *Fineness.* Not more than 8% on a No. 100 and not more than 25% on a No. 200 sieve. *Time of setting.* At least 30 mins. for initial set and from 1 to 10 hours for hard set. *Tensile strength.* See table: same conditions as for natural cement. *Constancy of volume.* Same as for natural cement, with the addition that a third pat is exposed in an atmosphere of steam, above boiling water, in a loosely closed vessel for 5 hours. *Sulphuric acid and magnesia.* Not more than 1.75% SO_3 and not more than 4% MgO .

Age.	Tensile strength of:			
	Natural cement.		Portland cement.	
	Neat.	Mixed with 3 parts of standard Ottawa sand.	Neat.	Mixed with 3 parts of standard Ottawa sand.
24 hours (in moist air)	lb. 75	lb. —	lb. 175	lb. —
7 days (1 in moist air, 6 in water)	150	50	500	200
28 days (1 in moist air, 27 in water)	250	125	600	275

—A. S.

Calcium sulphate; Hydration of the hemihydrate of —. P. Rohland. Z. anorg. Chem., 1914, 89, 352—354.

WHILST colloids, such as marshmallow or gum arabic, retard the velocity of hydration of calcium sulphate hemihydrate, many electrolytes either retard or accelerate it, according to their concentration. The hydration velocity stands in direct relationship to the solubility of the hemihydrate in the electrolyte; an increase in solubility, produced for example by the formation of a complex ion, as in the case of NaCl , KCl , KBr , NH_4Cl , MgCl_2 , NaNO_3 , etc., is accompanied by an increased rate of hydration of the calcium sulphate, since the less soluble dihydrate crystallises out, and more hemihydrate dissolves. On the other hand calcium salts, soluble sulphates, alcohol, etc., decrease the solubility and retard the hydration, unless, as in the case of the sulphates, for example, other effects, at greater concentrations, mask the effects of the mass action law. Sodium, potassium, and magnesium sulphates in small concentration retard hydration; at greater concentration they accelerate it, owing to complex ion formation. Similarly sulphuric acid forms the HSO_4' ion and consequently accelerates the hydration.—G. F. M.

Corrosion of refractories by salts in coal. Searle. See II.A.

PATENTS.

Wood; Colouring and/or preserving —. F. T. Brooks, Cambridge. Eng. Pat. 24,595, Oct. 29, 1913.

THE wood is subjected to the action of *Chlorosplenium acroginosum* (*Peziza acroginosa*) or other fungus which is capable of colouring and/or preserving it from attack by putrefactive organisms. The sterilised wood may be introduced into a damp atmosphere, under sterile conditions, and should be inoculated with a pure culture of the fungus. —F. SODN.

Road-dust; Composition [from sulphite-cellulose waste lyc] for laying —. C. Ellis, Larchmont, N.Y. U.S. Pat. 1,119,500, Dec. 1, 1914. Date of appl., Sept. 9, 1907. Renewed Oct. 20, 1914.

AN emulsion of concentrated waste sulphite liquor of 30° B. (sp. gr. 1.263), a hygroscopic softening agent, and a non-tarry petroleum oil, the last named not exceeding 25%.—W. C. H.

Preserved wood and method of making same. Buoyant articles and process of making same. Process of treating wood for buoyant articles and product thereof. R. A. Marr, Assignor to American Wood Encysting Co., Norfolk, Va. U.S. Pats. 1,121,643, 1,121,644, 1,121,645, and 1,121,646, Dec. 22, 1914. Dates of appl., Feb. 8, 1913, and Jan. 13, 1914.

SEE Eng. Pat. 2084 of 1914; this J., 1914, 867. The naphthalene may be replaced by rosin, and a dye may be added to the treating bath.

Drying kiln [for wood]. U.S. Pat. 1,119,595. See I.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

[Iron] blast-furnace; Heat balance of the —. S. Cornell. Met. and Chem. Eng., 1914, 12, 747—750.

DATA relating to the operation of a plant comprising six 600-ton blast-furnaces are given in full detail, conclusions as to distribution of heat being summarised as follows:—

	Steam blown furnace with dirty gas.	Steam blown furnace with cleaned gas.	Gas blown furnace with cleaned gas.
	%	%	%
Work of reduction, melting, and hot blast	43.17	43.65	43.65
Work of cooling furnace	1.26	1.25	1.25
Radiation loss	5.55	6.35	6.35
Gas leakage loss	5.82	5.77	5.77
Loss of heat in stoves	8.47	5.79	5.79
Loss of heat in boilers	18.29	18.09	—
Loss of heat in cooling gas	—	5.09	5.09
Heat in steam made	18.52	25.05	—
Steam used by furnace	18.38	18.22	—
Steam heat saleable	0.14	6.82	—
Heat in gas cleaned and used in blowers	—	—	5.09
Heat in gas cleaned and used in auxiliaries	—	—	2.73
Heat in gas to electric units	—	—	25.41
Conversion of available gas into electricity	—	—	4.75

The efficiencies of the steam and gas blowing engines were 7.66% and 21.49% respectively; and the stove efficiency 57.8% with cleaned, and 45.9% with dirty gas.—W. E. F. P.

Iron ; Effects of pickling upon the corrosion of —.
E. A. Richardson. Met. and Chem. Eng., 1914,
12, 759.

The tests were made upon sheet irons of the same thickness and having the following compositions:—

Sample.	S	P	C	Mn	Cu
	%	%	%	%	%
A	0.020	0.003	0.01	0.052	0.048
B	0.059	0.117	0.10	0.319	0.268
C	0.045	0.094	0.10	0.406	trace
D	0.051	0.009	0.035	0.044	0.044

After annealing and cooling together under the same conditions, the test-pieces were cleaned by (1) grinding, (2) pickling in sulphuric acid, (3) pickling in sulphuric acid, followed by washing in water and dipping in dilute nitric acid, (4) pickling in sulphuric acid, followed by washing in water and dipping in a mixture of ammonia solution and hydrogen peroxide. The test-pieces were subsequently washed in water, dipped in alcohol, dried, exposed to the weather for 3 months, cleaned, etc., and re-weighed. The losses calculated to grains per sq. cm., were:—

Sample.	Method of cleaning test-pieces.			
	(1)	(2)	(3)	(4)
A	0.0597	0.0600	0.0441	0.0512
B	0.0372	0.0420	0.0293	0.0389
C	0.0952	0.0967	0.0646	0.0864
D	0.0651	0.0463	0.0497	0.0476

—W. E. F. P.

[Steel]. *Influence of the duration of heating before quenching.* A. Portevin. Bull. Soc. d'Encour., 1914, 121, 207—282. (See also this J., 1914, 791, 1011.)

PRELIMINARY experiments having indicated the time required for a piece of metal to attain at all points the temperature of a molten saline bath in which it was immersed, samples of steel (carbon steels with C 0.18 to 2.04%, chrome steels with Cr 8.82 to 29.34%, tungsten steels with W 5.30 to 15.03%, and molybdenum steels with Mo 1.19 and 2.53%) were maintained at different temperatures for varying definite periods, and then quenched. Mechanical tests on the quenched steels were found to be unsatisfactory, and the examination was accordingly confined to measuring the increase in the electrical resistance, and the change in hardness as measured by the Brinell and Shore instruments, and to microscopic appearance. The results showed that the formation of solid solutions takes an appreciable time, the speed of transformation increasing with the temperature. The properties of quenched steels are sharply dependent on the duration of heating before quenching. Care must be taken in practice to ensure that the whole of a given article has actually attained the required temperature, but, on the other hand, as decarburisation of the surface tends to take place when steel is heated in molten saline baths, the period of immersion should not be unduly prolonged.—T. ST.

Steel ; Improved method for the determination of nitrogen in —. L. E. Barton. J. Ind. Eng. Chem., 1914, 6, 1012—1013.

In the determination of nitrogen in steel (compare Braune, this J., 1904, 1114) the test solution and the standard for comparison sometimes develop

colours of different tones when treated with the Nessler reagent. To overcome this difficulty, dilute caustic soda solution is first distilled until the distillate gives no reaction with the Nessler reagent, then a solution of 5 grms. of the steel in 40 c.c. of hydrochloric acid free from ammonia is introduced into the retort, and distillation continued until 150 c.c. of distillate has been collected: 25 c.c. of a standard ammonium chloride solution and 150 c.c. of water free from ammonia are now introduced into the retort and a further 150 c.c. of distillate collected to serve as a standard. For the colour comparison 30 c.c. of the distillate from the steel solution (= 1 grm. of steel) are used.
—A. S.

Steel rails ; Specifications of United Steel Products Co. for standard —. Year-Book of Amer. Soc. Testing Materials, 1914, 390—403.

THE chemical composition of each heat of the steel from which the rails are rolled shall be within the following limits:—

Weight, lb. per yd.	45—60	61—70	71—80	81—100
Acid Bessemer steel	%	%	%	%
C	0.30—0.40	0.35—0.45	0.35—0.45	0.40—0.50
Mn	0.70—1.00	0.70—1.00	0.70—1.00	0.80—1.10
Si (max.)	0.20	0.20	0.20	0.20
P (max.)	0.10	0.10	0.10	0.10
Basic open- hearth steel	%	%	%	%
C	0.40—0.55	0.40—0.55	0.45—0.60	0.55—0.70
Mn	0.60—0.90	0.60—0.90	0.60—0.90	0.60—0.90
Si (max.)	0.20	0.20	0.20	0.20
P (max.)	0.04	0.04	0.04	0.04

In the case of the open-hearth steel the manufacturer shall furnish the chemical analysis of each heat of steel covering the elements specified in the table; whilst for acid Bessemer steel the carbon determination for each heat shall be furnished before the rails are shipped, and two analyses every 24 hours, one for each day and night shift respectively, covering the elements specified in the table. In both cases determinations shall be made on drillings taken from the ladle test ingot at not less than $\frac{1}{8}$ in. beneath the surface, and the manufacturer may be requested to furnish drillings for check analysis.

The specifications also cover details of manufacture and of mechanical tests.—A. S.

Manganese, nickel, iron, and cobalt, respectively, and carbon. (Researches in the field of high temperatures. V. to VIII.). O. Ruff, W. Bormann, and F. Keilig. Z. anorg. Chem., 1914, 88, 365—423. (See also this J., 1914, 647 and 1016.)

DETERMINATIONS were made of the solubility of carbon in the molten metals at definite temperatures, the boiling points of the pure and carbon-saturated metals under 30 mm. pressure, and the percentage of carbon in the vapour given off from the boiling carbon-saturated metals. Temperatures up to 1500°C. were measured by thermo-couple, and higher temperatures by a Wanner pyrometer. A carbon tube resistance furnace was used. In determining carbon-solubility 35—40 grms. of manganese and nickel and 25—30 grms. of iron and cobalt was melted in a graphite crucible, and then slowly heated to the desired temperature. This was maintained for about 30 minutes and the metal was then quenched. For the boiling point determination 25 grms. of metal in a graphite crucible was placed in the furnace which was then exhausted. The temperature was cautiously raised to avoid

spitting and the melt stirred with a carbon rod. The first uniform ebullition of the melt from the centre to the edge of the crucible was taken as the "initial boiling point." Initial boiling was quickly followed, as the temperature rose, by "severe spitting," when somewhat large pieces were thrown out of the crucible. In the case of iron, as the boiling point is about 2700°C . at 30 mm. pressure, and the carbon-solubility decreases above 2200°C ., the melt was heated slowly to 1800°C . and then very quickly to 2700°C . The boiling points of the pure metals were determined in crucibles composed of zirconium dioxide with 1% of starch, 20 grms. of metal being taken. To determine the composition of the vapour yielded by the carbon-saturated metals, 0.5 to 2 grms. of metal in a clean graphite crucible was placed in the furnace, which was exhausted and slowly heated to just below the initial boiling point. After some time the temperature was raised, during about 30 minutes, to that of "severe spitting." The cooled residue was weighed and a determination of carbon or metal made. In the calculation of the carbon in the evolved vapour, the known percentage of carbon in the saturated metal was used in the case of manganese, but in the other cases the figures used were the determined total loss from metal and crucible and the metal remaining in the residue.

Manganese-carbon. Determinations of carbon-solubility were made at about 1300°C ., 1400°C ., and 1500°C ., at atmospheric pressure in an atmosphere of hydrogen, the metal being cooled dry in a tube surrounded by ice. The carbon in the alloys was all combined. In determining the percentage of carbon a correction was made for the slag present derived from the guard tube of the thermo-junction. The results obtained were C 6.82% at 1312°C ., 6.93% at 1427°C ., and 7.05% at 1492°C . The mean values for the boiling points of manganese saturated with carbon under 30 mm. pressure were 1526°C . for "initial boiling point," and 1580°C . for "severe spitting." The upper end of the carbon-solubility line in the derived diagram was C 7.12% at 1525°C . The boiling point of pure manganese under 30 mm. pressure was found to be 1510°C . The vapour evolved from boiling manganese saturated with carbon at 30 mm. pressure contained C 1.94%. The residues contained graphite, and a completely volatilised melt left only flaky graphite. The solubility of carbon as such in the melts was extremely small, and the high percentage of carbon in saturated manganese at its boiling point under 30 mm. pressure is considered to indicate the existence of a carbide richer in carbon than Mn_3C .

Nickel-carbon. Cooling curves of Ni-C, carried out in an atmosphere of hydrogen and in magnesia crucibles, substantially confirmed Friedrich and Leroux's results (this J., 1910, 159). The melting point of pure nickel was found to be 1452°C ., the eutectic temperature 1311°C ., and the solid-solution and eutectic lines intersected at C 2.20%. The eutectic line is considered to terminate at 1300°C . and C 0.35%. The boiling point of carbon-saturated nickel under 30 mm. pressure was 2490°C ., the carbon content of the alloy being 6.3%. The course of the carbon-solubility line from this point to the intersection of the eutectic line at C 2.2% has previously been determined by Ruff and Martin (this J., 1912, 285). It first falls to the point 2100°C . and C 6.4% (corresponding to Ni_3C) and then curves down to the eutectic point. The boiling point of pure nickel under 30 mm. pressure was found to be 2340°C . The vapour from carbon-saturated nickel boiling under 30 mm. pressure contained C $0.28 \pm 0.017\%$.

Iron-carbon. The carbon-solubility line for iron determined by Ruff and Goecke (this J., 1912, 233) was confirmed. The boiling point of

carbon-saturated iron under 36 mm. pressure was 2650°C ., the carbon content being 7.4%. The determination of the boiling point of pure iron was uncertain but the most probable value was $2450 \pm 50^{\circ}\text{C}$. under 36 mm. pressure. The vapour from carbon-saturated iron boiling under 36 mm. pressure contained C $0.92 \pm 0.04\%$. The residue on complete volatilisation was not a carbide but only graphite. The significance of the changes in direction in the carbon-solubility line is discussed.

Cobalt-carbon. The carbon-solubility line runs from the point 1300°C . and C $2.4 \pm 0.2\%$ (the intersection with the eutectic line) to $2415 \pm 10^{\circ}\text{C}$. and C 7.5% (the boiling point of carbon-saturated cobalt under 30 mm. pressure). The curve shows a change of direction at the point corresponding to the composition Co_3C . The combined carbon in the quenched alloys varied between 0.1 and 0.3%. The boiling point of pure cobalt under 30 mm. pressure is $2375 \pm 40^{\circ}\text{C}$. The carbon content of the vapour yielded by carbon-saturated cobalt boiling under 30 mm. pressure is $2.0 \pm 0.6\%$.
—T. St.

Boron steels. G. Hannesen. Z. anorg. Chem., 1914, 89, 257—278.

ALLOYS containing up to 8.5% B were examined. By slow cooling three types of crystals were obtained. With 0—1.38% B, mixed crystals of δ -iron separated first, from 1.38—4% mixed crystals of γ -iron, and from 4—8.5% B, Fe_5B_2 , which was found to be the lowest boride of iron. It melts at 1351°C ., and forms needle-shaped crystals of rhombic section. The temperatures of the change of γ into β -iron, and of β into α -iron are both lowered by the presence of boron. By rapid cooling of steels containing from 0.375—2% B a martensitic structure was obtained, but in no case was an austenitic structure produced, since γ -iron dissolves much less boron than carbon. All the boron steels and also Fe_5B_2 are magnetic. Quenched and slowly cooled steels containing 0.125—4% B both showed a hardness 5 to 6 on Mohs' scale, except slowly cooled steels with 0.25—1% B, which contained boropearlite, and, in contrast to carbon pearlites, were harder than the other steels. When Fe_5B_2 formed the chief structural element (that is, with more than 4% B) the hardness rapidly increased, becoming, with 8% B, equal to that of corundum.—G. F. M.

Platinum: Analysis of. F. Mylius and A. Mazzucchelli. Z. anorg. Chem., 1914, 89, 1—38.
(See also Mylius and Foerster, this J., 1892, 690.)

SCHEMES are given for the qualitative and quantitative examination of nominally pure and commercial platinum, based on a critical review of known methods and the results of special experimental work. The qualitative examination permits of the detection of 1 mgrm. each of Pd, Pt, Rh, Ru, Ir, Au, Ag, Cu, and Fe in a chloride solution.

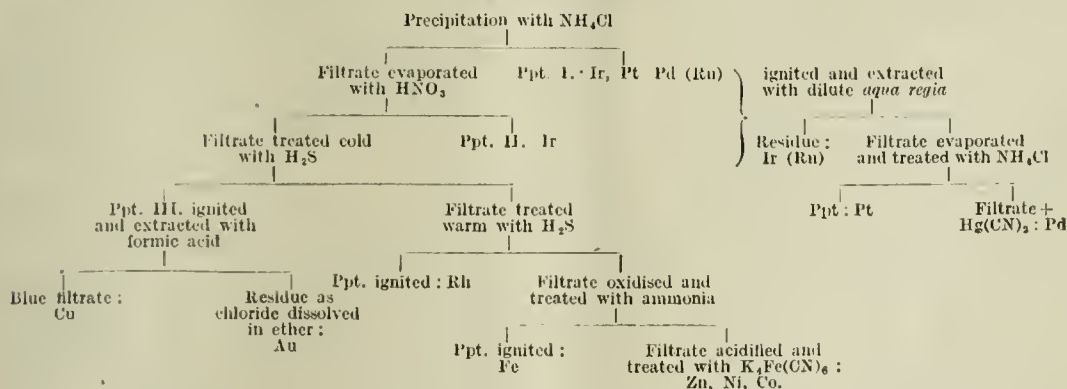
In the quantitative analysis of commercial platinum the traces of ruthenium present may be disregarded. The approximate purity of the metal is first ascertained by dissolving 0.1 grm. in *aqua regia*, evaporating with sodium chloride, dissolving the residue in 10 c.c. of water, heating with about 0.02 grm. of sodium carbonate, treating the cooled solution with 1 or 2 drops of sodium hypochlorite or hypobromite solution, and again warming. If the solution retains its orange yellow colour and no precipitate is formed, the metal may be regarded as "nominally pure" platinum, but if the colour darkens and a dark blue precipitate gradually forms, the metal is classed as impure or "commercial" platinum.

Group precipitation.	Secondary separations.
I. The solution is evaporated nearly to dryness, diluted with 2 c.c. of water, and filtered. Precipitate: Agl.	(6.) The precipitate is treated on the filter with ammonia, and HNO_3 added to the filtrate. White precipitate indicates Ag. The dark residue on the filter is transferred to (5).
II. The filtrate from I is saturated with NH_4Cl , filtered after 1 hour, and the precipitate washed with NH_4Cl solution. Precipitate: double chlorides of Pt, Ir, Ru.	(5.) The precipitate from II., together with residues from (1) to (6), is heated in hydrogen, ultimately to incandescence, the reduced metal treated with diluted <i>aqua regia</i> , and the solution evaporated, Pt being detected by formation of the yellow double ammonium chloride. The insoluble residue is ignited with 0.3 grm. NaNO_3 in a gold or silver spoon. It dissolves in the melt, colouring it yellow, whilst Ir remains as a blue residue.
III. The filtrate from II. is evaporated to dryness with 3 c.c. of dilute HNO_3 , the residue treated with dilute HNO_3 , so as to obtain a solution nearly saturated with NH_4Cl , filtered, and the residue washed with a very small quantity of a solution of $\text{HNO}_3 + \text{NH}_4\text{Cl}$. Precipitate: double salts of Pd, Ir, and Ru.	(4.) The precipitate from III. is evaporated with HCl , the residue treated with 3 c.c. of water, and the solution saturated cold with H_2S . The sulphide precipitate is evaporated with <i>aqua regia</i> , and the solution of the evaporation residue tested for Pd with $\text{Hg}(\text{CN})_2$. Any residues containing Ir are transferred to (5).
IV. The filtrate from III. is evaporated to dryness with dilute HCl , the residue dissolved in 5 c.c. of water with addition of 1 drop of dilute HCl , and the solution rapidly saturated with H_2S at about 18°C . The black precipitate is filtered off after 10 mins., and washed with water. Precipitate: sulphides of Au and Cu.	(3.) The sulphide precipitate is dissolved in dilute <i>aqua regia</i> , the solution evaporated, the residue dissolved in dilute HCl , and the solution extracted with ether. If the ether layer is coloured yellow and gives a precipitate with SO_2 , Au is indicated. The aqueous layer is treated with H_2S , the precipitate filtered off, washed, ignited, and treated with dilute HNO_3 . Cu is detected by a blue coloration of the solution on adding excess of ammonia. Any residue insoluble in HNO_3 is transferred to (5).
V. The filtrate (6–8 c.c.) from IV. is warmed and treated with H_2S for $\frac{1}{2}$ hour, the excess of H_2S boiled off, and the brown precipitate filtered off and washed with water. Precipitate: rhodium sulphide.	(2.) The sulphide precipitate is dissolved from the filter in hot dilute <i>aqua regia</i> , the solution evaporated, and the residue warmed with concentrated HCl . A rose-red solution which gives a yellow precipitate on warming with a 1% solution of ethylmercaptan indicates Rh. The filtrate may contain traces of Ir.
VI. The filtrate from V. is boiled, oxidised with HNO_3 , treated with ammonia, and the precipitate filtered off. The evaporation residue from the filtrate should consist only of ammonium salts and be completely volatilised on heating.	(1.) The precipitate from VI. is ignited, dissolved in HCl , and Fe detected by the Prussian blue reaction. Any insoluble residue is transferred to (5).

Commercial platinum. 10 grms. is dissolved in *aqua regia* in a flask of quartz glass and the solution evaporated with 6 grms. of sodium chloride. The residue is evaporated several times with water,

platinum-sodium chloride. The precipitate, consisting mainly of the oxides of the foreign metals, together with some platinum, is analysed according to the following scheme:—

Chloride solution of the oxides.



then heated for 1 hour at 120°C ., treated with about 100 c.c. of water, and the solution filtered. The small quantity of residue may contain gold, silicates, iron salts, silver chloride, etc., and is analysed separately. The solution is diluted to 500 c.c., made faintly alkaline with 0.8 grm. of sodium bicarbonate, heated to boiling, cooled, and again heated with a solution of 0.8 grm. of sodium bicarbonate in 20 c.c. of saturated bromine water; the solution should remain faintly alkaline. When a test portion of the yellow solution no longer gives a dark coloration with the hypobromite solution, the whole is filtered (after addition of alcohol, if necessary, to coagulate the precipitate), and the black precipitate washed with water, the filtrate being heated with alcohol and again filtered through a separate filter. The solution contains nearly the whole of the platinum as

Nominally pure platinum. 50 grms. is converted as described above, into the platinum-sodium chloride, which is recrystallised several times from a 1% solution of sodium carbonate. The mother liquors, together with the solution obtained by treating the small quantity of insoluble matter left from the first operation, are evaporated first with *aqua regia*, then with hydrochloric acid, and the residue heated to 150°C ., treated with water, and filtered. The solution may be analysed as described under commercial platinum, or it may be faintly acidified, treated with ammonium chloride, and filtered. The precipitate consists of platinum-ammonium chloride contaminated by a little iridium. The filtrate is treated warm with hydrogen sulphide for several hours, the sulphides ignited and the residue dissolved in *aqua regia* (the precipitate is dissolved directly in *aqua regia* if

lead or other volatile metals are present). The filtered solution is analysed according to the scheme given above. All precipitates of platinum ammonium chloride must be treated for the separation of iridium, which is effected by reduction with hydrazine in strong hydrochloric acid solution, the platinum being precipitated and the iridium left dissolved.

The Ir content of commercial platinum can be rapidly estimated by dissolving 0.01 gm. in *aqua regia*, evaporating, dissolving the residue in concentrated hydrochloric acid to 100 c.c., and comparing the colour with that of a standard solution of Pt and Ir in concentrated hydrochloric acid.

In the following table are given analyses of the impurities contained in three platinum muffles: I. and II. behaved well in use, but III. was strongly corroded, with formation of soot:—

	I.	II.	III.
	$\frac{\text{g.}}{\text{g.}}$	$\frac{\text{g.}}{\text{g.}}$	$\frac{\text{g.}}{\text{g.}}$
Ir	2.2	2.23	1.61
Pd	?	0.13	0.15
Au	0.30	0.3	—
Rh	trace	trace	0.15
Cu	0.13	0.18	0.09
Fe	0.13	0.12	0.11
Ag	—	—	trace
Ni	trace	trace	trace
Undetermined	—	—	0.1
Total	3.0	2.96	2.25

—A. S.

[Ore] pulp constants. G. H. Clevenger. H. W. Young, and T. N. Turner. Eng. and Min. J., 1914, 1079—1094.

IN calculating the percentage of dry slime in wet pulp, the assumption that the specific gravity of the solution is unity leads to errors which increase as the percentage of solids in the pulp decreases. Tables have been constructed which give the results of such calculations when the specific gravity is taken as 1. and the correction to be made for the difference between 1 and the true specific gravity of the solution. The tables are given for specific gravities of dry slime of from 2.50 to 3.00 and for wet pulps of from 1010 to 1500 grms. per litre. Tables are also given showing the pounds of dry slime in a cubic foot of pulp, the number of cubic foot of wet pulp necessary to produce one ton of dry slime, the dilution ratios of solution to dry slime, and the number of cubic feet for each foot of depth of cylindrical tanks.—W. F. B.

Copper smelting industries of Canada. A. W. G. Wilson. Report No. 209, Canada Dept. of Mines, Mines Branch, Ottawa.

THE development of the copper smelting industries of Canada is reviewed and the plants now in operation are described and illustrated. The report covers 184 pages, contains 42 tables, and is illustrated by 43 plates, 39 figures, and 4 maps.

Copper-zinc alloys; Binary — and ternary copper-zinc-lead alloys. N. Parravano. Gaz. Chim. Ital., 1914, 44, II., 475—502.

THE equilibrium diagram of Cu-Zn alloys based on the author's results is similar to that of Shepherd (this J., 1905, 241), except that the decomposition of β into $\alpha + \gamma$ (see Carpenter and Edwards, this J., 1911, 133; 1912, 133, 926) is taken into account, and the limits of the horizontals are fixed. The limiting saturation of α at 905° C. is 39.5% Zn. The horizontal at 838° C. corresponds to the formation of γ , the limiting saturation of β being 57% Zn; that at 700° (formation of δ) extends

to 29.5% Cu, with the maximum effect at 27.5% Cu; that at 595° (formation of ϵ) extends to 24% Cu, with the maximum effect at 17.5% Cu; that at 545° (decomposition of δ into $\gamma + \epsilon$) extends from 30 to 19% Cu, the eutectoid decomposition point being at 26% Cu; and that at 425° C. (formation of η) extends from 13 to 3% Cu. The thermal effect at 470° C., discovered by Roberts-Austen (see Carpenter and Edwards, *loc. cit.*) was observed in alloys containing 63—39% Cu. Examination of ternary Cu-Zn-Pb alloys showed that lead does not dissolve, in the solid state, in the α or γ Cu-Zn solid solutions, and that in lead brasses it is simply admixed mechanically with the Cu-Zn alloy.—A. S.

Manganese supplies. Engineering, Jan. 1, 1915.

THE total production of manganese ore throughout the world ranges from 2,000,000 to 2,250,000 tons, of which about 49% come from Russia; the output is distributed as follows according to the most recent figures:—Russia, 987,724 tons; India, 674,315; Brazil, 163,506; Germany, 75,787; Austria, 17,717; Spain, 16,678; Turkey, 14,123; Japan, 10,955; Greece, 10,581; Hungary, 10,410 tons. The productions of other countries are smaller. Exporting countries are Russia, British India, Brazil, Germany, Belgium and France. One of the first effects of the war was the action of Russia, which placed an embargo on the export of manganese ore, but early in October this was raised. Great Britain exports large quantities of ferro-manganese to the United States; in fact, American steel-makers depend mainly on this country for their supply of this alloy. There are said to be ample supplies of ferromanganese in Germany. An embargo has been placed on shipments of manganese ores from British India to the United States, and it is practically impossible for Russia to export her output. That will tend to develop the Brazilian output. Deposits of mangiferous iron ores are being opened up in California, which may render the United States independent of Indian and Russian supplies. The production of manganese ore in Brazil has assumed an importance never known before; British and American steel manufacturers have been taking about 65,000 tons annually, and arrangements are now being made in the States for the importation of a much larger quantity. The Brazilian ore is of exceptional quality, principally pyrolusite and rhodonite. There are vast supplies; in the vicinity of Corumbá there are more than 100,000,000 tons of ore.

Our imports of manganese ore during recent years have been:—1909, 330,500 tons; 1910, 482,200; 1911, 358,910; 1912, 387,730; 1913, 601,170; 1914 (first 11 months), 446,200 tons.

We import manganese ore from Russia, Portuguese possessions in India, Spain, Brazil, British India, and in very small quantities from Germany. From Russia imports were 137,650 tons in 1909, 163,630 tons in 1912, and 241,890 tons in 1913.

From Portuguese India our imports have recently increased to 24,710 tons. Imports from Brazil and Spain are decreasing. Imports from British India last year were 308,790 tons, and in 1909 109,480 tons. Our exports of manganese ore in 1914 were only 9960 tons. Exports go mainly to Belgium, and, to a very limited extent, to the United States.

Our imports of mangiferous iron ore had risen to 211,640 tons in 1913. None of this was re-exported; of ore produced in this country only 34 tons was exported last year; during 1910 the quantity reached 786 tons. Our imports come from Spain and Greece; those from Spain are increasing rapidly, whilst those from British India have ceased lately. Our exports of the ore produced in this country for the first 11 months of

1914 were 1498 tons, compared with 27 tons for the corresponding period of 1913.

In addition to manganiferous ores, there are several other sources of supply, such as manganiferous iron and silver, also the manganiferous residuum from zinc-roasting. In the United States there are many deposits, but only in a few places do they occur in sufficient quantity to be of high commercial value. Deposits occur in the New England, Appalachian, and Piedmont regions in the Eastern United States, and to a limited extent in Central Western California. Manganiferous iron and silver ores are also widely distributed; but manganese mining is not a very important industry in the States, owing to the discontinuous and somewhat scattered nature of many of the deposits.

Manganese alloys capable of magnetisation; Studies of—F. Heusler. Z. anorg. Chem., 1914, 88, 185—188.

Of the alloys of 30% manganese-copper with tin, that containing 39.5% Sn, corresponding with the formula, $\text{Sn}_{10}\text{MnCu}_{10}$, showed the maximum magnetisation; with 15% manganese-copper a similar maximum was given by an alloy, $\text{Sn}_5\text{Cu}_5\text{Mn}$; so that in each case the sum of Mn and Cu atoms is three times that of the Sn atoms. These alloys are regarded as derived from the intermetallic compound, SnCu_3 . Similar relationships hold for AlCu_3 .—J. R.

Babbitt metal; [Determination of] copper [and lead] in—E. W. Hagmaier. Met. and Chem. Eng., 1914, 12, 753.

To 1 gm. of the alloy, 15 c.c. of hot water and sufficient tartaric acid are added to keep all the tin and antimony in solution, then 5 c.c. of nitric acid, and the liquid boiled until solution is complete. The solution is heated with 5 c.c. of sulphuric acid until nitrous fumes cease to be evolved (avoiding charring), cooled, 50 c.c. of water is added and the lead sulphate settled and filtered off. The filtrate is diluted to 400—500 c.c., 1—2 c.c. of hydrochloric acid added, and the copper precipitated upon a strip of pure aluminium and determined as usual.—W. E. F. P.

Lead oxide-copper oxide; The system—J. C. J. Cunningham. Z. anorg. Chem., 1914, 89, 43—52.

In the cupellation of alloys, copper when present together with lead is oxidised and absorbed by the cupel, although copper oxide alone is not absorbed. Examination of mixtures of lead oxide with up to 30% of copper oxide showed that no compounds of the two oxides are formed. Mixtures containing more than 30% CuO attacked the platinum containing vessel. Lead oxide melts at 875° C. and the melting point is lowered by addition of copper oxide. The two oxides form an eutectic mixture melting at about 698° C.—A. S.

Zinc blende and lead sulphide; Rate of solution of—F. Rosenkränzer. Z. anorg. Chem., 1914, 88, 452. (See this J., 1914, 752.)

THE relative susceptibilities of different ores to the attack of dilute sulphuric acid are more correctly expressed in terms of equal volumes of the powdered ores than of equal weights, as was done by the author in his investigation (this J., 1914, 752). The four zinc blendes did not vary much in specific gravity, but when the heavier galena is included in the common scale the figure for the latter becomes almost doubled.

—T. ST.

Metals; Solutions of—in boiling mercury. Ebullioscopic experiments. E. Beckmann and O. Liesche. Z. anorg. Chem., 1914, 89, 171—190.

THE results of ebullioscopic experiments on solutions of Na, K, Ca, Mg, Ti, Cd, Zn, Sn, Pb, Bi, Ag, and Au are tabulated. The ebullioscopic constant of pure mercury was found to be 114.0. With solutions of the alkali and alkaline-earth metals and thallium in mercury, the constant was too high and increased with the concentration of the dissolved metal, indicating the formation of amalgams. In some cases the deviation from the normal value was sufficiently great to indicate the approximate composition of the amalgams, viz., NaHg_5 to NaHg_{12} to KHg_{14} , CaHg_{10} . The heavy and precious metals appear to dissolve in the mercury in the monatomic form, but a distinct tendency to association was observed with Sn, Pb, and Bi.—A. S.

Mineral production of the United Kingdom in 1913. Board of Trade J., Jan. 14, 1915.

THE following table shows the quantity and value (definitive figures) of the minerals produced in the United Kingdom in 1913, as compared with 1912:—

Description of Mineral.	1912.		1913.	
	Quantity.	Value at the Mines and Quarries.	Quantity.	Value at the Mines and Quarries.
	Tons.	£	Tons.	£
Alum shale....	11,258	1,155	8,741	874
Arsenical pyrites	2,450	2,049	35	29
Arsenic	2,194	17,901	1,695	16,616
Barium (compound)....	45,377	39,430	50,045	42,136
Bauxites.....	5,790	1,414	6,055	1,563
Bog ore	3,340	855	3,335	959
Chalk	4,285,412	190,799	4,858,126	213,479
Chert, flint, etc.	74,718	13,426	74,858	12,781
Clay and shale.	12,803,950	1,633,736	13,859,821	1,778,971
Coal	260,416,338	117,921,123	287,430,473	145,535,669
Copper ore ..	1,787	12,985	2,569	21,138
Copper precipitate	146	6,404	163	5,891
Diatomite	62	62	151	308
Fluorspar	47,246	17,263	53,663	14,955
Gold ore	170	4,784	4	434
Gravel and sand	2,191,451	167,640	2,409,152	184,818
Gypsum	285,291	110,591	285,338	95,450
Igneous rocks .	6,638,215	1,210,418	7,098,493	1,386,022
Iron ore	13,790,391*	3,763,837	15,997,328*	4,543,558
Iron pyrites ..	10,522	4,324	11,427	5,988
Lead ore	25,409	295,607	24,282	293,525
Lignite	62	31	81	40
Limestone (other than chalk) .	11,500,660	1,207,022	12,740,664	1,369,168
Manganese ore.	4,170	3,371	5,393	4,072
Mica	29,962	11,317	32,986	12,734
Ochre, amber, etc.	13,947	13,661	15,135	14,460
Oil shale	3,184,826	765,730	3,280,143	822,394
Salt	2,122,250	577,473	2,247,758	608,869
Sandstone	3,839,567	1,122,391	3,977,393	1,143,431
Slate	383,422	972,022	370,756	926,739
Soapstone	8	2	40	30
Sulphate of strontia	19,370	15,020	18,425	14,287
Tin ore (dressed)	8,166	1,012,290	8,355	960,134
Uranium ore..	42	Not stated	95	Not stated
Wolfram ore .	193	16,873†	182	17,483†
Zinc ore	17,704	87,867	17,294	69,502
Total value .	—	131,220,853	—	160,112,607

* Exclusive of 431 tons in 1912 and 520 tons in 1913 of micaceous iron ore used for paint, and placed under the heading of "Ochre, amber, etc."

† Value of 192½ tons only for 1912 and of about 180 tons only for 1913.

The increase in the total value of the minerals raised during the year is mainly accounted for by the increased production of coal and its enhanced value, the average price of coal being 10s. 1.52d. per ton in 1913, as compared with

9s. 0-68d. in 1912. The quantity of coal exported, exclusive of coke and manufactured fuel and of coal shipped for the use of steamers engaged in foreign trade, was 73,400,118 tons. France received over 12½ million tons, Italy over 9½ million tons, Germany nearly 9 million tons, Russia nearly 6 million tons, Sweden over 4½ million tons, Argentina over 3½ million tons, Spain over 3½ million tons, Egypt over 3 million tons, Denmark over 3 million tons, and Norway and the Netherlands each over 2 million tons. Adding the 3,906,436 tons exported in the form of coke and manufactured fuel, and the 21,031,550 tons shipped for the use of British and foreign steamers engaged in foreign trade, the total quantity of coal which left the country was 98,338,104 tons as against 85,842,905 tons in 1912. The amount of coal remaining for home consumption was 189,092,369 tons, or 4·108 tons per head of the population. 39,560,489 tons were used in the manufacture of coke and briquettes, and 21,223,607 tons in the blast furnaces for the manufacture of pig iron, as against 35,322,147 tons and 17,997,854 tons, respectively, in the previous year.

The output of iron ore yielded 5,138,958 tons of iron, or more than one-half of the total quantity of pig iron made in this country.

Production of metals and minerals in the United States. Eng. and Min. J., Jan. 9, 1915.

Metals.

Metal.	Unit.	1913.	1914.
Aluminium	lb.	(g) 49,601,500	(h) 45,000,000
Copper (a)	lb.	1,225,735,834	1,135,730,818
Ferromanganese ..	long tons	229,834	172,514
Gold (b)	§	88,884,400	92,823,500
Iron	long tons	30,736,477	23,083,580
Lead (c)	short tons	433,476	533,373
Nickel (e)	lb.	47,124,330	(e) 30,067,064
Quicksilver	flasks	(h) 20,000	16,300
Silver (b)	troy oz.	66,801,500	67,929,700
Zinc (d)	short tons	358,262	360,689

(a) Production from ore originating in the United States. (b) The statistics for 1912 and 1913 are the final and those for 1914 are the preliminary statistics reported jointly by the directors of the Mint and the U.S. Geological Survey. (c) Production of refined lead from ore and scrap originating in the United States: antimonial lead is included. (d) Total production of smelters, except those treating dross and junk exclusively; includes spelter derived from imported ore. (e) Imports; for 1914, first 10 months only. This nickel is refined in the United States for the production of metal, oxide, and salts. (g) As reported by the Metallgesellschaft Frankfurt am Main. (h) Estimated.

Mineral and Chemical Substances.

Substance.	Unit.	1913.	1914.
Arsenic	lb.	4,624,140	8,651,940
Coal, anth. (a) ...	short tons	91,626,825	91,552,187
Coal, bitu. (a) ...	short tons	478,688,867	419,547,599
Coke (a)	short tons	45,953,808	34,418,933
Copper sulphate ..	lb.	54,330,000	31,776,670
Iron ore	long tons	61,847,116	42,911,897

(a) The coal and coke statistics are the estimates of Coal Age.

Gravimetric determination of zinc. Treadwell. See XXIII.

PATENTS.

Iron, pure iron alloys, and phosphorised pure iron and iron alloys; Production of pure —. R. B. Carnahan, jun., Middletown, Ohio, U.S.A. Eng. Pat. 28,440, Dec. 9, 1913. (See also Eng. Pats. 27,201 of 1909 and 5015 of 1911; this J., 1910, 960, 219; 1912, 77.)

PIG iron is overblown in a highly basic Bessemer furnace until the Si, S, P, C, and Mn together

do not exceed about 0·14 %; the sulphur should be below 0·03%. The metal is deoxidised and degasified by means of aluminium so that not more than 0·05% of oxygen remains. Other metals may be added to the purified iron, and the phosphorus may be raised to 0·05—0·5% by the addition of ferro-phosphorus, preferably in the ladle during tapping. The resulting ingot is free from slag and crystalline, and suitable for rolling or forging. A phosphorised Ni-Fe alloy produced in the way described is highly resistant to corrosion.—T. St.

Armour plates; Cementation process for —. E. C. Marks, London. From Soc. Anon. Italiana Gio. Ansaldo & Co. Eng. Pat. 18,386, Aug. 7, 1914.

THE plates are arranged in furnaces with packing pieces so that boxes open at top and bottom are formed. Solid cementing agents are introduced at the top, and gaseous cementing agents at the bottom.—O. E. M.

Iron and steel; Hardening of —. E. Sweet, Binghamton, N.Y., Assignor to J. W. Boyd, Denver, Colo. U.S. Pat. 1,121,572, Dec. 15, 1914. Date of appl., Oct. 6, 1911.

THE iron is dipped into a mixture of molten potassium cyanide and charcoal, and quenched in oil.—O. E. M.

Metals [steel]; Cleaning compound for —. G. D. Feidt, Assignor to American Chemical Paint Co., Philadelphia, Pa. U.S. Pat. 1,119,781, Dec. 1, 1914. Date of appl., Sept. 14, 1914.

A CLEANING agent for steel consisting of a mixture of orthophosphoric acid, alcohol, and carbon tetrachloride.—T. St.

Ore separators. A. M. Plumb, Denver, Colo., U.S.A. Eng. Pat. 24,194, Oct. 25, 1913.

THE separator is of the jig type, the action being produced by intermittent impulses of air applied to the entire bottom of the separating chamber. A longitudinal partition divides the matter in the separating chamber into two columns which communicate near the bottom of the chamber. Discharge openings are arranged so that the weights of the columns are equal. The heavier ore particles work down and under the partition and are subsequently discharged at the further side.—T. St.

Ores; Concentrating —. H. Fairbrother, London. From Deister Machine Co., Fort Wayne, Ind., U.S.A. Eng. Pat. 3442, Feb. 10, 1914.

A VIBRATING concentrating table has two or more plateaus extending across it at right angles to the direction of vibration, the heights of the various plateaus being different and increasing in the direction of flow of the values. The highest plateau extends to the mineral discharge edge. The steps from lower to higher surfaces are bevelled to reduce retardation of the flow of concentrates. Rifles extend across the table in a direction transverse to the direction of flow of the pulp, the rifles tapering from points in the rear of the first plateau so that an accumulation of gangue at the step is prevented. One or more rifles substantially higher than the others are provided to cause the formation of pools, and so insure proper distribution of pulp across the surface of the table. These higher rifles also taper, but they preferably slightly overlap the bevelled step up to the first plateau.—T. St.

Ore; Apparatus [tube-mill] for crushing — or the like. W. B. Easton, Chicago, U.S.A. Eng. Pat. 14,234, June 12, 1914.

NEAR the discharge end of the tube is a transverse perforated plate forming a chamber in which vanes are mounted to raise and discharge the water and crushed ore through the hollow axial trunnion. The operative parts of the vanes are controlled from the outside so that the rate of discharge can be regulated.—T. St.

Fusible substances [metals]; Process of and apparatus for applying coatings or deposits of — to surfaces. E. Morf, Zürich, Switzerland. Eng. Pat. 25,132, Nov. 1, 1913. Under Int. Conv., Nov. 5, 1912. (See also Eng. Pat. 28,001 of 1912; this J., 1913, 792.)

THE material to be deposited is fed automatically in rod or other suitable form to the nozzle of the burner and sprayer at a rate depending on the pressure of the air blast required for spraying. In one form of apparatus the compressed air is passed through a turbine which actuates the feeding device through gearing. A single valve controls the supplies of compressed air and heating gases, and the several operations—feed, melting, spraying and projection of the fusible substance—are thus all effected automatically at the same proportional rate.—T. St.

Metals; Process of treating — for the purpose of rendering them proof against oxidation, rusting or the like. J. A. McLarty, Toronto, Canada. Eng. Pat. 27,141, Nov. 25, 1913. Under Int. Conv., March 21, 1913. Addition to Eng. Pat. 25,013 of 1913.

THE metal (iron, steel, bronze, brass, etc.) is subjected in a closed vessel to the action of the gases, etc., produced by heating a mixture of sawdust, crude petroleum, and water. The temperature of the metal is kept very much below red heat. The oxygen in the vessel may be removed by igniting the vapours before the vessel is closed. The time of exposure for small articles is about 4 to 5 hours, and the pressure inside the vessel may be either above or below atmospheric.—T. St.

Slags; Generation of steam from the heat contained in —. C. Vautin, London. Eng. Pats. 28,015, Dec. 5, 1913, and 2393, Jan. 29, 1914.

MOLTEN slag is brought into contact with water in a closed vessel and the granulated slag continuously removed. The steam evolved contains hydrogen sulphide, sulphur, sulphur dioxide, fine particles of slag, etc., and hence has a deleterious action on turbine blades (cf. Eng. Pat. 3623 of 1909; this J., 1909, 987). It is therefore passed through a heat exchanger where clean steam is generated. The condensed primary steam is returned to the primary generator, suitable valves being placed in the return pipe for the escape of uncondensed gases and for running the condensed water to waste when overcharged with impurities. Eng. Pat. 17,564 of 1888 is referred to.—T. St.

Tin andterne plates; Manufacture of — and apparatus therefor. R. B. Thomas, London, H. S. Thomas, Llandaff, and W. R. Davies, Whitchurch, Glamorgan. Eng. Pat. 28,450, Dec. 9, 1913.

THE plates are picked up singly by a sucker on an arm, and fed singly to rollers which convey them successively through pickling, swilling, tinning, greasing, and dusting or branning apparatus. Motion through the tin pot is rapid relative to that through the grease pot.—O. E. M.

Furnaces; Electric induction —. J. Härdén, Luton. Eng. Pat. 570, Jan. 8, 1914.

TO check the leakage from the primary field following on the mutual induction between the primary and induced fields, the primary winding is made to surround the portion of the magnetic core actually encircled by the bath, and also to spread in planes above and below the bath; also the ampère-turns are increased in number in proportion as the magnetic leakage field tends to increase. The tendency of the bath to form a surface sloping downwards towards the centre is thus largely eliminated, and the rolling motion is suppressed. The primary winding, and also the bath, may be subdivided, the subdivisions of the bath encircling separate limbs of the magnetic frame, but uniting at one part. With a polyphase current, a separate hearth and a separate magnetic core and winding are provided for each phase, the hearths uniting at one part.—T. St.

Annealing furnace. C. Kugel, Brunswick, Germany. U.S. Pat. 1,118,869, Nov. 24, 1914. Date of appl., Sept. 20, 1913.

THE furnace consists of a charging and heating chamber situated beneath a cooling chamber open at the bottom. The latter has a rotary cover, in which are connections by means of which frames containing the metal may be moved from one chamber to another.—T. St.

Roasting-furnace shaft. H. H. Stout, Assignor to General Chemical Co., New York. U.S. Pat. 1,119,325, Dec. 1, 1914. Date of appl., Apr. 25, 1913.

INNER and outer tubular walls, spaced from each other, are apertured and joined at the apertures by tubular connections which are attached to one of the walls in such a manner that the inner and outer walls can move slightly longitudinally in relation to each other.—T. St.

Furnace; Metallurgical —. U. Wedge, Ardmore, Pa. U.S. Pat. 1,119,483, Dec., 1 1914. Date of appl., Feb. 28, 1914.

A SERIES of superposed hearths, alternately fixed and rotating, is contained in a cylindrical casing. Rabblers are fixed to the under surfaces of each hearth for acting on the material on the hearth below. The casing of the furnace has inlet and outlet flues communicating with the interior.—T. St.

Roasting and smelting furnace; Combined —. W. R. Heslewood, Assignor to Hydro Vacuum Smelting Co., Oakland, Cal. U.S. Pat. 1,121,559, Dec. 15, 1914. Date of appl., March 9, 1914.

THE hot gases from a smelting furnace rise into a superimposed roasting furnace, from which the ore is allowed to fall as required into the smelting furnace.—O. E. M.

Crucible-furnace. G. Mellen, Mount Vernon, N.Y. U.S. Pat. 1,120,732, Dec. 15, 1914. Date of appl., Feb. 23, 1911.

THE crucible is surrounded on its sides and bottom by a closely fitting gas-tight shell, and this in turn by refractory material. The lower parts of this combination are surrounded by an inclosed combustion chamber. The shell has a screwed-on cover, provided with handles and with a conduit for introducing and withdrawing gas, and the crucible has a lid spaced from the cover.—T. St.

Ores, intermediate products, and other metalliferous materials (blendes); Process of roasting—R. von Zelewski, Belgium. U.S. Pat. 1,097,500, May 19, 1914. Date of appl., Feb. 18, 1913.

BRIQUETTED sulphide ores, etc., are piled in chequerwork form in an enclosure, and hot products of combustion and air under pressure are supplied to heat and ignite the liberated gases. When the gases are ignited the supply of the products of combustion is stopped, but that of air is continued until the briquettes reach a slag condition.—T. St.

Ores; Process for treating—W. A. Thacher, Lake City, Colo., Assignor to The Acid Process Co. U.S. Pat. 1,119,473, Dec. 1, 1914. Date of appl., Oct. 30, 1911. Renewed Feb. 16, 1914.

SULPHIDE ores are mixed with acid in a closed vessel and a stream of compressed air is passed through the mixture. A portion of the charge is sprayed in the path of the acid fumes and gases rising from the charge, and any acid gases which pass beyond the spray are collected in an absorbing liquid.—T. St.

Alloy; Pyrophoric—A. Kratky, Vienna, Assignor to H. B. Smith, Brooklyn, N.Y. U.S. Pat. 1,118,138, Nov. 24, 1914. Date of appl., April 26, 1913.

A PYROPHORIC alloy containing approximately 84% of a metal of the cerium group, 8% Mg, and 8% Zn.—T. St.

Aluminium alloy and method of producing the same. W. A. McAdams, Bay Shore, N.Y. U.S. Pat. 1,121,267, Dec. 15, 1914. Date of appl., April 15, 1914.

THE alloy consists of Al 100, Cu 18, Zn 5, Sb 3 parts by weight. A portion of the aluminium is melted and heated to a high temperature. The copper, antimony, and balance of aluminium are then introduced in turn, the temperature allowed to fall, the zinc added, and the whole well agitated.—T. St.

Aluminium alloys. W. A. McAdams, Bay Shore, N.Y. U.S. Pats. (A) 1,121,268 and (B.) 1,121,269, Dec. 15, 1914. Date of appls., April 15, 1914.

ALLOYS composed of (A) Al 100, Ag 20, Zn 10, and Cu 5; and (B) Al 100, Cd 30, Sn 5 parts by weight.—T. St.

Gold; Process of recovering rusty—and native platinum metals. R. E. Lyons, Bloomington, Ind. U.S. Pat. 1,118,944, Dec. 1, 1914. Date of appl., Nov. 17, 1913.

MATERIAL containing particles of precious metal which will not normally amalgamate, is treated with an amalgam, which is normally stable in water and contains a metal more electro-positive than mercury, and capable of alloying with the precious metal at ordinary temperatures. A reagent is also added which will attack the metal in the amalgam so that hydrogen is evolved on the surface of the precious metal, whereby the latter can become amalgamated.—T. St.

Metals; Process and apparatus for recovering precious—F. A. Wiswell, Oakland, Cal. U.S. Pats. 1,120,175 and 1,120,637, Dec. 8, 1914. Date of appls., Feb. 11, 1914.

FINELY divided material containing fine particles of precious metals is subjected, with agitation, to the action of an aqueous solution of mercuric chloride and sulphuric acid in the presence of iron, and at the same time an electric current having its

polarity periodically reversed is passed through the mass. The precious metals become amalgamated, and the mass containing the amalgamated particles is then passed into metallic mercury. The apparatus comprises a rotatory drum mounted inside a horizontal outer shell by means of engaging teeth. The drum contains an axial bore through which passes a shaft rigidly fastened to the apertured heads of the bore. The shaft is spaced from the bore and extends through the outer shell. Inlet and outlet conduits lead into opposite ends of the shell. The drum and the shell are insulated from each other and are connected respectively with the opposite poles of a source of current.—T. St.

Metals; Process of reducing—C. G. Fink, Schenectady, Assignor to General Electric Co., New York. U.S. Pat. 1,119,588, Dec. 1, 1914. Date of appl., Feb. 9, 1910.

A METALLIC arsenide (smaltite) is intimately mixed in the powdered form with powdered calcium oxide and carbide, and the mixture heated to the reaction temperature under reduced pressure.—T. St.

Ores; Method of forming agglomerated bodies from—W. Schumacher, Osnabrück, Germany, Assignor to General Briquetting Co., New York. U.S. Pat. 1,121,048, Dec. 15, 1914. Date of appl., April 30, 1912.

FINE ores of the hæmatite or limonite groups are reduced in the presence of lime to a lower state of oxidation, reduction to metallic iron being prevented. The reduced ore is briquetted in presence of a suitable catalytic agent for use in the blast-furnace, cohesion of the particles being brought about by reoxidation of the lower oxides previously formed.—T. St.

Ovens and dryers suitable for use in the manufacture of tiles, bricks, pottery, for annealing, etc. Eng. Pat. 18,821. See VIII.

Rubber-coated metal surface and method of producing the same. U.S. Pat. 1,120,795. See XIV.

XI.—ELECTRO-CHEMISTRY.

Insulation of electric conductors; Action of acid mine water on—H. H. Clark and L. C. Ilsey. U.S. Bureau of Mines. Techn. Paper 58, 1913, 24 pages.

FOUR different types of insulation were used in the tests: (1) Wire (0.162 in. diam.) covered with eight layers of varnished cotton cambric (0.146 in. thick), and one layer of cotton braid (0.056 in. thick), saturated with a composition. (2) Wire (0.325 in. diam.); rubber layer (0.0925 in. thick), containing 30% Para; cotton tape (single layer); cotton braid with weatherproof finish (2 layers, 0.035 in. and 0.033 in. thick). (3) Wire (0.162 in. diam.); varnished cambric, 11 layers (0.116 in. thick); cotton braid with weatherproof finish (2 layers, 0.029 in. and 0.04 in. thick). (4) Lead-sheathed telephone cable, composed of 5 pairs of paper-covered wires, surrounded by lead $\frac{3}{8}$ in. thick. The cables were sprinkled with 0.45% sulphuric acid or a 1.2% solution of ferrous sulphate in this acid three times daily for the first 4 weeks, once daily for 10 weeks, twice daily for 76 weeks and subsequently once daily, and, beginning eight months after the tests were started, the insulation resistance was measured at intervals over a period of two years. The rubber insulation showed no

apparent deterioration, and the insulation resistance, although only about half the original, was still very good. The telephone cable also gave good results. The cambric-covered wires, (1) and (3), had practically lost their insulation, mainly through the penetration of the liquid between the layers.—E. W. L.

Temperature uniformity in an electric furnace; Production of —. A. W. Gray. Bull. Bureau of Standards (U.S.A.), 1914, 10, 451—173.

UNIFORMITY of temperature longitudinally in a furnace tube is best obtained by inserting in each end of the tube a double plug composed of two blocks of material of high heat conductivity, separated by a considerable layer of a poor conductor, the outer block of each plug being heated to a temperature approximately the same as that of the middle of the furnace tube by a heating coil abutting against its outer end. By applying this principle a furnace was constructed in which it was possible to heat the middle 30 cm. of a furnace tube, 62 cm. long, so uniformly at temperatures up to 700° C., that irregularities in the temperature distribution were less than the effect of heterogeneity in the thermo-element. The middle portion of the furnace tube was completely filled by an iron block, in which were two longitudinal cavities of square cross-section, disposed respectively above and below the axis of the tube and serving for the reception of the bar to be heated and of a control bar. The ends of the tube were closed by double plugs as described above. The furnace tube was enclosed by two spaced concentric iron heating tubes with air in the intermediate spaces, the space between the larger heating tube and the outer shell of the furnace being filled with a composition of asbestos and magnesia. The ends of the furnace were closed by insulating heads composed of two discs of asbestos board separated by a layer of asbestos-magnesia composition. The heating tubes were wound longitudinally with nichrome ribbon, a flat, woven mat of the ribbon and strips of micasbestos (an insulating preparation of flake mica and a resinous cement) being wrapped around the tube, between layers of micasbestos, and the whole covered with asbestos cloth. The resistance was formed in two halves, which were connected in parallel. With this furnace the maximum drop in temperature at the ends of the middle 30 cm. of the furnace from the temperature at the middle was 1° at 667° C. and 0.25° C. at 145° C., and the mean temperature in the whole 30 cm. was lower than the temperature at the middle by 0.37° at 667° C. and 0.08° at 145° C.

—A. S.

Silver voltammeter; The —. Part IV. E. B. Rosa, G. W. Vinal, and A. S. McDaniel. Bull. Bureau of Standards (U.S.A.), 1914, 10, 475—536. (See also this J., 1914, 482.)

DETERMINATIONS of the voltage of the Weston normal cell, using silver voltameters of the porous cup type and of the new form devised by F. E. Smith (Nat. Phys. Lab. Report, 1910, 32) gave concordant results, the value at 20° C. being 1.01827 volts. With a pure electrolyte in the voltammeter, the effect of acid can be expressed by the equation: $y = -4.5x + 0.02x^2$, where x represents the acidity and y the decrease in the silver deposit, both in parts per million. With a pure electrolyte the deposited silver contains no appreciable quantity of included matter. It is concluded from the whole of the results obtained at the Bureau of Standards that the silver voltammeter is an instrument of precision capable of checking the constancy of the Weston normal

cell according to the decision of the International Technical Committee. A simple form of silver voltammeter giving results accurate to within a few hundredths of 1% is described and illustrated, the anode being a large silver ring set in a glass dish containing the electrolyte, and the cathode a small platinum ring (10.5 grms.) resting in a shallow glass dish submerged in the electrolyte and so arranged that the whole could be lifted out together.—A. S.

PATENTS.

Anodes; Suspension of electrolytic —. H. R. Boissier, Long Island, N.Y. Eng. Pat. 11,610, May 11, 1914. Under Int. Conv., May 9, 1913.

THE anode is formed with a projecting neck, either grooved or with projections on one or opposite sides, so that it may be engaged with detachable hooks or clamps.—B. N.

Particles present in an ionised medium; [Electrically] collecting —. W. W. Strong, Mechanicsburg, Pa. U.S. Pat. 1,096,765, May 12, 1914. Date of appl., Dec 28, 1912.

THE particles are separated by subjecting the ionised medium to the influence of an electric field, and are collected on a suitable movable dielectric element placed between the most intense part of the field and the medium.—B. N.

Separating finely-divided particles of solids or liquids from a gas. W. W. Strong, Pittsburgh, and A. F. Nesbit, Wilkesburg, Pa., Assignors to R. B. Mellon, Pittsburgh, Pa. U.S. Pat. 1,120,561, Dec. 8, 1914. Date of appl., Feb. 11, 1913.

SUSPENDED particles are separated from gaseous and liquid bodies by the action of an electric field, between electrodes maintained at a high difference of potential, oscillatory in character and of high frequency. The amplitude and damping of the oscillations are controlled by pre-determined and adjustable values of resistance, self-inductance, and capacity. The electrodes are arranged in a circuit which has one or more spark gaps, flame discharges being prevented in the gaps.—B. N.

Gases; [Electrical] purification of [combustible] —. E. L. Hall, Assignor to Security Savings and Trust Co., Portland, Oreg. U.S. Pat. 1,120,475, Dec. 8, 1914. Date of appl., April 4, 1913.

THE combustible gas is purified by partially removing sulphur compounds, and then altering the character of the remaining impurity by the action of a silent electric discharge; the altered sulphur compounds are finally removed by absorption.—B. N.

Moulded metallic article [dynamo-brush] and method of making the same. W. R. Whitney, Schenectady, Assignor to General Electric Co. New York. U.S. Pat. 1,121,960, Dec. 22, 1914. Date of appl., Oct. 12, 1910.

SEE Eng. Pat. 27,621 of 1911; this J., 1912, 1187.

Obtaining elements with the aid of volatile compounds of the same. Fr. Pat. 469,355. See VII.

Electric furnace intended principally for the manufacture of nitrides. Fr. Pat. 469,554. See VII.

XII.—FATS; OILS; WAXES.

China wood oil (tung oil); Index to patents, technology, and bibliography of—. Compiled and published by G. H. Stevens and J. W. Armitage.

AN index, covering 135 pages, to a compilation of over 800 publications and nearly 200 patents relating to Chinese wood oil. The patent specifications are given in their original form, and in all cases translations are given in full if the original text was not in English. The matter is arranged on about 2000 sheets, 8½ by 11½ ins., gathered in loose-leaf binders into four volumes, with ample space left for inserts. Only a small manuscript edition has been prepared. Further particulars may be obtained from G. H. Stevens, 77, Orange Avenue, Irvington, N.J., U.S.A.

PATENTS.

Seeds, nuts, and other oil-containing materials and substances; Expressing of oil from— and liquid from liquid-containing substances and the like. G. R. Schueler, Kingston-upon-Hull, and H. V. Wright, Brough, Yorks. Eng. Pat. 27,994, Dec. 5, 1913.

THE material is forced under pressure through a chamber the diameter of which gradually increases. The interior of the chamber may be either plain, grooved, or arranged in steps, and the outlet end is fitted with a device which regulates the size of the opening and takes up the pressure put upon the material. The expansion of the material as it passes through the chamber causes a continuous re-arrangement of the particles, thereby allowing the oil to escape freely.—W. P. S.

Polymerised products from animal oils; Process for the manufacture of—. W. Kaempfe, Grossenhain, Germany. U.S. Pat. 1,121,925 and 1,121,926, Dec. 22, 1914. Dates of appl., April 8 and Sept. 30, 1913.

SEE FR. Pat. 445,565 and Eng. Pat. 21,835 of 1913; this J., 1913, 34; 1914, 604.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

The higher oxides of lead and their dissociation. Reinders and Hamburger. See VII.

Varnishes and coatings of cellulose acetate. Clement and Rivière. See V.

PATENTS.

Lead oxide; Method of, and apparatus for carbonating—. F. H. Sharpe, Liverpool. Eng. Pat. 17,579, July 24, 1914.

LITHARGE, water and a little acetic acid are fed through a pipe and cock into the upper end of a vertical cylindrical carbonating vessel, with a conical lower half and spherically-rounded bottom. The carbonating gas is pumped in through a central vertical pipe, ending in a bell-mouth close to the bottom of the vessel, and having lateral branches just above the delivery end, these branch pipes being curved in such a way as to impart an upward whirling motion to the liquid and suspended solids. When samples drawn from a test-cock in the side of the vessel indicate that

the carbonating process is complete, the contents of the vessel are blown out through a cock near the bottom.—E. W. L.

[*Pigment*] furnace. C. D. Holley, Assignor to Acme White Lead and Color Works, Detroit, Mich. U.S. Pat. 1,116,703, Nov. 10, 1914. Date of appl., Mar. 3, 1911. Renewed Apr. 9, 1914.

ABOVE the low arched roof of the furnace chamber is a waste-gas chamber. Burners open into the furnace chamber at different points near the front, and there are also a door at the front and a pair of spaced doors at the back of the chamber. Communication between the furnace chamber and waste gas chamber is established by ports, controlled by dampers, of which there are one above each door and one in the roof between the pair of doors. By this arrangement it is possible to circulate flame gases under the arched roof and over any part of the hearth as desired.—A. S.

Ultramarine; Crucible furnace, heated by gas, for the manufacture of—. Le Bleu d'Outremer. Fr. Pat. 469,240, May 14, 1913.

UNDER the hearth of the furnace are two superposed series of horizontal gas and air flues. Gas from two or more producers is delivered to some of the lower flues and flows thence into the corresponding upper flues through openings, the size of which increases with the distance from the inlet. The air is supplied in a similar manner through the other flues, flowing in the opposite direction to that of the gas. The hot gases from the combustion chamber in the middle of the lower part of the furnace pass through openings in the lower part of the walls of the furnace and then through two conduits to the chimney. One conduit is divided in the middle by a partition to cause the gases to take a longer path and thus allow their heat to be more completely utilised. The temperature of the furnace can be regulated by varying the number of gas producers used and also by means of dampers in the gas-inlet flues.—A. S.

Colouring matters [pigments]; Manufacture of yellow to brown—from iron sulphide. Bayerische A.-G. für Chem. u. Landwirthschaftlich-Chem. Fabrikate, H. Hackl, and H. Bunzel. Fr. Pat. 469,711, March 16, 1914.

YELLOW to brown pigments of good covering power are obtained by the atmospheric oxidation of hydrated sulphide of iron, preferably in presence of moisture. For example, waste ferrous chloride solution from the pickling of iron is treated with barium sulphide solution, and the precipitated iron sulphide is oxidised by means of air, filtered off, and washed. The free sulphur may be removed by a suitable solvent if desired.—A. S.

Ink; Process for making—. R. Hochstetter, Cincinnati, Ohio. U.S. Pat. 1,119,960, Dec. 8, 1914. Date of appl., Feb. 4, 1914.

A PULP colour is mixed with a varnish, separated water is drawn off, and the mixture is dried by heating and agitation under reduced pressure.—W. P. S.

Rosin; Process for purifying—. H. T. Yaryan, Assignor to The Yaryan Naval Stores Co., Toledo, Ohio. U.S. Pat. 1,120,007, Dec. 8, 1914. Date of appl., Feb. 24, 1913.

MELTED rosin is passed through screens and allowed to fall, in a finely-divided condition, through a chamber where it is subjected to the action of an ascending current of air heated to above the melting point of the rosin.—W. P. S.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Indiarubber production in 1914. S. Figgis and Co., London. *India Rubber J.*, 1915, 49, 77—79.

IN 1914, 11,800 tons of plantation rubber were exported from Ceylon and India and 49,700 tons from Malaya, etc., as compared with 11,830 and 36,200 tons respectively in 1913; the 1914 figures do not include some direct Dutch shipments. The supply from Brazil, including Amazonas, Bolivia, Peru, etc., was 37,000 tons in 1914, against 39,000 tons in 1913. The total production of raw rubber in 1914 is estimated at 115,500 tons. Practically no guayule was made and less reclaimed rubber was used. Exports in 1914 from West Africa amounted to 8500 tons, from Loanda 450 tons, and from Congo, French Congo, and Sudan, 3900 tons, the corresponding figures for 1913 being 10,000, 400, and 4100 tons respectively. England imported 2650 tons and France 1700 tons from W. Africa in 1914.

Action of acid mine water on insulation of electric cables. Clark and Ilsley. *See XI.*

PATENTS.

Rubber: Manufacture of [raw]— R. C. Fulton and D. A. MacCallum, Glasgow. *Eng. Pat.* 9066, April 9, 1914.

LATEX is coagulated by spraying it into, or otherwise mixing it with, a dilute (10—20%) solution of an aldehyde or ketone, such as acetaldehyde or acetone, in water or other inert solvent, except alcohol. The ultimate weight of the rubber is increased from 3—5% by the precipitation with it of protein, which is claimed to improve the quality. It is advantageous to add 1% of formalin to the latex before coagulation, to prevent or check subsequent putrefactive changes.—E. W. L.

Rubber-coated metal article and method of producing the same. L. Daft, Rutherford, N.J., Assignor to Electro-Chemical Rubber and Manfg. Co. U.S. Pat. 1,120,795, Dec. 15, 1914. Date of appl., Feb. 17, 1912.

A RUBBER covering is fixed by vulcanisation, on a metal surface containing bismuth, with or without one or more of the metals, copper, zinc, and arsenic, but not tin.—E. W. L.

XV.—LEATHER; BONE; HORN; GLUE.

Tanning materials; Supply of— Ch. of Comm. J., Jan., 1915.

IN 1913 the value of tanning extracts of all kinds imported into the United Kingdom reached £922,600. Supplies from Italy have now been wholly, and from France partially, stopped owing to the increased demand for military purposes. Quebracho extract is arriving in fair quantities from South America, but with the higher freight and insurance and the increased demand the price is bound to rise materially. The supply of Turkish valonia is cut off. Fortunately both South Africa and, in a lesser degree, the Commonwealth of Australia have for some years done a considerable export trade in wattle-bark, while East Africa is also now in a position to begin sending shipments. The value of wattle-bark for tanning has been sufficiently demonstrated by experiments conducted at the Imperial Institute. Wattle-bark has been used, moreover, and highly appreciated for some time in Germany, where the bulk of the supply forwarded to Europe from the British Colonies has hitherto been ultimately sent. As a large and constant supply is available at a price which is very low as compared with that of valonia

(which wattle-bark should be able to replace), it is hoped that wattle-bark will now be regularly used by British tanners.

PATENT.

Gelatine; Obtaining— from fish-bones, and subsequent treatment of said gelatine. G. H. Tatham, D. R. Blair, C. T. Westwood, and J. H. Dunkin, London. *Eng. Pat.* 28,453, Dec. 10, 1913.

FISH-BONES, freed from adhering flesh, are soaked for several days in running water, then freed from calcium salts by treatment with a 10% solution of alkali (potassium silicate) or acid (hydrochloric), and heated with a solution of potassium bicarbonate (2 to 3 grains in one pint of water per lb. of bones) in a steam-jacketed pan at 105°—110° C. for 25—40 hours. The steam pressure is slowly released, and commercially pure sheet gelatin (5% of the weight of bones) added. The clearer portion of the gelatin collects on this, and the darker, less soluble portion separates from it. The latter is purified by means of fullers' earth, kaolin, etc., whilst the clearer, soluble part is worked into the required form and rendered insoluble with formaldehyde or 10% tannic acid. The latter produces a product which darkens on exposure to light.—E. W. L.

XVI.—SOILS; FERTILISERS.

Manure heaps; Prevention of loss from— in winter and early spring. E. J. Russell and E. H. Richards. *J. Board Agric.*, 1914, 21, 800—807.

THE losses occurring during storage of a manure heap arise from rainfall, dissipation of gaseous compounds, and moving the heap. They can be prevented altogether under favourable conditions. In heaps stored in the open and under cover, the losses in nitrogen were 24—33% and 7—8% respectively. When a heap under cover was compacted so as to prevent dissipation of gas, the loss of nitrogen was nil. Moving the heap caused a loss of nitrogen varying from 10 to 27% under all conditions, whether covered or uncovered, compacted or not compacted. The nitrates formed on the outside of the heap are washed by rain into the heap and there undergo decomposition with evolution of gaseous nitrogen. To prevent loss the heap should be compacted, sheltered from rain, and undisturbed.—J. H. J.

Silicofluorides; Manufacture of— and the superphosphate industry. A. Hutin. *Rev. Chim. Ind.* 1914, 188. *L'Ind. Chimica, Min. e Met.* 1914, 1, 485—486.

MOST mineral phosphates contain fluorine, and in the manufacture of superphosphate this is converted into hydrofluosilicic acid, which is usually allowed to go to waste. By drawing the gases from the superphosphate chamber through a lead-lined tower in which they meet a spray of brine the acid is converted into sodium silicofluoride, which can be separated by filtration. The cost of recovery is very small and the sodium silicofluoride is worth about lire 50 per quintal (£20 per ton).—A. S.

Lime and magnesia; Comparison of silicates and carbonates as sources of— for plants. W. H. MacIntire and L. G. Willis. *J. Ind. Eng. Chem.*, 1914, 6, 1005—1008.

IF the ordinary methods of analysis be used, many soils may be described as containing carbonate when none is present (compare Marr, this J., 1909, 1213). The authors have shown previously (*Tenn. Stat. Bull.* No. 100) that by

using a vacuum of 4 ins., calcium carbonate in a soil can be completely decomposed and the carbon dioxide liberated at the ordinary temperature by means of phosphoric acid (1:15), which also has less action than hydrochloric acid on soil organic matter. Calcium is present in soils very often, and magnesium almost always, as silicate, and the silicates are more beneficial to the plants than the corresponding carbonates. The long-continued effects of the application of small or moderate amounts of burnt lime or calcium carbonate are due to the conservation of lime as silicate, from which lime is extracted in the form of bicarbonate by the soil solution.—A. S.

Felspar as a possible source of American potash.
Cushman and Coggeshall. See VII.

PATENTS.

Manures or fertilisers; [Manufacture of] artificial
— T. Twynam, Redcar, Yorks., E. K. Scott, Belvedere, Kent, and F. Howles, Manchester. Eng. Pat. 6275, March 12, 1914.

FINELY divided, phosphatic, basic slag is agitated, and treated at a moderate temperature with oxides of nitrogen and air issuing from a nitrogen-fixation furnace, operated by a high-tension electric arc. The necessary temperature is maintained by spraying water on to the slag or by the use of a sludge composed of ground slag and water. The resulting product contains citric-soluble phosphoric acid and the nitrates of the bases existing in the slag other than iron, which is only attacked at a higher temperature.—O. R.

Fertiliser and process of making the same. W. F. Downs, Jersey City, N.J. U.S. Pat. 1,120,917, Dec. 15, 1914. Date of appl., Nov. 13, 1912.

FINELY divided phosphate rock is intimately mixed with sufficient finely divided silica to give a ratio of $RO:SiO_2$, and the mixture is heated to below the sintering point or the volatilising point of phosphoric anhydride (720° – 1100° C.), the heating being continued until the product is insoluble in water, neutral to litmus, soluble in hydrochloric acid, and all or most of its phosphate soluble in neutral ammonium citrate.—O. R.

Soluble phosphates; Method of producing — J. W. Beckman, Niagara Falls, N.Y. U.S. Pat. 1,121,160, Dec. 15, 1914. Date of appl., April 30, 1913.

SOLUBLE phosphates are produced by heating alunit, or other mineral of the type, $R_xO_y \cdot K_2O \cdot S_2O_7$, with tricalcium phosphate or other mineral phosphate excepting that of an alkali metal.—O. R.

XVII.—SUGARS; STARCHES; GUMS.

Sugar beet; Cultivation of the — in Ireland.
J. Dept. Agric. and Tech. Inst., Ireland, 1914, 14, 471–482.

IN experiments carried out in 1912 and 1913, cultivation in rows on the flat in accordance with Continental practice produced a yield only 14 to 17 cwt. per acre greater, and a sucrose content only 0.3 to 0.7% higher, than cultivation on moulded up drill plots, which was not sufficient to compensate for the extra outlay involved in labour on the flat plots. Hence the system of moulding-up ordinary drills or ridges, which facilitates after-cultivation, appears to be best adapted to Irish conditions. The application of sodium nitrate was not remunerative under the conditions of manuring adopted, which in most of the experiments was as follows: farmyard manure, 15 tons; sulphate of ammonia, 1 cwt.; superphosphate,

3 cwt.; and kainit, 6 cwt. per acre. Sugar beets were grown alongside mangolds with the object of comparing the relative yields, the general averages being as follow: sugar beets (gross weight), 17 tons 9 cwt.; sugar beets (factory weight), 13 tons 10 cwt.; and mangolds, 28 tons 18 cwt. per acre. Thus, even when cultivated in the best manner, the factory weight of a sugar beet crop in Ireland was only about half that of a well-managed crop of mangolds.—J. P. O.

Sugar beet; Cultivation of the — in Canada.
F. T. Shutt. Report of the Dominion Chemist, Dep. of Agric., Canada, 1913, 242–245.

VERY satisfactory results have been obtained demonstrating that sugar beets suitable for profitable extraction of sugar may be grown in widely distant parts of Canada. The highest sugar content (17.86%) was reached at Lethbridge, Alberta, and the lowest (13.40%) at Brandon, Man., and at three of the Experimental Farms it averaged 17%, the purity of the juice being over 90%. The seed used was of three varieties: Vilmorin's Improved A, Vilmorin's Improved B, and Klein Wanzleben.—J. P. O.

Sugars; Influence of atmospheric conditions in the testing of — F. Bates and F. B. Phelps. Bull. Bureau of Standards (U.S.A.), 1914, 10, 537–555.

UNDER ordinary conditions the increase in polarisation due to evaporation is negligible in the case of refined sugar, and also with raw sugar, filtered once, provided the time required for filtration does not exceed 10–12 mins., but errors of several tenths of a sugar degree may be caused when one-fourth of the solution or more is filtered twice. In all cases error can be avoided by covering the funnel.—A. S.

Strontium in the beet sugar industry. H. C. Meyer. J. Ind. Eng. Chem., 1914, 6, 1036–1037.

THE price of refined strontium nitrate imported into the United States has trebled since August 1, 1914, and importation of crude strontium sulphate has consequently increased largely. The manufacture of strontium compounds in the United States is advocated, since at the present time the American manufacturer can purchase the raw material at a price approximating that paid by foreign manufacturers, and if a steady supply of strontium hydroxide could be assured, there would be a large demand from American beet sugar refiners for use in the desaccharification of molasses. At present either the lime or the osmosis process is used in the United States, but the strontia process is employed almost exclusively on the Continent, and, notwithstanding its higher initial cost, possesses many advantages.—A. S.

XVIII.—FERMENTATION INDUSTRIES.

Beers; Reports on the determination of the original gravity of — by the distillation process. I. and II. Memoranda and Tables. T. E. Thorpe and H. T. Brown. III. Report on the proposed revision of the Table of Original Gravities. IV. History of previous Tables of Original Gravities and a comparison of these with the Mean Brewery Table, 1909–10. V. The scientific principles underlying the empirical method of determining original gravity. H. T. Brown. J. Inst. Brew., 1914, 20, 569–713.

I. Thorpe and Brown. In 1909, the Commissioners of Customs and Excise directed a revision of the

Statutory Table of Original Gravities hitherto in use since 1880 (see this J., 1915, 45). The Commissioners instructed Sir Edward Thorpe to carry out the work in co-operation with Mr. H. T. Brown, who was nominated on behalf of the

brewing trade by the Institute of Brewing. After a study of malt worts prepared and fermented in the laboratory, the investigation was continued in ten breweries selected as representative of the various systems of brewing practised in the

TABLE I.

Readings from curves constructed from the averages of the curve readings of each brewing at each brewery, compared with the Mean Brewery Table constructed from the averages of the curve readings of all the brewings at all the breweries.

Spirit Indication.	Brewery.											Differences between "Mean Brewery Table" and—	
	A.	B.	C.	D.	E.	F.	G.	H.	K.	L.	Mean Brewery Table.		
	Corresponding degrees of gravity lost.											Highest brewery curve readings.	Lowest brewery curve readings.
1	4.25	4.30	4.25	4.25	4.20	4.35	4.20	4.20	4.25	4.20	4.25	+0.10	-0.05
2	8.55	8.65	8.55	8.60	8.50	8.75	8.50	8.50	8.55	8.45	8.50	+0.25	-0.05
3	12.95	13.05	12.90	13.05	12.95	13.20	12.85	12.85	12.00	12.75	12.90	+0.30	-0.15
4	17.45	17.55	17.40	17.55	17.45	17.05	17.25	17.30	17.40	17.05	17.30	+0.35	-0.25
5	21.95	22.10	22.00	22.10	22.05	22.10	21.80	21.85	21.90	21.50	21.85*	+0.25	-0.35
6	26.55	26.70	26.65	26.70	26.70	26.55	26.40	26.40	26.45	26.00	26.40	+0.30	-0.40
7	31.20	31.40	31.35	31.30	31.35	31.00	31.00	30.95	31.10	30.55	31.00	+0.40	-0.45
8	35.85	36.15	36.10	35.95	36.10	31.00	35.75	35.50	35.75	35.20	35.65	+0.50	-0.45
9	40.55	—	—	40.60	40.85	—	40.55	40.10	40.40	39.95	40.30	+0.55	-0.35
10	—	—	—	—	45.65	—	45.40	44.80	45.10	44.95	45.00	+0.65	-0.20
11	—	—	—	—	—	—	50.25	49.60	49.90	—	49.85	+0.40	-0.25
12	—	—	—	—	—	—	55.20	—	54.80	—	54.85	+0.35	-0.05
13	—	—	—	—	—	—	—	—	59.85	—	59.95	—	-0.10

* 21.93 true average.

TABLE II.

Original gravities of beer after storage in casks. Summary of the maximum differences between the true original gravity and the original gravity as calculated from the old Statutory Table and from the Mean Brewery Table.

Brewery.	Description of beer.	Time since cask filled.	Spirit Indication.	True original gravity.	Original gravity calculated from—			
					Old Statutory Table.	Difference from true original gravity.	Mean Brewery Table.	Difference from true original gravity.
C	Strong Ale	6 months	11.88	104.34°	101.31	-3.03	101.86	-2.48
C	"	6 "	12.14	104.34°	101.49	-2.85	101.95	-2.39
G	"	4 "	11.25	95.65°	92.50	-3.15	93.25	-2.40
G	"	4 "	11.20	95.65°	92.43	-3.22	93.18	-2.47
H	"	15 "	13.73	89.94°	86.25	-3.69	86.48	-3.46
H	"	15 "	13.79	89.94°	86.65	-3.29	86.69	-3.05
K	"	6 "	13.63	106.83°	105.02	-1.81	105.30	-1.53
K	"	6 "	13.08	100.83°	104.89	-1.94	105.36	-1.47
Mean		difference ..	.. ..	.. ..	.. ..	-2.87	.. ..	-2.41
E	Export Stout	15 months	10.33	70.46°	68.24	-2.22	69.06	-1.40
E	"	15 "	10.19	70.46°	67.68	-2.78	68.74	-1.72
L	Stout	8 "	11.44	76.10°	74.61	-1.49	75.20	-0.84
Mean		difference ..	.. ..	.. ..	.. ..	-2.16	.. ..	-1.32
K	Export Ale	1 day	8.50	64.69°	62.55	-2.14	64.00	-0.69
K	"	1 "	8.64	64.69°	62.76	-1.93	64.18	-0.51
K	"	6 months	9.71	64.23°	62.35	-1.88	63.48	-0.75
K	"	6 "	9.68	64.23°	62.32	-1.01	63.27	-0.96
Mean		difference ..	.. ..	.. ..	.. ..	-1.96	.. ..	-0.73
H	Export Ale	4 months	8.08	56.87°	54.20	-2.67	55.59	-1.28
H	"	15 "	13.04	56.87°	54.20	-2.67	55.19	-1.68
E	"	15 "	9.37	55.40°	52.80	-2.60	54.58	-0.82
E	"	15 "	9.42	55.40°	52.83	-2.52	54.72	-0.68
G	"	4 "	8.33	54.49°	51.29	-3.20	53.28	-1.21
G	"	4 "	8.29	54.49°	51.33	-3.11	53.28	-1.21
F	"	4 "	7.16	49.01°	45.73	-3.28	47.96	-1.05
F	"	4 "	7.13	49.01°	45.66	-3.35	47.91	-1.10
Mean		difference ..	.. ..	.. ..	.. ..	-2.92	.. ..	-1.13
Mean of all differences for original gravity of 90° and over ..						-2.87	.. ..	-2.41
Mean of all differences under 80° of original gravity						-2.50	.. ..	-1.06
Mean of all differences						-2.63°	.. ..	-1.53°

United Kingdom. Owing to the custom of making up the worts for fermentation from separate "lengths" of varying gravities, and pitching before all the "lengths" are added, it was impossible in most cases to determine the true original gravity from samples taken from the vats. This was done, however, where possible, and the results confirmed the accuracy of the alternative method of sampling on which exclusive reliance had to be placed in other cases. This method was to take a number of samples (30—40 in some cases) of the wort from the pipe filling the vat, at suitable intervals of time, each representing a certain volume of wort run in, and to secure a "miniature collection" by mixing together volumes of the different samples proportional to the quantities of wort represented by them. Samples of the fermenting wort were withdrawn from different portions of the vat, at frequent intervals, and investigated. Owing to the impossibility of obtaining samples containing the proper proportion of yeast, except in the early stages of fermentation, it was decided to filter the worts before determining the spirit indication. All determinations were carried out independently by two analysts, and wherever possible results were "smoothed out" by means of curves. An original gravity table was compiled for each of the 42 brewings investigated, relating to worts made with malt, or malt and flaked maize, with and without brewing sugars. These tables show slight variations in the gravity lost, corresponding to a certain spirit indication. Worts of high original gravity show a smaller loss of gravity for a given spirit indication than weaker worts, but the maximum difference does not exceed 0.4° , or, if worts of original gravity exceeding 80° are excluded, 0.2° . When brewing sugars other than sucrose are used as adjuncts, the gravity lost for a given spirit indication is slightly higher than for all-malt worts, but up to a spirit indication of 8° the difference does not exceed 0.31° of gravity. Variations due to these causes, and also to differences in the reproduction of the yeast and the amount of alcohol lost in different breweries, are thus comparatively small. From the average of the results for all the brewery worts investigated, with the exception of those to which cane sugar had been added, a Mean Brewery Table (the basis of the New Statutory Table, see this J., 1915, 45) was compiled, which is shown in Table I., together with corresponding tables relating to worts of each brewery. As may be seen from Table I., when the Mean Brewery Table is used to interpret the results of the distillation process, the extreme variations will be very small, and the Table may be accepted as the most accurate obtainable for general application. Where, as in the case of brewery L, it operates against the brewer, the authors consider that a special allowance should be made. The Table applies to filtered worts at any stage of fermentation up to the point at which they are racked into casks for consumption or storage.

When cane sugar is used as a brewing adjunct, inversion takes place in the early stages of fermentation, and this would increase the gravity by about 0.2° for every 10 lb. of sucrose in 100 galls. of wort. Owing to fermentation of the invert sugar the actual effect is always less than this, and by the time a spirit indication of 4° or at most 5° is reached, the whole of the invert sugar has disappeared and no correction is subsequently required. The authors consider that the full correction for the sucrose inverted, as stated above, should be made in all cane sugar worts which at the time of distillation have not attained a spirit indication of 5° .

II. *Thorpe and Brown.* Some of the beers investigated as described above were stored in casks in certain of the breweries, for periods

up to nearly 18 months, and samples were taken from time to time. On account of the further production of alcohol during storage, the Mean Brewery Table was extended by extrapolation from 13° to 16° of spirit indication. The results of the investigation of the stored beers are summarised in Table II. The differences between the true original gravities and those calculated from the Mean Brewery Table correspond closely with the strengths of the beers, and are evidently due to losses of alcohol during storage. The loss or apparent loss of alcohol is due to three causes:—(1) A small but sensible absorption of the beer into the wood immediately after filling, and dilution of the beer by water remaining in the wood from the washing of the casks. (2) A slight evaporation of alcohol and water through the wood. The loss of alcohol appears to be independent of the external conditions, but that of water is greater in a dry store than in a damp cellar, and therefore in the latter case the spirit indication will decrease, whilst in a dry store it will remain constant or even increase. (3) Oxidation of alcohol to acetic acid. Graham, Hofmann, and Redwood stated that fresh worts may contain 0.1% of acetic acid, and that all increase beyond this can be regarded as derived from the alcohol of the beer, for which a corresponding correction must be made in the spirit indication. The authors, however, found that fresh worts contain practically no volatile acid, and that the amount produced during fermentation and storage is quite negligible so long as the beers remain sound. This was the case with all except two of the beers investigated, even after 18 months' storage. Two of the strong ales were sensibly acid at the end of storage, and the losses of gravity in these cases were the highest found, viz., 3.46° , 3.05° , and 2.48° . If the spirit indications had been corrected on the assumption that all the volatile acidity was acetic acid derived from alcohol, the losses would have been nearly 1° lower. In exceptional cases of this kind the volatile acidity has to be estimated and allowed for. The official method of determining acetic acid in beers, by titrating with standard ammonia solution and deducting 0.1% from the total acidity so found, is not satisfactory. The best method is by distillation in steam; and a more convenient one, though not in all cases quite so accurate, is to reckon as acetic acid the loss of acidity of a sample of the beer after evaporating to dryness on an open steam bath.

The last column of Table II. makes it evident that when beer is exported on drawback, or in other similar circumstances, an allowance of 2° on the declared gravity is a sufficient margin to cover all losses during storage due to differences between the true original gravity of the beer and that calculated from the Mean Brewery Table in the case of all beers of an original gravity not exceeding 90° . For beers of a higher original gravity a margin of 3° might be allowed.

III. *Brown.* A more detailed report of the investigation. The influence of yeast reproduction is discussed very fully. For the filtration of the wort prior to distillation ordinary filter paper was used, and the first portions of filtrate were rejected. No sensible loss of alcohol occurs if the funnel is covered with a clock glass.

IV. The necessity for a suitable means of determining original gravity first arose in 1847, when the use of sugar as a brewing adjunct was legalised, and the drawback of Excise Duty on exported beers was made calculable from the original wort gravity. The table first employed was one compiled by Dobson and Phillips, based on the method of partial evaporation. Its accuracy was disputed, however, and in 1852 Graham, Hofmann and Redwood were appointed to examine and if necessary revise the table. Their table, based on the method of distillation, accorded well with that

of Dobson and Phillips, and has been enforced by statute since 1880. Compared with this table, the Mean Brewery Table operates adversely to the brewer by indicating higher amounts of gravity lost for a given spirit indication, and therefore lower original gravities. In no case, however, does the difference corresponding to any spirit indication exceed 1.45° of gravity lost, if allowance is made for the fact that the Mean Brewery Table refers to filtered, and the older table to unfiltered worts. The inaccuracy of the older table is mainly due to the fact that in their fermentation experiments (Graham, Hofmann and Redwood employed about six times as much yeast as is used on the average in brewing. Under these conditions very little yeast reproduction can have occurred, so that the loss of extract by assimilation must have been abnormally low, and moreover an appreciable amount of alcohol must have been added to the wort with the yeast.

V. Brown. The author sought a rational basis for the determination of original gravity by the distillation method, by taking account of the various causes which contribute to the loss of gravity during fermentation. The Mean Brewery Table was re-calculated so as to refer the gravity lost to the weight of alcohol in 100 c.c. of the beer instead of to the spirit indication. The values thus obtained are shown in columns 1 and 2 of Table III, whilst column 3 reveals the almost exact rectilinear relation between them. This direct proportionality must be due to mutual compensation of the effects of various disturbing factors of which the chief is the assimilation of extract required for yeast reproduction. As a rule, in malt worts the rate of multiplication of the yeast falls off rapidly after the alcohol-content has reached about 0.5%, and practically ceases when the alcohol-content is about 3%. The loss of gravity owing to yeast reproduction may be calculated by multiplying the weight of yeast (dry substance) formed, by 4.5, and in brewery worts it amounts on the average to 1.6° of gravity. In column 4 of Table III are shown the values of column 2 corrected for this loss of gravity apportioned according to the magnitude of the yeast crop at different stages. Here again (as shown in column 5) the loss of extract remains almost exactly proportional to the quantity of alcohol formed, although various sugars are present in wort and their solution densities change with the concentration. The slight irregularities corresponding to the earlier stages of fermentation (see col. 5) are mainly due to the sucrose derived from the malt, the inversion of which tends to raise the original gravity of the wort and thus diminish the gravity lost. Malt worts contain 0.164—1.274% of sucrose, and the complete inversion of this would raise the gravity by 0.11—0.29°; but owing to the fermentation of the invert sugar the actual effect must always be less than this, and is quite negligible after the alcohol-content has attained 1.5%. The change in volume of wort due to fermentation is far too small to have any practical bearing on the present investigation. The sugars of malt wort yield, in the aggregate, a larger percentage of alcohol than the same sugars do when fermented alone by yeast which is not under conditions favourable for reproduction; this fact deserves further study.

In column 6 of Table III are shown the quantities of alcohol produced, expressed as percentage of the sugar fermented (calculated from the corrected losses of gravity in column 4 by means of the solution factor 3.912). On the basis of these figures the author divides the period of fermentation into three stages, according as the alcohol-content of the wort is below 1.5%, between 1.5 and 3%, or above 3%. For these stages the average yields of alcohol per cent. of sugar

fermented are 55.7, 52.6, and 51.5% respectively, and conversely the factors 1.795, 1.901, and 1.941 may be used for calculating the weight of sugar fermented for a given weight of alcohol formed. The original gravity of a wort may be calculated from the residue gravity by means of the formula, Original gravity = Residue gravity + 3.912 × S + Y, in which 3.912 is the solution factor for the aggregate wort sugars, S is the weight of sugar which has disappeared, expressed as grms. per 100 c.c., and is found by multiplying the percentage of alcohol in the wort by one of the factors 1.795, 1.901, or 1.941, according to the stage reached by the fermentation (see above), and Y is the loss of gravity due to the assimilation of extract by the yeast. This formula gives values very close to the true original gravity in all cases.

TABLE III.

1	2	3	4	5	6
Alcohol grms. per 100 c.c.	Corresponding degrees of gravity lost, from Mean Brewery Table.	Gravity lost for successive incre- ments of 0.5 grm. of alcohol.	Values of Col. 2 corrected for yeast reproduction.	Values of Col. 3 corrected for yeast reproduction.	Percentage of alcohol on total sugar fermented (divisor 3.912).
0.5	4.00	4.00	3.38	3.38	58.0
1.0	8.00	4.00	7.11	3.73	55.1
1.5	12.00	4.00	10.90	3.79	54.0
2.0	16.05	4.05	14.76	3.86	53.1
2.5	20.10	4.05	18.60	3.84	52.7
3.0	24.10	4.00	22.50	3.90	52.2
3.5*	28.05	3.95	26.45	3.95	51.9
4.0	32.00	3.95	30.40	3.95	51.5
4.5	35.85	3.85	34.25	3.85	51.5
5.0	39.65	3.80	38.05	3.80	51.5
5.5	43.45	3.80	41.85	3.80	51.5
6.0	47.25	3.80	45.65	3.80	51.5
6.5	51.05	3.80	49.45	3.80	51.5
7.0	54.90	3.85	53.30	3.85	51.5
7.5	58.70	3.85	57.15	3.85	51.5

* Yeast reproduction ceases at this point.

Determination of original gravity by the method of evaporation.—In the course of the main investigation the gravity of the fermented worts was in many cases ascertained prior to the determination of the spirit indication by distillation. In 33 such cases, with worts of original gravities ranging from 1051—1075, the spirit indication, as found by subtracting the gravity of the wort before distillation from that of the residue made up to the same volume, was on the average 0.16° less than the spirit indication of the distillate. This difference was very constant, and apparently independent of the original gravity of the worts; it is partly accounted for by the greater contraction which alcohol undergoes when mixed with sugar solutions than when mixed with water alone. The general result indicates that in the determination of original gravity by evaporation the same table (Mean Brewery Table) can be used as for the distillation process, provided the observed spirit indication in the former case be increased by 0.16°.

—J. H. L.

Alcohol for industrial purposes. See page 53.

XIXA.—FOODS.

Cheese of the cheddar type; Bacteria concerned in the production of the characteristic flavour in

— A. C. Evans, E. G. Hastings, and E. B. Hart. J. Agric. Research, 1911, 2, 167—192.

THE organisms present in cheddar cheese in such numbers as to indicate that they must have some function in the ripening process, are included in the four groups: *B. lactis acidii*, *B. casei*, *Streptococcus*, and *Micrococcus*; each of these groups may be divided into a number of varieties according to

their fermentative powers. The flora of raw-milk cheese consists of all the varieties into which the four groups are divided, whilst the flora of pasteurised-milk cheese, with the exception of the *B. casei* group, is dependent upon the flora of the starter. The *B. casei* group is apparently responsible for the pungent taste which develops late in the ripening period of both raw-milk and pasteurised-milk cheeses; probably the growth of this group of organisms continues during the greater part of the ripening period. The action of two or more organisms growing together is not the sum of their individual actions when growing alone. When growing together, they may attack substances that neither can attack alone, or they may produce a larger quantity of acid than the sum of the quantities that either can produce alone. The organisms of the *B. casei* group, when added to pasteurised milk, produce a sour taste in the cheese during the early part of the ripening period, but no cheddar flavour develops when the starter consists of organisms of this group; the varieties capable of fermenting the more complex substances are liable to produce a bitter flavour. Starters composed of both *B. lactis acidii* b, and *Streptococcus* b, when added to pasteurised milk, improve the quality of the cheese and possibly starters may be discovered which will give the characteristic cheddar flavour to cheese prepared from pasteurised milk.—W. P. S.

Cheese of the cheddar type; Relation of the action of certain bacteria to the ripening of—. E. B. Hart, E. G. Hastings, E. M. Flint, and A. C. Evans. *J. Agric. Research*, 1914, 2, 193—216.

VARIETIES of *Streptococci* and *Micrococci* isolated from cheddar cheese produce large quantities of volatile acids, particularly acetic acid, when grown in sterilised milk; no formic acid is produced. The volatile acids result from the action of the organisms on the citric acid, lactose, or protein in the medium, and, as the organisms are present at times in very large numbers in cheese, they no doubt produce the greater part of the volatile fatty acids during the ripening process. One of the varieties of *Streptococcus* b forms comparatively large quantities of alcohols and esters which contribute to the flavour of the cheese. Lactic acid is not usually produced by the *Coccus* groups. The *B. casei* group of organisms yield results differing from those given by the *Coccus* groups; they form some propionic acid and large quantities of acetic acid and lactic acid (both active and racemic), but no formic acid. Cheese made from fresh milk containing chloroform does not contain any volatile fatty acids, showing that these are not formed by the inherent milk enzymes. Ammonia is produced both by the *Coccus* and *B. casei* groups when these grow in milk. Whey and fresh curds contain active lactic acid, whilst cheese 1 day old contains a mixture of active and racemic lactic acids. Certain members of the *B. casei* group form *l*-lactic acid and others *d*-lactic acid from milk; a mixture of these organisms produces racemic lactic acid. When a mixed culture of *B. lactis acidii* and the members of the *B. casei* group capable of forming *l*-lactic acid is allowed to grow in milk, racemic and active lactic acids are produced; the active acid is probably the result of the longer continued activity of *B. casei*. The racemic lactic acid found in cheese during the curing process may be produced to a small extent by enzymic action, but is more probably due to the combined action of *B. lactis acidii* and the organisms of the *B. casei* group.—W. P. S.

Peroxydase in milk; Rate of inactivation by heat of—. S. S. Zilva. *Biochem. J.*, 1914, 8, 656—669.

THE temperature coefficient for the inactivation of peroxydase in milk is found to be 2.23 per degree

Centigrade, a value about the same as that of the rate of coagulation of egg-albumin. The rate of inactivation of peroxydase below 70° C. is so small that the peroxydase reaction cannot be used as a test for pasteurisation. This reaction may, however, indicate whether "pasteurised" milk has been overheated. Small additions of acid retard, and of alkali accelerate, the rate of inactivation, whilst the presence of salts has a marked retarding effect, the retardation varying with different salts and being independent of the valencies of their ions. Salts have a similar action in the case of the enzyme in whey. As in milk, the inactivation of peroxydase in whey proceeds as a reaction of the first order.—W. P. S.

Rice-polishings; Investigation of the phosphotungstate precipitate from—. J. C. Drummond and C. Funk. *Biochem. J.*, 1914, 8, 598—615.

EXHAUSTIVE fractionation of the phosphotungstic acid precipitate obtained from an alcoholic extract of rice-polishings (husks) showed that the latter contain considerable quantities of choline and nicotinic acid; betaine, adenine, guanine, and possibly guanidine, were also detected. The substance, oryzanin, which is stated to have a powerful curative effect when administered in cases of beriberi produced by a diet of polished rice, could not be isolated (compare Suzuki, Shimamura and Odake; *Biochem. Zeitsch.*, 1912, 43, 89).—W. P. S.

Hydrocyanic acid from commercial kinds of linseed; Rate of liberation of—. S. H. Collins and H. Blair. *Chem. News*, 1915, 111, 19—20.

THE first crops of linseed grown in England from foreign seed of different origin showed great variations in the amounts of hydrocyanic acid to be obtained from them and in the rate of its evolution. For example the following amounts were obtained:—Russian, 0.088 to 0.175; German, 0.213; Roumanian, 0.115 and 0.183; Moroccan, 0.112; Indian, 0.210 to 0.233; and Japanese 0.270 parts per 1000. The Oriental seeds also showed low rates (35 to 55 mins.) for the evolution of half the total amount of hydrocyanic acid. The general result of growing linseed in England is to reduce the total amount of hydrocyanic acid and to increase the enzymic activity. English grown seed thus appears to be safer than foreign grown seed for feeding cattle. Seeds derived from temperate climates appear to give the best yields per acre and to produce linseed containing the smallest amount of cyanogenetic glucosides. (See also this *J.*, 1914, 273.)—C. A. M.

Brewers' grains as a feeding material; Value of dried—. E. T. Halnan. *J. Board Agric.*, 1914, 21, 821—825.

A COLLECTION of the data available on the feeding of cattle and sheep with brewers' grains. In Norfolk, sheep were fed on swedes and hay, together with equal weights of various mixtures of grains and seeds. The average gain per head per week during three months was 3.13 lb. in the case of cotton cake and dried grains, 3 lb. for cotton cake and barley, 3.14 lb. for linseed and dried grains, and 3.04 lb. for linseed and wheat. The grains were thus superior to wheat and barley in these mixtures. The price of the brewers' grains, £6 per ton, was less than that of the other foods used. In Scotland, sheep were fed with swedes and ½ lb. of linseed, maize, oats, or dried grains, and the last proved much superior to any of the other foods. Later experiments with sheep fed on swedes and hay, with the addition of a fattening food, showed that the best increase in weight occurred with undecorticated Bombay cotton cake, followed by a mixture of undecorticated cotton cake and dried grains, linseed, and a mixture of

decorticated cotton cake and dried grains in the order given. The cost of the Bombay cake was £4 6s. 8d. per ton and of the dried grains £5 1s. 8d., so that the former gave the better feeding value. In another series, brewers' grains at £5 12s. 6d. were inferior to linseed at £8 5s., but superior to oats and maize. The general result of the investigations is that brewers' grains can be used with advantage to replace the more expensive cereals. The analyses of the brewers' grains used averaged approximately as follows: moisture 12, proteins 20, oil 8, fibre 12, nitrogen-free extract 45, ash 2.65%.—J. II. J.

PATENTS.

Meat products and the like; Process and apparatus for smoking and curing—. R. Schwenger, New York. Eng. Pat. 12,928, May 26, 1914. Under Int. Conv., Jan. 19, 1914.

MEAT products, such as sausages, hams, fish, etc., are suspended in a chamber at the bottom of which is a layer of sawdust, which is ignited by means of a gas burner placed below a metal hood in contact with the sawdust; subsequently the gas supply may be cut off and air injected so as to continue the combustion. The rapidity of combustion is controlled by regulating the supply of air, and a separate supply of dry air may be admitted to the upper part of the chamber.

—W. P. S.

Cereal extract; Manufacture of—. A. Nilson, Chicago, Ill. U.S. Pat. 1,120,328, Dec. 8, 1914. Date of appl., June 15, 1914.

CRUSHED malted cereal in a green condition is mashed with water containing sodium chloride, the wort is drawn off, acidified, and fermented; after separating the yeast, the liquid is treated with sodium carbonate and sodium chloride, heated, precipitated albumin is separated, and the resulting liquid is concentrated. The product resembles beef extract in appearance and taste.

—W. P. S.

XIXB.—WATER PURIFICATION; SANITATION.

Magnesium; Rapid determination of—in water analysis in the presence of calcium. V. Froboese. Z. anorg. Chem., 1914, 89, 370—376.

THE calcium is precipitated by adding to 200 c.c. of the water, heated to boiling, sufficient oxalic acid to make it just acid to methyl orange and then 50% potassium hydroxide solution until faintly alkaline, excess being avoided. The cooled solution, which should have become slightly acid, is treated with *N*/10 KOH in presence of phenolphthalein until it is a pale rose colour, and then immediately titrated with *N*/10 potassium palmitate (this J., 1912, 555, and 1913, 158), the end point being indicated by the production of a distinct red coloration. With practice, results agreeing with gravimetric determinations to within a fraction of a milligram per litre, can be obtained.

—G. F. M.

PATENTS.

Water purification; Method of and apparatus for—. J. Patten, Baltimore, Assignor to S. M. Shoemaker, Eccleston, Md. U.S. Pats. (A) 1,121,393 and (B) 1,121,394, Dec. 15, 1914. Date of appl., Sept. 4, 1914.

(A) HOT water is sprayed into a tank in which the air is maintained at about 100° C. Means are provided for regulating the supply of air to, and the escape of gases from the tank. (B) A tank is provided with a steam injector, an air inlet and

outlet, an atomiser, and with means for heating the water before it is admitted to the atomiser. The atomised water collects in a discharge channel, from which it can be diverted should the temperature fall below a definite limit.—W. P. S.

Fumigating composition [for sterilising casks, etc.]. F. L. E. M. Signoret, Marseilles, France. Eng. Pat. 2150, Jan. 27, 1914. Under Int. Conv., Feb. 26, 1913.

SULPHUR is triturated to particles of less than 3 mm. diameter, immersed in 25—30% of its volume of commercial sodium (or potassium) silicate, dried, and compressed into blocks. The product may be burnt without risk of fused drops of sulphur becoming detached, and leaves a pumice-like residue.—F. SODN.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Camphor production in Formosa. Chem. Trade J., Jan. 9, 1915.

THE export of camphor from Formosa in 1913 declined from 8,649,319 lb., worth £553,550, in 1912, to 7,860,854 lb., worth £495,720. The total production of camphor during 1913 was 5,999,538 lb., to which must be added 3,573,602 lb. of camphor re-manufactured from 7,405,438 lb. of camphor oil, making the total output for the year 9,573,140 lb. Considerable stocks were in hand at the end of 1913. The future of the camphor industry continues to excite some apprehension owing to possible exhaustion of the existing camphor forests, and the tendency to diminution has been officially admitted. It is, nevertheless, claimed that present resources are sufficient to maintain an annual supply of about 6,500,000 lb. for eighteen years, and that by then the afforestation scheme will be far enough advanced for that quantity still to be produced. In 1913 about 3,000 acres were planted with 3,813,000 trees at a cost of £3,500, and as the scheme is to be continued for twelve years, large additions will be ultimately made to the existing reserves. Every effort is being made to render the method of production more efficient. In addition to distilling from the leaves of the camphor tree, efforts are being made to utilise profitably the dwarf camphor tree, which ordinarily produces very little camphor. Again, the 7,000 stills used throughout the country have been or will be rebuilt to give more efficient results. The export of camphor oil increased both in quantity and value, being 4,842,549 lb., worth £172,620, against 4,475,906 lb., worth £159,401, in 1912. The whole export went to Japan. The total production was 7,545,019 lb., but as mentioned above, a large quantity of camphor oil was re-manufactured. The re-manufacture of camphor oil leaves as by-products, brown oil, white oil, linalool, etc., which were exported to the value of £16,800. The estimated production of camphor during 1914 is about 6,500,000 lb., and of camphor oil 6,400,000 lb.

Allantoin in urine; Determination of—in the presence of dextrose. R. H. A. Plimmer and R. F. Skelton. Biochem. J., 1914, 8, 641—648.

UREA and allantoin may be determined together by Folin's magnesium chloride method (which depends on the fact that the nitrogen of these bases is quantitatively converted into ammonia when they are heated with fused magnesium chloride), and the urea alone by means of urease, the difference in the two results giving the quantity of allantoin. The presence of

dextrose in the urine, however, interferes with the determination of the urea by Folin's method, from 9 to 30% of the nitrogen being lost, but the sugar may be removed by precipitation with basic lead acetate and sodium hydroxide in the proportions:—



—W. P. S.

Alkaloids of quebracho bark. I. Constitution of aspidospermine. A. J. Ewins. Chem. Soc. Trans., 1914, 105, 2738—2748.

THE bark of *Aspidosperma Quebracho* ("quebracho blanco") yielded 0.06 to 0.2% of the alkaloid aspidospermine, $\text{C}_{22}\text{H}_{30}\text{O}_2\text{N}_2$, crystallising in needles from alcohol, m. pt. 208°C , $[\alpha]_D = -99^\circ$ in alcohol and -93° in chloroform. It is only feebly basic and gives no crystalline salts. When boiled with hydriodic acid one methoxyl and one acetyl group are hydrolysed, giving a new base, *aspidosine*, $\text{C}_{18}\text{H}_{26}\text{ON}_2$, crystallising from alcohol or xylene in rectangular prisms or plates, m. pt. 244° — 245°C , $[\alpha]_D$ about -16° ; this gives a hydriodide, m. pt. above 280°C , crystallising from hot water in octahedra and cubes. Aspidospermine on boiling with dilute hydrochloric acid is converted into *deacetylaspidospermine*, $\text{C}_{20}\text{H}_{28}\text{ON}_2$, m. pt. 110° — 111°C , $[\alpha]_D +2.8^\circ$, which on acetylation is reconverted into aspidospermine and on benzoylation gives *benzoyldeacetylaspidospermine*, m. pt. 186° — 187°C . Deacetylaspidospermine warmed for a few moments with methyl iodide is converted into a substance, $\text{C}_{20}\text{H}_{28}\text{ON}_2 \cdot 2\text{CH}_3\text{I}$, crystallising from methyl alcohol in octahedra, m. pt. 176° — 177°C , whilst with acetic acid and sodium nitrite it gives a substance, $\text{C}_{20}\text{H}_{26}\text{O}_4\text{N}_4$, probably *nitronitroso-deacetylaspidospermine*, which forms pale yellow prisms, m. pt. 155° — 156°C with decomposition. Aspidospermine oxidised with chromic acid gives a new base of probable formula, $\text{C}_{15}\text{H}_{22}\text{O}_2\text{N}_2$, m. pt. 192° — 193°C , having a crystalline hydrochloride, m. pt. 286° — 287°C . The existence of the various bases described by Hesse (this J., 1882, 200), with the exception of aspidospermine and quebrachine (yohimbine), could not be confirmed.—T. C.

Oxymorphine [pseudomorphine] in presence of morphine; Detection of—. L. Grimbart and A. Leclère. J. Pharm. Chim., 1914, 10, 425—428.

THE hydrochlorides of the bases are dissolved in 100—1000 parts of water, and the solution neutralised and treated successively with equal volumes of a 1% solution of potassium ferricyanide and a 10% solution of sodium acetate. When the amount of pseudomorphine present does not exceed 1 in 20,000 there is no precipitate. The precipitated pseudomorphine is collected and washed by centrifuging, dissolved in 1 c.c. of dilute hydrochloric acid, and precipitated by a slight excess of potassium bicarbonate. It is again collected and washed by centrifuging, and redissolved in 1 c.c. of weak hydrochloric acid. Small portions are tested for pseudomorphine by the above reagents, or by a saturated solution of sodium sulphate. Treatment with sulphuric acid containing 1 drop of formaldehyde in 5 c.c. produces a Venetian red coloration, unless a trace of ferricyanide is present, when a green coloration appears. The ferricyanide reaction for precipitating pseudomorphine is not interfered with by morphine, codeine, thebaine, apomorphine, or other commonly occurring alkaloids.—F. SHDN.

Digitalis. R. H. Hatcher. Druggists' Circular, 1914, 607. Amer. J. Pharm., 1914, 86, 567—568.

DIGITALIS of the first year's growth is probably as active as that of the second, and the cultivated is

as active as the wild-grown. The most active digitalis is not necessarily the best, the best being that which possesses maximum therapeutic action with a minimum of side actions, such as the nauseant and emetic. Digitalis will keep indefinitely when properly dried and stored. Pharmaceutical preparations of digitalis containing at least 60% of alcohol will keep indefinitely when securely corked and away from sunlight. At least two active principles, digitoxin and digitalin, and possibly a third, digitalein, are obtainable from digitalis leaf, but it is not certain whether these exist as such in the leaf. No digitalis principle or preparation has the advantage of digitalis without its undesired effects. The tincture, as well as the infusion when properly made, represents all the activities of the leaf, and fat-free tincture has no advantages. The determination of the digitoxin content affords no index of the therapeutic or pharmacological activity, but the therapeutic activity may vary in the same direction as the digitoxin.—T. C.

Papain; Standardisation of commercial—. F. W. Heyl, C. R. Caryl, and J. F. Staley. Amer. J. Pharm., 1914, 86, 542—550.

PAPAIN is supposed to have a higher digestive activity than the pawpaw juice (the dried albuminous exudation of the fruit of *Carica Papaya L.*) from which it is prepared, but no commercial product was found to have this increased activity. To determine the proteolytic activity, 1 c.c. of a 1% solution of papain or of pawpaw juice in 1% salt solution, which has been made up exactly 30 mins., is added, together with 9 c.c. of 1% salt solution, to 15 c.c. of egg-white solution in 1% salt solution, containing 0.4 grm. of coagulable protein, and the mixture is digested exactly 15 mins. at 80°C ; 1 c.c. of N/2 acetic acid is then added and the whole heated at 100°C for 10 mins. The undigested protein is filtered off, washed free from chlorides and then with alcohol and with ether, and after drying at 100° — 105°C the weight is compared with that from a blank experiment under identical conditions. A genuine pawpaw juice should digest at least 40% of the egg-white protein under these conditions. *Test for pepsin*: 2 c.c. of 1% salt solution, 3 c.c. of N/2 HCl, and 5 c.c. of 1% papain are added to 15 c.c. of egg-white solution, 0.5 c.c. of toluene is added to prevent putrefaction, and the mixture is digested at 40°C for 15 hours; 25 c.c. of 10% trichloroacetic acid is then added, the solution boiled for 10 mins., and the coagulum filtered off, washed, dried at 100° — 105°C , weighed, and compared with the amount obtained from a blank experiment. Seven samples of dried pawpaw latex digested 0 to 2.9% under these conditions. Pawpaw juice should give a strong tryptophane reaction with bromine water after digesting with Witte's peptone, hydrocyanic acid, and hydrochloric acid for 17 hours at 36° — 40°C , or 15 mins. at 80°C . Starch, sugars, and dextrin were found as adulterants in commercial samples of papain.—T. C.

Geranium and thyme oils; Constants of British East African—. J. C. Umney. Perfumery and Essent. Oil Rec., 1914, 5, 423.

A SAMPLE of geranium oil distilled in British East Africa, probably from *Pelargonium radula* var. *quercifolium*, had the following constants: sp. gr. 0.890; optical rotation, -10° ; refr. index at 25°C , 1.4706; esters as geranyl acetate, 9.6%. The odour of the oil was reminiscent of labdanum. Three samples of thyme oil distilled in British East Africa from: (1) English thyme grown from seeds, (2) English thyme grown from young plants, (3) French thyme grown from seeds, had the following constants:—

	Yield.	Sp. gr.	Phenols.	Refr. index.	Phenols.
No. 1	0.50%	0.001	32%	1.4900	Solidify
No. 2	0.70%	0.005	32%	1.4768	Liquid.
No. 3	0.38%	0.005	40%	1.4903	Partly crystalline.

The phenols in the oil from plants grown from English seed consisted chiefly of thymol whilst the phenols in the oil from English plants were apparently chiefly carvacrol. The climate of British East Africa is entirely favourable to the growth of *Thymus vulgaris* and probably would also be well suited to *Origanum hirtum* and other plants of the same species.—T. C.

Bay leaf oil industry of the West Indies. Report of Botanic and Experiment Station, Montserrat. Perf. and Essent. Oil Rec., 1914, 5, 425—427.

The bay leaf oil industry of the West Indies is gradually undergoing systematic improvement. An experimental plot of one acre was planted in Montserrat in 1908, and monthly reappings of the leaves commenced in January 1911, the yield of leaves and oil and the constants of the oil for each reaping being recorded to determine the factors operating towards improved yield and distillate. The monthly results obtained in 1913 are tabulated. It is suggested that bay leaf oil should be sold under certificate as the product of *Pimenta* or *Myrcia acris* and have a phenol content of 55—65%.—T. C.

Aspirin [acetylsalicylic acid]; Decomposition of — by water. D. E. Tsakalotos and S. Horsch. Bull. Soc. Chim., 1914, 15, 743—747.

In aqueous solutions, acetylsalicylic acid decomposes slowly into acetic and salicylic acids. The decomposition of a solution of 1 grm. in 500 c.c. of water, as measured by the increase of acidity, was nearly complete in about 100 days, and was accelerated by mineral acids. Acetic and citric acids accelerated the decomposition at first, but afterwards had a slight retarding influence.

—F. SHDN.

Denatured alcohol for rectified alcohol; Rapid tests to detect the substitution of —. F. Richard. J. Pharm. Chim., 1914, 10, 429—437.

The tests depend on the fact that acetone, always present in denatured alcohol, gives an immediate precipitate of iodoform when treated with iodine and an alkali. 1 c.c. of an aqueous or alcoholic liquid containing 1 part of acetone in 10,000 gives at once a distinct turbidity when treated with 1 c.c. of tincture of iodine prepared with pure alcohol or 2.5 c.c. of the official solution of iodine in potassium iodide and 20 c.c. of a 5% solution of potassium hydroxide. Iodine tincture is tested for the presence of denatured alcohol by mixing 1 c.c. with 20 c.c. of 5% of potassium hydroxide solution. The tincture may be shaken with copper turnings to remove the free iodine and neutralised, if acid, by treatment with copper oxide. When 5 c.c. is treated with a drop of a 0.1% solution of potassium permanganate the latter is immediately reduced if denatured alcohol be present. Preparations such as camphor tincture may be mixed with an equal volume of water and shaken out with twice the volume of pure ether, and the aqueous portion tested with iodine or permanganate.—F. SHDN.

Modification of the Kjeldahl method for determining nitrogen in organic substances. Wunder and Lascar. See XXIII.

XXII.—EXPLOSIVES; MATCHES.

Explosives; Production of — in the United States in 1913. A. H. Fay. Tech. Paper No. 85, U.S. Bureau of Mines, Washington, 1914.

The total production of explosives in the United States in 1913 was 463,514,881 lb., a decrease of 25,878,250 lb. on the production in 1912 (see this J., 1914, 768). The production of black powder amounted to 191,146,747 lb., permissible explosives 27,685,770 lb., and other high explosives 211,682,364 lb. In coal mines of the United States, 209,352,938 lb. of explosive was used in 1913 to produce 570,048,125 tons of coal; this is an increased production from 2.36 to 2.72 tons of coal per lb. of explosive over 1912. The use of "permissible" explosives in coal mines continues to increase.

PATENTS.

Safety explosives. A. C. Pearey, and Curtis's and Harvey, Ltd., London. Eng. Pats. 7647 and 17,656, March 26 and July 25, 1914.

A COOLING agent consisting of potassium nitrate, borax, and sodium or potassium chloride, is incorporated with a nitroglycerin-collodion cotton explosive.—O. E. M.

Nitrating cotton in vacuo; Process and apparatus for —. L. Dumons. First Addition, dated Feb. 14, 1914, to Fr. Pat. 445,833, July 6, 1912 (this J., 1912, 1203).

The bottom of the nitrating vessel is connected with a three-way cock by means of which it can be connected with one or other of two receivers. By means of a four-way cock, which is operated in unison with the three-way cock, each of these receivers can be connected alternately with a suction device and with a supply of compressed air. The nitrating acid flows from a high-level reservoir into the nitrating vessel and thence into each of the low-level receivers in turn, whence it is raised by the compressed air to the high-level reservoir.—A. S.

Explosive charges; Process and apparatus for the preparation of — from fusible explosives by centrifuging. Deutsche Sprengstoff-Akt.-Ges. Fr. Pat. 469,217, March 4, 1914. Under Int. Conv., March 29, 1913.

The moulds containing the fused explosive are suspended from stirrups attached to the periphery of a horizontal disc, which is rapidly rotated. A solid charge of high density, free from blow-holes, is obtained.—A. S.

Explosives with liquid oxygen; Absorbent material for use in forming —. Soc. l'Air Liquide, Paris. Eng. Pat. 29,773, Dec. 24, 1913. Under Int. Conv., Dec. 28, 1912.

SEE Fr. Pat. 463,876 of 1912; this J., 1914, 376.

XXIII.—ANALYTICAL PROCESSES.

Iron; A sensitive reaction, and colorimetric method for the determination of —. L. Tschugaeff and B. Orelkin. Z. anorg. Chem., 1914, 89, 401—404.

FERROUS salts give with 1.2-dioximes an intense red coloration, and the reaction is so sensitive that, using dimethylglyoxime for example, less than 0.00000005 grm. Fe can be detected in a solution containing 0.000000006 grm. Fe per c.c. Since ferric iron does not give the reaction, the

addition of a reducing agent (*e.g.* hydrazine sulphate) is always necessary. For the colorimetric determination of minute quantities of iron, 50 to 70 c.c. of the solution is mixed with 1 gm. of hydrazine sulphate and 5 c.c. of a saturated alcoholic solution of dimethylglyoxime, heated to boiling, and, after adding 10 c.c. of 25% ammonia, again heated for half a minute. The liquid is then diluted to 100 c.c. and compared with a standard tint freshly prepared from a solution of known iron content. The results are accurate to within 1–2% and are not influenced by the presence of alkali, alkaline earth, or magnesium salts. Zinc and aluminium, on the other hand, vitiate the accuracy of the determination.

—G. F. M.

Zinc; Cyanometric determination of—W. D. Treadwell. *Chem.-Zeit.*, 1914, 38, 1230–1232. (See also this J., 1910, 300, 375.)

For single volumetric determinations of zinc the use of standard potassium cyanide solution is preferable to titration with sodium sulphide or potassium ferrocyanide. The method gave satisfactory results in very dilute solutions: *e.g.* amounts of zinc varying from 0.25 to 0.01 gm. in 100 c.c. gave a mean error of 0.3 mgrm. Quantities of 6 mgrms. were estimated with fair accuracy by working at 5° C. Special operations are necessary in determining zinc in ores. A weighed amount (*e.g.* 0.5 gm. for an ore containing 30% Zn) of the powdered ore is evaporated almost to dryness in a covered porcelain dish with concentrated hydrochloric acid (7 c.c.), a little concentrated nitric acid being added if necessary. After partial cooling the residue is heated with a slight excess of sulphuric acid until copious white fumes are evolved, washed into a conical flask with water (25 to 40 c.c.), and digested with sulphuric acid (10% free acid) and aluminium turnings (5 grms.) until complete precipitation of the copper and reduction of the iron are attained. The solution is filtered rapidly, neutralised with sodium hydroxide, using methyl-orange indicator, and, after the addition of sulphuric acid (3 to 5 c.c. *N*/1 acid per 100 c.c.), treated with hydrogen sulphide for 15 mins. The corked flask is kept in a warm place for 30 mins. and the cooled contents are then filtered, and the filter thoroughly washed with a 2% ammonium sulphate solution containing a little hydrogen sulphide. Dilute hydrochloric acid (5 to 7 c.c. concentrated acid to 10 c.c. water) is next passed repeatedly through the filter, which is finally washed 5 or 6 times with hot, very dilute hydrochloric acid. Hydrogen sulphide is boiled off completely from the filtrate and washings, which are then washed into a small flask provided with a ground-glass stopper. First strong, then *N*/2, potassium hydroxide is added drop by drop till the solution is neutral to methyl-orange. Ammonium chloride (1 gm.) is added and the solution titrated with *N*/2 potassium cyanide between 15° and 20° C. At the point marked by the clearing of the liquid $4\text{CN} \equiv 1\text{Zn}$. Cadmium is not completely precipitated by aluminium: in this case, after treating with aluminium, hydrogen sulphide is passed into the hot solution until it becomes cold, the precipitate is filtered off after 30 mins., the greater part of the hydrogen sulphide boiled off, and the process continued as above. Electrolytic alkali, containing hypochlorites, is unsuitable for these processes. Acid solutions containing only zinc and iron are neutralised with dilute alkali until the resulting cloudiness disappears only with difficulty. To the boiling diluted solution (300 c.c.) is then added, drop by drop, a solution of potassium nitrite (1 gm.) and ammonium chloride (1 gm.). After settling, the precipitate is separated and washed well with hot water: provided that not more than 0.1 gm. iron

was originally present it is then free from zinc. The filtrate and washings are concentrated on the water-bath to 150 c.c., and the treatment with potassium nitrite and ammonium chloride is repeated. The ensuing filtrate, after concentrating to 40 c.c., is freed from nitrous acid by boiling with hydrochloric acid, washed into a flask, neutralised, and titrated with potassium cyanide.

—J. R.

Nitrogen in organic substances; New modification of the Kjeldahl method for the determination of—M. Wunder and O. Lascar. *Ann. Chim. Analyt.*, 1914, 19, 329–332.

From 0.1 to 0.6 gm. of the substance is weighed into a glass tube about 15 mm. high and 10 mm. in diameter, and introduced into a 300 c.c. vessel of Jena glass together with 3 grms. of oxalic acid, 2 grms. of sodium oxalate, and 0.5 gm. of freshly calcined vanadium pentoxide. A mixture of 5 c.c. of syrupy phosphoric acid and 25 c.c. of concentrated sulphuric acid is then added, cooling if necessary, and the mixture is heated gradually, with frequent shaking, until the organic matter is completely destroyed, when the liquid assumes a yellowish-green colour. If the organic substance contains nitrogen directly united to oxygen, two or three pieces (about 0.75 gm.) of iron wire should be added during the heating, and in all cases, after the liquid has cooled, it is diluted with 100 to 150 c.c. of water and heated gently with 0.5 to 0.75 gm. of iron wire for 30 mins. It is then transferred to a large flask, made alkaline with sodium hydroxide, and subjected to the ordinary Kjeldahl distillation process, the ammonia being absorbed in *N*/5 H_2SO_4 . The method is applicable to the determination of nitrogen in all forms of combination, and results are given with such different substances as morphine, indole, nitroso-dimethylaniline, oximes, and picrates, which show excellent agreement with the theoretical values.

—G. F. M.

Phosphorus; Gravimetric determination of minute quantities of—H. S. Raper. *Biochem. J.*, 1914, 8, 649–655.

BREARLEY and Ibbotson's method for the determination of phosphorus in steel is modified so as to be applicable to organic substances of which the quantity available is but small; the method consists, essentially, in oxidising the phosphorus to phosphoric acid, precipitating this as ammonium phosphomolybdate, and determining the molybdenum in the precipitate as lead molybdate. The substance is oxidised in the usual way with about 10 c.c. of a mixture of nitric and sulphuric acids, the volume of the residual solution is measured, and the solution is rinsed into a flask; 15 c.c. of 50% ammonium nitrate solution is added, then 0.75 c.c. of ammonia (sp. gr. 0.88) for each c.c. of the residual acid solution, and the whole is diluted to 100 c.c., heated to 80° C., treated with 10 c.c. of 10% ammonium molybdate solution and shaken for about 2 minutes; if precipitation does not commence within this time, less than 1 mgrm. of P_2O_5 is present and 5 c.c. of potassium hydrogen phosphate solution (5 c.c. = 1 mgrm. P_2O_5) is added; the mixture is maintained at 80° C. for a further 20 minutes, the precipitate then collected on a small paper-pulp filter, washed twice with cold water, dissolved in 6 c.c. of 10% ammonia, and the phosphoric acid again precipitated by treating the solution with 11 c.c. of nitric acid, 8 c.c. of ammonium nitrate and 8 c.c. of ammonium molybdate solution, and heating to 80° C. for 20 minutes. The yellow precipitate is collected, dissolved in 6 c.c. of dilute ammonia, 11 c.c. of concentrated hydrochloric acid and 10 c.c. of 4% lead acetate solution added, the mixture

heated to boiling and poured into a boiling mixture of 50 c.c. of 20% ammonium chloride solution and 50 c.c. of 50% ammonium acetate solution. The precipitate of lead molybdate is collected, washed with hot water, dried, ignited, and weighed. The weight of the precipitate multiplied by 0.0159 gives the quantity of P_2O_5 . If 5 c.c. of phosphate solution were added, 1 mgrm. of P_2O_5 is deducted from the result. The method may be employed for the determination of quantities of P_2O_5 as small as 0.1 mgrm.—W. P. S.

Flame standards in photometry. Rosa and Critten-den. See IIb.

Determination of ammonia by the boric acid method. Winkler. See VII.

Detection of carbonic acid, especially in mixtures of carbonate and sulphite. Petersen. See VII.

Salts coloured by cathode rays. Goldstein. See VII.

Determination of nitrogen in steel. Barton. See X.

Analysis of platinum. Mylius and Mazzucchelli. See X.

Determination of copper and lead in Babbitt metal. Hagmaier. See X.

Influence of atmospheric conditions in the testing of sugars. Bates and Phelps. See XVII.

Determination of original gravity of beers by the distillation process. Thorpe and Brown. See XVIII.

Value of dried brewers' grains as a feeding material. Halnan. See XIXa.

Rapid determination of magnesium in water analysis in presence of calcium. Froboese. See XIXb.

Detection of oxymorphone [pseudomorphone] in presence of morphine. Grimbert and Lelère. See XX.

Standardisation of commercial papain. Heyl and others. See XX.

Rapid tests for detecting the substitution of denatured alcohol for rectified alcohol. Richard. See XX.

Determination of allantoin in urine in presence of dextrose. Plummer and Skelton. See XX.

PATENT.

Gas-analysis apparatus; Automatic——. C. W. Heath, Cincinnati, Ohio. U.S. Pat. 1,121,244, Dec. 15, 1914. Date of appl., Feb. 21, 1913.

THE gas is drawn into a measuring vessel by the outward movement of an inert liquid separated from the driving liquid by a flexible diaphragm. The gas is then displaced through an absorbing vessel to a second measuring vessel by the inward movement of the inert liquid, the result of the analysis is automatically recorded, and the gas residue discharged.—W. F. F.

XXIV.—MISCELLANEOUS ABSTRACTS.

Chemiluminescence. S. Moeller. Archiv Pharm. Chem., 21, 440. Pharm. J., 1915, 33.

THE appearance of light has been noted in several chemical reactions, notably in that of Grignard, when an ether solution of an alkyl halide reacts

with magnesium dust. A red light is developed on mixing 35 c.c. of each of the following solutions:—A 1:2 potassium carbonate solution, a 1:10 pyrogallol solution, and a 35:100 formaldehyde solution; then adding 50 c.c. of 30:100 hydrogen peroxide solution. Also phenylmagnesium bromide, in ether solution, develops an intense green light on contact with moist air. The effect is not, however, due to the moisture, but to oxidation. The luminescence is stronger in an atmosphere of pure oxygen than in other gases. Ether which has stood for some months over calcium chloride reacts well; some, but not all, specimens of official ether do so also. Chemiluminescence is observed with most organic magnesium compounds, and its intensity is directly proportional to the molecular weight of the halogen derivative.

Reductase; Action of poisons on — and attempts to isolate this enzyme. D. F. Harris and H. J. M. Creighton. Biochem. J., 1914, 8, 585—590.

THE reductase present in pigeon's liver and muscle is soluble to some extent in 0.75% sodium chloride solution and in a mixture of this solution with glycerol, but not in pure glycerol; all attempts to isolate the active enzyme failed. The action of a number of substances (arsenious acid, potassium cyanide, mercuric chloride, gold chloride, osmic acid, manganous chloride, formaldehyde, etc.) on the activity of the enzyme is recorded. At higher concentrations some of the substances are relatively much more poisonous than at lower concentrations. Thus, formaldehyde has no toxic action in 0.01 molar solution but is the most active poison when the concentration is increased to 0.1 molar. The action of the poisons is discussed from a physiological point of view.—W. P. S.

Hydroxides of silicon, aluminium, and iron; Adsorptive power of —. VII. P. Rohland. Z. anorg. Chem., 1914, 89, 161—166.

THE determining factor in the adsorption of dyestuffs by colloidal clay, and also by colloidal hydrated zirconium oxide (this J., 1912, 847; 1913, 792) is the colloidal character of the dyestuff and not its acid or basic nature (compare Chapman and Siebold, this J., 1912, 808), or the number of atoms in its molecule (compare Biltz, this J., 1911, 677). For example, Vesuvium, a basic dyestuff, is only sparingly adsorbed, and Aniline Red, Malachite Green, Fluorescein, and Aurin, though having less than 55 atoms in the molecule, are all adsorbed by kaolin. The failure of Carli (Z. physik. Chem., 1913, 85, 2) to observe appreciable adsorption of colloidal ferric hydroxide by kaolin was probably due to the use of kaolin of low plasticity. Highly plastic kaolin from Saxony adsorbs colloidal ferric hydroxide almost completely.—A. S.

Trade Report.

Competition with Germany and Austria-Hungary.

IN connection with the efforts of the Board of Trade to assist British manufacturers and merchants to secure trade formerly in the hands of Germany and Austria-Hungary, lists have been prepared showing articles which a number of inquirers desire to purchase or to sell. The seventh list is now ready, and may be obtained by United Kingdom manufacturers and traders, together with copies of the previous lists (see this J., 1914, 896, 946, 1037, 1077), on application to the Board of Trade, Commercial Intelligence Branch, 73, Basinghall Street, London, E.C.

German Bureau of Chemical Technology. Chem. Trade J., Jan. 9, 1915.

THE recently organised German Advisory Bureau for Technical Subjects and Chemical Technology (Deutsche Begutachtungsstelle für Technik und Chemische Technologie) intends to open a central bureau in Hamburg to give information on all subjects connected with German manufactures and all new products put on the market. This undertaking is said to be well supported financially, and should prove very useful to German trade. Catalogues of all German manufacturers will be collected and classified. Special attention will be given to pushing German interests abroad. In carrying out this object the Advisory Committee will conduct its operations in all civilised countries. The Institute will employ a number of technical engineers and chemists, who will not only be skilled in their particular branches, but have a thorough practical knowledge of foreign languages. Care will be taken to co-operate with the manufacturing and commercial interests concerned, and to maintain the Advisory Bureau as a neutral official institution, whose opinions will be given from a strictly impartial standpoint. The institute is independent, it is asserted, of any private commercial or trade interests whatsoever.

France. Prohibited exports. Board of Trade J., Jan. 7, 1915.

A FRENCH Presidential Decree, dated the 21st December, embodies a revised list of prohibited exports. In virtue of this Decree, the exportation and re-exportation of the undermentioned articles from France is prohibited:—Acetone; acetic acid and medicinal salts thereof; nitric acid; salicylic acid; sulphuric acid; special steel; amyl, methyl and ethyl alcohols; anhydrous and hydrated alumina and salts of alumina; aluminium, ore and metal, pure or alloyed; antimony, ore and metal, pure or alloyed; antipyrine; aspirin; atropine; beetroots destined for the manufacture of sugar; bismuth and bismuth salts; rosin; colophony; oil of turpentine; bromine and bromides; caffeine; camphor; indiarubber, balata, gutta-percha, crude or melted down, including rubber waste and ebonite; calcium carbide; wood charcoal; carbons for electricity; chloral; chlorates and perchlorates; chloroform; chloride of lime; scrap and waste iron and steel; cocaine; collodion; wood creosote; copper, ore or metal, pure or alloyed, boilermakers' wares and tubes of copper; hydrogen peroxide; cinchona bark; tin, ore or metal, pure or alloyed; sulphuric and acetic ethers; ferro-chrome, ferro-nickel, and all ferro-metallic alloys; insulated wire and cable for electricity; formol; oleaginous fruits and seeds; glycerin; mineral tar and chemical products derived therefrom; animal greases (fats) other than that from fish (tallow, lard, lanoline, margarine); mineral oils, crude, refined, essences and heavy oils (petrol, benzol, toluene, etc.); castor and pulghera oils; iodine, iodides, and iodoform; condensed milk, with or without the addition of sugar; yeasts; filings and waste of copper, tin, zinc, pure or alloyed; magnesium; mercury (ore and metal); chrome, manganese and tungsten ores; iron ore; nickel, ore or metal, pure or alloyed; nitrates and nitrites; opium and preparations with base of opium; platinum; photographic plates and papers; lead, ore and metal, pure or alloyed, lead pipes; potassium, potash and potash salts; gunpowder and similar explosives (gun-cotton, nitrated cotton, nitroglycerin, etc.); amidopyrine (pyramidon); quinine and salts thereof; sea salt, salina salt, and rock salt, crude or refined; thorium salts, cerium salts, and other salts of rare earths; caustic soda; sulphur and pyrites; sugar,

unrefined, refined, and candy; sulphonals; dyes derived from coal-tar (alizarin, aniline); theobromine; cake from oilseeds, and brewery dregs for feeding cattle; zinc, ore or metal, pure or alloyed.

Exemption from the above prohibitions, however, may be accorded, under conditions to be laid down by the Ministry of Finance. General permission has been granted for the export of iron ore to the United Kingdom.

German prohibition of exports. Chem. and Drug., Jan. 16, 1915.

THE Pharm. Zeit., in its issue of January 2, 1915, states that a new Decree of December 24, 1914, prohibits the exportation from Germany of the following medicinal and pharmaceutical products. At the same time all former Decrees are revoked:—Acetanilide; acetylsalicylic acid (aspirin); alypine; arecoline and arecoline hydrobromide; ethyl ether; ether (anæsthetic); atropine and its salts and other derivatives; bromine, bromides, hydrobromic acid, bromates, and organic bromo-compounds; cinchona-bark, quinine, quinine salts, and other quinine derivatives; chloral hydrate, methyl and ethyl chlorides in tubes and flasks; chloroform; coca-leaves, cocaine and its salts; colchicine; diethylbarbituric acid and its salts (e.g., medinal); digitalis-leaves and their preparations (e.g., digalen, etc.); duboisine and its salts and other compounds; eucaine; formaldehyde solution, paraformaldehyde; galls; gutta-percha-tissue; ipecacuanha (also when free of emetine); iodine (crude and re-sublimed), hydriodic acid, iodides, and organic iodo-compounds; carbolic acid; rubber; codeine and its salts; caffeine and its salts, derivatives, and preparations; cresol, cresol-soap solutions, lysol; mastic and mastic preparations, such as mastisol; morphine and its salts and compounds; anæsthetic mixtures (such as Schleich, etc.); novocaine and its compounds and preparations; opium and opium-preparations (such as powdered opium), opium tinctures, opium extract; pantopon; paraffin; Peru balsam; phenacetin; propional; dimethylamino-phenyldimethyl-pyrazolone (pyramidon); phenyldimethylpyrazolone (antipyrin); phenyldimethylpyrazolone salicylate (salipyrin); mercury and mercurials and preparations, such as ointments, tablets of corrosive sublimate; castor oil; salicylic acid and its salts; salvarsan and neo-salvarsan; colchicum-seeds and preparations thereof; Schleich's solutions and Schleich's tablets for the preparation of the solutions; scopolamine (hyoscine) and its salts; suprarenine, adrenalin, paraneprine, epinephrine, epirenin, and their compounds and preparations; senega; simarubabark; theobromine and its salts, compounds and preparations; tropacocaine and its compounds and preparations; vaseline; veronal, veronal sodium; tartaric acid; bismuth and bismuth-compounds; wool-fat, lanoline; citric acid. A large number of articles for which the prohibition of exportation had been revoked are replaced on the list—e.g., salvarsan and neo-salvarsan.

Books Received.

COPPER SMELTING INDUSTRIES OF CANADA. A. W. G. Wilson. Report No. 209. Dept. of Mines, Canada. See X.

INDEX TO PATENTS, TECHNOLOGY, AND BIBLIOGRAPHY OF CHINA WOOD OIL. G. H. Stevens and J. W. Armitage. See XII.

Birmingham Section.

Meeting held at Birmingham University, on
Thursday, December 10th, 1914.

MR. H. T. PINNOCK IN THE CHAIR.

POLYMERISED DRYING OILS.

BY R. S. MORRELL, M.A., PH.D.

When linseed oil is heated it gradually thickens and grades of "litho oils" are produced depending on the temperature and the duration of the heating. According to Lewkowitsch (*Oils, Fats, and Waxes*, 4th ed., Vol. 3, 95), the thickening is a polymerisation process. There is no appreciable oxidation, but the iodine value is lowered and the oil no longer gives a crystalline hexabromide. The "litho oils" (burnt varnishes) dry fairly quickly at the ordinary temperature, but in the thick lithos the drying power has much deteriorated. The glyceryl radicle of the oil is unaltered in the process. Lewkowitsch states that the chemical changes are not yet fully understood and they may be conveniently summarised under the term polymerisation. Safflower, sterulia, poppyseed, and castor oils also thicken when heated, and in the case of Chinese wood oil (tung oil) the thickening is very rapid and is difficult to control. The final stage is the production of a gelatinous mass, solid in the case of tung oil, which is insoluble in ordinary solvents, but easily saponified by alcoholic potash. The acids obtained from the above oils possess in like manner the property of thickening when heated.

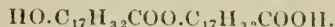
Litho oils have been studied by a number of investigators, among whom may be mentioned Lewkowitsch, Normann (*Chem. Zeit.*, 1907, 188; see this J., 1907, 262), Fahrion (*Farbenzeit.*, 17, 2530; see this J., 1913, 95); Schafringer, Rassow, Wolff (*Farbenzeit.*, 1913, 1171; see this J., 1913, 496), and Fokin (*J. Russ. Phys.-Chem. Soc.*, 1913, 45, 283; see this J., 1913, 496).

Fahrion considers that the polymerisation of tung oil proceeds on the same lines as in the case of linseed oil and that there are indications of mixed glycerides in the oil taking part in the polymerisation.

Schafringer (*Dissert.*, 1913, Freiburg) summarises an investigation on the thickening of castor, linseed, and tung oils. He states that castor oil polymerises to a viscid mass on partial distillation, whereby part of the glyceryl radicle is expelled, but the iodine value is unaltered, showing that polymerisation has not occurred at the position of the double linkages. Linseed oil thickens by union at the double linkages of the molecules and not through oxidation; most probably the linolenic glyceride is the first to be changed. Wood oil thickens similarly to linseed oil and the process may proceed in two stages, of which the first gives at one and the same temperature the same intermediate product, but at different temperatures different intermediate substances are formed. The polymerisation is in no case reversible.

Rassow (*Z. angew. Chem.*, 1913, 26, 316) has shown, in the case of castor oil or ricinoleic acid, that di- and poly-ricinoleic acids are formed whose iodine values are the same as that of the original

acid, but the acid values have been reduced to one half (or less) that of the parent acid. He assigned to di-ricinoleic acid the formula,



Instances of the polymerisation of substances containing unsaturated groupings are so numerous that mention need be made of only one case which seems relevant to the study of litho oils.

Kronstein (*Ber.*, 1902, 35, 4153) has investigated the polymerisation of styrol ($\text{C}_6\text{H}_5\text{CH}:\text{CH}_2$), which proceeds in two stages. The first stage is a gradual thickening, followed by gelatinisation, which constitutes the second stage. The product of the second stage is insoluble in benzol. The gelatinisation is accompanied by evolution of heat and occurs when half the styrol has passed into the intermediate stage, showing that the gelatinisation must have been produced by union of monomolecular styrol with the intermediate polymeride. Depolymerisation takes place on further heating, and when 50% of the styrol has been distilled off the residue consists of the intermediate substance. Further heating decomposes the styrol molecule.

It has been noticed by investigators that the final product of the thickening of linseed oil is insoluble in light petroleum, and in this communication the results of the study of an intermediate product, soluble in light petroleum but insoluble in acetone, will be described. Similar intermediate products have been obtained from poppyseed and tung oils.

Experimental.

Linseed oil from various sources was thickened in bulk or in smaller quantities in the laboratory, and to avoid oxidation the operation was performed as far as possible in an atmosphere of carbon dioxide or hydrogen. Hydrogen under ordinary conditions or under pressure without a catalyst is stated to have no action on unsaturated fatty acids (*Thorpe's Dictionary, Oils, Fats, and Waxes*, 2nd Ed., Vol. 3, 57); nevertheless it was found that under the conditions of the experiments a very slight addition occurred and subsequently carbon dioxide was used instead. The oil was heated for 28–60 hours at 260°C and the thickened oil was completely soluble in light petroleum. In the case of tung oil the temperature and time of heating were 240°C. and 20 minutes, respectively, and the heating was stopped as soon as any of the substance insoluble in light petroleum was formed, in other words as soon as gelatinisation commenced.

A summary of the constants of the oils showed that a considerable change in the chemical and physical properties had occurred.

The fall in the iodine value is essentially a function of the temperature, because linseed oil which has been kept at 260°C. for 28½ hours, can be heated for a further period of 20 hours at the same temperature without any change, but on raising the temperature to 293°C. and continuing the heating for further 2½ hours, the iodine value fell to 89–97 and a substance was formed which was insoluble in light petroleum and in carbon tetrachloride. The glyceryl values are not very satisfactory, but considerable difficulty was experienced in getting good results by the actin method, and the differences are attributed to unavoidable experimental error.

It is evident that one phase of a change in the linseed oil is complete between 260° and 280°C., and that above that temperature another makes its appearance.

	Linseed oil.				Tung oil.	
	Raw.	Thickened in bulk 260°—280° C.	Thickened in hydrogen at 260°—280° C.	Thickened in CO ₂ at 260°—280° C.	Raw.	Thickened.
Specific gravity (15° C.)	0.933	0.9527 : 0.969	0.9654	0.969	0.9405	0.9561
n_D	1.4831 (19° C.)	—	—	1.4915 (19° C.)	1.5172 (14° C.)	1.5134 (15° C.)
n_D	0.3053 (15° C.)	—	—	0.2998 (15° C.)	0.3140 (14° C.)	0.3117 (15° C.)
Molecular weight (in benzene)	805	—	—	1686—1704	797	1431
Acidity	0.4	5.15	2.4	1.7	3.3	2.3
Saponification value	197—203	188—193	195—196	200—203	192—4	190—201
Iodine value	185	103—106	93—128	118—134	165—168	143—171
Glycerol %	9.62	—	—	10.4	10.47	8.3
Crystalline hexabromide	33.5%	none	none	none	none	none

It was found that the oil, thickened between 260° C. and 280° C., contained two modifications, one insoluble in acetone and the other soluble, but both soluble in light petroleum. These modifications were separated by extracting the thickened oil with hot acetone until no more was dissolved. Five extractions were necessary and about ten times the volume of hot acetone was used. Table 2 gives a comparison of the properties of the modifications. Tung oil shows a similar behaviour to that of linseed oil in furnishing a modification insoluble in acetone. It will be shown later that olive oil does not give an insoluble form, and in the case of poppyseed oil the insoluble modification is not produced below 290° C.

under the investigation of poppyseed oil. The figures given are the extremes, in the case of the iodine values, and the mean in other cases of a large number of determinations, the work of several years. It is noticeable that the 50% transformation resembles the behaviour of styrol.

The investigation of the properties of the two modifications of linseed oil showed that important chemical changes had occurred. The oils (insoluble and soluble in acetone) were transformed into lead or barium salts. The lead salt from the oil, *insoluble in acetone*, was insoluble in ether and the barium salt was only slightly soluble in benzol alcohol (about 17.45% was soluble) but was insoluble in ether. The lead salt from the

TABLE 2.

	Linseed oil.	Thickened linseed oil.		Tung oil.	Thickened tung oil.	
		Insoluble	Soluble		Insoluble.	Soluble
		in acetone.			in acetone.	
Solubility in acetone	100%	42—60%	41—52%	100%	47.5% (240° C.) 27.8% (210° C.)	46.6% (240° C.) 72% (210° C.)
Sp. gravity (15° C.)	0.933	0.9763 0.980	0.9527 0.9593	0.9405	— —	0.9542 0.9408
n_D	1.4831	1.4964	1.4846	1.5174 (12.5° C.)	—	1.5114 (11.5° C.)
n_D	0.3053	0.2892	0.3035	0.3204 (12.5° C.)	—	0.3143 (11.5° C.)
Molecular weight (in benzol)	805	1788—2517	904—975	797	—	876.2
Acidity	0.4	0.2	7.5—8	3.3	0.567	2.47
Saponification value.....	197	190—204	193	192	198.5	192.6
Iodine value	185	97—121	92—143	168	76.5—151	93—140—157

Consideration of the figures in the table allows some important conclusions to be drawn. At 260° C. approximately equal quantities of the two components are present in linseed oil. When tung oil is heated to 240° C. for 20 minutes until gelatinisation commences, or when a substance insoluble in light petroleum appears, approximately equal quantities of the components are present; above that temperature the oil is no longer completely soluble in light petroleum. The modification insoluble in acetone has a much higher specific gravity. The acidity has undergone no great change, and it is only natural that the soluble oil should have the higher acid value. The iodine values are in all cases lower than those of the raw oils; they vary with the time of contact with Wijs' solution. Although the iodine values of linseed or tung oil are practically unchanged when the oil is left in contact with the iodine solution for hours or even days, the iodine values of the components may vary by 30—40 units under the same conditions. This variation can be explained by the slow disruption of the polymerised molecules. Consideration of the molecular weight values shows that the first stage is the production of a double molecule, but the part of the oil soluble in acetone has not varied appreciably. The slightly higher value will be referred to later

oil, *soluble in acetone*, was completely soluble in ether (allowing for the presence of the usual quantity of insoluble lead salts of saturated fatty acids present in linseed oil). The barium salt was dissolved by benzol-alcohol and on cooling 15.5% separated out, consisting of a mixture of an oleic acid with stearic and palmitic acids. The barium salt, soluble in benzol-alcohol, was found to be quite insoluble in ether. Precautions to exclude air and prevent oxidation were taken in all cases.

Barium and lead linolenates and linolates are soluble in ether and in light petroleum. Lead oleate is soluble in ether and barium oleate is very sparingly soluble in benzol-alcohol (Farnsteiner, Z. Unters. Nahr. u. Genussm., 1901, 63) but is insoluble in ether. From the behaviour of the barium and lead salts it was evident that in addition to polymerisation, some linkage movements had occurred either in a displacement relative to the carboxyl group or in a ring formation of the single molecule. All traces of linolenic or linoleic acids had disappeared, but stearic and palmitic acids were still present and could be identified and separated. Some form of an oleic acid was also present.

From the lead and barium salts of the two oils the corresponding acids were obtained in the usual manner.

	Acid from oil insoluble in acetone.	Acid from oil soluble in acetone.
Specific gravity . . .	0.9802 (15° C.)	0.9476 (15° C.)
Mol. weight in acetic acid)	363—452* (*Sample not completely soluble in light petroleum)	311—344
Iodine value	108—135	137—143.6
Salts	Ba and Ag salts insoluble in water; Na salt crystallisable from alcohol	—
	Partially reduced to stearic acid by hydrogen and nickel	—
Oxidation products of acids with alkaline permanganate	Traces of dihydroxystearic acid. Some caproic, azelaic, stearic, and palmitic acids, no sativic or linusic acids	13% yield of dihydroxystearic acid. No sativic or linusic acids. The unattacked acid gave a silver salt:— $C_{18}H_{31}(OH)_2O_2Ag$.

The acid from the oil, *insoluble in acetone*, became insoluble in light petroleum when kept in a vacuum. On distillation at 245°—250° C. (44 mm.) about 50% passed over, leaving a dark residue. On redistillation at 225°—230° C. (15 mm.) the whole of the first distillate passed over and gave a solid acid (m.p. 31°—32° C.). The iodine value of this acid was 109 and it gave a fluid dibromide (35.1% Br). Analysis of the acid showed it to be $C_{18}H_{32}O_2$ or $C_{18}H_{34}O_2$, with a molecular weight 278 (in glacial acetic acid).

When the acid obtained from the oil, *soluble in acetone*, was distilled, about 50% passed over at 222° C. (20 mm.), leaving a waxy residue soluble in ether, but insoluble in light petroleum and in glacial acetic acid. In benzene solution the residue gave a molecular weight value of 2803 and an iodine value of 118—141. (The molecular weight of oleic acid in benzene is double that of the acid in glacial acetic acid solution). The distillate was fluid and on analysis gave numbers agreeing with the formula, $C_{18}H_{32}O_2$ or $C_{18}H_{34}O_2$. Its molecular weight in glacial acetic acid was 289 and its iodine value 139—140 (unchanged with the time). On reduction with hydrogen and nickel it gave a 78% yield of stearic acid.

From the above facts it is evident that all traces of linolenic and linolic acids have disappeared. Moreover it seems most probable that mixtures of acids are present in the insoluble and soluble forms of the oil, in accordance with Fahrion's view that the oil contains mixed glycerides. It is clear that the acids obtained from the oils are monomolecular rather than dimolecular and that on distillation polymerisation of part occurs.

The distillates are monomolecular and un-polymerised; moreover they are more saturated, and the open chain character is shown, in the case of the oil soluble in acetone, by the reduction to stearic acid almost completely. The iodine values, molecular weights, and the general properties of their salts are best explained on the assumption of mixtures of altered (unoxidised but partially polymerised) linolenic, linolic, and oteic acids.

A comparison of the properties of olive oil and heated olive oil showed that the evidence of isomeric change in a non-drying oil was very slight.

In order to throw light on this assumption it was necessary to investigate the methyl esters

of the thickened linseed oil and to examine the properties of poppyseed oil, because isomerism may occur when this oil is kept at 260° C. for some time.

TABLE 3.

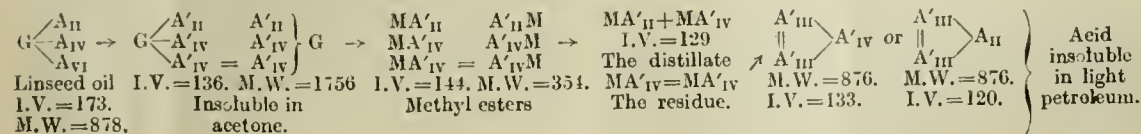
Olive oil.

	Raw.	Thickened at 260° C. for 28 hours.
Sp. gr.	0.9154	0.9254
no.	1.4704 (19° C.)	1.4720 (18° C.)
I.V.	85—94	72.5—85
Lead salt	soluble in ether (8% saturated acids)	soluble in ether (11.3% saturated acids)
Barium salt	74% insoluble in benzol-alcohol	67% insoluble in benzol-alcohol
Barium salt	insoluble in ether	insoluble in ether
Cerium salt	soluble in ether	almost completely soluble in ether
I.V. oleic acid . . .	96	92

Methyl esters from thickened linseed oil (insoluble in acetone). These were prepared by Bull's method (Ber., 1906, 38, 3570; this J., 1906, 1158) from a linseed oil, insoluble in acetone, which had a molecular weight 1964 and iodine value 130. The methyl esters had the following constants:—Sp. gr., 0.9381 (15° C.); n_D 0.3063 (20° C.); acidity, 14.2 (i.e. 7% free fatty acids); iodine value 121.3 (1½ hours), 163.7 (384 hours); [for olive oil the iodine value is 92 (1½ hours), 86.7 (384 hours)]. Molecular weight in benzene, 362—377 (calculated for a simple ester, 294). The yield was 86% of the theoretical. On distillation about 40% passed over between 200° and 213° C. (15 mm.). The correct boiling point may be considered as between 203° and 210° C. The distillate was colourless and solidified to a waxy solid of m. pt. 7°—9° C. with a specific gravity 0.8936 (15° C.), n_D 0.306 (20° C.); molecular refraction, M_D = 89.9, and iodine value 131 (1½ hours) and 131 (72 hours). Molecular weight in benzene, 278 (calculated 294). The methyl ester, distilled as above, was found to contain traces of methyl stearate, which were removed as the acid, and the ester after removal of the saturated acid gave a tribromo-acid. On reduction with hydrogen and colloidal palladium some stearic acid was obtained.

The residue left in the flask had a molecular weight 628 and sp. gr. 0.9725; molecular refraction, M_D = 188.7, and iodine value 124 rising to 166 in 5 days. This substance was not homogeneous, because 62% was insoluble in light petroleum, and the insoluble part had iodine value 115—184 and a mean molecular weight 870. From it an easily crystallisable sodium salt was prepared, of m. pt. 232° C. (Na 7.6%) with iodine value 120, rising to 181—185 in 6 days (sodium oleate, iodine value 80.3, rising to 86.8 in 6 days).

From the examination of the methyl esters it appears that mixed glycerides must be present in the linseed oil (insoluble in acetone). If linseed oil be assumed to contain glycerides of the acids A_{II} , A_{IV} , A_{VI} (where A is a C_{18} acid combining with 2I, 4I, and 6I, respectively, and the proportions of A_{II} , A_{IV} , A_{VI} are variable and interchangeable between molecules), then the oil insoluble in acetone would consist largely of molecules according to the following scheme:—



The proportion of A_{II} present is really much smaller than is given by the above scheme, and it is replaceable by small amounts of stearic and other saturated acids, which will account for their occurrence in the oil insoluble in acetone. It must be noted that the above supposition does not account for 50% of the insoluble modification formed in the thickening. The acids, A'_{II} , A'_{IV} , A'_{VI} , are different, after the thickening, from the ordinary oleic, linolic, and linolenic acids, and there would seem to be good reason for the conclusion that linkage changes have occurred during the thickening and anterior to the polymerisation.

Thickened linseed oil (soluble in acetone). If linseed oil, soluble in acetone, be heated above 260° C. to 292°—315° C., it thickens and about 50% becomes insoluble in that solvent. (The modification originally insoluble in acetone at 260° C., when heated for 5 hours at 293° C., gave nearly 50% insoluble in light petroleum.)

If it be considered that the linolenic glyceride be the first to undergo polymerisation, then it is evident that in the case of the oil, soluble in acetone, the glyceride containing the linolic acid will be the most important factor.

Rollet (Z. Physiolog. Chemie, 1909, 33, 411; this J., 1909, 1209) and other investigators have worked out the properties of linolic acid from the study of the unsaturated acids present in poppyseed oil. It was therefore necessary to examine in detail the changes which poppyseed oil undergoes when heated, and to compare them with those of the thickened linseed oil soluble in acetone. The summary is given in Table 4.

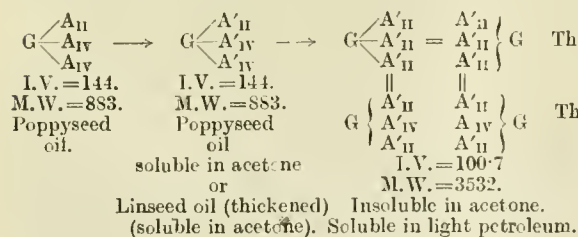


TABLE 4.

	Poppyseed oil.	Poppyseed oil, thickened at 260° C. for 28 hours.	Thickened linseed oil (soluble in acetone).
Specific gravity	0.92418 (18° C.)	0.9354 (22° C.)	0.9527 (15° C.)
n _D	1.4737 (20° C.)	1.4792 (22° C.)	1.4846
M.W.	776.6	900—910	900—974
Acidity	32—33	—	8
I.V.	130—136	115—132	92—143
Solubility in acetone	complete	complete	complete
Lead salt	soluble in ether (6.75% saturated acids)	soluble in ether (8% saturated acids)	soluble in ether
Barium salt ..	soluble in benzol-alcohol, soluble in ether	soluble in benzol-alcohol, 86.2% insoluble in ether	85% soluble in benzol-alcohol, insoluble in ether
I.V. of the acid	126—132	125—132	137—140
M.W. of the acid (in acetic acid)	278	314	311—330
Yield of tetra-bromo acid	50%	6%	No crystalline bromo acid

From the above facts it may be concluded that there is a close connection between the properties of the thickened linseed oil (soluble in acetone) and poppyseed oil thickened under the same conditions. It is evident that the linolic acid has undergone some modification, because although the

iodine value is unchanged, the yield of tetra-bromo acid is small and the solubility of its barium salt is altered.

If poppyseed oil, which has been thickened at 260° C., is heated to 290° C., a further comparison with linseed oil (soluble in acetone) can be shown in the following table:—

TABLE 5.

	Poppyseed oil thickened at 270° C. for 284 hours and at 290° C. for 6 hours.	Linseed oil (soluble in acetone) M.W. 906, I.V. 130—136, heated for 6 hours at 293° C.		
	Soluble in acetone.	Insoluble in acetone.	Soluble in acetone.	Insoluble in acetone.
M.W.	40%	50%	46.9%	40.4%
(in benzene)	989	4054	941	3633
I.V.	97—128	96—134	95—126	104—146
Solubility in light petroleum ..	soluble	soluble	soluble	soluble

The connection between the two oils is again very close. It has not been possible to obtain a modification from poppyseed oil or from thickened linseed oil (soluble in acetone) insoluble in petroleum, which points to the presence of linolenic acid as necessary for its formation.

The following scheme may represent the changes which poppyseed oil undergoes on heating, and may also with some certainty represent the corresponding changes in linseed oil (soluble in acetone).

than when dimethyl sulphate is used instead of sulphuric acid. Linseed oil with dimethyl sulphate and acetic anhydride gives a greenish colour.

The above observation may be considered as evidence of the formation of a ring substance before gelatinisation. The investigation of thickened tung oil is in progress, and the results will form the subject of another paper.

SUMMARY.

(1) Linseed and poppyseed oils contain mixed glycerides of variable amounts of unsaturated acids, in addition to small quantities of saturated glycerides, the acids being interchangeable, and their amounts are dependent on the sources and probably on the ripeness of the seed.

(2) Thickening by polymerisation, without change in chemical composition, occurs when there are at least two pairs of doubly linked carbon atoms in the molecules of the acids of the glycerides.

(3) Before polymerisation occurs there is a shifting of the linkages in the molecule, and, in the case of tung oil, there is some slight evidence of ring formation.

(4) The thickening is due to polymerisation of the mixed glycerides, and the first stage is the formation of a product insoluble in acetone, which may be a double molecule of linked glycerides in the case of linseed oil, or a quadruple molecule in poppyseed oil.

(5) The change is dependent on the temperature, and an equilibrium is established when 50% of the modification has been formed.

(6) At higher temperatures the final stage is the formation of a polymer insoluble in light petroleum which seems to be determined in linseed oil by the linolenic acid glyceride.

The author desires to express his thanks to Messrs. Mander Brothers, of Wolverhampton, for permission to publish the results of this investigation.

DISCUSSION.

MR. F. H. ALCOCK asked what was the cause of the opacity in tung oil varnishes and also of the offensive smell of tung oil? Had any difference been observed in the behaviour of cold-drawn and hot-drawn linseed oils?

MR. COTTERILL inquired as to the method of distinguishing between varying samples in relation to iodine values.

DR. MORRELL explained that when tung oil was exposed to light it passed into an isomeric modification which was very easily oxidised to a white, insoluble substance. It was the formation of this modification and its subsequent rapid oxidation which was essentially the cause of the opacity of wood oil varnishes. The difference between cold-drawn and hot-drawn linseed oil would be in the amount of mucilage present. The linseed oil and the wood oil used contained no rosin. In the coagulation of wood oil by means of dimethyl sulphate great care must be taken in handling the reagent. Arachis oil had not been investigated. In the hexabromide test for linseed oil the hexabromo-acid ought to be separated and its melting point determined. In the determination of the iodine values, all values obtained were compared with a blank determination made with pure olive oil for the same time of contact with the Wijs solution.

Canadian Section.

Meeting held at Toronto on April 16th, 1914.

PROF. J. W. BAIN IN THE CHAIR.

THE MANUFACTURE OF CONDENSED MILK, MILK POWDERS, CASEIN, ETC.

DISCUSSION OF METHODS OF ANALYSIS.

BY R. T. MOHAN, B.A.S.C.

As early as 1810 an English Patent was granted to De Heine covering the evaporation of part of the water from milk, and its preservation with cane sugar. Other early English Patents on condensed milk were granted to Newton in 1835, Grimway in 1847, De Lignac in 1847, and in France to Appert in 1827. The first patent for a vacuum pan for evaporating milk was granted, I believe, to Green in England in 1813 (Eng. Pat. 3754).

The object of these early inventors is clearly shown in Newton's English patent No. 6787, 1835, which reads: "For preparing animal milk so that it may be preserved for any length of time with its nutritive properties, and capable of being transported into any climate for domestic and medicinal purposes; this being effected by adding to the milk a certain amount of sugar, and evaporating it by any suitable means, using only a gentle heat to quicken the operation. It may be brought to the consistency of cream, honey, or soft paste, or even into dry cakes. Cocoa, coffee, or tea may be evaporated with it."

The first instance of the successful manufacture of condensed milk on a commercial scale in America was in 1856 by Gail Borden, founder of the present firm of Borden's (U.S. Patent 15,553 in 1856; English Patent 509, 1856). Up to the year 1861 there was little demand for condensed milk, but during the civil war a great demand was created, and from that time on it has steadily increased.

The Anglo-Swiss Condensed Milk Co. was started by U.S. Consul Page, of Zürich, Switzerland, who first made the product in 1865, and in 1866 incorporated the Anglo-Swiss Co., which now produces over 80 per cent. of all the condensed milk manufactured in Australia and Europe.

Milk was first preserved by sterilisation in 1856, and unsweetened concentrated milk, or what is now known as evaporated milk, was first successfully manufactured in Highland, Illinois, in 1885.

The U.S. Census Report of 1909 shows a production of 214,518,310 lb. of sweetened condensed milk, and 280,278,234 lb. unsweetened evaporated milk, increases of 8% and 154% respectively over 1905. The 1913 output in the United States amounted, I am told, to about 250,000,000 cans of sweetened and about 390,000,000 lb. evaporated.

The milk supply for the condensing must be ample for the factory's capacity, and must be of the highest quality. It is under the rigid inspection of the factory, and constant inspection is also conducted of the herds, pastures, barns, and dairies. Rigid instructions are enforced in regard to cleanliness of the animals and dairies. No feeding or other operation which would raise dust is allowed for one hour previous to milking. Strict instructions are issued against the use of certain foods, such as turnips, garlic, etc., and only limited amounts of ensilage are allowed. Immediately after milking the milk is cooled and aerated by running it over black tin coils through which cold brine or water circulates, and then stored in a cool place till brought to the factory. Each can as

delivered at the factory is opened by the receiver, who is able to detect any undesirable odour in the milk. In addition to the flavour, the temperature is noted. Tests are also made for acidity, any milk above 0.2% being usually refused. As the farmer is usually paid on the basis of percentage of fat, a small sample is taken each day and tested for fat, or sometimes the test is made on a composite sample of a week's delivery, the sample being preserved with mercuric chloride.

It is customary to make frequent bacteriological tests on the supply from each farmer. A good practical test for the number of organisms present in the milk is the redactase test, which is based on the fact that normal cow's milk has the power of decolorising certain dyestuffs, the time of decolorisation (reduction) depending on the number of micro-organisms it contains. The test is conducted as follows:—1 c.c. of methylene blue solution is mixed in a glass tube with 10 c.c. of the milk to be examined, 2 c.c. of paraffin oil is floated over it to exclude air, and the tube is kept at about 115° F. (46° C.). If the dye is decolorised within one hour, the milk is regarded as very bad from a hygienic standpoint; if decolorised within 3 hours it is of second quality; if the colour persists for more than 3 hours the milk is good.

Another test depends on the decomposition of hydrogen peroxide by an enzyme present in milk, known as catalase, the catalytic power of which is increased by the bacteria present. This method has not come into general use in Canada.

To determine the nature of the bacteria, so-called "fermentation tests" are applied. The best known of these is the "Wisconsin curd test," in which a pint of milk is heated in a sterilised jar to about 98° F., 10 drops of standard rennet extract is added, and the jar is closed and incubated for about eight hours at 98° to 102° F. The jar is then opened and the odour observed, the curds are cut with a knife, and the appearance is noted. Good clean milk contains practically no organisms but the lactic acid bacteria, which produce no gas and no bad odours, and the curd formed, therefore, should have only an occasional irregular hole. Milk produced under insanitary conditions will produce more or less gas, and the curds will be full of large irregular holes.

Another "fermentation test" is conducted by incubating samples of the milk in sterilised tubes at about 100° F. After twelve hours the samples are examined, and the bacterial content of the milk is judged by the character of the curd, etc.

The milk after weighing is poured through a large strainer and run into large enamelled vats, fitted with stirrers, on the floor below. The room in which these vats are placed is kept as cool as possible. The treatment of the milk from now on depends on the product to be made.

Condensed milk.—The Canadian standard is not less than 28% of milk solids, and not less than 7.7% of milk fat. The last inspection of milk made by the authorities and recorded in Bulletin 257, Inland Revenue Dept., shows that the product on the market complies exceptionally well with this standard.

The fresh milk is drawn from the receiving vats into large copper vats known as fore-warmers, where it is heated after addition of the requisite amount of cane sugar. Some of the fore-warmers are heated by copper jackets, while others depend on live steam from an open pipe; the latter method introduces some condensed water from the steam, but the amount is very small. The amount of sugar added varies from 16 to 19 lb. to 100 lb. of raw milk. In some cases the sugar is added to the whole quantity of milk before it goes into the pan, whilst in others one-half or three-quarters of the milk is run in, and the sugar added to the remainder. The temperature to which the milk is heated

before it goes to the pan also varies in different factories. These variations by different operators are mainly directed towards overcoming crystallisation in the finished product.

The milk is now sucked into the vacuum pan, and the "condensing" operation begins. The concentration is carried out at a vacuum of about 28 in. and a temperature about 140° F. The vacuum pans used are single type evaporators made of copper, round at each end, with straight sides. They are heated by a steam jacket at the bottom and also internally by large coils, and are connected to a water-jacketed condenser.

The "condensing" takes about two hours. Samples are drawn off at frequent intervals through a double sealed test cup. The consistency is tested by means of hydrometers, the end point being 35° to 36° B. More often, however, the sample is cooled to 70° F., and the appearance and the way the milk "strings" are noted. The operators get quite expert in judging the concentration of condensed milk in this way. As soon as the right consistency is attained, the valves are opened, and the finished product is run into ordinary milk cans (about 14 gallons), which are then placed in a shallow iron tank through which cold water circulates; here they are stirred and cooled, to make the product smooth and free from lumps. The tanks are provided with a series of cam wheels, driven from a central shaft, and so constructed that the milk cans fit rigidly on them. A stationary wooden paddle is placed in each can, and as the cans revolve the milk is stirred and cooled. After cooling, the syrupy product is filled into cans and sealed. This product is not sterilised, preservation being dependent on the low percentage of moisture present and the absence of air in the cans. Table 1 shows the average composition of the product compared with that of other evaporated milks and milk powders. If properly made and kept air-tight, it keeps for several years. It contains too much sugar for use as an infant food.

TABLE 1.

Average composition of condensed milks.

	Solids. %	Ash. %	Fat. %	Pro- tein. %	Lac- tose. %	Cane sugar. %
Condensed whole milk	72.6	1.6	10.0	8.0	12.0	41.0
Condensed skim milk	70.0	2.0	1.0	10.5	14.5	42.0
Evaporated milk	26.3	1.6	7.9	7.7	9.1	—
Whole milk powder . .	96.3	5.6	26.8	32.0	31.9	—
Skim milk powder . . .	91.7	6.9	1.7	33.8	49.3	—

The product obtained as outlined is made from whole milk, and complies with the standard in every way. A skim milk product is also made, but this is always sold as "skim condensed milk." It is manufactured in the same way. (See Table 1 for composition.)

The greatest difficulty in the manufacture of condensed milk is to prevent "sandy," due to crystallisation of the lactose or cane sugar. A decrease in concentration to prevent this is impossible, as the successful keeping of the product depends on its having less than 30% of moisture, and to effect this the sugar must be added in a proportion to give about 41% cane sugar. Over-concentration and the use of too much sugar increase this sandy condition, but even with proper conditions of amount of sugar and percentage of solids, the lactose generally crystallises. Each manufacturer seems to have his own method of overcoming this, and for this reason practice varies in regard to the method of and time of adding sugar, temperature, etc., in the pan, and the method of cooling.

On opening a can of condensed milk a layer of sugar is often found on the bottom. This may either be lactose which has settled, or cane sugar separated out owing to an excess being used. It is not detrimental to the product, except that the layer of milk above may not have enough solids to preserve it as long as it should be kept.

Another defect in condensed milk is so-called "buttons." On opening a can and pouring out the contents, one or more small lumps, varying in size from a pin-head to a bean, may be found, attached to the side of the can. These are called "buttons," and are not easy to explain. Some state that they are insoluble casein compounds formed by the action of the metals of the tin plate. The peculiar feature, however, is that they appear to grow. A satisfactory explanation for this trouble is yet to be given, I believe.

Occasionally a can of milk is found to be in a thick, gelatinous condition. This denotes too much milk solids and not enough cane sugar to make a syrup.

Other defects are rancidity, brown colour, blown tins, or putrid odour. These conditions are due to too low percentage of solids to prevent bacterial changes, but at most they are rarely very marked until the milk is from 2 to 4 years old.

Thus it is seen that the manufacturer is faced with a difficulty as regards this product. Too little sugar may result in a gelatinous product or one that will not keep, whilst too much may cause excessive "sandiness" and separation.

Evaporated milk in Canada is defined as milk from which a considerable portion of water has been evaporated, and contains not less than 26% of milk solids, and not less than 7.2% of milk fat. This product therefore does not contain any added sugar, and is preserved by sterilisation.

The milk is drawn from the receiving tanks into the fore-warmers as before. Here it is brought to a boil, and then drawn into the pan and condensed as before, the operator drawing off an occasional sample, and testing the solids by hydrometer; when the proper density is reached the valves are opened, and the milk is run over a series of cooling coils to prevent any rapid multiplication of organisms. From the coolers the milk runs into large copper vats, and a sample is tested for fat and solids. If these tests are satisfactory, the milk is next homogenised by breaking up the fat globules into very minute particles, and mixing them so intimately with the caseous matter of the milk that the cream does not rise to the top. It is claimed that homogenising makes the milk more digestible. This process is accomplished by heating the milk to about 185° F., and forcing it through fine metal capillary tubes under a pressure of about 250 atmospheres against a conical surface of agate or metal. Homogenised milk cannot be separated by means of a separator. From the homogeniser the milk goes to the filling machines, where it is run into cans, which are sealed and transferred to the steriliser. The sterilisers are large circular iron drums, with a revolving framework inside. The cans, in crates, are placed in compartments of the revolving framework. When filled, the door is closed, the retort nearly filled with water, and the temperature raised to the desired point and maintained for the necessary time, the can revolving all the time. The steam is then turned off, and cold water run in till the cans are cold. The time and temperature are very important, and are very variable, so that this part of the work is in charge of experts. The factors governing the sterilisation are acidity, solids, fat content, the season of the year, and size of cans. Milk of high acidity (over 0.4%) will easily curdle with high temperature, hence the reason for keeping the acidity as low as possible on the fresh supply. The effect of acidity on the milk is shown by Table 2

made from actual experiment. The same milk was used in each instance, and the same temperature and time.

TABLE 2.
Effect of increased acidity on milk. Fresh milk 0.17% lactic acid.

Concentration.	Acidity.	Condition of milk.
1.58 : 1	0.30	Not precipitated
1.74 : 1	0.34	" "
1.90 : 1	0.40	" "
1.99 : 1	0.43	" "
2.11 : 1	0.48	Small lumps of curd
2.25 : 1	0.54	Large " "

NOTE.—Chemical changes during concentration and sterilisation apparently affect the acidity.

Milk of different seasons will stand different temperatures, fortunately the highest in the summer. The fresh milk varies in composition with the seasons, and hence the concentration also has to be varied to bring the product up to standard. Table 3 illustrates this:—

TABLE 3.
Variation in concentration with seasons.

	Solids in fresh milk.	Concentration.	Solids in condensed milk.	Condition of condensed milk.
June	12.68	2.00 : 1	25.38	Smooth, no separation or curdiness.
August	11.75	2.21 : 1	26.01	
November	13.40	1.99 : 1	26.62	

NOTE.—Lower concentration causes separation of fat, and higher causes curdy milk.

In most factories it is customary to make a trial sterilisation on a small batch to see what temperature the milk will stand before it curdles. To do this a small steriliser is built on the same plan as the large one, and holding half a dozen cans. The milk is sterilised at 235° to 240° F. (113°—116° C.) for about 30 minutes. The milk is next shaken to make it smooth and uniform. About 4 dozen cans are fitted into crates, and placed in a machine which has a very rapid oscillating motion for one to three minutes, depending on the milk. After shaking, the milk is stored in a warm place (practically a large incubator) for about three weeks prior to shipping. Any "leaks" or "swells" are then picked out, and the good cans are labelled, cased, and shipped.

This, therefore, is a product which is desirable from every standpoint, handled under sanitary conditions, and completely sterilised. It is a concentrated whole milk product containing no adulterants, and finds a ready use for general and for infant feeding.

Absolute cleanliness is maintained in the factories. All pipes are cleansed daily with hot soda solution and then with live steam, and the vats, coolers, and vacuum pans are scalded, scrubbed, and sand-papered every day.

Defects.—Swells, flat soured, and sweet curdling in evaporated milk are due to under-sterilisation. Curdiness (other than sour curd) is due to precipitation of the curd as a hard mass under the action of the heat on a product of high solids and acidity. The hard grains sometimes found in the bottom of the cans consist of mineral matter, mostly calcium phosphate, precipitated owing to over-concentration.

Plain condensed milk is milk evaporated about 4:1, which is filled into barrels, and used within a day or so by ice cream manufacturers and confectioners.

Analysis of condensed milk.

Sampling.—In the evaporated or unsweetened variety there is little difficulty in getting a uniform sample from the can, as it is only necessary to stir it thoroughly. However, the condensed or sweetened variety presents a possibility of error, especially when the sugar has settled. The best method of sampling in this case is to transfer the whole contents of the can to a large mortar, and thoroughly grind and mix it; a 40% solution is then prepared and analysed.

Solids.—For the sweetened condensed milk a quantity of the 40% solution is evaporated to dryness, *in vacuo*, or in a McGill oven (in which the product is dried in a current of air at 70° C.). Drying to a constant weight on a steam bath or in an ordinary air oven does not ensure accurate results, as the solids seem to retain a small proportion of the moisture with great tenacity, and if dried too long undergo chemical changes.

For the unsweetened or evaporated milk two methods are available, one by taking the specific gravity of the 40% solution and calculating the solids by formula, the other by evaporation and weighing. For taking the gravity hydrometers with special scales, called lactometers, are used. The two most common are the New York Board of Health and the Quevenne lactometers. In Canada the former is used almost entirely. The formula used to calculate the solids is:— $S = 1.2F + 0.25(G - 1000) + 0.14$, where *S* is the percentage of solids, *F* the fat, and *G* the specific gravity referred to water as 1000.

This gives good results, but only providing the fat has been determined accurately. It is obvious, therefore, that this method cannot be relied on entirely, and a quantity of the milk must be dried *in vacuo* and the residue weighed.

Ash is determined by burning the residue after evaporating the milk for solids. A temperature sufficiently high to volatilise the chlorides must be avoided.

Protein is determined by the usual Kjeldahl method. The conversion factor is somewhere between 6.25 and 7.04. Provisionally the factor 6.38 is used.

Sugar.—In evaporated milk the only sugar present is lactose, and this is determined either by the polarimeter or by the gravimetric Fehling process.

In the condensed milk there is, in addition to the lactose, a large percentage of cane sugar, and accurate results are difficult, co-operative work by the U.S. Association of Agricultural Chemists on the same samples having shown results for lactose varying from 9.74% to 12.05%, and for cane sugar from 43.06% to 46.74%.

The author has had a batch of milk prepared specially, and from the weight before and after concentration calculated what the composition of the finished product should be: invariably analysis showed a little more lactose and a little less cane sugar than there should be. It was thought possible that in the concentration there was a slight inversion of the cane sugar, making it appear to be lactose, but from experiments on mixtures of cane sugar and lactose under similar conditions, it is certain that no change takes place.

Fat.—The determination of fat is by far the most important of all, and it is most difficult to get accurate and concordant results.

Table 4 will show some results obtained by different methods. These results only deal with evaporated milk, as the condensed milk requires different treatment.

TABLE 4.

Determinations in Fat by Different Methods.

Calculated fat.	Babcock.	Ether extraction.	Rose-Gottlieb.
% 7.25 7.98 8.74 9.14 9.70 10.35	% 6.9 7.7 8.1 8.7 9.1 10.3	% 6.83 7.46 8.13 8.33 8.67 9.13	% 6.87 7.78 8.26 8.90 9.40 10.07
Average 8.86	8.46	8.09	8.55

The most reliable of these methods is the Rose-Gottlieb, but this averages 0.31% fat low. The reason for these differences lies in the physical change which the milk has undergone during the concentration, homogenising, and the sterilisation. The casein has been invisibly precipitated into an insoluble curd, and each very minute particle of precipitated casein encloses a small amount of fat. In order, therefore, to extract all the fat it is necessary to dissolve completely the curd and liberate the fat. To this end many modifications and new methods have been proposed. With one or two exceptions these are not feasible.

In the ordinary Babcock method it is almost impossible to get a clear fat column: the acid appears to char the milk to a greater or less extent, depending on the concentration, season of the year, etc. The only rapid and accurate modification known to me is as follows:—4.5 grms. of the milk is accurately weighed into an ordinary Babcock test bottle, 17.5 c.c. of water added, and thoroughly mixed. Then 17.5 c.c. of concentrated sulphuric acid is added and mixed to dissolve the curd completely, and the mixture is centrifuged for five minutes. The bottles are filled to the neck with hot half-strength sulphuric acid, centrifuged again for 2 minutes, filled to the top of the graduations with boiling water, centrifuged for 1 minute, and the fat column read at 185° F. This reading multiplied by four gives the percentage of fat in the evaporated milk. The important points to be observed in this method to obtain a clear fat column and complete recovery of the fat, are correct dilution of the milk (4:1) before adding the strong acid, and the addition of hot half-strength acid in place of water after the first centrifuging.

TABLE 5.

Fat by modified methods.

Calculated fat.	Modified ether extraction.	Modified Babcock.
7.25 7.98 8.74 9.14 9.70 10.35	7.20 8.00 8.75 9.20 9.65 10.40	7.30 7.98 8.68 9.20 9.60 10.40
Average 8.86	8.86	8.86

In the gravimetric methods it is also necessary first to remove the caseous matter, and then extract the fat. This is best done by the following method. A weighed amount of the evaporated milk diluted 4:1 is absorbed on a filter coil free from fat, placed in an extraction cone, and without any preliminary drying extracted in a Soxhlet apparatus with 1% acetic acid for two hours. This removes most of the protein matter. The cone is washed with hot

water to remove the acetic acid, dried in an air oven at 100° C. for six or eight hours, and extracted for eight hours with ether in the ordinary way, and the extracted fat weighed.

The reliability of these modified methods is shown in Table 5.

In determining the fat in condensed milk there is an added difficulty of the presence of cane sugar. For gravimetric estimation the modified ether extraction method described above is to be recommended. For a rapid centrifugal method, the following modification (by Leach) gives fair results: 15 c.c. of the 40% solution of condensed milk is measured into a Babcock bottle, and enough of a copper sulphate solution is added to precipitate the proteins. The bottle is then centrifuged, and the precipitated proteins carry the fat to the bottom of the bottle. The clear liquid above is then drawn off by means of a pipette having a wisp of cotton wool over the end to prevent any of the precipitate being withdrawn, and the remaining fat and protein is thoroughly mixed with water and again centrifuged. This operation is repeated until the sugar has all been removed. 17.5 c.c. of water is added to the precipitate, then 17.5 c.c. of strong sulphuric acid, and the operation continued as in the ordinary Babcock test. This method eliminates the trouble due to charring of the sugar, but still has the defects connected with the Babcock test when used for evaporated milk.

Milk powders.—In making these the difficulty has been to produce a powder which when mixed with water would produce a fluid similar to milk in appearance, flavour, and physical properties. Many methods have been tried, and numerous patents granted, but, with one or two exceptions, there has been little success. The two most successful processes are by drying on steam-heated rolls, and by spraying the milk into a tower.

In the roller system, the milk is run on to steam-heated metal rolls, generally *in vacuo*. The dried powder is scraped off the rolls, and ground. The resultant powder, while fairly good, is not as soluble as it should be.

The spraying system has been more successful. The milk is first reduced in a vacuum pan to about one-fifth of its volume. It is then atomised into the top of a hot chamber, the moisture being removed while the fine particles of milk are falling to the floor. The dried product accumulates on the floor as a very dry flour, and needs no grinding. The powders produced by these spraying systems are excellent, and find a ready use with bakers, confectioners, etc. For composition see Table 1.

These products are analysed by making a solution the strength of ordinary milk, and analysing this. All the difficulties mentioned for the analysis of evaporated milk are also met with in this product.

Casein.—When the milk supply is too heavy to be handled by the evaporators, it is usual to skim the milk, ship the cream in to the cities, and prepare casein from the skim milk. The present uses of casein are numerous and increasing. They include paints, dressing for textiles, cements and mucilages, plastic masses, sizing for paper, food products (under trade names such as Sanatogen), and many others.

The casein content of ordinary cow's milk averages 3.2%. It is easily precipitated by acids. Technically, it may be made by spontaneous souring of the milk, or more often by the addition of acids, as hydrochloric, sulphuric, or acetic acid; also by precipitation by rennet. Combinations of these methods are also used, the casein being sometimes dissolved in alkali and re-precipitated by another acid. Many patents cover the manufacture of this product, each one of which has its own special claims. The casein is washed and dried on trays, preferably in a vacuum drier. It is then ground.

The trade in America is controlled by two companies, the Union Casein Company and the Casein Company of America, both of which manufacture many products from the raw material.

Those specially interested in casein and its compounds are referred to Robert Scherer's book on "Casein: Its Preparation and Technical Utilisation."

Not infrequently the whey (after the separation of the casein by rennet) is evaporated down, and the lactose obtained. Processes similar to the manufacture of ordinary sugar are used.

London Section.

Meeting held at the Northampton Institute, Clerkenwell, on Monday, January 4th, 1915.

PROF. W. R. HODGKINSON IN THE CHAIR.

PRODUCTION OF NITRATES FROM AIR, WITH SPECIAL REFERENCE TO A NEW ELECTRIC FURNACE.

BY E. KILBURN SCOTT, A.M.I.NST.C.E., M.I.E.E.

In papers on the "manufacture of nitrates from the atmosphere" read before the British Association, in August, 1911, and before the Royal Society of Arts, in May, 1912, I pointed out that we were entirely dependent upon raw material from overseas from which to make explosives, and in case of war might be in a serious position, and I urged the necessity of starting the production in this country of nitrates from air by electricity.

Messrs. A. McDougall and F. Howles, of Manchester, first made nitric acid from the air in a practical way about a dozen years ago, but Norway has the honour of making the process a commercial success, Professor Birkeland and Dr. S. Eyde being principally responsible.

Although the first installation in Norway of about 160 horse-power was only started about ten years ago, the business has gone ahead with such leaps and bounds that nearly a quarter of a million horse-power is employed for making nitric acid from the air, in that country alone. Some of the furnaces take over 4000 H.P., and one factory absorbs 140,000 H.P., whilst another of 120,000 H.P. is being built.

For several years I have been at work on the problem of evolving a new furnace to work with three-phase alternating current, also a system of working a complete plant with a view to obtaining better yields than are obtained by the present single-phase furnace plants abroad. I propose to give some particulars of the furnace and method of working.

All nitrogen fixation furnaces have electrodes of metal between which alternating current arcs are formed. These arcs are "blown" into flames by a magnetic field or an air blast, and provision is made for the passage of large quantities of air through these flames.

Owing to the great heat of the electric arc, and possibly also to electrification, some of the air is acted upon and the nitrogen and oxygen combine to form nitric oxide. As this gas dissociates unless it is immediately cooled, it is necessary to provide a cooling zone in close proximity to the flames and arrange for the gas to enter that as quickly as possible.

The principal points to be considered in the design of a furnace are:—

First. To ensure that as much of the air as possible is brought into contact with the arc flames.

Second. To remove quickly and cool the fixed gas.

Third. To dispose the electrodes so as to minimise adjustment and renewals.

Fourth. To provide automatic regulation of current and continuity of working.

Before proceeding to describe my own furnace it will be an advantage to describe briefly those in use abroad.

The Birkeland-Eyde Furnace.

The best-known furnace is that due to Birkeland and Eyde. At the Notodden works in Norway there are 32 of them of 600 to 1000 K.W. each, and at the Saaheim works there are 8 of 3500 K.W. each. The furnace consists

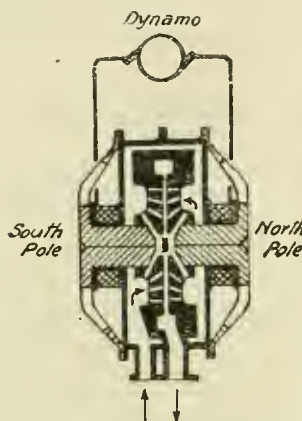


FIG. 1A.

Birkeland-Eyde single-phase furnace with magnetic field for blowing the arc flame.

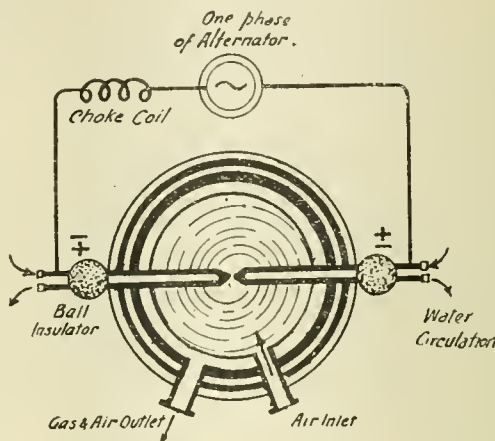


FIG. 1B.

of steel castings built up as shown in Fig. 1A and having between them a cylindrical structure of firebrick, shown in black, with a disc-shaped chamber in the centre. Air enters by a pipe at the base of the furnace and passes into the central chamber by means of a large number of small holes. After flowing radially through the central reaction chamber it collects in a circular channel just inside the periphery of the furnace and passes to the outlet pipe and away. Two U-shaped electrodes project horizontally into the disc chamber from each side, as shown in Fig. 1B. They are made of copper tubes $1\frac{1}{2}$ in. diam. and about $\frac{3}{8}$ in. thick, and the total length of each tube before being bent into shape is about 20 feet. Each electrode is adjustable vertically and sideways. Arcing tips of copper are attached to the rounded ends of each tube, and these tips are spaced about one-third of an inch apart when in the normal position. Cold water circulates through each electrode in insulated pipes, as indicated by the arrows in Fig. 1B.

It is a peculiarity of this furnace that both alternating current and direct current are used. The former is for the arc and the latter for the powerful electric magnet, the north and south poles of which are shown, in Fig. 1A, embedded in the firebrick lining. The direct current supply is indicated at the top of Fig. 1A, and the alternating current single-phase supply at top of Fig. 1B.

The magnetic field is at right angles to the electrodes, and consequently, when alternating currents flow, the magnetic field blows or deflects the arcs outwards into the disc-like chamber. As each electrode is alternately positive and negative, the arc flames are projected rapidly first to one side and then to the other, so that to the eye there appears to be a constant circular sheet of flame. In the 1000 K.W. furnaces the flame is about $6\frac{1}{2}$ ft. diameter and in the 3500 K.W. furnaces 8 ft. diameter. The pole faces are about 25 cm. apart, and the magnetic field is about 5000 C.G.S. lines per sq. cm., consequently very large magnetising coils are necessary, and about 10% of the total energy is required to excite them.

It should be especially noted that this furnace works with single-phase alternating current, and therefore on a three-phase circuit the furnaces must be used in sets of three. The design is such that it is not possible to utilise all the three phases in a single furnace. The three fur-

naces are connected in delta as shown in Fig. 2. The full voltage between phases is available at the terminals of each furnace, and at Notodden this is 5500 and at Saaheim 11,000 volts.

A peculiar feature of the arc flames of this furnace is that in moving along the electrodes they do not do so concentrically but somewhat as shown by the circular broken lines indicated diagrammatically in Fig. 1B.

As the cooling air is the controlling factor it is not possible to preheat that which enters the arc flame at the centre.

At the International Congress of Applied Chemistry in 1912 Dr. Samuel Eyde gave the temperature of the flames as 2500°C . to 3000°C ., and the temperature of the escaping gases between 800°C . and 1000°C . He also stated that the most exposed parts of the electrodes of the furnace require to be changed every third or fourth week and the lining every fourth to sixth month. Each of the furnaces at Saaheim is said to take just under 2000 cub. feet of air per minute.

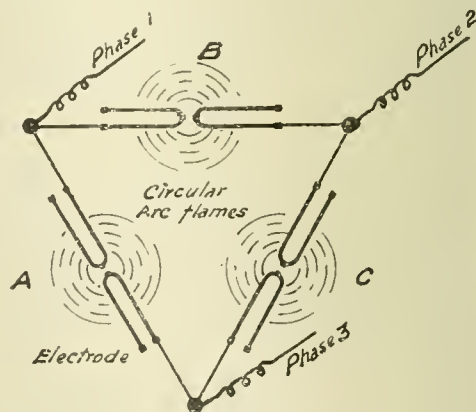


FIG. 2.

Three Birkeland-Eyde furnaces connected in delta.

The Schönherr-Hessberger Furnace.

This furnace is used at the Christiansand works of the Badische Anilin und Soda Fabrik, where there are 12 furnaces of 450 K.W. each; at the Saaheim works there are 96 of 1000 K.W. each.

The apparatus consists of four annular steel tubes arranged vertically as shown in Fig. 3. The outer tube is about 3 feet diameter, is made of plates riveted together, and is lined with firebrick. The innermost tube, about 6 in. diameter, forms the reaction chamber, and up the centre a standing arc flame is maintained by means of a

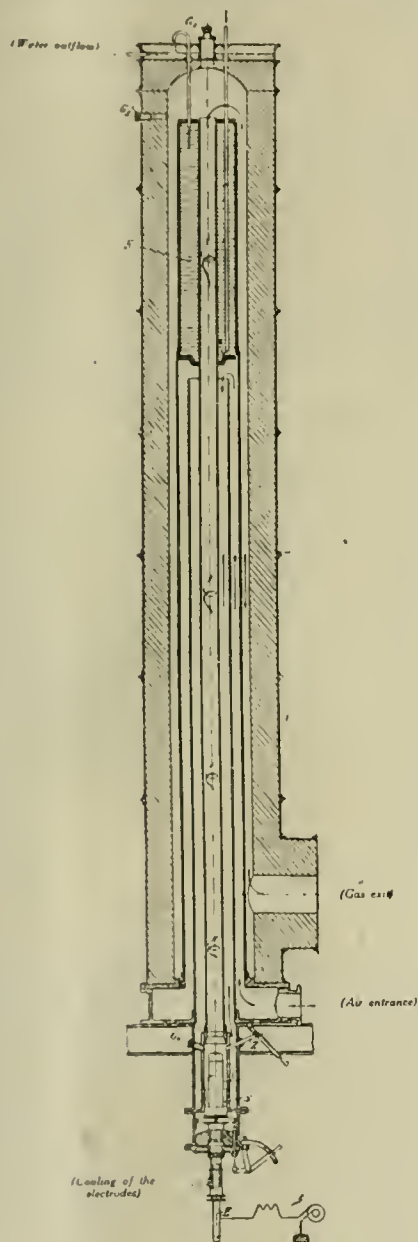


FIG. 3.

Schönherr-Hessberger single-phase furnace, with combined preheater.

whirling current of air. The air inlet and outlet tubes are so arranged that outgoing hot gases preheat the incoming air as indicated by the arrows in Fig. 3. It is therefore a furnace and a preheater combined. By means of a number of tangentially arranged air inlets at the bottom of the reaction tube, the air is given a whirling motion, which helps to keep the arc flame in the centre of the tube. The pressure of the air at the bottom is equal to 50 to 100 cm. of water.

The bottom electrode consists of an iron rod insulated from the furnace. It passes through a water-cooled copper gland, and as it burns away is pushed upwards, fresh rods being screwed on as required to give continuity of working.

The arc is started by means of a lever (marked Z in Fig. 3), which is momentarily placed between the bottom electrode and the reaction tube, the latter being of course at earth potential. The whirling air current then extends the arc upwards to a water-cooled electrode, K, at the top. The top of the arc plays about inside this electrode, and pits the surface.

Some of the air comes in contact with the arc flame and is converted into nitric oxide, and at the top, where the arc strikes from the centre to the side, the fixed gas mixes with the rest of the air that is whirling past. This and the water jacket of the electrode act as the cooling zone. Experience has shown that good yields of gas can be obtained when the air travels parallel to the arc. The furnaces are connected in star as shown in Fig. 4.

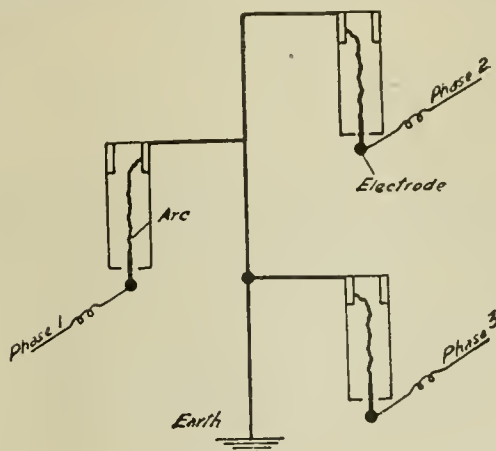


FIG. 4.

Three Schönherr-Hessberger furnaces connected in star.

Although claims for three-phase working are made in the Schönherr patent and three arc flames are shown inside one tube, they could not work that way, as they would collapse together. Also it would be impossible to have three separate whirling air currents in one tube.

As compared with the Birkeland-Eyde furnace, the Schönherr-Hessberger has the advantage of using only one kind of electric current, and there is thus less electrical gear. Other things being equal the energy required for a given output of gas should be less, and in actual practice this appears to be the case.

The 450 K.W. furnaces at Christiansand have standing arcs about 15 feet long and the 1000 K.W. furnaces at Saaheim have arcs about 20 feet long. This makes the furnaces very long and difficult to repair, e.g., those at Saaheim are about 40 feet high.

The relatively great height of the furnace, combined with the difficulty of maintaining so long an arc, presents considerable mechanical and electrical difficulties in building for large powers. That is partly why the furnaces at Saaheim are only for 1000 K.W., whilst the Birkeland-Eyde furnaces are of 3500 K.W.

This question of the limiting size of furnace is important because it would appear that the larger the furnaces the better the yield for a given amount of electrical energy and for a given expenditure in furnace plant. This is always the case when radiation losses form a large part of the total power.

The Pauling Furnace.

The Pauling furnace is used in nitric acid factories at Gelsenkirchen, Innsbruck, and Milan, also at Roche de Rame, France, and in South Carolina, U.S.A.

The furnace is built on the lines of a horn type arrester—that is to say, it has two electrodes which diverge so as to give a fan-shaped space between them, and has an air blast which fills the fan-shaped space with flame, as shown diagrammatically in Fig. 5.

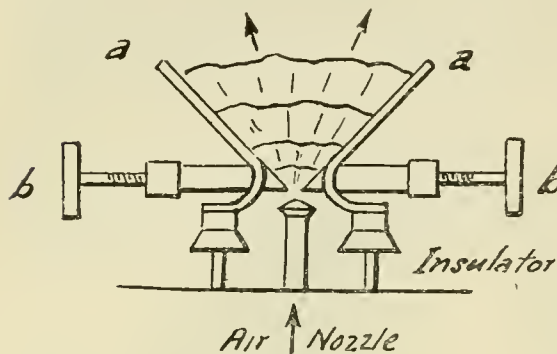


FIG. 5.

Diagram of the Pauling single-phase furnace.

To get the continuous blown arc flame it is necessary first of all to set the electrodes at such a distance apart that the applied voltage will easily jump across, and, second, to blow air between the electrodes so that directly an arc is struck it is immediately forced upwards and goes out, to be followed by others at each half-cycle of the alternating current. There is a separate Pauling furnace to each phase and each has two pairs of electrodes connected in series. There are ducts for the supply of air and a chimney at the top to carry off the gases. Two separate supplies of air are provided; one is preheated and goes to the bottom of each set of electrodes, and the other, which is for cooling purposes, strikes into the top of the arc flames. The velocity of the cooling blast may be less than the other, so as to mushroom out the flames at the top to facilitate cooling.

In order not to dilute the newly-fixed gas the cooling blast consists of some of the air and fixed gas which has passed through the furnace and been cooled down.

The electrodes are of cast steel piping and each is in three pieces, so that the enclosed portion can be reversed when it is burnt or fritted. The electrodes are set several inches apart to allow the air supply to pass through, and from each electrode there projects a starting or kindling blade of thin copper set on edge so as to obstruct the air as little as possible. These kindling blades are approached to within about 3 millimetres of each other, and as they burn away are fed forward. They pass through the bottom horizontal bar of the main electrode. Each main electrode is carried on a triangular frame by insulators, and adjusting screws are provided to set it accurately.

The two pairs of electrodes are in series and the middle point is connected up to a high resistance in such a way as to bring a high voltage to bear on the gap between one pair of electrodes. This establishes the arc, and the tension at that point then sinks so that nearly full pressure is available for the other pair of electrodes. In this way a pressure nearly as high as that available for kindling the first arc is now active in kindling the second one, and in the instant when the latter is formed the circuit is completed through the two arc flames.

Although the Pauling furnaces at present in use are smaller than those employed in Norway, the design is such that there are no physical limitations as to size and height, etc. The structure of the furnace is simple as compared with the furnaces used in Norway, and repairs can be carried out easily. The air passes straight through the furnace without any devious or throttled passages.

Comparison of above furnaces.

Comparing the above it will be seen that the furnaces are of three distinct types, as follows:—

The Birkeland-Eyde is a *Magnetically Blown Arc Furnace*; the Schönherr-Hessberger is a *Long Standing Arc Furnace*; and the Pauling is an *Air Blown Arc Furnace*.

Each furnace is supplied with single-phase alternating current and the first two have single arc flames, whilst the Pauling has two separate arcs in series on a three-phase supply. All the types of furnaces are therefore worked in sets of three.

In the first and the last types the cooling is effected by blowing cool air into the top of the arc flame, whereas in the Schönherr-Hessberger furnace the only air which passes is that previously preheated in the furnace itself.

The Birkeland has the disadvantage that it is necessary to use direct current as well as alternating current. This not only uses up a considerable amount of electric energy but necessitates additional apparatus. Blown arc flames can be obtained just as effectively by an air blast.

From the standpoint of accessibility, the design of the Schönherr-Hessberger is perhaps most at fault, and its great height makes it difficult to construct for large powers. It is the only one with a combined preheater, but there is no advantage in this. For example at Saaheim there are 96 preheaters, whereas two or three separate ones would preheat all the air for the 96 furnaces more effectually and be very much cheaper.

The Birkeland-Eyde furnace has the most complicated refractory lining, and it is in close proximity to the arc flame it is expensive to maintain. The throttled and devious nature of the air path through the furnace requires considerable power to circulate the air, and it should be noted that when comparing various designs, it is necessary to take all the power into account.

When connected on a three-phase supply, three Birkeland-Eyde furnaces require six high tension electrodes, whereas three Schönherr-Hessberger furnaces require only three high tension electrodes, the other three being at earth potential. On the other hand three Pauling furnaces require no less than twelve high tension electrodes.

The electrodes of the Schönherr-Hessberger furnace are simpler and cheaper than those of the Birkeland-Eyde, which being of copper are expensive to renew. The electrodes of the Pauling furnace are complicated by reason of the copper kindling blades which require adjustment and renewal. There is also a possibility of water leaking from the joints.

Experimental apparatus.

Considering the universality of three-phase apparatus it is rather surprising that those interested in nitrogen fixation factories abroad should have kept to single-phase designs. It may be due to patent and royalty considerations and absence of competitive conditions.

In some respects the present position is somewhat similar to that which obtained when three-phase alternators first came to the front. Until then single-phase had always been used, but very soon single-phase designs went out of use. Three-phase supply is now practically universal. When I commenced to develop a new design of nitrogen fixation furnace I decided that the proper thing to do was to choose such a method of producing the arc flames that the furnace could be constructed as a self-contained three-phase unit having only three electrodes.

Until I had actually demonstrated my three-phase furnace at work there were several who anticipated difficulties in starting three arcs, also trouble from unequal burning away of electrodes, unequal balancing, etc. Experience has shown conclusively that none of these difficulties exists. The furnace works much better and steadier than a single-phase furnace, and this has been remarked upon by several who have seen both types at work.

When current has to be taken from a general power supply the importance of having a three-phase furnace cannot be over-estimated.

In such negotiations as I have had for a supply of electric energy, I have generally been asked whether the load would be balanced and what were the chances of continuity of working.

When a company owns its own water power, as in Norway, and has plenty to spare, with no other consumers to consider, then such questions as maintaining a balanced and a constant load on all three phases is not so important.

Fig. 6 shows the lay out of my experimental plant as fitted up at the Northampton Polytechnic Institute, Clerkenwell (by permission of Dr. Mullineux Walmsley).

closed, a stream of high tension sparks immediately jumps across from the wire to the electrodes. The air dielectric being thus broken down, the main three-phase current can then follow. These two electrical circuits do not interfere with each other.

The bottom ends of the main electrodes are set far enough apart to allow the air to pass freely, and they do not require any adjustment because the pilot sparks always make a path for the main current to get across.

The operation of starting up the furnace is very simple. First turn on the air blast, then close the isolating switch

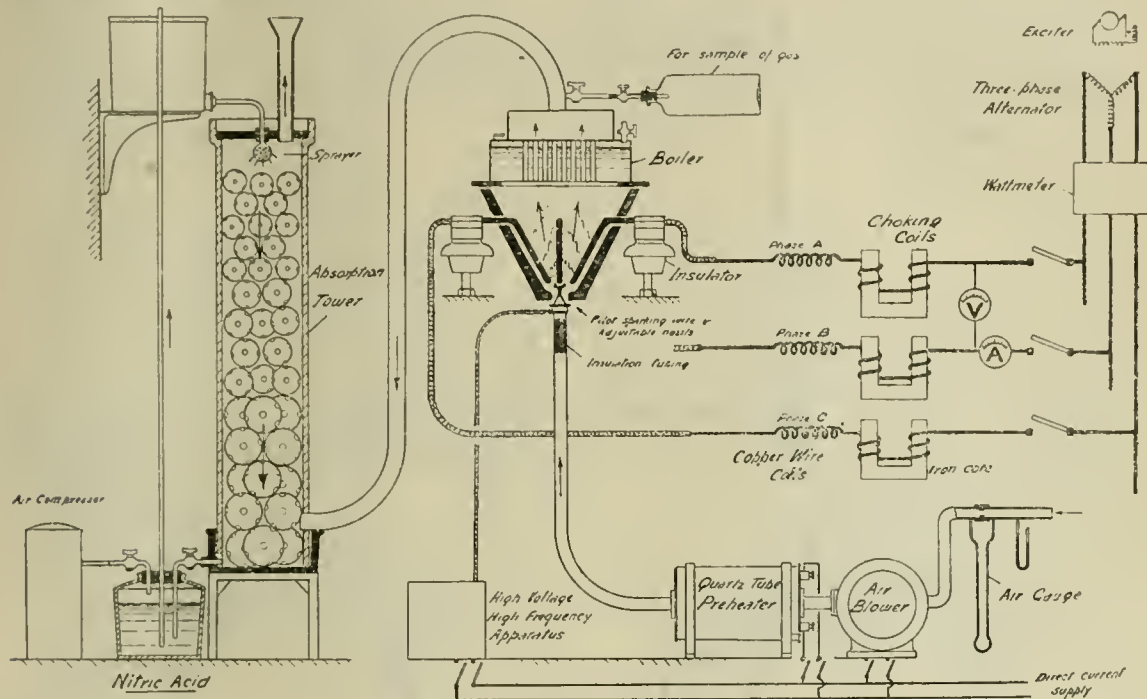


FIG. 6
Experimental Apparatus.

Three-phase current at 2000 volts, 25 periods, supplied from the power house of the Institute passes via a watt meter and three-pole isolating switch to two sets of choking coils. The first has U-shaped laminated cores, and it is possible to regulate the choking effect by connecting more or less coils in series. The second consists of insulated tubes on which a single layer of wire is wound. These latter are to take care of sudden rises of pressure. The proper proportioning of the choking effect is a most important factor, a point which I early appreciated when assisting Mr. Howles in nitrogen fixation experiments about 14 years ago.

The three electrodes of the furnace are attached to double petticoat porcelain insulators spaced 120° apart, two of which are shown in the centre of Fig. 6. The electrodes are of steel, and the inclined sides are bent at about 30° from the vertical line. A standard fireclay crucible serves as the wall of the furnace. The bottom of the crucible is drilled through, and immediately beneath is the air-supply pipe, the nozzle of which consists of an iris diaphragm.

The upper portion of the pipe is made of insulation material and a No. 18 gauge iron wire is attached to the nozzle so as to project vertically upwards with its point midway between the three electrodes and just below them. This wire is for the pilot sparks and it is connected to a high frequency high voltage apparatus somewhat similar to apparatus used in wireless working.

Current from an ordinary lamp pendant supplies the apparatus, and when the tumler switch of this circuit is

so as to make the electrodes alive and finally close the tumler switch of the high frequency set. Directly this is done the sparks jump from the wire to the electrodes and the three-phase are flames are started. To stop the furnace, the tumler switch is switched off and the are flames then stop.

Air is supplied by an electrically driven blower, and it is measured by a manometer as indicated at the right-hand bottom corner of Fig. 6. It is only necessary to measure the difference in height of liquid in the U-tube, and then by means of a formula the amount of air is quickly calculated. The method is much more handy and cheaper than a meter; besides, with a wet meter the air may take up moisture.

The three phases working together give a combined flame of more or less inverted cone shape. The air enters this and blows the arc flames up to a point at the top which flickers about like an ordinary flame.

On top of the furnace (in fact the roof) is a boiler with vertical copper tubes for the gases to pass through. The position of the boiler can be adjusted vertically. It is, of course, connected to earth. As the peak of the arc flame is the neutral point of the three-phase supply it does not matter if it strikes on to the bottom of the boiler. As a matter of fact during the experiments I have frequently placed the boiler so low as to cut off a considerable portion of the upper zone of flame. Although the tubes are only soldered into thin tinplate, there was no difficulty in doing this, for the steam raised in the boiler carries off the heat very rapidly.

In the pipe leading from the boiler a cock is provided to allow of the gas being drawn into glass bottles from which the air has been exhausted. This is the usual method of testing.

a cross-section through the boiler. The construction of the electrode should be noted. It consists of a steel tube divided longitudinally into two parts so that the cooling water travels down one side and up the other.

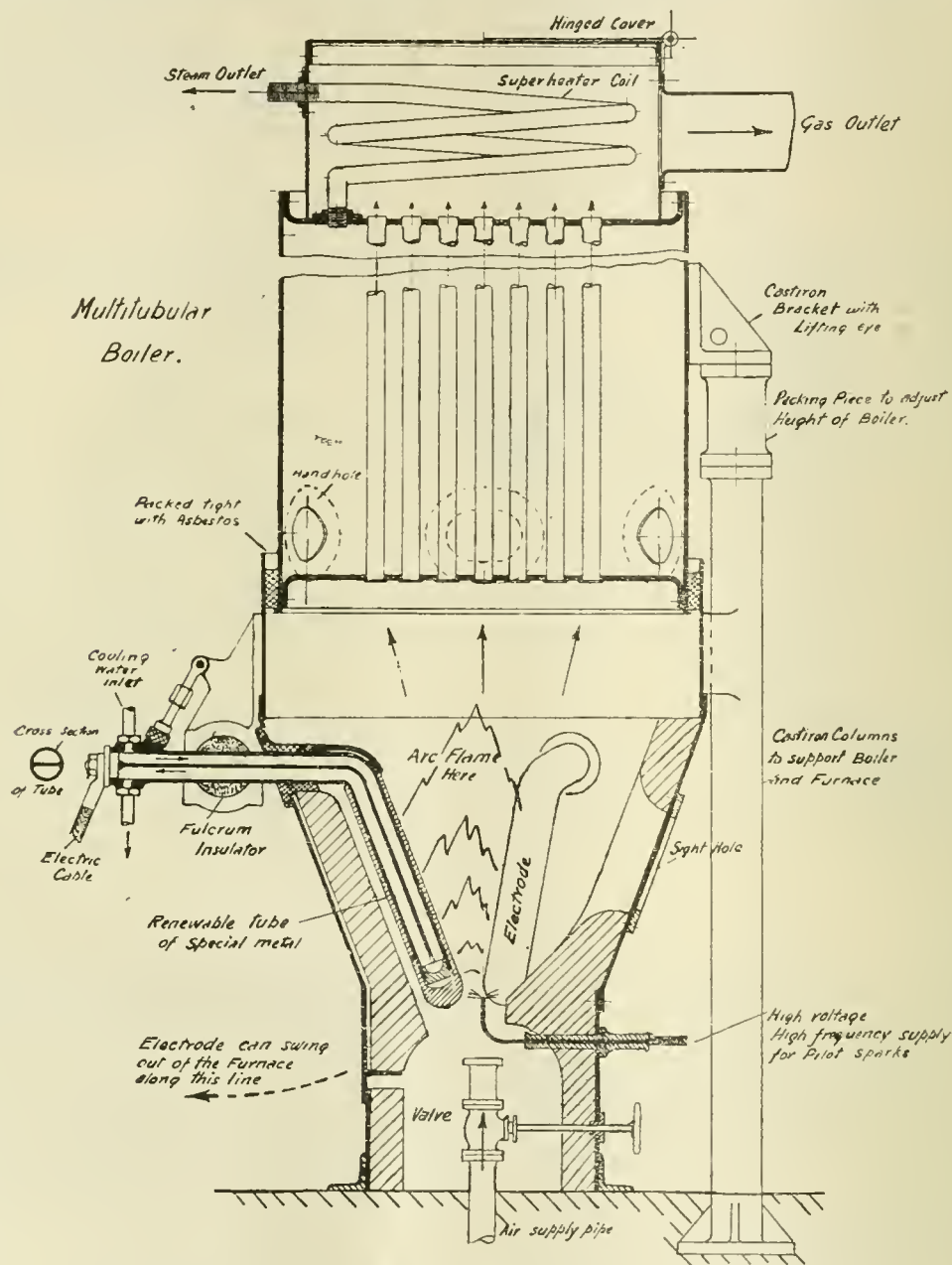


FIG. 7.

Kilburn-Scott three-phase furnace for fixation of nitrogen

For the purpose of absorbing the gases an earthenware pipe filled with Guttman hollow balls is provided. See left of Fig. 6. Water trickling down meets the gas going up, and so forms nitric acid which collects at the bottom. The liquid can be raised by compressed air and so passed through several times.

Kilburn-Scott Three-phase Furnace.

Fig. 7 shows my design of a full-sized commercial furnace and Fig. 8 shows the plan of the three electrodes and also

A renewable tube of cast steel is slipped over the cooling tube from the bottom, and when one side of it is burnt or pitted by the arc flames it can be turned round to present a new surface. The turning can be done in a few minutes. This form of electrode has the advantage of giving minimum insulation where it passes through the furnace wall, for if there were horizontal limbs top and bottom both these would have to be insulated. Also by dispensing with a horizontal bar at the bottom it is much easier to arrange for the pilot sparking conductor and the air

supply. The electrode swings from a large insulator at the outer end of the horizontal limb, so that the electrode can be quickly swung out of the furnace and also swung back again with the certainty of returning to its correct position. The pilot sparking conductor passes through a porcelain insulator fixed in the wall of the furnace below the electrodes, which part of the furnace is of course comparatively cool.

The boiler is carried by three cast iron columns which are at 120 degrees apart and set between the three electrodes. Space for adjustment is provided between the furnace and the boiler, so that the height of the boiler above the electrodes can be varied to suit the size of the arc flames and the velocity of the air. The bulk of the brickwork is remote from the arc flames, so that ordinary plain fire-bricks can be used. As all brickwork and refractory material is porous to a certain extent, the whole is enclosed with thin steel plates which are electrically "earthed" and sectionised.

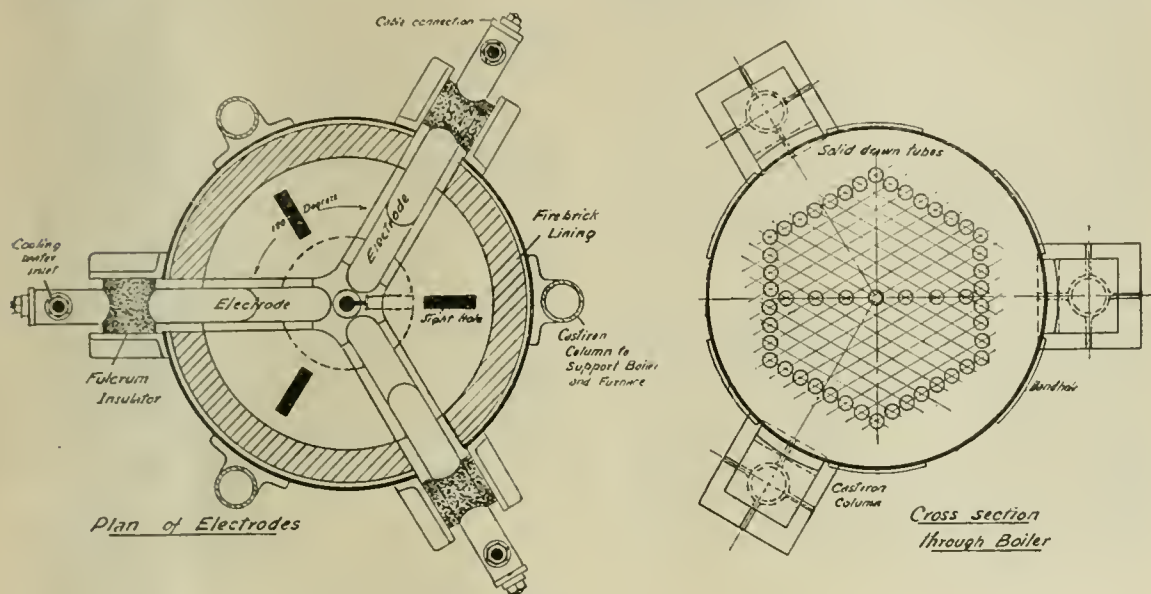


FIG. 8

Kilburn-Scott three-phase furnace.

The boiler shown has straight tubes, and although it would be better to have a good clean water feed I do not anticipate trouble even if the water should not be very good. Experience with the Bonecourt boiler shows that with very high temperature and good circulation there is little tendency to form scale.

The following may be said to be the special features which distinguish my furnace from those used in Norway and elsewhere.

It is essentially a three-phase furnace using the electric energy exactly as generated, and giving three arc flames within one furnace wall. Also for a given periodicity of supply, thrice as many arcs in a given time as would be the case with single phase.

The three phases give a combined flame of conical shape which is hotter than if the same energy were expended in three separate furnaces because the latter have only a single flat flame and the radiation losses are much greater. The greater bulk of the three phase flame also enables more air to come into contact.

As compared with three single phase furnaces the first cost, the attendance cost, and the maintenance cost are all lower. The space occupied is also much less and there is less brickwork, ironwork, foundations, piping, etc. There are only three electrodes as compared with six for three single phase furnaces and this considerably simplifies the electrical and water connections and the renewing of electrodes, etc.

Three arcs together help to maintain each other because current is always flowing in one or other of the phases. Thus continuity of working is assured and the load is always balanced. When current is purchased from a power station these are most important matters.

By breaking down the air dielectric with high frequency pilot sparks, the arcs start directly the zero points of the alternating current waves are crossed and this improves the efficiency and power factor. There are no kindling knives to burn away and get in the way of the air supply.

The electrodes can be placed at the most suitable distance for the air supply and do not require any adjustment whatever. The control of a large furnace can be effected by a small tumbler switch on the high frequency apparatus.

The boiler forming the roof of the furnace cools the fixed gas very effectively because of the latent heat of steam, and at the same time the steam so raised can be used to generate electric energy, so that the combination can work regeneratively.

Method of Working.

The regenerative working is indicated diagrammatically at the extreme left of Fig. 9. The steam turbo-3-phase alternator may be taken to represent a complete power plant, or it may be merely auxiliary to a bulk supply received from some instance away. A pipe connects the electric furnace boiler to the steam turbine.

The turbine may get its steam from the furnaces only and thus be of a low pressure type, or it may also receive a supply from a main high pressure boiler, in which case it would be of the mixed pressure type. In any case this is well-known steam engineering practice, and so long as steam is available from the furnace boiler good use can be made of it.

Some figures for a furnace plant taking say 1000 kilowatts will show the value of such regenerative working.

One k.w. hour equals 3417 British thermal units of heat, so the plant will absorb 3,417,000 B.Th.U. units per hour.

To evaporate one pound of water into steam at 150 lb. per square inch 1100 B.Th.U. units are required, and assuming an efficiency of only 80% the boiler should give

$$\frac{3,417,000 \times 0.8}{1100} = 2500 \text{ lb. of steam per hour.}$$

A turbo alternator using this steam at the rate of say 16.5 lb. of steam per k.w. hour will thus give

$$\frac{2500}{16.5} = 150 \text{ kilowatts.}$$

That is to say the regenerative value of steam raised by the furnace is about 15 per cent.

The saving may be taken as being fully as much as that because in addition to the saving in electric energy there are a number of incidental advantages in connection with such regenerative working not the least of which is the very effective cooling of the fixed gas.

Of course the steam could be regenerated at low pressure, but that is in no way a disadvantage because low pressure steam turbines working on a good vacuum are very efficient pieces of apparatus as witness the many exhaust steam turbines now in use. It merely means that more steam would be generated at the lower pressure.

It will be readily seen that the furnaces used in Norway are not suitable for the application of a boiler directly. Utilisation of steam in a prime mover would necessitate generating plant quite different from the water power plant to which they are accustomed and have plenty of. In this country steam generating plant is almost universal, and conditions are in every way favourable to the utilisation of heat; indeed, the ideal combination would be to build a nitric acid factory alongside an existing steam power-station.

Such steam as is raised in the Norwegian plants is merely that necessary for general purposes in the factory for evaporation, etc., and they obtain all they want from the gases after they have been first cooled down to about 400° C. This in itself shows the great amount of heat energy that is wasted.

Three phase current is supplied to the furnace through choking coils and it will be noted in Fig. 9 that near the furnace I have shown diagrammatically an oxygen making plant and a preheater.

The oxygen may come from some process of which it is by-product or it may be made specially, but in any case the question of its purity is quite unimportant. It should be noted that there are two oxygen supply pipes, one joins with the air supply pipe to the preheater and furnace and the other goes to the oxidation tower.

The concentration of nitric oxide has the highest value at each temperature when the product of oxygen and nitrogen is a maximum. It can be shown that it is directly proportional to the square root of the product thus:—Oxygen and nitrogen as in air = $0.21 \times 0.79 = 0.16$. Equal parts oxygen and nitrogen $0.5 \times 0.5 = 0.25$.

Then as

$$\sqrt{\frac{25}{16}} = \frac{5}{4}$$

The increased yield is therefore as 4 is to 5, or 20 per cent.

It is interesting to record that about a dozen years ago Mr. F. Howles, who was then carrying out work in conjunction with the late Mr. Arthur McDougall, published results obtained by enriching the air with oxygen. The production from air was 34 grams of nitric acid per k.w. hour, but double that amount was given by using a mixture of 1 part nitrogen to 2 parts oxygen.

The ideal condition would be obtained by linking up the nitric acid factory with an industrial process which gives off oxygen as a by-product. There are several such industries. For example, the manufacture of hydrogen for aircraft; the manufacture of calcium cyanamide; one method of manufacturing sodium cyanide. There is also the manufacture of hydrogen for increasing the density of oils for margarine, etc.

The production of hydrogen is carried on at the aircraft factory at South Farnborough and some of the oxygen there produced is sent to Woolwich Arsenal and other works for oxy-acetylene welding but this only absorbs a portion of the output.

The oxygen produced in a calcium cyanamide factory is a by-product from the manufacture of nitrogen by the liquid air process, the nitrogen being necessary to convert calcium carbide to cyanamide. At the present time all the oxygen produced at the Odda works in Norway is wasted, because the company is not allowed to bottle and sell it. There are seven Linde plants each producing 350 cubic metres of pure nitrogen per hour, or a total of

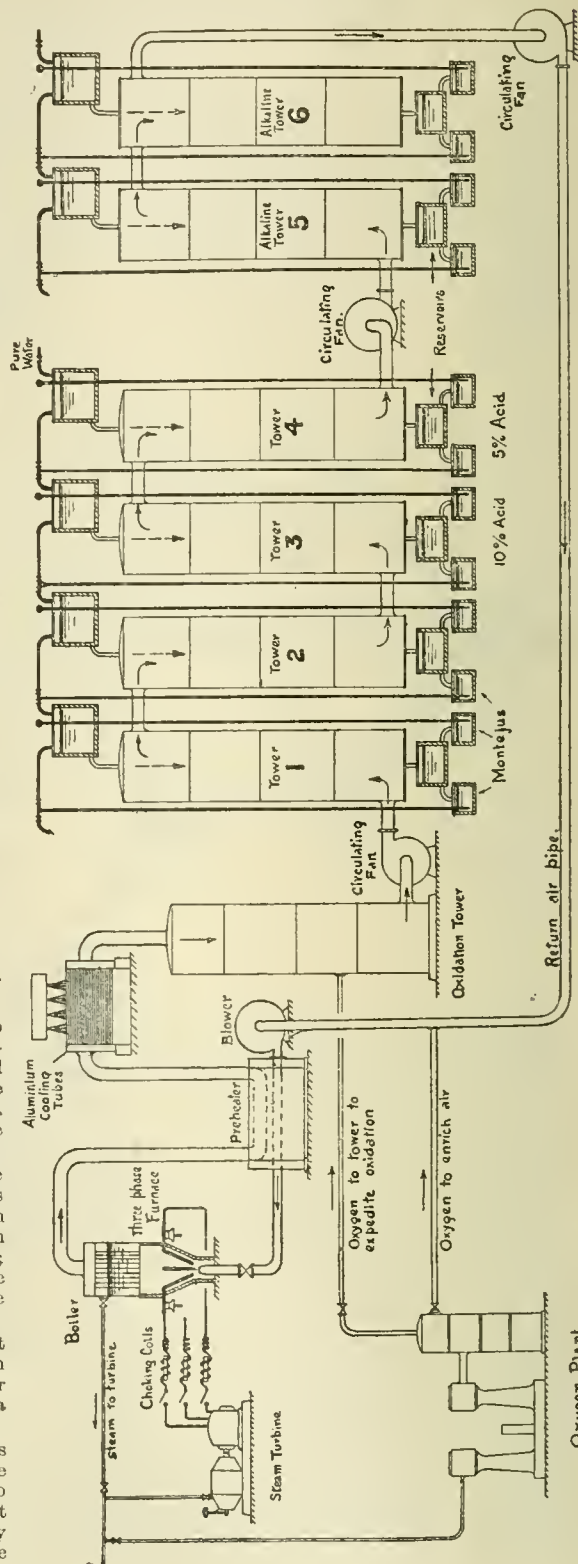


Fig. 9.—Layout of Plant for manufacture of nitric acid, etc., from atmospheric nitrogen, working regeneratively with Kilburn-Scott furnace and with oxygenated air on closed cycle.

2450 cubic metres. The amount of oxygen wasted per hour is therefore $\frac{2450 \times 21}{79} = 650$ cubic metres per hour.

This oxygen is pure, because for making cyanamide it is essential to have the nitrogen absolutely pure. Consequently it is very expensive. In the direct furnace process the case is quite different, because the oxygen is only required to raise the percentage of oxygen until it and the nitrogen are about equal. A plant to do this is simple and cheap.

Absorption System.

When the air plus the make-up oxygen passes through the furnace some of it is converted into nitric oxide and we will now trace the progress of the gases as they may be called through the rest of the apparatus.

They first go to a nest of cooling tubes made of aluminium (see top of Fig. 9), over which water is flowing, then through the preheater where some of the heat is imparted to the supply to the furnace, and then to a circular tower made of steel plates lined with acid-proof brick. This is a very large tower, and during the several minutes that it takes in passing through oxidation to nitrogen peroxide proceeds.

It then comes under the influence of the exhauster and passes into the first of the four acid absorption towers (see middle of Fig. 9). Each of these has an acid-proof open-work filling, to allow the gases and the liquor to pass freely through but at the same time bring them into intimate contact.

The gases travel up Tower 1, down Tower 2, up Tower 3, and down Tower 4. Pure water is supplied at top of Tower 1, and passing down forms, with the nitrogen peroxide, nitrous and nitric acids. The nitrous acid being unstable in an aqueous solution forms into more nitric acid and nitric oxide, and this nitric oxide changes again to nitrogen peroxide, and so on.

The final result is that dilute nitric acid runs out at the bottom, and when it reaches about 5% strength at bottom of Tower 4 it is transferred to the top of Tower 3, where it meets with stronger gas. It is then transferred to top of Tower 2, and so on, on the contra flow principle, gaining strength at each tower until it reaches any desired strength up to about 50%.

After passing the acid absorption towers some gas (up to 20%) still remains, and this can be absorbed either by sodium carbonate or milk of lime to form a solution of nitrate and nitrite, or by caustic soda to form sodium nitrite. Sodium nitrite can be made by fusing metallic lead with sodium nitrate, but the electrical way is much better and cheaper.

In proof of this, it is necessary to refer to the Badische Anilin und Soda Fabrik Works at Christiansand, in Norway, which produces all the sodium nitrite required by the company by electric furnace for direct fixation of nitrogen from air. Previously to the establishment of these works they had supplied all their requirements by the chemical method.

One remarkable feature of the products made by the direct electrical process is their extreme purity. Sodium nitrate made in Norway can compete with the natural Chilean product because of its greater purity.

The movement of the gases through the system is usually effected by fans made of aluminium, and besides those in the pipe line there may be fans to each tower.

Silicon iron or tantiron fans can be used instead of aluminium, and although more expensive in first cost they are a stronger job. Pumps of this metal can also be used for raising the acid from the bottom to the top of the towers.

It may be of interest to mention that the Tantiron Foundry at New Cross has supplied a great deal of acid resisting plant to the electro-chemical factories in Norway. This metal has come to the front very opportunely.

Although it has not been done, the writer sees no reason why the whole operation should not be carried out in a closed cycle. Several chemical operations are carried on in closed cycles, and it is a little curious that this has not hitherto been applied to the nitric acid process.

It will be seen from Fig. 9 that after passing through all the absorption system the gas and air is not allowed to escape into the atmosphere but is brought back to the furnace.

If it were allowed to escape there would of course be great waste of oxygen, but by working in a closed cycle only make-up oxygen is required, and therefore a small oxygen plant will do.

The gain is not merely in the amount of gas fixed, but there is also a considerable advantage in expediting oxidation to nitrogen peroxide.

The several absorption towers, piping, fans, etc., allow leakage, but this will not matter, for the oxygen plant merely keeps the percentage at about 50%, and to provide a little more or less oxygen is immaterial.

Products.

In order to concentrate the dilute acid from the absorption tower it is first heated to drive off some of the water, and this brings it to about 66% strength. Beyond that point more of the water can be removed by sulphuric acid.

This process is purely chemical, and the principles are well known, but of recent years a number of improvements in detail have been made to expedite and cheapen the process. That due to H. Pauling seems to be very effective.

Superheated steam as a heat carrier flows as a counter-current against a stream of nitric acid and sulphuric acid. The steam is gradually absorbed by the sulphuric acid and converted into water, whereby its latent heat is liberated for evaporation of the nitric acid. By using a path of sufficient length, nitric acid of 96% strength is obtained from a mixture containing one part of 48% nitric acid to two parts of 94% sulphuric acid.

Fig. 10 shows a typical lay out of a factory to produce concentrated nitric acid and for the details of concentration plant, and I am indebted to Mr. Glyn W. A. Foster, B.Sc., who was research chemist to H. Pauling's company, the Salterpetrasäure Industrie Gesellschaft, for many years, and who for several months carried out tests on my furnace.

For a good many industrial operations the acid can be used at about 66%, and if manufactured near to where it is to be used, there is no advantage in concentrating from the point of view of cheapening transport. For the manufacture of ammonium nitrate, fertilisers, etc., a strength of 40% or even lower is sufficient.

The manufacture of ammonium nitrate is very simple, as the dilute nitric acid direct from the absorption tower has merely to be treated with ammonia. As we have any amount of ammonia in this country it is obviously an easy and profitable product to make here.

It does not appear to be generally known that the explosives manufacturers in this country for several years have been obtaining supplies of ammonium nitrate from Norway. It has been made at Notodden by merely combining the electrically produced nitric acid with ammonia sent from this country; and as about 75% of the liquor is water, it has meant the carriage of much water and some ammonia to Norway, and finally the carriage of the nitrate back again, a good deal of it going to Nobel's works in Ayrshire.

As may be easily supposed, this business has been very profitable to a few middle-men in this country, whilst money has been going abroad which should have built up a profitable industry here.

It is this kind of thing that has caused scientific and engineering circles in Germany to get the impression of us which they have. One cannot imagine any German shipping thousands of tons of water across the North Sea for the little ammonia it contained, and then buying the product back again at a greatly enhanced price.

Owing to the war the Notodden factory is now about to obtain a supply of ammonia by treating calcium cyanamide with steam.

It was indirectly through this importation of ammonium nitrate that I took up the development of a new furnace. Some years ago I was engaged in lecturing to farmers and others regarding the new fertilisers made by electricity from air. Thinking that the time was ripe for the establishment of a factory in this country, I asked for the terms of a license

to use the Norwegian furnaces here. It was made very apparent that they did not want the manufacture started here so I decided to develop a furnace.

Later on it may be worth while to make a nitrated phosphatic fertiliser from the waste basic calcareous slag produced by open hearth steel furnaces. The slag from these furnaces is often in an insoluble or tribasic form, and so cannot be advantageously used for agricultural purposes. By treating it with dilute nitric acid or the gases from the electric furnace, a part of the phosphoric acid can be changed into the soluble form, whilst at the same time, lime in the slag is converted into calcium nitrate. The present output by this form of slag in Middlesbrough alone is about 150,000 tons per annum.

a long time. As a matter of fact at the Norwegian factories, the engineers carry on a never-ending series of tests and they are constantly trying modifications.

Samples of the gas are drawn off at regular intervals into large gas bottles which have had the air exhausted from them by a powerful pump. These are temporarily connected with the gas current by opening a tap and a sample of nitric oxide drawn in. This is changed to nitric acid and tested. Then, knowing the percentage contained in the sample, the air flowing through the furnace and the electric energy supplied, the yield can be calculated.

The effect of varying the velocity of the air passing through the furnace is very marked; it is, in fact, one

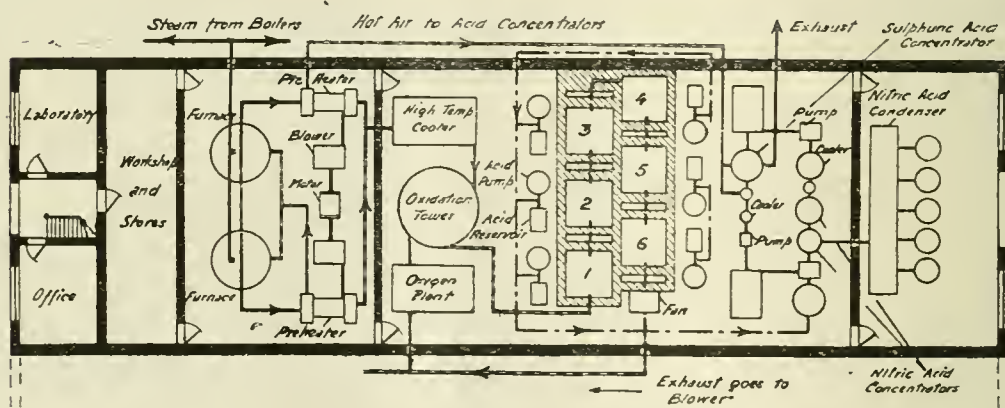
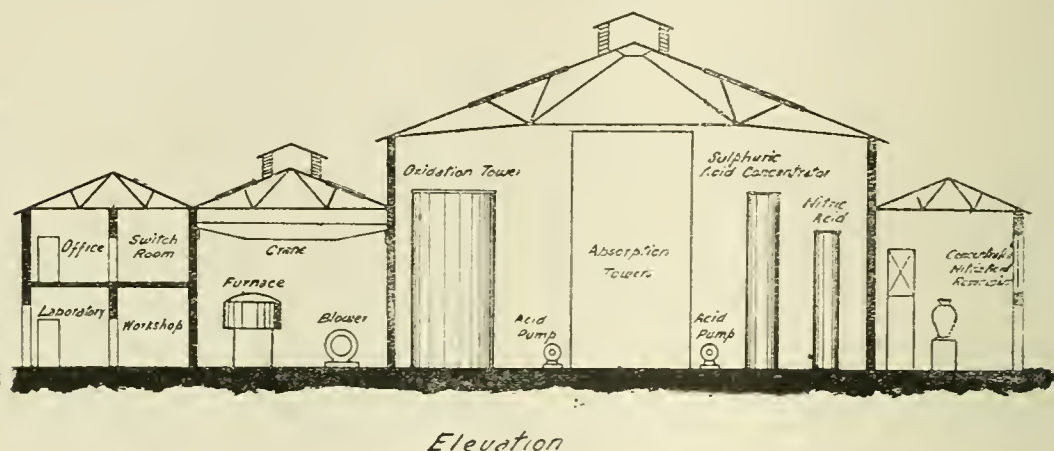


FIG. 10.

Layout of Plant for the direct manufacture of concentrated nitric acid from air by electric power.

Concentration and Yield.

To obtain the best results from a furnace a nice adjustment of conditions is necessary, for there are several factors which influence each other. For example:—

(a) The voltage and current on which depends the heat of the arc flames. (b) The pressure and quantity of air and its velocity through the arc flame. (c) The amount of preheat of the air. (d) The effectiveness of the cooling of the fixed gas. Also a number of smaller factors such as leakage, evenness of air pressure, condition of the electrodes and the furnace lining.

It will be easily seen that with so many variables the adjustment of any furnace for the best conditions takes

of the most important factors in determining on the one hand the percentage concentration of gas and on the other the yield for k.w. hour. A low velocity is favourable to a high percentage concentration, whilst a high velocity is favourable to a high yield per k.w. hour.

At various times extraordinary high percentage concentrations have been claimed. For example: Haber and König state they obtained concentrations of 9.5 to 10% with air at 100 mm. pressure. Brode is also said to have obtained 7.2% with platinum electrodes and 5.8% with iridium electrodes, and he ascribes the lower result to a decomposing influence of the fine particles of the iridium on the nitric oxide in the flame.

On the other hand, Prof. Nernst has given the following percentages as the theoretical maxima for various temperatures:—

Absolute temperature ° C.	Nitric oxide formed %.
1500	0.1
1928	0.5
2202	1.0
2403	1.5
2571	2.0
2854	3.0
3103	4.0
3327	5.0

An interesting point to note about these figures is that as the temperature rises the yield increases at a greater rate. Thus a difference of 369° C. raises the theoretical yield from 1 to 2%, whereas only 224° C. is required to raise the theoretical yield from 4 to 5%.

Since the Notodden factory was first started the percentage concentration of nitric oxide has been doubled, merely by making small modifications in furnace construction and adjusting the air supply and the electric current. Yet the percentage is still under 2%. The fact that it is so much lower than the theoretically possible is really a most promising feature of the direct method, because it indicates the great scope there is for improvement. A process that is highly efficient from the start is a very tame proposition.

High concentration is chiefly beneficial in making the auxiliary plant, absorption towers, etc., more efficient, and as these cost much more than the furnaces it is desirable.

The main thing of course is the yield per k.w. hour or k.w. year. It will be of interest to detail a few of the statements that have been published.

It is convenient to state the yield of a furnace as so many kilograms of pure nitric acid per k.w. year. It does not mean that pure acid is necessarily made but that the nitric oxide gas coming away from the furnace would if desired produce that amount of pure acid.

Prof. Hofer has calculated the maximum theoretical yield of pure nitric acid per k.w. year as 1850 kgs. with arc flames at 4200° C. and 819 kgs. with arc flames at 3200° C. That is to say, a difference of 225% in the yield for an increase in temperature of only 30%. These are, of course, the yields under laboratory conditions and do not include any auxiliary power, but they serve to show the very great importance of a high temperature.

In actual practice the term electric energy should really include all that is used for working the furnace and not merely the energy of the alternating current arc. For example, it should include the losses in the choking coils and resistances, and in the case of the Birkeland-Eyde furnace the energy taken by the magnetising coils. It should also include the motive power for driving the blowers, etc., because some furnaces require more power to blow the air through them than others. Continuity of working is also most important.

Pauling guarantees 60 grammes of nitric acid per k.w. hour of electric energy measured at the factory switch-board, and this is equal to:—

$$\frac{60 \times 8760}{1000} = 525 \text{ kg. k.w. year,}$$

For 8000 hours a year this gives 480 kg. or just under half a ton per annum.

Dr. Eyde has stated that at the Notodden factory the output per k.w. year is 853 to 938 kgs. of nitrate of lime containing 13% of nitrogen, or reckoned in pure nitric acid, it averages 500 to 550 kgs. with 900 kgs. as the best result.

In another statement the annual production at Notodden is given as 20,000 tons of nitrate of lime, 4000 tons of sodium nitrate and 4000 tons ammonium nitrate. As the Notodden factory is supplied with electric energy from a power house containing four turbo alternators each of 10,000 h.p. or 30,000 k.w. in all, this works out at 0.66 ton of nitrate of lime, 0.133 ton sodium nitrate and 0.133 ton of ammonium nitrate per k.w. year.

The estimate of the annual production of the Saahheim factory has been given as 70,000 tons of nitrate of lime and 8000 tons of sodium nitrate. The Rjukan power house has ten turbine generators aggregating 100,000 k.w.,

so this works out at 0.7 ton of nitrate of lime and 0.08 ton of sodium nitrate per k.w. year.

Averaging up all the above it is safe to assume that a nitrogen fixation plant with single-phase furnaces on existing lines will give the equivalent of half a ton of pure nitric acid 96% per k.w. year, or stated in the other products which are manufactured, say three-quarters of a ton of nitrate of lime, and one-tenth of a ton of sodium nitrate.

Conclusion.

I am convinced that it is possible to considerably increase the present yields, and to summarise briefly the following are some of the reasons:—

Gain by regenerative working.—Theoretically the energy saved by using steam from the boiler to generate electricity is about 15%.

Gain by oxygenated air.—By blowing through the furnace equal parts of oxygen and nitrogen instead of air the yield is increased by 20%.

Gain by increased temperature.—The theoretical yield increases from 819 to 1850 kg. per k.w. year or 225%, when the temperature of the arc flames is increased from 3200° C. to 4200° C. or only 30%.

I claim that a combined three-phase arc flame is hotter and acts on more of the air than three single-phase flames each in separate furnaces, and that, taken in conjunction with the other features of my design detailed above, including the effective cooling, by a boiler, using the steam so raised regeneratively, and also blowing oxygenated air through the furnace, a yield considerably in excess of that obtained in Norway is possible.

When considering manufacture, one naturally thinks first of water power. It is true that such powers as we have are not large; but the assumption that they are not worth harnessing, or if developed electrical products cannot be made profitable, is quite untrue. The success of the aluminium works in Scotland and North Wales is evidence of that.

As a matter of fact, it should not cost any more, if as much, to harness a water power here as it does to harness a similar one abroad, because the main expense is in the hydraulic and navvying work, the concrete dams, and steel piping, etc. Unfortunately, we are handicapped by difficulties in obtaining necessary authority from Parliament. No doubt in the future nitrates will be made by electric energy from a water power, but it is not necessary to wait for that.

Our main concern is to make nitrates now, and the obvious thing to do is to take the energy of an existing power station, preferably one utilising waste heat. Such stations have a great advantage over water power in being situated in industrial centres where carriage of raw materials and finished products is small.

For solutions such as nitric acid and ammonia the question of carriage is all important, and it is one reason why so many factories have their own plants to make acid from sodium nitrate. The lowest price, however, at which it can be made in that way in normal times is about £18 a ton, reckoned as pure concentrated acid. The electrical method can produce it much cheaper. Working on a restricted hour basis is no disadvantage, because nitrogen fixation furnaces can be switched on and off at any time like arc lamps. They thus make an ideal load for "off-peak" hours.

Although the cost of electricity is higher than in Norway this is not a very material factor, because the carriage of ammonia to Norway and ammonium nitrate back, and especially the carriage of nitric acid over the sea, is several times greater per ton than the cost of power per ton to manufacture the product.

The carriage of such solutions across the sea and on the railway is difficult, for it is not merely a question of finding ships to accept such cargo at reasonable rates, but special heavy tanks have to be provided and to be maintained. As a matter of fact, the carriage of nitric acid from Norway has not been attempted.

Even if Norway could compete, the establishment of factories in this country to make nitric acid, ammonium

nitrate, and sodium nitrite from the air is a national duty. They are urgently wanted for explosives and for the aniline dye industry.

Now that a Special Committee has been appointed to assist in the establishment of chemical industries hitherto carried on abroad, I hope it will not be long before we have factories for producing nitrates from the air by electric power.

DISCUSSION.

The author was asked what would be the smallest practicable commercial unit. One of the main advantages of Pauling's furnace was, that it could make small quantities of acid, such as were used in many manufacturing processes, and at a reasonable cost.

Mr. KILBURN SCOTT said he would naturally prefer to work continuously and on a large scale, but the direct electric process could be economically worked on a moderate scale and also intermittently. His idea of a small commercial unit would be about 1000 kilowatts, having say three furnaces of 330 kilowatts each. A thousand-kilowatt plant, including furnaces, absorption towers, circulating fans, piping, and all auxiliary apparatus, but not including the steam turbine which he proposed should be a part of the system when working regeneratively, could be put down for something like £6 or £7 a kilowatt. Of course, the larger the plant the lower the cost per kilowatt; thus for a 10,000-kilowatt plant the price per kilowatt would come down to £5 or £6 per kilowatt. This price per kilowatt was a convenient way to state the cost of the installation, but it must be understood that the bulk of the £5 or £6 was not for furnaces and electrical gear but for the absorption towers, circulating fans, piping, and other non-electrical apparatus. The purely chemical part of the plant was the most expensive and occupied most space. It would be feasible to start with a smaller plant than one of 1,000 kilowatts; for example, one might have first a 330-kilowatt furnace, then add another 330, and so on, or the units might be two of 500 kilowatts each. He did not think it would be commercially advisable to go smaller, but it all depended on local conditions and the cost of energy and of carriage.

Mr. G. NEVILL HUNTLY said that some seven or eight years ago he tested a nitric acid plant by Moscicki. The main point claimed by the inventor was not that the yield of nitric acid per kilowatt-year was notably increased, but that the concentration of nitric oxide was greater. He thought that at that time the concentration at the Notodden works in Norway was about 0.75%. The Moscicki furnace was said to give about 2%, and the inventor claimed for that a considerable saving in the capital cost of the absorbing system. As the Moscicki furnace had not been mentioned by Mr. Kilburn Scott, he assumed it had not been commercially successful, although the inventor was one of the pioneers in the preparation of nitrates from the air.

Mr. KILBURN SCOTT said that all the furnaces in use abroad worked with a single-phase arc, and whether the arc flame was produced one way or the other, as a long-standing arc blown by a whirling current of air, or magnetically directed as in the Birkeland-Eyde and Moscicki furnaces, the temperature and electrical conditions were pretty much the same. Also, as the cooling was effected by excess air in all these single-phase furnaces the possible concentrations would not vary much: they all appeared to give 1½ to 2%, depending on the velocity of the air. All single-phase furnaces at present in use had certain inherent defects, and the concentration and yield was limited thereby. His own furnace had a 3-phase arc flame which was hotter and of better

shape to ensure contact with the air than single-phase flames, each in a separate furnace. The radiation losses of the 3-phase furnace were much lower, and it had many other advantages which he had pointed out. The hotter flame gave better results, and the efficient cooling by the boiler also gave more fixed gas, whilst at the same time generation of power by steam from the boiler would materially reduce the total power drawn from the main supply. These improved conditions would give both a higher concentration and a higher yield, but of the two he considered the yield was the most important.

The author was asked if the presence of moisture in the air and the introduction of steam influenced the equilibrium. Also, did air pressure influence the yield?

Mr. KILBURN SCOTT said that Professor Guye had stated the yield was increased somewhat if the air was freed from moisture. If there should be a water leak from the electrodes the yield would drop immediately. As to the use of high pressure opinions differed widely. In 1907 Briner and Durand obtained higher percentages by lowering the pressure. Schönherr claimed that the vertical movement of the ascending current of air lowered the pressure in the centre of the air column, and that tended towards higher yields. On the other hand, Muthmann and Hofer in 1903 noted that while using the higher temperatures of the electric arc a marked increase in yield accompanied the use of compressed air. Rossi, in some experiments with air up to 50 atmospheres, is said to have succeeded in converting one-third of the oxygen present into nitric oxide and securing concentrations of 16% NO. Haber experimented in 1910 with a small Schönherr furnace with pressures up to 20 atmos., and was led to the conclusion that an increase of pressure offered no practical advantage. Personally he (the author) thought there would be a number of mechanical difficulties in getting high pressures inside commercial furnaces constructed of refractory bricks for all such linings were porous. In the construction of electric furnaces a number of electrical details had to be carefully considered. For instance, when dealing with alternating electric currents inside a steel structure, it was necessary to avoid "eddy currents," i.e., currents induced in the steel structure. The efficient insulation of the electrodes where they passed through the wall of the furnace was also important. Great pressures could be attained in laboratory apparatus which were quite out of the question on a commercial scale. No doubt an electric furnace for fixation of nitrogen could be made tight against high pressures, but it was not clear that there would be sufficient advantage to make it worth while. The direct process gave good results without high pressure. Regarding depreciation he did not think it would be more than 10%. The lining of his furnace was remote from the arc flames, being behind the electrodes, and it was a very simple firebrick structure. The depreciation of the boiler would be higher than that of the furnace proper, but on the other hand depreciation on the absorption towers was very low. They were built on the lines of a brick chimney, and it was usual to allow only 2% for depreciation there. As the absorption plant formed the largest and most expensive part of the plant, 10% depreciation on the cost of the whole system was ample. There was no expensive catalyst or other expensive material to renew. There was nothing to go wrong with the furnace: it was more robust than an arc or induction furnace for smelting metals. He agreed with Mr. Lynn that by-product recovery was the proper way to generate power from coal, and that if produced in that way it could be sold in bulk for a 24-hour supply at a price that would compare

favourably with Norwegian water power. It would of course be more profitable to run the plant 8760 hours per year, as against the restricted hour basis of 5200 hours a year. At the same time these furnaces could be switched on and off at any time. Under such conditions a certain amount of heat energy would be lost by radiation during the periods of stopping and starting. That might be got over by passing a certain amount of current through a heating rheostat at a low voltage so as to keep the lining, etc., warm during the standing hours.

Mr. A. H. LYNN said that the capital cost of nitric acid plant in Norway had been very high indeed. It would be interesting to know what was Mr. Kilburn Scott's idea as to cost of a plant for direct fixation of nitrogen. The author had omitted to mention the production of power by making producer gas and simultaneously recovering by-products. If such a plant were erected near collieries where suitable coal was obtainable, the gas could be obtained for nothing, or even at a profit. By utilising this gas either in large gas engines or under steam boilers and utilising steam turbines, power costs of 0.1 penny per kilowatt-hour could be attained in Great Britain, not on the restricted service basis of 5200 hours a year, but continuously for 8760 hours per annum. He (the speaker) had installed such plants for the Badische Anilin und Soda Fabrik, and also for the Hoechst Farbwerke, for electro-chemical purposes, to use even comparatively expensive coal. It was probable that the electric furnace could be utilised much more profitably if it could be worked continuously.

Mr. W. F. REID said that perhaps Mr. Kilburn Scott had not had the opportunity of trying his boiler on a large scale; others had found it was not practicable to expose a boiler to such a great heat. The heating of the water might possibly be managed, but the nitrous gases corroded the metal very rapidly. The great difficulty was to cool the gases as soon as possible after the initial fixation of the nitrogen, because otherwise the nitrogen compounds produced were decomposed again by the heat. In the Pauling process the gases were cooled in a very ingenious way by means of an English invention. The stoves designed by Cowper to heat the air supply for blast furnaces were used, but the process was reversed. There were two of them in the plant shown in one of the figures. The hot gases and air passed through the chilled brickwork, and the brickwork took up the surplus heat. The two chambers were used alternately, so that the gases could be chilled without great wear and tear. He had not the slightest doubt, in view of the experience already gained on the matter, that 10% depreciation of a boiler in that position would not be nearly enough. The absorption of the gas seemed to him to be a great problem. A small quantity of a valuable product had to be absorbed when mixed with a very large quantity of gas. He had visited several of the factories, and at most of them large volumes of orange fumes were escaping at the exit. The bulk of the nitric acid used in this country must be concentrated; dilute acid was of very little use. In some of the factories an ordinary tower was used like those used to concentrate waste acid in explosives factories, which worked fairly satisfactorily. He was inclined to think that the future of the industry would lie in the oxidation of ammonia made from the atmosphere. Large quantities of nitric acid were being made in Belgium by that process, until the Germans interrupted it. There was no necessity to take the ammonia from this country to Norway in order to get nitrate of ammonia when they had the means of producing it from the atmosphere. In the direct electric process a small quantity only of the electric power was utilised in producing combination of the two gases. If the waste heat could be

economised, and power produced in some better way than Mr. Kilburn Scott suggested doing with his boiler, a great proportion of the power might be economised. So far he was not aware of any process that did that, but it would give enormous economy. It would be a more efficient process if the only energy lost was that employed in the actual combination. Mr. Kilburn Scott placed the minimum power required for a factory very low indeed when he said 1000 H.P. If anybody had surplus power they might utilise a portion to make nitric acid. Personally he would not advise the erection of plant under 40,000 or 50,000 H.P. He quite agreed with what had been said with regard to producer gas power. With the utilisation of waste products on the spot where the stuff was wanted and used, he thought they could compete with a factory which had in the first instance to put up plant to utilise water power. The cost of harnessing water power was very considerable, and they usually had to carry the material a very great distance, and the carriage of such materials at the present time was a serious matter. He had sought out all the water power in Scotland, but the biggest sources were taken up, and the reason the others were not utilised was because it would not pay on such a small scale.

Mr. KILBURN SCOTT said that it was not until the nitric oxide changed to nitrogen peroxide that it attacked metal, and that change did not take place until the temperature had dropped to below 600° C. Now the temperature of the arcs in these furnaces was somewhere about 3000° C., whilst the temperature at which the gases left the furnace was just under 1000° C. For example, Eyde had stated that the gases left his furnace at between 800° and 1000° C., and Schönherr had given about the same figures. Now 900° C. was below the temperature at which gases entered the tubes of high-class boilers. Boilers were used in Norway for the purpose of raising steam for various industrial purposes in the factory; in fact, evaporation of the products was about the only purpose they had to use the steam for. The gas entered the boilers at about 400° C., and left at about 200° C. Therefore it was clear that the gas went into the boilers at under the temperature at which it had changed into nitrogen peroxide, and as already stated it was not until it had changed into nitrogen peroxide that it attacked metal. He thought 10% depreciation was enough.

The Cowper stoves installed at the plant in the Haute Alpes were at some distance from the furnaces, and their purpose was solely to cool the gases and not to prevent dissociation. Dissociation must be prevented in the furnace itself, and in the Pauling furnace it was effected by blowing a separate supply of cooling air into the top of the arc flames. Before the gases reached the Cowper stoves they had already passed through the preheater. The most scientific and efficient way to cool the fixed gases was to take advantage of the latent heat of steam to absorb the heat rapidly. With regard to acid concentration, it was well known that acid could be brought up to 66% by mere heat evaporation. The absorption towers would give up to 50%, but up to 30 or 40% strength would do to make such products as calcium nitrate and ammonium nitrate. The Ostwald catalytic process in use in Belgium, at Vilvorde, made the acid at 40 to 50%, so that for the higher concentrations the sulphuric acid plant was required for that just as for any other process. As regards the minimum horse-power advisable for the plant, one nitric acid factory complete with Cowper stoves worked by power from a glacial stream, etc., absorbed only 4000 kw., having nine furnaces of 450 kw. each. Another plant which had been running most successfully in Italy for many years with energy purchased from a power company took 7500 kw. Ten years

ago the largest plant in Norway was of only 120 kw., capacity. A nitric acid factory at Legnano, near Milan, which had been using Pauling furnaces for many years worked on that restricted service. It used 7500 kilowatts, and electric energy was supplied by a power company during the off-peak hours at 20s. per kilowatt-year.

One considerable source of waste power which could be readily harnessed for the electric production of nitric acid was that of modern by-product coke oven plants, which gave a surplus of about 50% of the whole gas produced. Mr. Twynam, of Middlesboro, and himself were interested in a proposal to convert this waste gas into electrical energy, then utilise the energy in a Kilburn-Scott furnace for the production of nitric acid, and finally combine the nitric acid with the ammonia in the whole of the coke oven gases so as to form nitrate of ammonia. Figures which had been got out showed that it would be more profitable to use the surplus gas and the ammonia in that way than merely to make the less valuable sulphate of ammonia, as at present, the sulphuric acid for which had to be purchased.

The Ostwald patents for making nitric acid by the catalytic process taken out about a dozen years ago, were transferred in April, 1910, to a company called Nitrates, Ltd., promoted by Mr. A. S. Barton. Not only had there been no profits, but Mr. Barton had admitted that the process had been most inefficient, and £78,604 had been spent in twelve months on account of the factory.

*Meeting held at Burlington House on Monday,
February 1st, 1915.*

MR. W. F. REID IN THE CHAIR.

Specimens of chemicals and apparatus were displayed, which hitherto have been mainly produced abroad, but now are being manufactured in this country.

The following is a list of the exhibitors and products:—

*Messrs. Baird and Tatlock, Ltd. (London).—*Glass apparatus of their own manufacture, porcelain boats and crucibles, thermometers, burettes, and reagent chemicals.

*Messrs. W. and R. Dalston, Ltd. (Maidstone).—*High-grade filter papers, suitable for laboratory analysis.

*Messrs. A. Boake, Roberts and Co., Ltd. (Stratford).—*Anethol, eugenol, citral, citronellal, geraniol, triacetin, terpeneless oils of lemon and ginger.

*The British Glass Wool Co. (2, Compton Road, N.).—*Glass wool.

*The British Laboratory Ware Association, Ltd.—*English-made glass beakers, flasks, tubing, etc., Doulton porcelain ware, and Royal Worcester porcelain crucibles, etc.

*Messrs. Butterworth Bros., Ltd. (Newton Heath, Manchester).—*Glass tubing, Tenax leadless resistance glass, canes for tungsten wire.

*Corticine Floor Covering Co., Ltd. (Aldersgate Street, E.C.).—*Articles of compressed cork.

*Messrs. Higgins Bros. (Liverpool).—*Salicylic acid.

*Messrs. Johnson and Matthey (Hutton Garden, E.C.).—*Magnesium metal and powder, barium platinocyanide for X-ray screens.

*Manchester Oxide Co. (Manchester).—*Pure barium and ammonium sulphocyanides.

*Morgan Crucible Co., Ltd. (Battersea, S.W.).—*Combustion and pyrometer tubes.

*Messrs. James Powell and Sons (Whitefriars Glass Works, E.C.).—*Glass flasks and tubing.

*Messrs. A. G. Thornton, Ltd. (Manchester).—*Sectional papers, true to scale, replacing German-made products.

After a brief description of the exhibits had been given, Mr. J. J. EASTICK moved a resolution urging the Government to take such steps as would tend to the production and refining within the Empire of sugar sufficient for the Empire's consumption. The resolution was supported by Capt. G. L. Courthope, M.P., Mr. C. S. Parker, Mr. W. T. Chadwin, and Mr. Buckmaster. Further discussion was adjourned till March 1st, 1915.

Manchester Section.

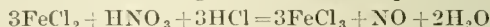
*Meeting held at the Grand Hotel, on Friday,
December 4th, 1914.*

MR. JULIUS HÜBNER IN THE CHAIR.

A RAPID METHOD OF ESTIMATING NITRATES.

BY EDMUND KNECHT.

The oldest method for the quantitative determination of combined nitric acid is that of Pelouze, in which a known weight of the substance to be assayed is boiled with excess of ferrous chloride (or sulphate) and concentrated hydrochloric acid, when the following reaction takes place:—



The remaining ferrous chloride is then estimated either with standard bichromate or permanganate. An alternative method (Knecht and Hibbert, "New reduction methods in volumetric analysis," p. 67) is to estimate the ferric chloride directly by means of titanous chloride.

The nitrometer of Lunge affords a rapid and accurate means of estimating combined nitric acid, and is perhaps the most universally used, especially in works practice. It is based upon the fact that nitrates, in presence of concentrated sulphuric acid and metallic mercury, yield the whole of their nitrogen as nitric oxide, which is measured directly as such.

A third method is a gravimetric one and is based upon the property of diphenyl-endanilohydrotriazole (Nitron) of forming a sparingly soluble precipitate with nitrates.

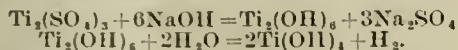
A fourth method of estimating nitrates is based upon the quantitative reduction of nitric acid to ammonia in presence of excess of caustic alkali by means of a suitable reducing agent, according to the scheme:—



The ammonia formed is collected in standard sulphuric acid and the extent of the neutralisation of this is ascertained by titration with standard alkali, or in case very small quantities only are present the distillate is nesslerised. The reducing agent originally employed in this method was zinc dust, but later it was found that aluminium was more suitable for the purpose. In both cases, however, a considerable amount of time was considered necessary to effect complete reduction.

In a paper published in 1903 (Ber., 36, 166; this J., 1903, 232) the author drew attention to the fact that titanous hydroxide was capable of effecting the complete reduction of nitrates to ammonia. A further examination of this reaction showed that the reduction is almost instantaneous.

When caustic soda is added to a solution of a titanous salt, black titanous hydroxide is precipitated, but this begins to decompose almost at once, yielding nascent hydrogen and the white titanous hydroxide, probably according to the following equations:—



The new method, or rather the modification of the old method, is based upon this reaction, and when properly carried out has given entirely satisfactory results.

A convenient amount of nitrate for a single estimation is about the equivalent of 0.1 gm. potassium nitrate. Thus, in the assay of a commercial sodium nitrate, about 1 gm. is accurately weighed, dissolved in water, and made up to 100 c.c. Of this, 10 c.c. are measured into a copper flask, excess of caustic soda is added, and then about 20 c.c. of commercial titanous sulphate or chloride. The distillation can then at once be proceeded with and, after the boiling has been continued for a quarter of an hour, the operation is finished and back titration is effected.

It is essential that the reagents should be added in the sequence as stated, for if the acid solution of the titanous salt is allowed to react with the nitrate, reactions take place which result in the expulsion of a portion of the nitrogen either as nitrous or nitric oxide, and the result is consequently unreliable. It is also obvious that the titanous salt should be free from ammonia. Personally I have not had any trouble in this respect, but I am informed that ammonia has been found in small quantities in some of the older commercial products. In the newer products, however, this is not the case, and the price need not be a deterrent, for two estimations can be carried out at a cost of the reagent of considerably less than one penny.

Two estimations carried out in the manner described on pure potassium nitrate gave respectively 99.80% and 99.83%. The results have been corroborated by different observers and have invariably revealed the reliability of the process.

Nitrites are also quantitatively reduced to ammonia by the action of titanous hydroxide in presence of excess of caustic alkali. This was shown to be the case by a duplicate experiment with pure crystallised silver nitrite, which yielded in both cases 99.47% AgNO_2 .

The quantitative reduction of nitric acid to ammonia by the lower oxide of a metal as described in the above short note is, I believe, the only instance of its kind, and I am convinced that the method affords the most rapid of all existing processes for the exact estimation of combined nitric acid. Any curtailment of time required for such an estimation is a gain to the analytical chemist and indirectly to the industries. The method has been introduced with success into the practical curriculum of the Chemical Department of the Municipal School of Technology, Manchester.

DISCUSSION.

Dr. T. J. I. CRAIG said that all the titanous sulphate made in the Manchester Alum Works was now free from ammonia. Aluminium amalgamated with mercury reduced nitrates in acid solution, and it was employed in one laboratory in the Manchester for sewage and water analysis; when small quantities of nitrate were present a piece of aluminium was amalgamated by immersion in a dilute Nessler solution. The sample of water was poured on, and acid was added, and in two hours the nitrates were reduced to ammonia

which was then distilled off and determined. He had tried Prof. Knecht's new process and found it reliable.

Mr. J. H. LESTER pointed out that the use of aluminium amalgam was adopted by himself in 1888, at the suggestion of Dr. Ormandy.

Professor KNECHT, in reply, said that he had not tried aluminium amalgam, but could quite understand that it would work more rapidly than aluminium alone. Copper vessels were used because they prevented the "bumping" which occurred rather badly in glass, and also after the titanous hydroxide had been precipitated, it was difficult to clean the vessels, as it adhered very firmly to the glass. He could not say definitely whether very dilute solutions of nitrates would be instantaneously reduced, but the reason why the titanous hydroxide acted so rapidly was that there was a very large surface, probably something like a thousand times as great as with a metal, and consequently the reduction was very much more rapid. He should imagine that in very dilute solutions nitrates would be instantaneously reduced. He could not say whether organic matter would disturb the course of reaction.

Nottingham Section.

Meeting held at Nottingham, on Wednesday, December 9th, 1914.

MR. L. ARCHBUTT IN THE CHAIR.

DISCUSSION ON A "RAPID AND ACCURATE METHOD FOR THE DETERMINATION OF CARBON IN IRON AND ITS ALLOYS."

BY DR. ERNST SZÁSZ (this Journal, 1914, 994).

Mr. T. H. ADAMS said that the rapidity of the method was for some classes of work very desirable, provided that accuracy could be obtained, but this he rather doubted. He strongly deprecated the patenting of an analytical method as tending to hinder research. The amount of steel burnt was small compared with the amount usually taken for the direct combustion process. The preliminary purifying train for the oxygen was, in his opinion, unnecessarily complicated. He could not see the necessity for the incandescent platinised asbestos, as compressed oxygen prepared, as was the greater proportion made in this country, from liquid air could hardly contain any tangible quantity of carbon monoxide or hydrocarbons. In his opinion the best method was first to burn steel of well-verified carbon content each day before commencing any unknown samples. If the correct result was obtained it was proof that all was in order. When working in this way the only preliminary purifying train required was a soda-lime tube and a valve flask of sulphuric acid similar to the one described in the paper. The oxygen gas holder was also unnecessary. For years he had worked from a cylinder with an ordinary reducing valve with satisfactory results. It seemed probable that the capacity of the combustion tube together with the connecting tubes and condenser was at least 60—70 c.c. The total capacity of the measuring vessel was only 150 c.c., and this was not completely filled by the evolved carbon dioxide and the oxygen used for washing out. It seemed, therefore, that all the

carbon dioxide had to be washed out by about an equal volume of oxygen, that is, the apparatus was only once rinsed out by oxygen: that was not enough. If the process had been given about double the time and used as a gravimetric process it would have been better. The necessary temperature in the furnace to induce the commencement of the rapid absorption of oxygen by the steel was, in his experience, about $1000^{\circ}\text{C}.$ and the figure given by the author, $1150^{\circ}\text{C}.$ was really higher than was necessary, but perhaps that was a vital point in the process when extreme rapidity was required.

Mr. BERNARD COLLITT said that the estimation of carbon in steel by direct combustion in a current of oxygen was thoroughly worked out in England before adoption in America and Germany, and was described by Dr. John E. Stead at the 1904 meeting of the Iron and Steel Institute in America; he stated that his attention had been drawn to the method by one of his old pupils who had used it successfully as early as 1890. The use of a pre-heating tube or furnace to burn organic matter in the oxygen to carbon dioxide was recommended in the standard method of the American Foundrymen's Association six years ago or more. He failed to see the necessity of drying the oxygen before it reached the steel. Over 30 years ago Prof. J. O. Arnold had shown that chemically dry oxygen would not unite with bright steel turnings at a full red heat; Hilpert (Ber., 1913, 46; this J., 1913, 509) stated that whilst with dry oxygen a temperature of $1200^{\circ}\text{C}.$ was necessary for the complete combustion of steel and iron, with moist oxygen a temperature of $950^{\circ}\text{C}.$ was sufficient. Besides eliminating the calcium chloride tube for the oxygen entering the combustion tube, could not the chromic acid bulb for the leaving oxygen be also eliminated by using as sealing liquid for the gas a solution of sulphuric acid (1 to 10) containing some dissolved chromic acid? The measurement, instead of weighing, of the carbon dioxide produced by the combustion of carbon in steel, etc., had been suggested by Wiborg in 1887. It was impossible to find any difference between his method and that described by Wirtz in "Stahl und Eisen" in 1913, where it was claimed that carbon estimations in steel "analytically exact and faultless" could be made in three to four minutes at a cost of 1½d. per estimation. The apparatus was different, but the methods were identical.

The CHAIRMAN said he had experimented with the direct combustion process ten years ago, when Dr. Stead described in the Journal of the Iron and Steel Institute his method in which the steel drillings were mixed with manganese ore. It was soon found to be unnecessary to mix anything with most steels, and that the sole condition for success was to get the right temperature, which must be in the neighbourhood of $1000^{\circ}\text{C}.$ The steel, while burning, absorbed the oxygen as fast as it could conveniently be passed in, and the form of combustion apparatus used was governed by the method of measuring the CO_2 formed. The very ingenious apparatus described by Dr. Szász, no doubt, answered admirably the inventor's purpose, and gave correct results. But it would be absurd to put up an expensive and complicated apparatus of that kind unless a very large number of analyses had to be made regularly in a very short space of time. In an ordinary laboratory, dealing with only a few samples of steel per day the analyst would find it more economical and convenient to use the much simpler apparatus necessary for absorbing the CO_2 and weighing it. A moderate number of samples daily could be dealt with in that way without the constant attention needed by Dr. Szász's apparatus, and time left for other work to be carried on by the same operator. The oxygen usually supplied in cylin-

ders in this country needed no such elaborate purification as Dr. Szász described, but it was desirable to pass it through a simple purifying train containing soda-lime, calcium chloride, and a sulphuric acid drying tube. If it was necessary to work much more rapidly, the CO_2 might be measured by means other than weighing. There were several ways in which it could be done, and Dr. Szász's method was one of these. He did not think there was anything in his particular method which radically modified what they already knew.

Obituary.

CARL LIEBERMANN.

Geh. Rat. Prof. Dr. Carl Liebermann died in Berlin on Dec. 28th, 1914, at the age of 73. In his early years he was assistant to Prof. Adolf Bayer, and in 1879 was appointed Professor of Organic Chemistry at Charlottenburg, a post which he held until his death. He will always be remembered for his work in connection with the synthesis of alizarin. Having recognised that natural alizarin was a derivative of anthracene, Graebe and Liebermann in 1869 succeeded in preparing alizarin by fusing dibromoanthraquinone with caustic potash, and in the same year, Graebe, Liebermann, and Caro discovered that anthraquinone-sulphonic acid was converted into alizarin by fusion with caustic potash (see W. H. Perkin; this J., 1885, 4, 432). Liebermann made an extensive investigation of other dyestuffs, including aurin, pittacal, brazilin, quercetin, xanthorhamnin (rhannetin) archil, cochineal, and catechu. He also carried out much valuable research in connection with the alkaloids, particularly those of coca, and his method for converting ecgonine into cocaine is used at the present time. He was successful in synthesising isonarcotine, cinnamylcocaine, and the two truxillines, in isolating hygrine and cuscohygrine from cusco leaves, and in elucidating the constitution of tropacocaine, opianic acid, and the truxillic acids.

MAURICE BRICKDALE LLOYD.

Captain M. B. Lloyd, late of the Royal Artillery, was born in 1863, received his first commission in 1884, and served for some years in India as lieutenant and captain in the R.H.A. Later he passed into Woolwich, and at the conclusion of the two-year course was appointed to the staff of the College as Instructor in Chemistry and Electricity, which appointments he held until transferred to the Home Office as an Inspector of Explosives. As an Inspector he did valuable work for the Government, and conducted inquiries in several cases of public interest. Leaving the Army, he became, in 1908, a director of Curtis's and Harvey, Ltd., where his technical knowledge, particularly in the location and construction of danger buildings and as to naval and military ammunition, found ample scope. He was a member of the War Office Committee on Shipments of Explosives and of the Celluloid and Abel Heat Test Committees. He also compiled a booklet on the construction of stores and magazines for explosives, and the Home Office regulations concerning them.

He died, after a short illness, on February 5th.

Journal and Patent Literature.

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I.—GENERAL PLANT; MACHINERY.

PATENTS.

Cooling air to low temperatures; Process of, and apparatus for —, also applicable to the production of ice. R. P. van Calcar, Begstgeest, J. Ellerman and J. H. Martijn, The Hague, Holland. Eng. Pat. 2950, Feb. 4, 1914. Under Int. Conv. Feb. 26, 1913.

A CURRENT of air is drawn by a fan through a closed chamber into which a volatile liquid, such as ether, ethyl chloride, or the like, is also introduced. The cooling produced by the evaporation of the volatile liquid condenses the moisture as frost or snow, which is deposited on the surface of a layer of sodium or calcium chloride or other salt capable of forming a freezing mixture with snow or ice. The basket or cage containing the salts surrounds a vessel containing water, which is frozen by the cold produced. The cooled air, after leaving the chamber, is passed through another chamber cooled externally and having a number of globular expansions which form baffles and impart a whirling motion to the air. This causes the condensation and deposition of the volatile liquid, which is collected for re-use.—W. H. C.

Gases; Apparatus for washing —. W. B. Davidson, Birmingham, and A. J. Liversedge, Croydon. Eng. Pat. 19,028, Aug. 25, 1914.

THE patent relates to apparatus in which the gas enters the compartments of the washer at the bottom near the side and meets a spray of washing liquid produced by a centrifugal device mounted on a central vertical shaft. To prevent the spray from entering the gas-inlet passage, a grid composed of substantially vertical, concentric, annular plates, or of one or more strips wound spirally, is provided, in conjunction with a curved deflector over the gas passage. The washing effect is increased by the thin streams of liquid flowing down the plates of the grid. The device may be applied not only to gas-washers of the type described in Eng. Pat. 9302 of 1914 (see this J., 1911, 1082; in the figure there given, 3 is the grid and 2 the deflector), but also to other washers, such as the Feld sprayer.—A. S.

Gases of low boiling point; Apparatus for cooling and liquefying —. Industriegas-Ges. für Sauerstoff- und Stickstoff-Anlagen m. b. H. Ger. Pat. 276,977, April 18, 1912. Addition to Ger. Pat. 198,503.

IN the apparatus described in the chief patent (see Fr. Pat. 446,560; this J., 1913, 142), the cooling tube is enlarged, or a vessel is interposed, at a place where the temperature is below the liquefying point of the more easily condensable gas. Any liquefied or solidified material which passes from the receiver proper into the cooling tube, is retained in this enlargement or vessel, and the less easily condensed constituent passes on to the final portion of the cooling tube, where it is cooled to its liquefying point.—A. S.

Transmission or exchange of heat between fluids; Apparatus for the —. A. D. Harrison, Wolverhampton. Eng. Pat. 4252, Feb. 18, 1914.

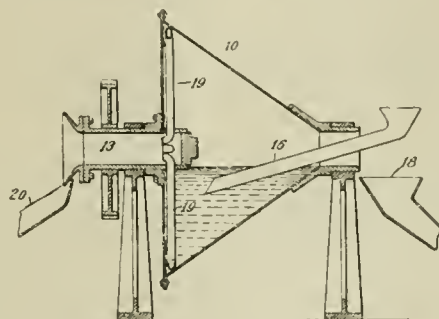
To allow for the alteration in volume of the fluids flowing in opposite directions through a heat-inter-

changer, the latter is built up of plates bolted together and having two non-communicating, adjacent passages or series of passages between them, the flanges and baffles which constitute the walls of the passages being so arranged that the cross-section of the passage for the fluid being heated increases and that for the fluid being cooled decreases from the inlet to the outlet.

—W. H. C.

Separating coarse particles from divided material. H. W. Hardinge, New York, U.S.A. Eng. Pat. 11,213, May 6, 1914.

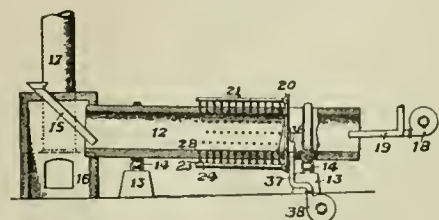
THE material is mixed with water and fed through the shoot, 10, into the rotating conical barrel, 10. The coarse particles settle to the lowest part of the



barrel and are scooped up by the conveyor pipes, 19, and discharged through the hollow shaft, 13, into the shoot, 20. The finer material is discharged from the smaller end of the barrel into the shoot, 18.—W. H. C.

Furnace or kiln; Rotary —. G. F. Downs, Buffalo, N.Y. U.S. Pat. 1,121,906, Dec. 22, 1914. Date of appl. April 25, 1914.

A CIRCULAR head, open at one end, is mounted upon a rotary cylindrical furnace (see figure), and is connected by manifolds and pipes with the



interior of the cylinder, and by its open end, during part of the rotation, with a wind-box to which gas or air under pressure is supplied. When not in communication with the wind-box, the open end of the manifold is closed by a plate held against it by a spring.—W. H. C.

Distillate condenser and steam generator. C. L. Suhr, Oil City, Pa. U.S. Pat. 1,122,169, Dec. 22, 1914. Date of appl. April 7, 1914.

THE vapours from the still are led downwards and around the tubes of a horizontal tubular heater, to

a coil condenser. Water is passed through the heater, and the steam given off is passed into the still. The supply of water and the discharge of steam are controlled by float-valves.—W. H. C.

Filtering colloidal materials; Apparatus for —. J. von Kruszewski. Ger. Pat. 275,888, Dec. 23, 1913.

THE material is passed successively through two or more sieves, arranged in series. The sieves, or one or more of them, are coated with fat or the like, or treated in any other way to render them incapable of being wetted by the liquid passing through. With this arrangement considerable quantities of colloidal slime can be filtered clear, in a short time, without the use of high pressure. —A. S.

Treating liquids or solids with gases, liquids or mixtures of these; Apparatus for —. R. Timm. Ger. Pat. 276,119, Oct. 5, 1913.

A RECEPTACLE for the material under treatment rotates about a horizontal or inclined axis, on hollow bearings, the median axis of the receptacle



intersecting the axis of rotation, between the bearings, at such an angle that the centre of gravity of the empty receptacle lies on the axis of rotation. Several such receptacles, communicating one with another, may be mounted, in series, about a common axis, as shown in the figure; the arrangement may be such that the centres of gravity of the receptacles next to the bearings, *b*, lie outside the axis of rotation, *CD*, but the centre of gravity of the complete series of receptacles lies on the axis. The receptacles may be fitted with perforated partitions, *i*, the perforations in adjacent partitions being so arranged that a certain number of them are always covered by the liquid or solid under treatment. The apparatus is especially suitable for dissolving solids and preparing suspensions. —A. S.

IIA.—FUEL; GAS; MINERAL OILS AND WAXES.

Coal and coke; Determination of ash in —. F. Weissner. Chem.-Zeit., 1914, 38, 1254—1265, 1289—1290.

THE ash-content of coal determined by incineration is always lower than the true content of mineral matter, chiefly owing to the conversion of carbonates into oxides during ignition, and the results obtained over a naked flame in an open dish are higher and more accurate than those obtained in a muffle, because in the former case the loss mentioned is partly compensated by fixation of sulphur dioxide from the gases of the flame (see this J., 1912, 674). In coke, however, the quantity of carbonates present is almost negligible, and the ash-content determined by incineration tends to be high, owing mainly to the oxidation of the sulphur to sulphates and, when a naked flame is used for heating, to the absorption of sulphur dioxide. If the weight of ash obtained, whether over a naked flame or in a muffle, be diminished by subtracting the weight of sulphuric anhydride present in it, the result accords closely with the true content of mineral matter in the coke. By incinerating in a muffle, at not below 900° C., sulphates are mostly

decomposed and fairly accurate results may be obtained without any correction. An example is given of a coke containing 0.1% CO₂ as carbonate, 0.08% S as sulphide, 0.14% Fe as sulphide, 0.82% FeO, 0.08% SO₃, and 12.76% of silicates, making altogether 13.98% of mineral matter. The ash-content found by incineration at 750° C. was 14.36%; at 900° C., 14.13%; and over a naked flame, 14.67%. (Cp. Wagener, this J., 1913, 935).—J. H. L.

Peat; Utilisation of —, in Italy [production of ammonium sulphate]. U. Rossi. Monthly Bull. Agric. Intelligence, Rome. J. Roy. Soc. Arts, 1915, 63, 162—163.

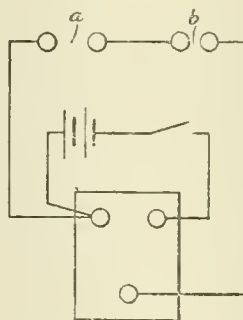
AT Orentano and Codigoro, artificially dried peat, containing 25% of water, is carbonised in a turret-shaped oven, 26—33 ft. high, by the Mond process. From 1 ton of peat containing 2.5% N about 175 lb. of ammonium sulphate are thus obtained at a cost of from 4s. 10d to 5s. 7d. per cwt. The factory at Orentano has been working since 1910, the present daily capacity being 1800 cub. ft. of peat, yielding 50 tons of ammonium sulphate per month; at the works at Codigoro, operated since 1912, 150 tons of dried peat, yielding 10—12 tons of ammonium sulphate, are treated daily.

—W. E. F. P.

Measuring flame velocities in gas and dust explosions; An instrument for —. J. D. Morgan. Engineering, Jan. 8, 1915, 39—40.

ADVANTAGE is taken of the reduction in the resistance of air or gas to the passage of an electric spark caused by the rise in temperature which

takes place as the flame of the explosion moves along. Two spark gaps, *a*, *b*, are arranged in the circuit of wires from an induction coil. Under normal conditions a spark will not jump the wider gap, *a*, but if the resistance of the air at *a* be lowered, owing to rise of temperature, and a spark passes, a spark will also pass at *b*. The gap, *a*, is placed in the path of the explosion wave, and the gap, *b*, is arranged in conjunction with a drum



carrying a band of smoked paper on which the spark will make a record. The time of rotation of the drum is registered on the paper by a line of marks made by the vibrations of a tuning fork of known periodicity. The sparking plug which fires the explosive mixture is also in series with a second spark gap, and the spark produced at the latter makes a record on the drum. The distance between the firing point and the position of the recording gap, *a*, being known, and the time interval between the firing spark record and the record corresponding to the spark produced at *a* being obtained from the tuning fork record, the time taken by the flame to travel the distance can be calculated. Several recording gaps are arranged one after the other in the path of the flame, and all register on the same drum.—W. H. C.

Coal-gas; Determination of hydrogen sulphide in —. A. B. Way. Amer. Gas Institute. J. Gas Lighting, 1914, 128, 660—661.

A WIDE-MOUTHED bottle of about $\frac{1}{2}$ gallon capacity is fitted with a three-hole rubber stopper, which is always inserted to the same depth. A thermometer passes through one hole, and glass inlet and

outlet tubes, provided with rubber connections and pinch cocks, through the others. Gas to be tested is passed through the bottle to expel the air, and the outlet cock is closed to ensure a pressure in the bottle, which is brought to the normal, when the sample has cooled, by opening one of the pinch-cocks while the loose end of the rubber tube is immersed in water to a depth of $\frac{1}{4}$ inch. The cock is closed, the tube connected with a levelling bottle, and the other tube with a burette containing a solution prepared by dissolving 20 grms. of cadmium chloride in 125 c.c. of water and 50 c.c. of strong ammonia, filtering and making up to 1 litre with 300 c.c. of strong ammonia and water. By means of the levelling bottle about 30 c.c. of the solution are drawn into the gas bottle, and the burette and levelling bottle are disconnected. After shaking, the pressure is released by slowly opening the pinch-cock, and the contents of the bottle are poured on to a dry filter and washed with water. The filter and precipitate are placed in the bottle, an excess of $N/20$ iodine solution, 3 c.c. of starch solution, about 200 c.c. of water, and 50 c.c. of commercial hydrochloric acid are added, the stopper is inserted, the bottle shaken for a minute or two, and the excess of iodine titrated with $N/20$ thiosulphate solution. Using $N/20$ iodine and a bottle holding 2000 c.c., 1 c.c. of iodine solution represents 18.62 grains of H_2S per 100 cubic feet of gas.—W. C. H.

Natural gas as an economic mineral; Inflammable — J. A. L. and W. H. Henderson. Inst. Min. and Met., Jan. 21, 1915. [Advance proof.]

STATISTICS and graphs are given showing the rapid rise of the natural gas industry, particularly in the United States, which produces 97% of the world's supply. In 1912 the production in liquid volume was 85%, of that of petroleum, in weight 41%, and in value 52%. The average price was 7.52d. per 1000 cub. ft. "Dry" gas, consisting mainly of methane (50–95%) with smaller quantities of ethane, propane, and butane, has an average calorific value of about 1100 B.Th.U. per cub. ft., weight 48 lb. per 1000 cub. ft., and sp. gr. 0.63 (air=1). Its production was 263% of the volume of manufactured gas and its average price was 21.5% of that of the latter. It is the most efficient fuel known for nearly all purposes, its principal limitation being the restriction of its use to the area which can be supplied by pipe line. "Wet" gas from the oil wells contains a larger proportion of heavier gases such as ethane, propane, butane, and sometimes ethylenes, its chief value being its gasoline content. Four commercial products are obtained, viz., ordinary motor spirit; the light product which is mixed with naphtha to produce motor spirit; semi-liquid "gasol," distributed in high-pressure containers; and residual "dry" gas. Very large quantities of gas have been and are still being wasted.

—W. F. F.

Petroliferous mounds of Texas and Louisiana; Origin of the — J. Chautard. Comptes rend., 1915, 160, 69–72.

THE following geological changes are suggested as an explanation of the formation of the petroliferous mounds of Texas and Louisiana:—Sedimentation in an intermittent lagoon of various salt formations, sands, and clays with buried organic debris, and layers of anhydrite corresponding to the periodical drying up of the lagoon; decomposition into hydrocarbons of the organic matter buried in the saline sediments; transformation of the anhydrite into gypsum, with concomitant increase in volume, causing the upper layers to be elevated into the form of mounds; migration of the petroleum under the

influence of the pressure exerted on their parent rocks, whereby eventually it is concentrated beneath the impermeable exterior of the mounds.
—G. F. M.

Oils from peal. Perkin. See IIb.

Fireclay goods and their use in gas works. Holgate. See VIII.

PATENTS.

Gas in the atmosphere of mines; Means for detecting, indicating, and recording the presence and proportions of — H. R. Webster, Horsforth, Yorks. Eng. Pat. 29,094, Dec. 17, 1913.

IN apparatus of the type in which the presence of firedamp is detected by diffusion through a porous vessel and the distension of a diaphragm, the movements of a rod connected to the diaphragm are multiplied by toothed gearing or other mechanical device and indicated or recorded by a pointer. The casing carrying the multiplying and indicating device is connected with the base piece carrying the porous vessel in such a way that the two parts can be moved towards or away from each other in order to bring the pointer to the zero mark.

—W. F. F.

Vertical retorts. Means for charging vertical retorts. A. Waddell, Dunfermline, Fife, Eng. Pats. (A) 6112 and (B) 6113, Mar. 10, 1914.

(A) THE partition dividing a pair of retorts extends nearly to the crown of a single arch which forms their common floor, and which has an inclination almost sufficient to discharge the coke by gravity. A curved pusher resting on the arch is reciprocated from one retort to the other by rack and pinion gear; or a single retort may have a plane sloping floor, with a pusher travelling parallel to it. (B) To charge the retort with minimum loss of gas, the coal bogie has within it a discharging sleeve movable vertically, which is lowered on to a ring supported on the usual conical valve of the retort. On lowering the valve the sleeve descends with it and rests on the mouth of the retort, thus preventing lateral escape of gas.—W. F. F.

Coke; Method of cooling — Wärme-Verwertungs-Ges. m. b. H. Ger. Pat. 276,982, Aug. 19, 1913.

THE coke is cooled dry in jacketed chambers, water being circulated through the jackets at a high velocity and under such pressure that no evolution of steam occurs. The same water is used to absorb waste heat from all other sources in the coking installation, and a chamber is interposed in the circuit, in which a lower pressure prevails, and in which steam is evolved.—A. S.

Producer gas; Process and arrangement of plant for the treatment and recovery of tar and ammonia liquor from — Q. Moore, Glasgow, and The Dowson and Mason Gas Plant Co., Ltd., Manchester. Eng. Pat. 2650, Feb. 2, 1914.

THE gas is cooled to 100°–160° F. (38°–71° C.) in an air-cooled condenser and passed through a tar-extractor and second air-cooled condenser at a higher level. The tar and condensed liquor from the extractor and second condenser flow back through the first condenser in the reverse direction to the hot gas, whereby the tar is dehydrated. The tar and ammonia liquor are separated by decantation, and the latter is passed first through a heat exchanger, where it heats the water for the producer jacket, and then through a scrubber in the reverse direction to the gas from the second condenser. A strong ammonia solution is thus obtained.—W. F. F.

Petroleum-distilling apparatus. Process for distilling petroleum. R. E. Humphreys. Assignor to Standard Oil Co., Whiting, Ind. U.S. Pats. (A) 1,122,002, and (B) 1,122,003, Dec. 22, 1914. Dates of appl., June 14, 1913, and Jan. 20, 1914.

(A) IN a horizontal cylindrical still, the liquid is circulated between curved plates arranged substantially parallel to the still bottom, and each formed in two sections. The outer edges of the sections are hinged at opposite ends of a horizontal diameter of the still, and the inner, lower edges are detachably hooked together. (B) The above apparatus is used for treating paraffins from petroleum distillation boiling above 500° F. (260° C.), to obtain products of lower boiling point, by heating at 650°—850° F. (343°—454° C.), and a pressure above 4 atmospheres in contact with catalytic metal plates, and condensing only a small fraction.—W. F. F.

Gasoline; Means for controlling still-pressure in manufacture of —. F. M. Rogers and T. S. Cooke, Assignors to Standard Oil Co., Whiting, Ind. U.S. Pat. 1,122,220, Dec. 22, 1914. Date of appl., Aug. 5, 1914.

Two gas-discharge pipes are provided, one slightly smaller than necessary to maintain the desired pressure alone, and the other of small capacity and provided with a valve operated by the pressure in the still, so that it releases separate measured quantities of gas.—W. F. F.

Cooling hot or molten fats and fatty emulsions and the like. Eng. Pat. 10,863. See XII.

Water purification. [Removing gasoline, etc.] U.S. Pat. 1,121,994. See XIXb.

IIB.—DESTRUCTIVE DISTILLATION ; HEATING ; LIGHTING.

Peat; Oils from —. F. M. Perkin. J. Inst. Petroleum Technologists, 1914, 1, 76—84.

THE destructive distillation of dry peat yields a thick tar containing paraffin wax, and an aqueous distillate containing ammonia, acetic acid, acetone, and methyl alcohol. The gases evolved are sufficient to carbonise the peat if it has been previously dried till it contains only 20% H₂O. Coke hard enough for metallurgical purposes is obtained from suitably dried briquetted peat. The tar is fractionated, finally with superheated steam, to prevent carbonisation, and the fractions are washed with alkali and acid. The oils are largely paraffinoid. The yield from a briquetted Yorkshire peat was 38 galls. per ton, giving on fractionation 1.35% of oil of sp. gr. 0.867 below 150° C., 29.90% of sp. gr. 0.953 below 250° C., 50.00% of sp. gr. 0.941 above 250° C., and a residue of hard pitch. The last fraction contained 6% of paraffin wax. From 11 to 22 lb. of ammonium sulphate per ton was also obtained. The cost of dried peat should not exceed 4s. 6d. per ton, and on this basis the production of oil and carbon should be remunerative. Details of a plant to treat 50 tons of wet peat per day show that the capital required is £3070, and the labour charges £748 16s. for 6 months. Labour charges would be lower for a larger plant. (See also this J., 1914, 395.)—O. E. M.

Hardwood distillation industry in America. E. H. French and J. R. Withrow. Amer. Inst. Chem. Eng., Dec. 4, 1914. Met. and Chem. Eng., 1915, 13, 30—39.

A HISTORY of the development of the industry is given, and the various methods of distillation in

use and the design and construction of the apparatus are considered in relation to the yields and production costs of crude wood-alcohol, acetate of lime, and charcoal. In the most successful and modern system, the wood is carbonised in ovens (width 6 ft. 3 in., height 8 ft. 4 in., length 26—54 ft.; capacity 5—10 cords of 52 in. wood), to which tubular condensers are attached. The products obtained per cord (about 2 tons) of average, seasoned wood are:—crude liquor (containing 8—8.5% of acid and 4—4.5% of alcohol), 215—220 galls.; tar, 22—25 galls.; charcoal, 52 bushels (1040 lb.); and gas, 11,000—12,000 cub. ft., the latter consisting largely of air and carbon dioxide in the early stages, but having an important fuel value from the middle to the end of the distillation. The yields are greatly influenced by the manner in which the carbonisation is conducted, too high a temperature at the height of the run (above 750° F. [399° C.] at the neck of the oven) resulting in the formation of excessive quantities of non-condensable gases and tar, to the detriment of the more valuable products. The final products obtained are:—wood-alcohol (82%), 11 galls., value \$2.75 (11s. 5½d.); acetate of lime, 216 lb., value \$3.78 (15s. 9d.); charcoal, 52 bushels, value \$3.38 (14s. 1d.); total value \$9.91 (41s. 3½d.) as against a total production cost of \$8.85 (36s. 10½d.) per cord. For an oven plant operating on the above lines the cost of installation is about \$2000 (about £420) per cord per day capacity. In the United States there are, at the present time, 53 oven-, 31 retort-, and 6 kiln-plants having total daily capacities of 2909, 593, and 1300 cords, respectively; and in Canada, 1 retort- and 9 oven-plants having total daily capacities of 48 and 424 cords respectively. The annual production of crude wood alcohol in America is between 10 and 11 million gallons.

—W. E. F. P.

Flaming arc carbons; Chemistry of —. W. C. Moore. Amer. Electrochem. Soc., Nov., 1914. Met. and Chem. Eng., 1915, 13, 52—55.

THE chief constituents of flaming arc carbons for yellow and white light (those most commonly employed) are calcium fluoride and rare-earth compounds, respectively; but smaller proportions of other constituents or "addition agents" (usually three or more) are also present. All materials should be free from silica, ferric oxide, alumina, and similar impurities which, by promoting the formation of slag or non-volatile compounds would cause poor or irregular burning. Other factors being equal, the candle power developed is dependent on the amount of flame material and the proportions of the addition agents present: the following comparative results were obtained with cored carbons:—

Parts of calcium fluoride by weight	3	2	1	0
Parts of other salt by weight	0	1	2	3
Mean spherical candle power	927	1058	765	574

H. P. Gage (Phys. Rev., 1911, 33, 111) found that with cored yellow-flame and white-flame carbons the energy radiated as light from the arc stream was 39 and 27.5%, respectively, of the total radiant energy, these values being for the spectral region between 3800 and 6800 Angström units and an alternating current at 13.5 amp. In general, flaming arcs are of two types, according as the sheath or the core of the carbon appears the more luminous; an arc of the first kind is obtained with carbons containing calcium fluoride, and of the second with carbons containing chromic oxide; with few exceptions, arcs of the latter type give light of shorter wave-length.—W. E. F. P.

Translucent marble for lamps. Voegel. See VIII.

PATENT.

*Charcoal; Manufacture of decolorising—*from vegetable materials impregnated with salts before carbonisation. C. G. Hanhart. Ger. Pat. 275,973, Aug. 19, 1913.

THE vegetable material is impregnated with an easily soluble salt, such as calcium or magnesium chloride, then carbonised in presence of air at a comparatively low temperature, and the salts removed from the charcoal by lixiviation.—A. S.

III.—TAR AND TAR PRODUCTS.

Benzol; Sale and export of—. Modification of test. J. Gas Lighting. 1915, 129, 198.

IF 95% of the sample distils below 90° C. instead of below 81° C. as previously specified (see this J., 1915, 21), the sample may be sold without permit.—W. H. C.

PATENT.

*Acenaphthene; Process for obtaining—*from coal tar oils. Ges. f. Teerverwertung m. b. H. Ger. Pat. 277,110, Nov. 8, 1913.

WHEN heavy coal-tar oil is submitted to fractional distillation, a mixture of acenaphthene and other substances crystallises from the after-runnings of the acenaphthene fraction. According to the present patent this is mixed with some of the liquid distillate between the naphthalene and acenaphthene fractions and again distilled to recover the acenaphthene.—A. S.

IV.—COLOURING MATTERS AND DYES.

National dye scheme. Board of Trade Announcement, Jan. 29, 1915 (see also this J., 1915, 73).

THE provisional committee of users of dyes, which has been appointed to confer with the Board of Trade as to a scheme for the establishment of a national dye-making industry on a large scale, met on January 27th and 28th at the Board of Trade offices. The members of the enlarged Committee are:—Sir A. F. Firth, Bt., Sir Frank Hollins, Bt., Sir Mark Oldroyd, Mr. H. W. Christie, Mr. J. Clarkson, Mr. Charles Diamond, Mr. Kenneth Lee, Mr. G. Marchetti, and Mr. R. D. Pullar.

The Committee eventually came to a unanimous decision in favour of the adoption of a modified scheme, which it is believed will be acceptable to the various interests concerned. The full details of the scheme adopted will be made public after a further meeting of the Committee has been held, but it is now possible to indicate its general lines, which differ in certain important respects from those of the scheme already made public.

The proposal is to form a company with an initial share capital of £2,000,000, of which £1,000,000 will be issued in the first instance. The Government will make to the company a loan for 25 years amounting to £1 for every £1 of share capital subscribed up to a total of £1,000,000, and beyond that, £1 (up to a maximum sum of £500,000) for every £1 of share capital subscribed. The Government advance will bear interest at 4% per annum payable only out of net profits, the interest to be cumulative only after the first five years. There will be no compulsory sinking fund, but the dividend on the shares will be

limited to 6% per annum on the paid up share capital so long as any part of the Government's advance is outstanding.

In addition, and with the desire of promoting research, the Government have undertaken for a period of 10 years to make a grant to the company for the purposes of experimental and laboratory work up to an amount not exceeding in the aggregate £100,000.

With the object of securing that the company shall remain British and of preventing undue preference or encroachment on the businesses of British manufacturers of products other than dyes and colours, the Government will nominate two directors of the Company with special powers in relation to these matters. There is, however, no intention of using these powers to prevent the company from giving priority to shareholders in the supply of dyes or from making the by-products incidental to the manufacture of dyes.

The terms of the proposed agreement to be entered into between users of dyes and the company have been considerably modified in favour of the users.

An option has already been obtained for the acquisition of important dye-making works and negotiations for other options of a like character are in progress, whilst there is reason to believe that arrangements satisfactory to both parties can be made with important producers in Switzerland. Early steps will be taken to develop the supply of dyes both by the enlargement of the plants of the undertakings acquired and in other ways.

It is proposed that the company shall take powers to arrange for the assistance of a committee of experts conversant with the dyeing trade and its requirements, and in this connection Lord Moulton has promised to give the company the benefit of his assistance and advice.

It is believed that the steps thus taken will provide for the full and immediate utilisation of available resources for the manufacture of dye-stuffs and will provide an organisation capable of expansion so as to deal with the problem on a more comprehensive scale.

Dyestuffs in the United States; Proposed manufacture of—. Board of Trade J., Jan. 21, 1915.

THE Benzol Products Company of Philadelphia, which is connected with an important company manufacturing coal-tar products and said to be supported by a capital exceeding 100,000,000 dols. (about £20,550,000), has purchased seventy-five acres of land at Marcus Hook, Delaware Co., Pa., with a view to erecting large modern factories for the production of coal-tar dyes. Two thousand workmen, it is stated, will be employed, and it is estimated that production will commence in about six months' time.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

"Kemps" [in wool]. H. Priestman. J. Soc. Dyers and Col., 1915, 31, 5—8.

PHOTOGRAPHS of a "kemp" show that the medulla is composed of approximately spherical cells which, through some peculiarity of growth, take the place of the spindle-shaped cells of the normal wool-fibre. These spherical cells occupy the same volume as the normal medullary cells, making the kemp fibre about one-fourth the length and twice the diameter of the normal fibre. The opacity of a "kemp" is an optical effect of refraction and the kemp becomes transparent when saturated with a liquid such as benzene.

"Flat kemps" owe their curious lustre and opacity to the fact that they are collapsed hollow tubes. It is not certain whether the internal cells are completely missing, as has been suggested, but if they are present, they are entirely modified and contracted in size, leaving a hollow air-space. The latter view is supported by the fact that in certain processes of black dyeing the fibre swells out again, apparently through the expansion of some substance on the interior wall of the tube. In many cases normal internal cells are visible at the root-end in the form of a tuft, with the appearance of having been pushed out of the tube by pressure; this is the only direct evidence that "flat kemps" have at one time contained normal spindle-shaped cells.—J. F. B.

Acetylcelluloses. E. Knoevenagel. *Verein deutscher Chemiker*, June, 1914. *Z. angew. Chem.*, 1914, 27, 505—509.

ACETYLCELLULOSES are now made exclusively by the action of acetic anhydride on cellulose in presence of a catalyst, the use of acetyl chloride having been abandoned. Many catalysts, especially sulphuric acid, induce acetolysis of the cellulose molecule, a process quite distinct from hydrolysis and leading ultimately to the transformation of the cellulose into cellobiose octaacetate and dextrose penta-acetate (see also this J., 1914, 102). Earlier methods of preparing acetone-soluble acetylcelluloses proved unsatisfactory because they involved decomposition of the cellulose molecule by hydrolysis or saponification and hence yielded products which gave solutions of low viscosity. A series of investigations in the author's laboratory has shown that by heating acetylcelluloses insoluble in acetone with ethyl acetate, benzene, acetone, alcohol, amyl alcohol, acetic acid, ethylene bromide, acetylene tetrachloride, cyclohexanone, etc., easily soluble acetylcelluloses can be obtained without any appreciable hydrolysis or saponification of the cellulose molecule. The transformation is accelerated by a small quantity of water and by neutral and acid salts, e.g., sodium ethylsulphate, methylamine bisulphate, zinc chloride, ammonium nitrate, aniline salts. The soluble acetylcelluloses prepared in this way are stated to possess more valuable qualities than those obtained by other methods. The changes are attributed to intramolecular transformation of the cellulose acetate. —A. S.

Wood; Formation of furfural in the steaming of —. E. Heuser. *Z. angew. Chem.*, 1914, 27, 654—655.

THE furfural produced in the steaming of wood or straw under 4 atmos. pressure (this J., 1914, 856) is formed from the pentosans. No formation of furfural, however, occurs on boiling with water or steaming at the ordinary pressure, even with the addition of acetic or formic acid. The effect of varying conditions was studied in the case of xylose. When an aqueous solution of this pentose (0.41 gm. in 60 c.c.) was heated in a sealed tube at 135°—140° C. for 8 hours, the furfural produced amounted to 11.70% of the weight of xylose. Under the same conditions, with the addition of 8 c.c. of 10% acetic acid and 4 c.c. of 10% formic acid, the yield of furfural was increased to 31.32%. Still higher yields were obtained by increasing the temperature or the concentration of the organic acids.—J. F. B.

Nitrocellulose from cotton and wood celluloses. Schwalbe and Schrimpf. *See XXII.*

PATENTS.

Drying apparatus more particularly for the treatment of textile materials. E. Feuillet, Boulogne sur Seine, France. Eng. Pat. 29,774, Dec. 24, 1913. Under Int. Conv., Jan. 7, 1913.

SEE U.S. Pat. 1,108,565 of 1914; this J., 1914, 1066.

Apparatus for making bisulphite liquor [for paper making]. U.S. Pat. 1,119,004. *See VII.*

Varnish [for fabrics]. Eng. Pat. 13,100. *See XIII.*

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Colouring matters as the cause of tendering of fibres. P. Heermann. *Chem.-Zeit.*, 1914, 38, 1281—1282.

SAMPLES of raw silk, boiled-off unweighted silk, and boiled-off and weighted silk, were dyed yellow with dyestuffs containing nitro groups, picric acid, Naphthol Yellow S, and Azoflavine FF being used. Samples kept unexposed to light retained their strength and gave no reaction with diphenylamine and sulphuric acid, but samples exposed to light turned browner, and gave the nitric acid test with diphenylamine and sulphuric acid. Tendering occurred in all samples exposed to light, but more quickly with weighted silks than with the unweighted silks. On longer exposure to light the colour faded and further tendering occurred, and the weighted silks failed to give the nitric acid test with diphenylamine. The explanation given is the formation of a nitro-derivative of the silk fibre by nitric acid split off from the dyestuff, the nitro-derivative under the action of light being stable in the case of unweighted silk, and unstable in the case of weighted silk. In no case was the formation of a peroxide detected by means of zinc iodide-starch solution as Gebhard has suggested (see also this J., 1914, 1153).—G. H. F.

Mercerising; A new process of —. E. Knecht. *J. Soc. Dyers and Col.*, 1915, 31, 8—10.

A CONSIDERABLE mercerising effect is produced, without injury to the feel and tensile strength, by immersing cotton yarn for 30 seconds in hydrochloric acid of 38° Tw. (sp. gr. 1.19). Stronger acids (39°—40° Tw., sp. gr. 1.195—1.2) make the fibre harsh and brittle. The mercerising effect is still considerable with hydrochloric acid of 37° Tw. (sp. gr. 1.185) but ceases with weaker acids from 36° Tw. (sp. gr. 1.18) downwards; lowering the temperature does not increase the activity of the weaker acids. The mercerisation is accompanied by shrinkage amounting to 8% with acid of 38° Tw. and 4% with acid of 37° Tw.; the yarn becomes curly, but attempts to produce lustre on Egyptian cotton by treatment under tension were not successful. The treated cotton exhibits most of the properties of hydrated cellulose; it is characterised by an increased affinity for substantive dyestuffs which is greater when the fibre is dyed without drying; the microscopic appearance is not much changed. —J. F. B.

PATENTS.

Cleansing of linen, woollen, cotton, and other goods. F. L. Bartelt, Bristol. Eng. Pat. 28,500, Dec. 10, 1913.

THE material is washed, cleansed, and "nourished" by treating it with a mixture of sodium carbonate and an aqueous solution of glycerin. —B. N.

Dyestuffs: Fixing—upon textile fibres. B. Leech, Macclesfield. Eng. Pat. 29,479, Dec. 22, 1913.

THE fibres are impregnated with a suitable acid (e.g., tannin), and then treated with a solution of a silicate. In the case of basic dyestuffs this treatment precedes the dyeing process, but with indigo and other vat dyestuffs the dyed material is treated as described.—B. N.

Dyestuffs: Application of [sulphide]—E. Lodge and J. M. Evans, Huddersfield. Eng. Pat. 29,852, Dec. 29, 1913.

IN dyeing union goods with sulphide dyestuffs, reduction to the leuco compound is effected by an alkali hydrosulphite in presence of an alkali sulphite.—B. N.

Printing of textile fabrics and the like. H. Levinstein, and Levinstein Ltd., Manchester. Eng. Pat. 29,359, Dec. 20, 1913.

FAST printed shades are obtained upon vegetable fibres by printing the fabric with a paste containing a non-substantive azo dyestuff capable of forming an insoluble compound with formaldehyde, and subsequently treating the dyestuff upon the fabric with formaldehyde.—B. N.

Coating or covering fabrics with a layer of adhesive material. F. Stoffel, Paris. Eng. Pat. 15,262, June 25, 1914. Under Int. Conv., Dec. 29, 1913.

ADHESIVE material, such as gelatin, in a pasty condition, is pulverised and projected on to the fabric by means of a blow-pipe. The material is uniformly spread on the fabric, and is cooled, coagulated, and almost completely dried by the expansion of the air during pulverisation.—B. N.

Waterproofed textile material and process of making same. R. A. Marr, Assignor to General Waterproofing Co., Inc., Norfolk, Va. U.S. Pats. (A) 1,121,647 and (B) 1,121,648, Dec. 22, 1914. Date of appl., Jan. 13, 1914.

(A) THE textile fabric or cordage is impregnated with an impermeable, preservative waterproofing agent, comprising diatomaceous earth and an insoluble, inert, hydrocarbon carrier, such as paraffin and naphthalene, solid at ordinary temperatures but liquid at temperatures near the boiling point of water. (B) The water-insoluble carrier is composed of paraffin, a dyestuff soluble in it, and rosin, the impregnation being carried out above 100° C., and the temperature of the impregnating material decreased during the process.—B. N.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Sulphuric acid: Apparatus for the concentration of—W. Mason. Met. and Chem. Eng., 1915, 13, 17—18.

DETAILS are given of a "capsule" plant, comprising 6 lead pans and 40 capsules (basins) of fused silica, in which 4 tons of acid (95.25% H_2SO_4) were produced from 65% acid per 24 hours at a cost of 6s. 4d. per ton. The acid condensed from the exit gases was 2.23% of the total, as against about 15% in the glass retort system of concentration. The total cost of the apparatus, including erection, is estimated at £265. With careful and regular working an ordinary furnace may be used, and the loss due to breaking of the capsules thereby minimised. With a forced-draught

furnace, too high a temperature is produced in the lower part of the plant, leading to bumping and breaking of the capsules.—W. E. F. P.

Boric acids in alcohol: Some properties of solutions of the—A modified boiling-point apparatus. J. B. Firth and J. E. Myers. Chem. Soc. Trans., 1914, 105, 2887—2892.

THE change in the boiling point of pure ethyl alcohol, with varying quantities of orthoboric and metaboric acids and with boron trioxide, was determined by enclosing the ordinary Beckmann apparatus in a Dewar vessel, and heating the liquid electrically by means of a fine platinum wire. With low concentrations of the substances, the boiling points of ethyl alcohol solutions are lower than the boiling point of the pure solvent. The maximum lowering is produced by the least volatile substance, boron trioxide, and the least with orthoboric acid, metaboric acid occupying an intermediate position. With higher concentrations the boiling point is raised, the least volatile substance having the greatest effect.

—B. N.

Cyanides, thiocyanates, ferro- and ferricyanides: Rapid detection of—in mixtures. F. Feigl. Chem.-Zeit., 1914, 38, 1265.

SOLUTIONS to be tested are treated with an excess of zinc nitrate, warmed, and filtered. Thiocyanates remain in the filtrate, and cyanides, ferro-cyanides and ferricyanides can be detected in the washed precipitate by spot tests made on filter-paper with small quantities of the precipitate and strongly acid solutions of mercurous, ferric, and ferrous (free from ferric) salts respectively. The tests are not affected by the presence of fluorides, phosphates, borates, sulphates, chlorides, bromides, iodides, chlorates, carbonates, nitrates, or silica, but chromates and ammonium salts must first be removed. In presence of borates, mercurous salts produce a green coloration which cannot be confused with the black colour given by cyanides. The test with mercurous salts is useless in presence of sulphides, sulphites, or compounds which reduce the reagent. In such cases cyanides may be detected by warming gently some of the washed zinc precipitate with dilute sulphuric acid in a porcelain crucible covered with filter-paper moistened with ammonium sulphide solution, and afterwards testing the paper for thiocyanates by means of acid ferric chloride solution.—J. H. L.

Tri-ammonium citrate. R. A. Hall. J. Amer. Chem. Soc., 1915, 37, 208—216.

TRI-AMMONIUM citrate, $(\text{NH}_4)_3\text{C}_6\text{H}_5\text{O}_7$, is obtained quantitatively when dry ammonia is passed into a boiling absolute alcoholic solution of citric acid. It is stable, crystalline, very soluble in water, and alkaline towards rosolic acid. A solution of sp. gr. 1.09 at 20° C. is recommended for use in phosphoric acid determinations in place of "neutral" ammonium citrate solution.—J. R.

Lead oxide: Determination of peroxide in commercial—L. S. Dean. Chem. News, 1915, 111, 2.

THE peroxide is decomposed with hydrochloric acid in presence of potassium iodide, using carbon tetrachloride or chloroform as indicator, the excess of potassium iodide being titrated with standard potassium iodate solution: $2\text{PbO}_2 \equiv \text{KIO}_3$ (cf. L. W. Andrews, J. Amer. Chem. Soc., 1903, 23, 792). The method is as accurate as Bunsen's method and possesses the advantages that small quantities of peroxide can be estimated in presence of organic matter, no special apparatus is needed, and larger amounts of substance, e.g., litharge,

can be used, as the whole of the oxide need not be dissolved.—R. G. P.

Rare earths; The electrolysis of solutions of the ——. L. M. Dennis and B. J. Lemon. J. Amer. Chem. Soc., 1915, 37, 131–137.

THE solutions were electrolysed in a glass cell, 12 cm. in diam. and 13 cm. high, the cathode being a 3 cm. layer of mercury and the anode a platinum wire of 0.76 mm. diam. The surface of the cathode was kept clean by violent agitation with an air current. With an E.M.F. of 9 volts a fairly rapid precipitation of hydroxides occurred from a neutral solution of the nitrates of neodymium, praseodymium, lanthanum, and samarium containing 50 grms. of the oxides per litre. Fractions of the hydroxides filtered off at intervals of 5 or 6 hours showed a gradual decline in atomic weight from 140.9 to 138.9. This method when applied to a mixture of the nitrates of praseodymium and lanthanum resulted in a fairly rapid concentration of lanthanum in the solution; and fractional electrolysis of a mixture of earths from xenotime effected a similar concentration of yttrium in the solution, while the first three fractions of precipitate were rich in erbium. The process may in certain cases be preferable to fractional crystallisation or precipitation.—J. R.

Hydrogen and chlorine; Interaction of —, under the influence of the alpha particles. H. S. Taylor. J. Amer. Chem. Soc., 1915, 37, 24–38.

THE combination of hydrogen and chlorine under the influence of the α -particles from radium emanation is a reaction of the first order and is analogous to the corresponding photochemical reaction.—J. R.

Heavy chemicals. Board of Trade Bulletin No. 67.

THE following statement shows for a recent year the value of the under-mentioned heavy chemicals exported from Germany, Austria-Hungary, and the United Kingdom, respectively, to all destinations:—

Description.	From Germany (1912).	From Austria-Hungary (1913).	From United Kingdom (1913).
	£	£	£
Aluminous sulphates (including alums)	390,400	3,945	77,400
Arsenic and its oxides and compounds	56,400	—	13,500
Bleaching materials	245,800	11,900	168,600
Coal products, not dyes:			
Carbonate of ammonia	5,800	1,000	132,300
Aniline oil and aniline salts	628,400	130	28,900
Benzol, toluol, etc.	342,500	—	302,800
Carbolic acid (including phenol)	194,100	8,250	190,500
Coal tar	163,300	3,850	84,900
Naphthalene	44,300	7,750	37,700
Pitch	183,200	78,600	1,100,000
Anthracene, creosote and other tar oils	360,500	—	592,400
Copper sulphate	87,100	4,100	1,701,200
Potassium or sodium cyanide	472,000	—	562,200
Soda compounds:			
Soda ash	319,900	12,100	563,300
Sodium bicarbonate	18,400	175	123,600
Caustic soda	125,700	80	723,700
Sodium chromate and bichromate	77,600	100	59,900
Soda, raw and crystallised	6,000	800	45,300
Sodium sulphate	158,800	3,785	114,000
Sulphuric acid	186,400	28,000	62,700
Total	4,066,600	164,565	6,684,900

The following statement shows for the year 1912 the value of the under-mentioned heavy chemicals exported to the United Kingdom from Germany

side by side with the production in the United Kingdom in 1907:—

Description.	German Exports to United Kingdom (1912).	Produced in the United Kingdom in 1907.
	£	£
Aluminous sulphates (including alums) ..	83,900	216,000
Arsenious acid, arsenic acid, and arsenic compounds	3,000	55,000
Bleaching materials	44,600	527,000
Coal products not dyes:		
Carbonate of ammonia	850	132,300*
Aniline oil and aniline salts, etc.	51,800	28,900*
Benzol, toluol, etc.	2,700	189,000
Carbolic acid (including phenol and cresol)	8,300	216,000
Coal tar	250	911,000
Naphthalene	1,900	45,000
Mineral pitch	—	559,000
Anthracene, creosote, and other tar oils	3,200	712,000
Copper sulphate	400	1,549,000
Potassium or sodium cyanide	12,700	562,200*
Soda compounds:		
Soda calcined, bleaching soda, etc. ..	250	3,390,000
Bicarbonate	3,400	
Caustic soda, solid or liquid	3,100	
Soda, raw and crystallised	150	
Sulphate and bisulphate	1,800	59,900*
Chromate and bichromate	31,600	
Sulphuric acid	1,200	955,000
Total	£255,100	£10,407,300

* Exports only.

It is thus clear that in these particular lines British manufacturers have no need to fear German competition in the home market.

Germany's principal markets for alums are Switzerland, France, Netherlands, Belgium, United States, Sweden, Spain, Italy, and Argentina, and in those markets, with the exception of the United States and Argentina—where the United Kingdom does a fair trade—Germany has hitherto held a very strong position, but there would appear to be openings for the sale of British-made alums in all these countries.

German exports of arsenic compounds are about four times those of the United Kingdom. The principal market for both countries is the United States, the larger share, however, falling to Germany. In Italy the United Kingdom does a somewhat larger trade than Germany, but elsewhere, particularly in Scandinavia, France, Russia, Brazil, Uruguay, Dutch East Indies, and Argentina the German product has the larger sale. There should be possibilities of extending the sales of British-made arsenic compounds in several of these markets. British exports of bleaching powder to the principal Colonial and neutral markets are only slightly smaller than those of Germany. The principal market for both countries is the United States, the advantage lying with the United Kingdom. In Denmark, British India, China, and Brazil we hold strong positions, but elsewhere the bulk of the trade falls to Germany, though fair amounts are supplied by the United Kingdom to the Netherlands and Russia. The United Kingdom has practically the whole of the export trade in carbonate of ammonia to the principal Colonial and neutral markets, though there is a certain amount of German competition in Italy and Switzerland, and in the South American markets.

Germany does the bulk of the export trade in aniline oil and toluidine, and there appear to be openings for the British-made article in the United States, Switzerland, Italy, Russia, Spain, Belgium, Netherlands, Turkey, and Japan. The bulk of the benzol and toluol exported from both Germany and the United Kingdom is sent to France. In

present circumstances there would appear to be exceptional opportunities for extending the sale of British-made benzol and toluol in that market. Openings also exist in the Belgian, Dutch, Italian, Swiss, Russian, Argentine, and United States markets, though the possibilities in these markets are much smaller. The exports of carbohic acid from Germany to the principal colonial and neutral markets are slightly larger in the aggregate than those of the United Kingdom. The distribution, however, varies considerably. Thus the United Kingdom supplies the bulk of the carbohic acid required in British India, Sweden, and Netherlands; Germany, on the other hand, has hitherto taken the lead in supplying the French, Swiss, Russian, and Japanese markets. In the United States market the United Kingdom and Germany up to the present have shared the market about equally. Valuable openings for the sale of carbohic acid would appear to exist in France, Italy, Switzerland, Russia, Japan, and the United States. The United Kingdom already holds the bulk of the coal tar trade with British India, British South and West Africa, and Australia, while Germany holds a long lead in the Belgian, French, and Russian markets, which at the moment offer considerable openings for the supply of British-made coal tar. Naphthalene is a small trade. The United Kingdom does the bulk of the business with British South Africa, Netherlands, and Italy. Germany takes the lead in Sweden, Denmark, Belgium, Switzerland, Russia, and Turkey, while the United Kingdom and Germany roughly divide the trade with France, China, and the United States fairly equally between them. There should be a number of small openings in the markets mentioned. In some of the smaller markets, *e.g.*, Netherlands, Switzerland, and Turkey, the larger portion of the pitch imported comes from Germany, but in the larger markets, although Germany does a fair trade, the United Kingdom holds a far stronger position than Germany. This is particularly the case in Belgium, France, Russia, and Egypt. Over 90% of the United Kingdom exports of tar oil, creosote, etc., are sent to the United States, where there is not very much competition from German tar oil. On the other hand Germany sent nearly one-half her total exports of tar oil to the Netherlands, Belgium, and France, to which markets British exports of tar oil are relatively small. Both the United Kingdom and Germany do a fair trade with Canada, Norway, Sweden, Italy, Russia, and Brazil, but in Switzerland and Roumania the British product is unrepresented, the whole of the trade going to Germany.

Germany has only a very small export trade in copper sulphate. Her two largest markets, Switzerland and Servia, are the only ones to which the United Kingdom does not export this substance. Germany has a firm grip on the United States cyanide market, and also supplies larger quantities than the United Kingdom to British South Africa, Mexico, Russia, Spain, and Italy, whilst the Dutch East Indies, Switzerland, Belgium, and the Netherlands, were not supplied with any of this chemical by the United Kingdom in 1913. The United Kingdom exports of soda ash are greater than the exports of "soda calcined, refined; bleaching soda, etc.," from Germany, but the markets supplied by the United Kingdom are quite different from those supplied by Germany. Thus, though the United Kingdom practically controls the distant markets of Japan, British India, Argentina, Brazil, United States, Russia, Dutch East Indies, and Chile, Germany has very little competition from the United Kingdom in European markets, *e.g.*, Belgium, Switzerland, Sweden, Norway, and Denmark. There is also room for extension of the United Kingdom trade with Netherlands and Italy.

The United Kingdom exports considerably more sodium bicarbonate than Germany, though our present trade might be extended in the Swedish, Danish, Belgian, Dutch, Swiss, and Russian markets. More than 60% of Germany's total exports of caustic soda in 1912 went to Switzerland, whereas in this market the United Kingdom was quite unrepresented as regards this commodity in 1913. In all other markets the United Kingdom export trade exceeds the German, except in the case of Belgium. The countries which offer the greatest scope for British enterprise in this trade, in addition to Switzerland and Belgium, are Italy, Roumania, Scandinavia, the Netherlands, and Russia. The greater part of the export trade of both Germany and the United Kingdom in sodium chromate and bichromate is with Western Europe (France, Netherlands, Switzerland, Belgium, and Spain). In all of these markets Germany has, so far, had the major portion of the trade, and it would seem that there is ample opportunity for British traders to increase their exports to these markets. The United States also was largely supplied with this chemical by Germany, and German trade to the value of £2,000 with British possessions might be secured by British exporters. Soda crystals is a small trade, and one in which the United Kingdom does more export trade than Germany. There are, however, a few markets which might be captured from Germany in the present circumstances, *viz.*, Switzerland, Russia, France, and Belgium, whilst extensions might be made in the case of the Netherlands, Brazil, Chile, and the United States. There is a large market for sodium sulphate in Belgium and the Netherlands, the exports from Germany to these two countries being about 3½ times as great as the exports from the United Kingdom. In the United States, Brazil, Italy, France, and Denmark, German exports are greater than British, whilst the United Kingdom sent none of this commodity to Switzerland, Roumania, Venezuela, and Mexico in 1913. The export trade in sulphuric acid to most of the neutral markets specified was almost entirely in German hands. In present circumstances an appreciable share of the trade might now be obtained by British manufacturers of sulphuric acid.

Austria's exports of heavy chemicals are insignificant compared with those of Germany and the United Kingdom. Her principal markets are Roumania (for chloride of lime, carbohic acid, naphthalene, calcined soda, and sulphuric acid); Russia (for coal tar and pitch); Italy (for coal tar pitch); Servia (for coal tar and pitch, copper sulphate, and calcined soda); and Bulgaria (for carbohic acid and naphthalene).

The ternary system, $\text{CaO-Al}_2\text{O}_3\text{-SiO}_2$. Rankin and Wright. See IX.

Use of titanous chloride in quantitative analysis. Monnier. See XXIII.

PATENTS.

Bicarbonate of soda; Production of—. C. White, London. Eng. Pat. 21,546, Sept. 24, 1913.

A SOLUTION of magnesium bicarbonate and chloride is treated with sodium chloride and carbon dioxide, under such conditions that the liquor remains approximately saturated with magnesium chloride. For example, magnesium oxide, hydroxide, or carbonate, mixed with water, is treated with carbon dioxide under pressure, the solution is saturated with magnesium chloride, a concentrated solution of sodium chloride added, and carbon dioxide again introduced under pressure; the precipitated sodium bicarbonate is then separated and the residual solution treated with

magnesium oxide, etc., to prepare a further quantity of magnesium bicarbonate solution, and so on.—F. SODN.

Salt; Apparatus for the manufacture of—. J. W. Stubbs and J. Hollins, Middlewich. Eng. Pat. 28,469. Dec. 10, 1913.

A BRINE evaporating vessel having vertical evaporating tubes is constructed with external circulating downcomers from the upper to the lower chamber, these downcomers having a long flat cross-section which decreases from the top downwards, so as to present a large cooling surface and also secure an effectual precipitation of salt in the bottom of the lower chamber. A firebrick casing, communicating with a furnace, surrounds the evaporating tubes, a central passage between the tubes serving for cleaning purposes, and each tube-plate is protected from the heat by an adjacent loosely fitting false tube-plate. Vessels are arranged in series with communicating flues, and a by-pass flue, with dampers, allows any vessel to be cut out from the system.—F. SODN.

Salt; Production of cooking—from rock salt. L. W. Damman. Ger. Pat. 276,344, Sept. 20, 1913.

FINELY ground rock salt is introduced into a bolting mill in which it is moistened with a water spray. The treated salt contains 97% NaCl, is more crystalline than the original material, and does not cake on keeping.—A. S.

Alkaline [potassium] compounds [and cement] from alkali-bearing rocks [especially felspar] or weathering products; Method of producing soluble—. P. Radmann, Godegard, Sweden. Eng. Pat. 12,136. May 16, 1914.

AN intimate mixture of alkali-bearing rock or weathering product and gypsum, to which limestone may be added, is heated below fusion point and the resulting mass treated, e.g., by washing, to recover soluble alkali compounds. A suitable mixture contains 0.25—1 part by weight of gypsum to 1 part of felspar, to which up to 3 parts of limestone may be added; it should be pulverised to the "fineness of cement" and heated preferably to 1000°—1250° C. The residue, with or without limestone, may be burned to cement.—F. SODN.

Potash salts; Apparatus for treating, especially dissolving, salts such as crude—. R. Fleischer. Ger. Pat. 276,070, Oct. 1, 1913.

IN a continuous apparatus for dissolving salts, the helical agitating blades are made with an arched cross-section, so that they act also as scoops for lifting the material and delivering it again into the liquid. The blades may be provided with transverse strengthening bars, which serve also to diminish the rate of flow of the material through the apparatus.—A. S.

Potassium and sodium salts from ashes of algae. C. Klingbiel. Ger. Pat. 277,109. Oct. 5, 1913.

THE solution obtained by lixiviating the ashes is treated with excess of phosphoric acid, and after the thiosulphates are decomposed, it is rendered neutral to methyl orange by addition of alkali, and treated in the usual way to separate potassium and sodium salts. The double sulphate of potassium and sodium is not formed, and the separation of the alkali salts by crystallisation can be carried further than has been possible hitherto, so that a final mother liquor of relatively small volume and rich in iodine is obtained, from which iodine can be recovered by treatment with chlorine.—A. S.

Nitrogen compounds; Electrochemical process for producing—. J. W. Wood. Moulton, Iowa. U.S. Pat. 1,118,993. Dec. 1, 1914. Date of appl., Feb. 11, 1913.

SOIL containing alkali and/or alkaline-earth compounds is maintained in a moist state and subjected to an electric current, whilst air is being forced through the material, preferably from below.—F. SODN.

Bisulphite liquor [for paper making]; Apparatus for making—, using pyrites. V. Drewsen, New York. U.S. Pat. 1,119,004, Dec. 1, 1914. Date of appl., Oct. 11, 1910.

WEAK sulphurous gases from a burner pass successively through a scrubber, having a continuous closed water circulation, and a gas cooler. A portion of the gases from the cooler then passes through a system of absorption towers, in which sulphur dioxide is absorbed by the circulation of an aqueous sulphurous liquor and finally of alkali liquor; at one point of this system sulphurous gases from the aqueous absorbent are recovered in concentrated form by operation of a heating device receiving heat from the hot gases. A system of tanks for making bisulphite, each having means for spraying the bisulphite or lime liquor therein, receives the concentrated sulphurous gases and another portion of the weak gases from the cooler, gases and liquor passing in opposite directions in the system.—F. SODN.

Hydrous alkali-metal silicate and method of producing it. E. A. Paterson, North Tonawanda, N.Y. U.S. Pat. 1,119,720, Dec. 1, 1914. Date of appl., June 20, 1914.

A DRY, amorphous alkali silicate containing a large proportion of silica, relatively little alkali, and less than 19% of combined water, is obtained in a spongy condition by subjecting a powdered alkali silicate, rich in silica, to a hydrating treatment, preferably by moistening with a solution of the same silicate and confining under low steam pressure, until sufficiently hydrated to be readily soluble in cold water.—F. SODN.

Colloidal solutions of metals; Manufacture of stable—. B. Schwerin. Assignor to Elektro-Osmose A.-G. (Graf Schwerin-Ges.), Frankfurt-on-the-Maine, Germany. U.S. Pat. 1,119,647, Dec. 1, 1914. Date of appl., April 18, 1914.

A METALLIC salt in solution is mixed with silicic acid and reduced, preferably with hydrazine hydrate.—F. SODN.

VIII.—GLASS; CERAMICS.

Lamps; Translucent marble for—. Voegel. Elektrotechn. Zeits. J. Gas Lighting, 1914, 128, 662.

MARBLE treated by H. W. Engel's process (this J., 1914, 87) was tested in regard to its power of diffusion and its transparency to visible, ultra-violet, and infra-red rays. Samples 3.5 mm. thick were compared with opaline and with ground glass. Photometric measurements showed that 67% of the illumination passed through the ground glass, 23% through the marble, and 19 and 14% through clear and dark opaline glass respectively. The marble screens were illuminated uniformly to the edges, and compared with opaline gave the impression of pure white. They also transmitted more of the red and blue, but absorbed green-yellow, thus giving a violet-red tint. Measurements of the radiating intensities from the vertical up to 90° showed that, in spite of its

great transparency, the marble was not inferior to opaline glass in dispersion. The treated marble was equally transparent to the visible and the ultra-violet rays, but absorbed the infra-red rays to an extent hitherto unknown.—W. C. H.

Fireclay goods, and their use in gas works. T. Holgate. *J. Gas Lighting*, 1914, 128, 292—294, 363—364, 480—481, 536—537, 599—600, 661.

A REVIEW of the report of the Refractory Materials Committee of the Institution of Gas Engineers (see this J., 1914, 682). In regard to the effect of pressure on the melting point, results obtained with both English and American fireclays show that over a range from atmospheric up to 125 lb. per sq. in. additional pressure, the depression of the melting point is about 2.5° to 4° C. per lb. pressure. The depressions vary with different clays and do not seem to follow the normal melting points. Thus "a typical china clay of first-class quality," normally melting at 1770° C., melted at 1410° C. under a load of 112 lb. per sq. in., whereas another clay melted under corresponding conditions at 1750° C. and 1580° C. respectively, and its melting point was lowered by pressure less than that of any other mentioned. (See also Bleining and Brown, this J., 1910, 1309; 1911, 1387.) From such data it seems possible to select material suitable for, say, gas-producers which would not stand the strain in retort settings. To ensure accuracy in tests of this kind, the importance of uniformity of treatment of the specimens and of the methods of heating is emphasised. Modern petrology has shown the important part played by hydrogen in the formation of minerals from a rock magma, and the author suggests that at the high temperatures at which fireclays are burned, it may also influence the nature of the finished product, and he illustrates the importance of the amount of combined water by reference to some recent work on fireclays of the Glenboig district. In the Report stress is laid on the necessity of keeping fuel ash, often highly ferruginous, from contact with brickwork. The injurious effects of iron oxides on firebrick increase in the order Fe_2O_3 , Fe_3O_4 , FeO , consequently reduction of ferric oxide by furnace gases must be prevented. Magnetic iron compounds can now be removed from clays on the large scale by the use of magnets (see this J., 1914, 257), but many iron compounds are only feebly magnetic. Pyrites can be removed if converted into oxide by roasting. The electro-osmosis process of purifying clay is also referred to (this J., 1914, 257). The magnetic properties of clay wares are due to magnetite and also to magnetic ferruginous silicates, and wares with speckled bodies, flashed surfaces, or black cores are always more magnetic than those free from such defects (see this J., 1913, 827).

—W. C. H.

Grinding [of pottery materials]: Fineness of —. F. Turner and A. Heath. *Trans. Eng. Ceram. Soc.*, 1913—1914, 13, 114—128.

POTTERY materials, whether pan or cylinder ground, generally pass a 130's lawn. Seventeen samples of commercial ground flint and stone were slipped with water, and sifted through 120's, 140's, 160's, 180's, 200's, and 250's lawns; the total residue on the lawns ranged from 0.38 to 9.66%. Such variations may affect the properties of a body. Thus plasticity is reduced by coarse particles, and generally speaking contraction varies inversely, and porosity and crazing directly, as the size of the particles. Elutriated fractions of flint and stone, comprising particles up to 0.01 mm. in size, were further graded by being suspended in water and allowed to settle for several hours. It was found that the finest fraction melted at cone 2, whereas the coarsest was still

solid at cone 9. Similarly on firing, the finest contracted much more than the other fractions, and also "dunted."—W. C. H.

Leadless [pottery] glazes: Notes on some —. J. A. Audley. *Trans. Eng. Ceram. Soc.*, 1913—1914, 13, 138—141.

THE following formulæ of Seger's were tried for covering fireclay with an opaque white glaze:— $0.6 (\text{K}_2\text{O}, \text{Na}_2\text{O}), 0.4 \text{CaO}, 0.6 \text{Al}_2\text{O}_3, 5\text{SiO}_2, 1\text{B}_2\text{O}_3$; $0.3 \text{K}_2\text{O}, 0.7 \text{CaO}, 0.1 \text{Al}_2\text{O}_3, 2.5 \text{SiO}_2, 0.65 \text{B}_2\text{O}_3$; $0.3 \text{K}_2\text{O}, 0.7 \text{CaO}, 0.1 \text{Al}_2\text{O}_3, 4 \text{SiO}_2, 1 \text{B}_2\text{O}_3$; $0.3\text{K}_2\text{O}, 0.7\text{CaO}, 0.3\text{Al}_2\text{O}_3, 4\text{SiO}_2, 1\text{B}_2\text{O}_3$. The mixtures were fritted, ground, applied as a thick paste to unfired fireclay discs, and fired in a muffle. All gave a firmly adhering white enamel, the two last being very brilliant. Apparently the enamels are only produced within a limited range of temperature, for at an increased temperature transparent glazes were produced. When silica was substituted for the boric acid the materials were not vitrified completely. The enamels seemed equally satisfactory for either Stourbridge clay or local (Staffordshire) marl bodies, and most of the trial pieces could be dropped while red hot into cold water without the enamel crazing or cracking.—W. C. H.

The ternary system, $\text{CaO}-\text{Al}_2\text{O}_3-\text{SiO}_2$. Rankin and Wright. See IX.

IX.—BUILDING MATERIALS.

[*Portland cement clinker.*] *The ternary system, $\text{CaO}-\text{Al}_2\text{O}_3-\text{SiO}_2$.* G. A. Rankin and F. E. Wright. *Amer. J. Sci.*, 1915, 39, 1—79.

FOLLOWING previous investigations in the U.S. Geophysical Laboratory (see this J., 1907, 95; 1909, 1124; 1911, 545), the authors studied all the compounds, both binary and ternary, which are found in dry fused mixtures of CaO , Al_2O_3 , and SiO_2 , with regard to melting points, dissociation temperatures, invariant points, location of eutectics, boundary curves of monovariant systems, and fields of stability of divariant systems. The data obtained are used to discuss the nature and constitution of Portland cement clinker and the formation of certain natural minerals from the magma. Of the three components, the respective melting-points of pure lime and alumina (artificial corundum) are given as 2570° and 2050° C. (Kanolt); while the melting-point of silica is said to be variable according to the progress of its inversion, viz., α quartz— β quartz— β_2 tridymite— β cristobalite and α tridymite— β_1 tridymite— β_2 tridymite— α cristobalite— β cristobalite. Metastable quartz melts at about 1470° C. and cristobalite at 1625° or higher. In the binary system $\text{CaO}-\text{SiO}_2$ four distinct compounds exist, viz., CaO, SiO_2 ; $3\text{CaO}, 2\text{SiO}_2$; $2\text{CaO}, \text{SiO}_2$, and $3\text{CaO}, \text{SiO}_2$, most of which appear in more than one crystalline form. CaO, SiO_2 in the β - CaO form is the mineral wollastonite, and, in the α - CaO form, pseudowollastonite, which has not been found in nature but only in artificial slags. In the binary system, $\text{Al}_2\text{O}_3-\text{SiO}_2$, only one compound, sillimanite, appears; it forms eutectics both with Al_2O_3 and SiO_2 . The $\text{CaO}-\text{Al}_2\text{O}_3$ system contains four distinct compounds: $3\text{CaO}, \text{Al}_2\text{O}_3$; $5\text{CaO}, 3\text{Al}_2\text{O}_3$; $\text{CaO}, \text{Al}_2\text{O}_3$, and $3\text{CaO}, 5\text{Al}_2\text{O}_3$, most of which are dimorphous. Investigation of the ternary system, $\text{CaO}-\text{Al}_2\text{O}_3-\text{SiO}_2$, which necessitated 7000 experiments, with subsequent optical examination, showed that there are three new crystalline phases not found in the binary series; that there are 14 fields of stability, 30 boundary curves, and 21 quintuple points. Two of the new compounds, $\text{CaO}, \text{Al}_2\text{O}_3, 2\text{SiO}_2$ (artificial anorthite)

and $2\text{CaO}, \text{Al}_2\text{O}_3, \text{SiO}_2$, are stable in contact with the fused material; the other, $3\text{CaO}, \text{Al}_2\text{O}_3, \text{SiO}_2$, is not. The fields of stability for 14 compounds, including the original components, are described; and also the boundary curves and quintuple points, with concentration-temperature models and diagrams, and a final table of all the results. From these data and the theory of crystallisation it is possible to predict which substances will separate out from any slowly cooling solution containing only $\text{CaO}, \text{Al}_2\text{O}_3$, and SiO_2 , the order in which they separate, and the corresponding temperatures. Although the diagram exhibiting the final products of crystallisation presupposes the continuous attainment of equilibrium, yet it is possible to predict with considerable certainty the final product even when the reaction has not proceeded to completion. This occurs with Portland cement clinker, which would be essentially a mixture of $3\text{CaO}, \text{SiO}_2$; $2\text{CaO}, \text{SiO}_2$; $3\text{CaO}, \text{Al}_2\text{O}_3$, with some $5\text{CaO}, \text{Al}_2\text{O}_3$ and possibly free CaO ; a conclusion which has been confirmed by the work of the U.S. Bureau of Standards on commercial clinkers (see Bates, this J., 1914, 81).—H. H. S.

Cement. Board of Trade Bulletin No. 71.

The value of cement exported from Germany, Austria-Hungary, and the United Kingdom, respectively, to all destinations was as follows:—From Germany (1912): Portland cement, Roman cement, and hydraulic cements (tufa, trass, puzzolana, and puzzolana-sand, etc.), £1,723,900. From Austria-Hungary (1913): Portland cement, Roman cement, and other artificial cement, £215,900. From the United Kingdom (1913): Cement for building and engineering purposes, £1,273,100. In 1912 the value of Germany's exports of cement to the United Kingdom were valued at only £28,600, while no cement was exported from Austria-Hungary to this country.

The principal destinations to which German cement was exported, and the value of such exports in each case, were as follows:—Brazil, £281,300; Netherlands, £249,700; Chile, £142,300; Australia, £133,800; Russia, £111,700; France, £56,800; Dutch East Indies, £55,700; Turkey, £50,900; Philippines, £40,300; Uruguay, £29,800; and Belgium, £28,900; while a fair trade was done with the United States, Portuguese East Africa, and India. Austrian exports of cement in 1913 included: Bulgaria, £16,600; Russia, £18,950; Turkey, £13,425; Tripoli, £11,920; Argentina, £18,400; and Brazil, £12,800.

About one-half of our aggregate exports of cement goes to India, Ceylon, British Africa, and Australia, while one-third goes to Argentina and Brazil. The balance is spread over a number of small markets, of which the more important in 1913 were Spain, Egypt, Chile, and Uruguay.

Producing soluble alkali compounds [and cement] from alkali-bearing rocks. Eng. Pat. 12,136. See VII.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Steel; Microscopic examination of—. B. Strauss, Verein deutscher Chemiker, June 6, 1914. Z. angew. Chem., 1914, 27, 633–645.

A RESUMÉ of our knowledge of the micro-structure of carbon-, nickel-, and chromium-steels is given, together with photomicrographs, some in natural colours. Hitherto only the pearlitic chrome-nickel-steels have been used industrially, but recent work in the research laboratory of Krupp's has resulted in the production of high-percentage

chrome-nickel-steels of martensitic and austenitic structure. These have good mechanical properties and are very resistant to corrosion and to the action of acids. Instances are cited where microscopic examination has revealed the cause of failure of boiler tubes, axles, and tyres of railway wagon wheels. In electrically welded steel joints up to 0.12% N has been detected, and in joints made with the oxy-acetylene flame up to 0.02% N. When ammonia or nitrogen is led through molten iron, the metal only fixes 0.03–0.04% N, but by the action of ammonia on solid iron, up to 11.1% N (corresponding to Fe_4N_3) may be combined: fixation of nitrogen commences at about 300° C., and is most vigorous at 600°–800° C., diminishing again above 800° C. The micro-structure of nitrogenised iron is described and illustrated, and, in agreement with Le Chatelier (Rev. Mét., 1905, 506), the lines considered by Hanaman (Dissertation, Berlin, 1913, 30) to be due to needles of iron nitride, are regarded as analogous to Neumann lines and due to deformation, which is facilitated by the brittleness conferred on the ferrite grains by their nitrogen content. Bars of mild steel, 12.5 mm. diam., containing C 0.07, Si 0.05, Mn 0.30, P 0.021, S 0.014, Cu 0.06, and N 0.004%, were nitrogenised to different degrees, then the outermost layer was removed, and the mechanical properties of the bars (12 mm. diam.) determined. The results were:—

Heated at 700° C. in:		N.	Elastic limit.	Tensile strength.	Elongation.	Contraction.
		%	kilos. per sq. mm.	kilos. per sq. mm.	%	%
Ammonia, 24 hours		0.10	32.7	41.6	24.2	75
" 48 "		0.11	32.7	41.1	21.8	75
" 72 "		0.16	35.0	42.8	22.5	71
" 96 "		0.22	34.0	44.9	21.8	66
Hydrogen, 48 "		0.004	30.1	35.4	31.8	81
Nitrogen, 48 "		0.004	28.4	34.7	31.5	81

The magnetic properties of iron are deteriorated by nitrogen: the permeability is diminished and the hysteresis and coercive force increased; in the case of a mild steel containing about 4% Si, nitrogen caused a considerable increase in the hysteresis, without increasing the coercive force. If iron containing silicon or chromium be nitrogenised at about 800° C., nitrides of these elements are formed, which, unlike iron nitride, are very stable.—A. S.

Steel; Influence of titanium on the properties of—. F. A. J. Fitzgerald. Met. and Chem. Eng., 1915, 13, 28–29.

In the production of 9000 tons of steel rails, from 155 heats made under uniform conditions except as regards the presence or absence of added titanium, the proportion of heats yielding rails within the specification limits in regard to segregation was 36% when no titanium was used, and 43, 84, and 100%, respectively, when the steel contained 0.053, 0.077, and 0.10% Ti (see also Comstock, this J., 1915, 55–57).—W. E. F. P.

Iron; The corrosion of— and its application to determine the relative strengths of acids. J. A. N. Friend and C. W. Marshall. Chem. Soc. Trans., 1914, 105, 2776–2782.

EXPERIMENTS were made to determine the relationship existing between the minimum quantity of alkali required to inhibit the corrosive action of different salts, and the relative strengths of the acids and bases constituting the salts. Sodium and potassium carbonates and borax were used as inhibitors, and added in varying

quantities to a definite amount of a sodium salt, viz., the chloride, iodide, bromide, sulphate, nitrate, fluoride, acetate, sulphite; the results showed that when the salts are arranged in descending order of inhibiting carbonate concentrations, not only are they in the order of decreasing electrical conductivity of their acids, but the relative quantities of carbonate solution bear a general relationship to the values found for the strengths of the acids by electrical conductivity and hydrolysis methods. Experiments were also made with some of the above salts to determine the concentration at which auto-inhibition just begins, but the results were not comparable with those obtained by the addition of inhibitors. The curves obtained by plotting the quantities of sodium carbonate required to inhibit corrosion in the presence of varying quantities of sodium salts, show a distinct resemblance to the specific conductivity curves of the free acids corresponding to the salts, obtained from the data published by Kohlrausch.—B. N.

Silver; The removal of sulphur from —. C. C. Bissett. Chem. Soc. Trans., 1914. 105, 2829—2836.

THE addition of copper to molten silver is of little use for the removal of sulphur, but by adding a considerable excess of iron above the amount required to saturate the sulphur, the latter is removed as ferrous sulphide. The sulphur can also be slowly removed by blowing dry air through the molten silver at about 1000° C.—B. N.

Output of certain minerals and metals in the world. [C'd. 7732.]

THE Colonial and Foreign section (Part IV.) of the Mines and Quarries Report for the year 1912 contains a table showing the output of certain minerals and metals (contained in or obtained from ore raised) in the British Empire and in foreign countries during 1912, which may be summarised as follows:—

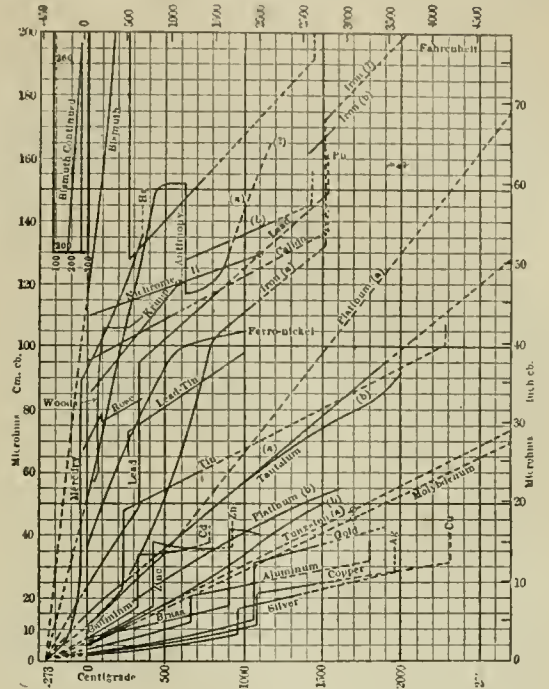
		United Kingdom.	British Colonies, Dependencies, and Possessions.	Foreign Countries.	Total for the World.
Coal	Metric tons	264,595,395	49,886,732	935,413,858	1,249,895,985
Copper	"	296	88,998	942,189	1,031,483
Fine gold	Kilos.	41	435,850	276,592	712,483
Iron	Metric tons	4,523,074	1,150,498	66,737,909	72,411,481
Lead	"	19,461	242,785	872,998	1,135,244
Petroleum	"	—	1,102,342	46,084,121	47,186,463
Salt	"	2,156,307	1,708,709	14,105,237	17,970,253
Fine silver	Kilos.	3,825	1,552,804	5,626,889	7,183,518
Tin	Metric tons	5,338	60,798	59,582	125,718
Zinc	"	6,139	203,026	808,564	1,017,749

The quantities of metals included are those which are considered obtainable from the ores raised in the countries in question, and must not necessarily be taken as a measure of the metallurgical industries of those countries. The total value of the estimated output shown in the table may be taken as representing about £1,047,000,000.

Electric resistances [of metals and alloys] at high temperatures; Comparisons of —. C. Hering. Met. and Chem. Eng., 1915, 13, 23—28.

EXISTING data, conveniently grouped, are correlated and represented by 5 uniform sets of curves; and notes are appended indicating,

for each material, the source, etc., of the information given. The curves relating to various



Iron: curve (a) from data given in Landolt and Börnstein's Tables and by Somerville (Phys. Rev., 31, 268); (b) from von Baur's data. Antimony: (a) from data of Northrup (J. Franklin Inst., 1913, 153), and (b) from figures of Bornemann and von Ranschenplat (Tables Annuelles de Constantes, 3, 258). Platinum: (a) from data in Landolt and Börnstein's Tables. Tungsten: (a) from Fink's figures (see this J., 1910, 825). Tantalum: (a) from Siemens' figures. The (b) curves for platinum, tungsten, and tantalum are from Pirani's data (Tables Annuelles de Constantes, 1, 227).

metals and alloys are shown in the accompanying chart.—W. E. F. P.

Mercury imports and exports; British —. Chem and Drug., Jan. 30, 1915.

	Imports. Bottles.	Exports. Bottles.
1906	38,823	27,712
1908	43,605	22,398
1910	44,595	24,748
1911	46,547	31,438
1912	47,261	32,240
1913	45,348	26,815
1914	37,568	22,975

NOTE.—A bottle of mercury is 75 lb.

Separation of tungsten from molybdenum. Marbaker. See XXIII.

PATENTS.

Iron; Electrolytic production of malleable or forgeable—. E. F. K. Harbeck, Partille, Sweden. Eng. Pat. 1137, Jan. 19, 1914.

MALLEABLE iron of any desired thickness is obtained electrolytically by the use of a solution of ferrous silicofluoride or fluoride, free from other metals, as electrolyte.—B. N.

Ferrophosphorus; Manufacture of—. D. I. Miller, Birmingham, Ala. U.S. Pat. 1,115,171, Oct. 27, 1914. Date of appl., May 6, 1914.

SUITABLE basic material (limestone) is mixed with natural phosphate rock and iron ore in the correct proportions to yield the proper ratio of acids to bases in the slag, and to liberate the required percentage of phosphorus, and the mixture is smelted with coke in a blast furnace. The process is applicable to natural phosphate rock too rich in silica to be used economically for the manufacture of fertilisers.—T. St.

Solutions [e.g. cyanide slimes]; Apparatus for treating solid-bearing—. L. C. Trent, Los Angeles, Cal., U.S.A. Eng. Pat. 21,413, Oct. 28, 1913.

AN apparatus for settling, decanting, and washing cyanide slimes and the like. The material is delivered from a launder into a short, depending, perforated cylinder situated centrally at the top of the vat. The cylinder is closed at its lower end by a conical deflector which distributes the material gently into the body of liquid in the vat. Near the bottom of the vat is a ring-pipe provided with holes in its under surface, and below this is a centrifugal agitator, the hollow radial arms of which are provided with nozzles. A pump withdraws fluid through the ring-pipe, and returns it through the nozzles of the agitator which thus revolves, and, by means of scrapers, forces the thickened mud towards outlets in the bottom of the vat. A by-pass between the withdrawal and return pipes, controlled by a valve, serves to regulate the flow of material. The vat is provided with try-cocks at different levels for testing the quality of the liquid.—T. St.

[Ore] separators; Magnetic—. A. F. Jobke, Cleveland, Ohio, U.S.A. Eng. Pat. 26,364, Nov. 17, 1913.

THE field of the separator has a working gap divided into zones of different strengths, which can be varied by varying the "reluctances" of the circuits corresponding to the several zones, without varying the length of the gaps which form the zones. For instance, the reluctances between adjacent members forming the zones may be varied, or removable magnetic elements may be used. The variation may be provided in the members of one or both sides of the working gap, and one or both opposing pole elements may be formed in sections spaced apart, opposing sections forming a zone of the gap, and the spacing providing the circuit reluctance. Both poles may be built up of a member of minimum reluctance and a section formed of laminations of alternately high and low permeability for increasing the reluctance of the section. A number of fields may be formed by primary and secondary magnetic structures, to cause each field to act as a working gap divided into zones of different strengths, adjacent zones being formed by spacing adjacent members of both primary and secondary structures to provide reluctance between members of similar polarity, the reluctance of the field

circuits being variable by varying the reluctances of the secondary magnet members.—B. N.

Ores; Treatment of—. O. C. Rudolph, London. Eng. Pat. 29,156, Dec. 17, 1913.

COMPLEX sulphide ores containing Cu, Pb, Zn, and Fe, with Ag and Au, are smelted, with the addition of fluxes if necessary, in an electric furnace to form a matte, which is then blown in a converter. The volatile matter driven off in both stages is passed through a wet condenser, where an acid solution of zinc sulphite and sulphate, with lead sulphite and sulphate in suspension, is formed. When the solution becomes sufficiently rich in zinc salts, it is freed from the lead precipitate and electrolysed, using perforated anodes. Two forms of condenser are described, both similar in principle, and each formed of a series of compartments: the first compartment is designed to retain solid matter suspended in the gases; the second is composed of fire- and acid-proof brick chequer-work, down which water is caused to trickle: the remaining compartments are provided with superposed rows of wooden baffle-rods, down which water trickles. The uncondensed and unabsorbed gases are finally drawn off to a chimney.—T. St.

Sulphide ores and other metallic sulphides; Process of treating—. K. Birkeland, Christiania, Norway. U.S. Pat. 1,121,606, Dec. 22, 1914. Date of appl., Jan. 23, 1913.

THE ores are treated with steam superheated by a flaming arc, the hydrogen produced being separated from the issuing gases, and passed in again with fresh quantities of steam.—O. E. M.

Zinc-furnace. O. E. Ruhoff, Madison, Wis. U.S. Pat. 1,121,874, Dec. 22, 1914. Date of appl., March 26, 1914.

AN electric resistance furnace is provided with a considerable number of electrodes, distributed so as to ensure uniform heating of the charge, which itself constitutes the resistance. The zinc is condensed in a relatively large number of clay condensers, supplementary condensers with coal barriers being provided for blue powder.—O. E. M.

Distillation furnace for zinc and the like. H. Hantelmann, Ger. Pat. 276,292, March 28, 1913.

THE furnace is mounted on horizontal hollow trunnions and contains only a single muffle, which is heated by the Bone system of surface combustion. The supply of gas and air is introduced through the trunnions, and can be cut off merely by rotating the furnace, which, normally, is held stationary by an easily movable spring device. Two such furnaces may be connected independently with a common supply of gas and air.—A. S.

Copper; Hardening and welding—. C. Bittner, Stafford, Kans. U.S. Pat. 1,122,062, Dec. 22, 1914. Date of appl., June 6, 1914.

COPPER is heated to a cherry red, and successive portions of its surface are treated with sodium "hyposulphite" and acetic acid, with or without alum. The treatment may be repeated at a lower temperature.—O. E. M.

Aluminium alloy; Hard—. W. de l'Or, Ger. Pat. 277,121, May 28, 1913. Addition to Ger. Pat. 265,924.

THE quantity of lead in the alloy described in the chief patent (this J., 1913, 1160) is diminished

about one-half. The portion of lead omitted may be replaced by a somewhat larger quantity of tin.
—A. S.

Nickel; *Process for improving the mechanical and chemical resistance of* —. Siemens und Halske A.-G. Ger. Pat. 277,242, March 4, 1913.

NICKEL is alloyed with tantalum. An alloy with 30% Ta is non-magnetic, can be easily rolled, forged, and drawn, and is equal to steel in elasticity and tensile strength. It is not attacked by boiling *aqua regia* or other acids, and is not oxidised when heated in the air, but may become brittle when very strongly heated.—A. S.

Iron and steel; *Art of making* —. W. J. Mellersh-Jackson, London. From Billings Process Co., Birmingham, Ala. U.S.A. Eng. Pat. 21,048, Sept. 17, 1913.

SEE U.S. Pat. 1,073,587 of 1913; this J., 1913, 1017.

XI.—ELECTRO-CHEMISTRY.

Silver voltameter; *The inclusion of electrolyte by the deposit in the* —. T. W. Richards and F. O. Anderegg. J. Amer. Chem. Soc., 1915, 37, 7—23.

THE amount of electrolyte included in the crystallised silver deposited in a silver voltameter varied with increasing surface and roughness of the cathode from 0.001 to 0.035% of the weight of the silver. Very pure silver remained after a brief ignition of the deposit at incipient redness, under which treatment the metal was not sensibly volatile. The experiments of the English, American, and German national bureaus upon this point and the results of other investigators in the field are adversely criticised. The correction is important in determinations of the values of the Farad, the standard Weston cell, electrochemical equivalents, and ratios of atomic weights. (See also this J., 1915, 91.)—J. R.

Electrolysis of solutions of the rare earths. Dennis and Lemon. See VII.

Electric resistivities [of metals and alloys] at high temperatures. Hering. See X.

PATENTS.

Electrical conductor. T. B. Allen and L. B. Coulter, Assignors to The Carborundum Co., Niagara Falls, N.Y. U.S. Pat. 1,121,601, Dec. 22, 1914. Date of appl., Sept. 24, 1913.

THE conductor consists of a porous base of silicon carbide impregnated with graphite, in a fine state of subdivision, equal to that of colloidal graphite when freed from moisture. It is characterised by practically uniform conductivity and high resistance to electrical discharge, and is given a coating impervious to oxygen at high temperatures.

—B. N.

Electrochemical process for producing nitrogen compounds. U.S. Pat. 1,118,993. See VII.

XII.—FATS; OILS; WAXES.

Castor beans; *The esterase and lipase of* —. (Studies on enzyme action. XII.) K. G. Falk and K. Suguira. J. Amer. Chem. Soc., 1915, 37, 217—230.

THE residue remaining after extracting the ground kernels of cold-pressed castor-beans with ether, gave results identical with those previously described for a somewhat different preparation when extracted with water and different saline solutions (see J. Amer. Chem. Soc., 1913, 35, 1904): 70% of the material (esterase) active

towards ethyl butyrate and 33% of that (lipase) active towards triacetin could be extracted with water. The activity of the preparation was unaffected by drying *in vacuo* over calcium chloride or phosphorus pentoxide; the considerable decrease in activity noticed on heating to 100°—110° C. is attributed to chemical change. An esterase preparation, probably identical with glycerophosphatase, was isolated by extraction with water, and a lipase preparation by extraction with 1.5-N sodium chloride solution. The relative proportions of the different forms of nitrogen in these two preparations and the original castor bean preparation were essentially the same, and the preparations appear to possess a protein nature.
—J. R.

Oils from less known seeds and fruits. E. R. Bolton and E. M. Jesson. Analyst, 1915, 40, 3—9.

RECENT introduction of machinery for separating the kernels from very hard nuts has enabled several little-known oils to be put upon the market. (1) *Balanites Maughamii*, Sprague (Portuguese E. Africa) yielded an olive-green pulp oil (4.4%) with a pronounced odour of butyric acid, and a valuable kernel oil (45.5%), which as yet cannot be obtained as a commercial product owing to the difficulty of separating the sticky pulp. (2) The pale yellow, semi-solid oil of *Calophyllum tomentosum*, Wight. (India) has an unpleasant odour. The kernel contains 70.3% and the whole fruit 50% of oil. (3) The kernels of *Calophyllum inophyllum*, L. (dhomba nuts) yielded 70.1% of a brownish-green oil. Although stated by Lewkowitsch to be poisonous, this is used as an edible oil by the natives of India. (4) *Melia azadirachta*, L. ("beni seeds," S. America), yielded a clear oil ("neem" or "margosa oil") containing much unsaponifiable matter, and having an odour of garlic. The kernel contained 43.6% and the whole fruit 14.8%. (5) *Fevillea cordifolia*, L. (Tropical America and W. Indies) yielded a solid fat (57.6% of the kernels) with unpleasant odour and bitter taste. Its refractive index was exceptionally high and it had good drying properties. (6) The seeds of *Telfairia pedata*, Hook (Jicongan nuts: Tropical Africa), yielded 60.9% of a pale yellow oil with little odour but bitter taste. Oil expressed from the whole fruit (35.9%) is said to contain toxic substances (Bontoux). (7) The seeds of *Canarium luzonicum*, Miquel ("pili nuts," Philippine Islands) contained 72.2% of a semi-solid fat with pleasant odour and taste. The kernels, which are used by the natives as substitutes for sweet almonds, are rich in proteins. (8) A semi-solid oil of pale yellow tint (macassar oil) was separated from the kernels of *Schleichera trijuga*, Willd. (India), known locally as nitas beans. Its high Reichert-Meissl value would render its detection in butter difficult, but for a peculiar colour reaction on saponification. The kernels contained 71.9% of oil. (9) *Sterculia fatida*, L. ("Java olives"):—The kernels (kaloem-pang beans or beligho seeds) yielded 52% of a viscous oil, which solidified when heated to 250° C., and gave a pronounced reaction in Halphen's cotton-seed-oil test. It would be suitable for salad oil. The pulp contained 6.9% of oil. (10) *Anacardium occidentale* L. (cashew nuts; S. America, W. Indies) yielded 44.8% of a pale yellow oil, which is not often separated owing to the high price of the kernels. (11) *Buchanania latifolia*, Roxb. ("Peru palm kernels," India and Burma) contains 61% of a pale oil (chironji oil) of pleasant odour and taste. (12) A soft brownish-green fat may be separated both from the seed (7.1%) and the fibrous shell of *Enocarpus distichus*, Mart. (S. America). (13) Fruit termed *Marquagua nuts* (Portuguese E. Africa) of an unidentified plant yielded 20% of a dark golden-yellow, somewhat viscous oil.

	1		2	3	4	5	6	7	8	9		10	11	12	13
	Pulp oil.	Kern oil.								Pulp oil.	Kernel oil.				
M. pt., ° C.	—	—			35	34	—	29	—	—	—	—	—	36	—
Solidif. pt., ° C.	—	—1°	25	17	(turbidity pt.)	—	6	14	20	—	—6	—	18	—	4
Saponif. value	—	191·5	170·5	190·5	185·6	192·9	193·6	197·0	227·0	—	193·8	193·7	198·7	209·2	189·3
Refractometer (Zeiss 40°C)	51·8°	57°	72·7	72·3	54·1	77·1	54·5	48·6	50·6	63·2	59·8	54·4	49·3	49·0	49·7
Iodine value (Wijs)	77·5	100·6	93·7	88·5	72·0	52·4	90·4	57·1	54·5	66·3	75·8	79·5	54·9	55·0	70·1
Free fatty acids % (as oleic)	79·0	1·22	3·46	26·2	3·15	0·28	0·31	1·44	7·93	—	1·0	0·8	4·45	65·9	15·3
Unsapon. matter %	—	0·88	4·0	1·2	7·7	—	—	—	—	—	—	—	—	2·15	1·26
Reichert-Meissl value....	—	—	—	—	8·27	—	—	—	16·0	—	—	—	—	—	—
Polenske value.....	—	—	—	—	0·25	—	—	—	0·27	—	—	—	—	—	—
Kirschner value	—	—	—	—	4·96	—	—	—	14·5	—	—	—	—	—	—

—C. A. M.

Action of fused potassium hydroxide on dihydroxy-stearic and dihydroxybehenic acids. Le Sueur and Withers. See XX.

Use of hydrogenised fish oil in the manufacture of margarine. Klimont and Mayer. See XIXA.

Feeding stuffs (oil cake). Board of Trade Bulletin. See XIXA.

PATENTS.

Fats and fatty emulsions and the like ; Process for cooling hot or molten —. Naamlouze Vennootschap Ant. Jurgens' Vereenigde Fabrieken. Oes, Holland. Eng. Pat. 10,863, May 2, 1914. Under Int. Conv., Feb. 26, 1914.

THE fat, etc., at a temperature a little above its m. pt., is taken up in an uniform layer on the periphery of a heated rotating cylinder, and is thence conveyed to the periphery of an adjacent cooling cylinder, which may rotate in the same direction but at a lower speed than the feeding cylinder.—C. A. M.

Unsaturated compounds [oils] : Process and apparatus for hydrogenating —. H. K. Moore. Berlin, N.H. U.S. Pat. 1,121,860. Dec. 22, 1914. Date of appl., Feb. 26, 1914.

SEPARATE streams or an intimate mixture of oil and hydrogen are passed continuously in the same direction through a finely-divided catalytic agent, which may be contained within a diaphragm porous to the oil and hydrogen, but impervious to the catalyst.—C. A. M.

Soaps ; Process for improving the washing properties of neutral — and at the same time increasing their keeping properties by admixture of hydrocarbons. C. Pleines, Gemlinde Zeist, Holland. Eng. Pat. 29,122, Dec. 17, 1913.

SEE Fr. Pat. 466,331 of 1913; this J., 1914, 603. Reference is directed, in pursuance of Sect. 7, Sub-sect. 4, of the Patents and Designs Act, 1907, to Eng. Pats. 16,329 of 1887, 13,700 of 1889, 13,853 of 1894, 16,406 of 1905, 7380 of 1906, 8982 of 1909, and 27,959 of 1912.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Painters' colours and materials (including varnish). Board of Trade Bulletin.

THE aggregate value of painters' colours and materials (including varnish) exported to all destinations from Germany, Austria-Hungary, and the United Kingdom respectively in a recent year reached the following amounts: From Germany (1912), £3,162,000; from Austria-Hungary (1913), £219,500; from United Kingdom (1913), £3,286,300. While the United Kingdom is quite an important market for these products for both Germany and Austria-Hungary, the United Kingdom sends little to them in return.

The principal descriptions of paints, etc., exported by Germany and Austria-Hungary in a recent year, so far as the particulars are available, were as follows:—

Article.	Exported from Germany (1912).		Exported from Austria-Hungary (1913).	
	To all Destinations.	To Principal Neutral Markets.	To all Destinations.	To Principal Neutral Markets.
Zinc white	£ 448,500	£ 338,000	142,400	44,600
Zinc grey	113,000	38,000		
White lead	256,500	216,000	700	370
Ultramarine; lakes, etc., of ultramarine.....	100,000	61,000	15,000	9,340
Bronze metal colours	316,000	273,000	2,900	800
Natural and artificial iron oxide (including yellow ochre), roasted, etc.	72,500	30,000	15,800	3,650
Umber, sienna earth, and other unspecified mineral colours	153,500	92,500		
Lithopone; Griffith's white.....	166,000	115,000	6,400	4,500
Colours for colour printing on paper prepared from lamp-black or Frankfurt black; printing ink and Frankfurt black	155,500	65,000	5,600	4,915
Barytes	208,000	152,000	(prepared blacks).	
Zinc powder	102,000	53,000	12,300	7,150
Pure and mixed blues; lakes, etc., of Prussian blue, chrome green, zinc green ..	115,000	75,000	(unspecified colours.)	
Chrome colours	102,000	51,000	6,100	5,170
Red lead	196,500	142,500	(Colours in cakes, small bags, pastes, tubes, bladders, flakes, glasses, shells, and boxes.)	
Copper colours (except Schweinfurt green) and other unspecified pigments and lakes, dry or paste	151,000	103,500		
Prepared colours not specified (ground with oil, oil varnish, glycerine, etc.); unprepared colours in small bags	259,000	166,500		
Varnishes and lacquers	247,000	140,000	12,300	9,665
Total	3,162,000	2,112,000	219,500	90,160

The particulars as to British exports to the more important Colonial and neutral markets in 1913 were as follows:—

Article Exported.	To all Destinations	To Principal Colonial and Neutral Markets
	£	£
Barytes	20,100	7,500
White lead	504,700	127,200
Zinc oxide	54,900	21,700
Unenumerated (including varnish) ..	2,706,700	1,888,500
Total	£ 3,286,400	2,044,900

The following detailed particulars show for a recent year the value of various descriptions of painters' colours and materials (including varnish) exported from Germany and Austria-Hungary, respectively, to the principal markets:—

(a) *Exports from Germany (1912).* *Barytes*:—United Kingdom, £98,000; Canada, £3,000; France, £4,000; Russia, £26,000; Argentina, £4,000; United States, £17,000. *Zinc White*:—United Kingdom, £138,000; Canada, £15,000; Norway, £22,000; Sweden, £33,000; Denmark, £18,000; France, £25,000; Russia, £19,000; United States, £51,000. *Zinc Grey*:—United Kingdom, £32,000; Norway, £2,000; Sweden, £4,000. *Red Lead*:—United Kingdom, £75,000; Canada, £5,000; British India, £14,000; Sweden, £7,000; Denmark, £6,000; France, £1,000; Portugal, £1,000; Italy, £2,000; Russia, £7,000; Dutch East Indies, £2,500; Brazil, £6,000; Argentina, £7,000; United States, £3,000. *White Lead*:—United Kingdom, £152,000; British India, £2,000; Sweden, £8,000; Denmark, £10,000; France, £5,000; Spain, £4,000; Portugal, £7,000; Russia, £6,000; Turkey, £5,000; Argentina, £17,000. *Pure and Mixed Blues, Lakes, etc., of Prussian Blue, Chrome Green, Zinc Green*:—United Kingdom, £26,000; British India, £5,000; Sweden, £4,000; Denmark, £3,000; Italy, £8,000; Russia, £11,000; China, £2,000; Japan, £4,000; Brazil, £3,000; United States, £8,000; Mexico, £1,000. *Ultramarine, Lakes, etc., of Ultramarine*:—United Kingdom, £33,000; Spain, £14,000; Italy, £3,500; Japan, £5,500; United States, £5,000. *Zinc Powder*:—United Kingdom, £17,000; British South Africa, £3,000; Denmark, £2,000; China, £4,000; United States, £25,000; Mexico, £2,000. *Lithopone*:—United Kingdom, £17,000; Canada, £5,000; Denmark, £3,000; Sweden, £4,000; France, £43,000; Italy, £4,000; United States, £9,000. *Natural and Artificial Iron Oxide (including Yellow Ochre), roasted, etc.*:—United Kingdom, £4,000; Australia, £2,000; Sweden, £2,000; Denmark, £2,000; France, £6,000; Italy, £1,000; Russia, £5,000; Brazil, £2,000; Argentina, £4,000; United States, £2,000. *Umber, Sienna Earth, and other Unspecified Mineral Colours*:—United Kingdom, £16,000; Australia, £2,000; British India, £3,000; Sweden, £7,000; Denmark, £5,500; France, £8,000; Spain, £3,500; Italy, £7,000; Russia, £11,000; Egypt, £4,000; Brazil, £6,000; Argentina, £3,500; United States, £12,000. *Bronze (Metal) Colours*:—United Kingdom, £38,000; Canada, £3,000; British India, £2,000; France, £15,000; Spain, £5,000; Italy, £9,000; Russia, £40,000; China, £3,000; Japan, £3,000; Brazil, £3,000; Argentina, £2,000; United States, £118,000. *Chrome Colours*:—United Kingdom, £23,000; Sweden, £5,000; Denmark, £3,000; France, £5,000; Italy, £5,000; Russia, £4,000; Japan, £2,000; United States, £4,000. *Copper Colours (except Scheele's Green) and other Unspecified Pigments and Lakes, dry or paste*:—United Kingdom,

£39,000; British India, £2,000; Sweden, £7,000; France, £8,000; Italy, £10,000; Russia, £5,000; China, £1,500; Japan, £7,000; United States, £24,000. *Colours for Colour-Printing on Paper, prepared from Lamp-Black or Frankfurt Black, Printing Ink and Frankfurt Black*:—United Kingdom, £8,000; British India, £2,000; Norway, £5,000; Sweden, £6,000; Denmark, £6,000; France, £8,000; Spain, £7,000; Italy, £6,000; Russia, £5,000; Brazil, £4,000; Argentina, £8,000. *Prepared Colours, not specified (ground with Oil, Oil Varnish, Glycerine, etc.)*; *Unprepared Colours in small bags*:—United Kingdom, £17,000; Australia, £3,000; British India, £3,000; British West Africa, £3,500; Norway, £5,000; Sweden, £10,000; Denmark, £10,000; France, £8,000; Spain, £9,000; Italy, £19,000; Roumania, £3,000; Russia, £8,000; Egypt, £1,000; China, £5,000; Japan, £6,000; Brazil, £15,000; Uruguay, £3,000; Argentina, £10,000; Chile, £5,000; United States, £13,000; Mexico, £3,000. *Lac Varnish, Laquers (not containing spirit)*; *Asphalt, Varnish, Coach-maker's Varnish, Japan Varnish*:—United Kingdom, £28,000; Norway, £8,000; Sweden, £11,000; Denmark, £20,000; France, £9,000; Spain, £5,000; Italy, £22,000; Russia, £7,000; Turkey, £3,000; China, £3,000; Brazil, £4,000; Argentina, £6,000; Chile, £2,000; United States, £12,000.

(b) *Principal Exports from Austria-Hungary (1913).* *Zinc White and Zinc Grey*:—United Kingdom, £9,000; Canada, £1,400; Portugal, £1,300; Serbia, £1,300; Roumania, £8,900; Russia in Europe, £12,200; United States, £7,600. *Ultramarine*:—Bulgaria, £1,500; Roumania, £2,900; Egypt, £1,600. *Lithopone*:—United Kingdom, £1,100; Sweden, £500; Italy, £2,250; Roumania, £650. *Prepared Blacks*:—Serbia, £1,000; Roumania, £3,000. *Oil Varnish (without Addition of Resin, Turpentine, or Mineral Oil)*:—United Kingdom, £15; Italy, £100; Serbia, £150; Roumania, £1,000. *Lac-varnish (with Resin, Turpentine, Mineral Oil, or Spirit)*:—United Kingdom, £150; Italy, £2,300; Greece, £800; Serbia, £700; Bulgaria, £900; Roumania, £2,400; Russia in Europe, £100.

(c) *Exports from United Kingdom.* *Barytes*:—Canada, £300; Russia, £4,100; United States, £3,000. *White Lead*:—British India, £41,500; Sweden, £1,400; Denmark, £2,600; France, £100; Spain, £400; Portugal, £2,100; Russia, £22,600; Argentina, £56,100. *Zinc Oxide*:—British India, £6,800; Canada, £5,100; Norway, £100; Sweden, £700; France, £1,000; Spain, £500; Portugal, £100; Italy, £100; Dutch East Indies, £200; Brazil, £3,200; United States, £1,100. *Unenumerated*:—British India, £339,900; British South Africa, £133,000; British West Africa, £25,700; Australia, £253,000; Canada, £115,000; Norway, £22,900; Sweden, £32,300; Denmark, £19,700; France, £136,100; Portugal, £24,000; Spain, £57,800; Italy, £59,500; Greece, £7,200; Bulgaria, £600; Roumania, £7,400; Russia, £34,300; Egypt, £30,400; Dutch East Indies, £17,000; China, £52,000; Japan, £80,600; Brazil, £116,700; Uruguay, £16,000; Argentina, £122,600; Chile, £64,000; United States, £89,900; Mexico, £9,800.

Determination of peroxide in commercial lead oxide.
Dean. See VII.

PATENTS.

Printing ink. M. Wolff, London. Eng. Pat. 4419, Feb. 20, 1914.

A CHEAP mineral base of kieselguhr (25 to 35 parts), barytes, or the like, is ground to an impalpable powder in a mill with rosin oil (20 to 30 parts), petroleum (20 to 30 parts), vegetable or carbon black (10 to 15 parts), and aniline dyestuffs (3 to

8 parts), without the addition of glycerin, glucose, or linseed oil, and without the application of heat or pressure.—C. A. M.

Varnish [for fabrics]. J. H. Harcastle and A. H. Taylor, London. Eng. Pat. 13,100, May 28, 1914.

A VARNISH for woven fabrics such as are used in the manufacture of aeroplanes, balloons, etc., consists of cellulose acetate, 1 to 2; acetone, 8; alcohol, 3; benzene, 3; chloroform, 1, and trichloroethylene, 4 parts. The varnish may be rendered more flexible by the addition of resorcinol diacetate, 0.5 part.—W. P. S.

Volatile and fusible products from wood; Process of extracting——. J. L. Dormon, New Orleans, La. U.S. Pat. 1,122,084, Dec. 22, 1914. Date of appl., Oct. 25, 1913.

AN inert gas (carbon dioxide) is circulated through a mass of the wood at a definite temperature (e.g., the b. pt. of turpentine) until all substances volatile or fusible at that temperature have been separated and collected. The temperature of the gas may then be raised, and further extractions made in stages until all volatile and fusible constituents have been removed.—C. A. M.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Rubber; Committee on exportation of——. Board of Trade, Jan. 22, 1915.

THE Board of Trade have appointed the Lord Balfour of Burleigh, K.T., the Rt. Hon. Russell Rea, M.P., and Mr. Henry Birchenough, C.M.G., to be a Committee to consider and advise on all questions relating to the export of rubber from the United Kingdom and from British Possessions. The Secretary to the Committee is Mr. J. K. Grebby, to whom all communications should be addressed at the Westminster Palace Hotel, London, S.W.

Sulphur in rubber; Determination of——. R. Gaunt. *Analyst*, 1915, 40, 9—11.

THE rubber (0.2 to 0.3 gm.) is placed in a small tube of hard glass, closed at one end, which is introduced into the middle of a combustion tube (30 to 35 cm.), drawn out at the rear end and connected with two small absorption flasks each containing 25 c.c. of 20 vol. hydrogen peroxide, whilst a loose plug of platinised asbestos is placed in front of the constriction. The part immediately below the mouth of the inner tube is gently heated, while a current of dry oxygen is drawn through the combustion tube, until the rubber no longer evolves gaseous products (which should burn at the mouth of the inner tube with a luminous but smokeless flame). Stronger heat is then applied until all carbon is burnt. The sulphur dioxide absorbed by the hydrogen peroxide is determined by titration or gravimetrically, a correction being made for any sulphuric acid originally present in the peroxide. In the case of rubber rich in mineral matter, sulphates in the ash are also determined. The results obtained as described in 90 mins. agree closely with those given by the method of Carius.—C. A. M.

XV.—LEATHER; BONE; HORN; GLUE.

Gambier; Note on the analysis of cube——. H. G. Bennett. *Collegium* (London), 1915, 1, 13.

For analytical purposes cube gambier should be treated as a dry material and not as an extract.

owing to the difficulty of filtration and to the amount of insoluble matter present. Better results are thus obtained, and the filtration is more rapid. Soaking over-night is unnecessary, and hot water is used from the commencement of the extraction, which takes only a short time.—F. C. T.

XVI.—SOILS; FERTILISERS.

Soil; Partial sterilisation of——by volatile and non-volatile antiseptics. W. Buddin. *J. Agric. Sci.*, 1914, 6, 417—451.

RUSSELL and other investigators have shown the general effects of partial sterilisation of soils by volatile antiseptics and heat (see this J., 1913, 1136; 1914, 560), and the author now records the action of benzene, cyclohexane, hexane, aliphatic alcohols (methyl to amyl alcohol), ether, acetone, chloroform, formaldehyde, toluene, phenol, cresol, quinone, quinol, pyridine, calcium sulphide, sulphur, sodium fluoride, and sodium chloride. The characteristic effects of true partial sterilisation were found to be produced by a large number of antiseptics, i.e., the number of bacteria at first decreased and then increased largely, protozoa and nitrifying organisms were killed, an initial increase of ammonia content was followed by a considerable increase in ammonia formation, and no increase in dose caused any change in the results obtained once true partial sterilisation had been attained. The intensity of the effect decreased gradually from that of the powerful non-volatile substances, through cresol (1/50 dose) and formaldehyde, to the more volatile, and less potent, substances, respectively, until finally the action of merely spreading out the soil in a thin layer was reached. Volatile antiseptics, though effective in increasing the productive capacity of a soil under laboratory and pot culture conditions, are unsuitable for application on a large scale.—W. P. S.

Soil; Increased nitrate content of a——when subjected to temporary drying in the laboratory. W. Buddin. *J. Agric. Sci.*, 1914, 6, 452—455.

SOIL dried by spreading out in a thin layer for 24 hours, then moistened, and submitted to incubation, was found to contain from two to three times more nitrate than another portion which had been kept moist before incubation. This increased amount of nitrate in the dried soil is not due to absorption of ammonia from the atmosphere, but to the formation of more nitrate from the residues in the soil, in spite of the fact that the numbers of bacteria are not increased.—W. P. S.

Soil; Evaporation of water from——. B. A. Keen. *J. Agric. Sci.*, 1914, 6, 456—475.

THE evaporation of water from the "sand" and "silt" fractions of soil, from china clay, and from ignited soil, can be explained by the known laws of evaporation and diffusion, but the evaporation of water from the soil itself is more complex, the relation between the soil and the soil water being of a different and closer nature than in the case of sand. The effect is not due to the soluble humus, but probably in part, if not mainly, to the colloidal properties of the clay fraction of the soil. The subject is also discussed from a mathematical point of view.—W. P. S.

Calcium carbonate; Protective action of——for *A. chroococcum*, against magnesium carbonate. C. B. Lipman and P. S. Burgess. *J. Agric. Sci.*, 1914, 6, 484—498.

THE effects of calcium and magnesium carbonates on nitrogen fixation by *A. chroococcum* in soils

and in solution were examined. Calcium carbonate up to 2% concentration in mannitol solution cultures acted solely as a stimulant, whilst the presence of more than 0.1% of magnesium carbonate had a decided toxic effect. In soil cultures, however, quantities of calcium carbonate larger than 1.4% had a slight toxic action, and magnesium carbonate was more toxic than in solution cultures, 0.1% being sufficient to inhibit the fixation of nitrogen. Calcium carbonate exercised a protective action in solution and soil cultures for *A. chroococcum* against the toxic properties of magnesium carbonate; in the case of soils, the best ratio was found to be 1.5% CaCO_3 to 0.1% MgCO_3 .—W. P. S.

Fertilizers. Board of Trade Bulletin No. 56.

THE value of certain descriptions of fertilizers (exclusive of potash compounds) exported from Germany, Austria-Hungary, and the United Kingdom to all destinations in a recent year was as follows:—From Germany (1912):—Basic slag, £1,368,200; sulphate of ammonia, £702,800; superphosphates, £984,200; other manures, £315,200; total, £3,370,400. From Austria-Hungary (1913):—Basic slag, £5,200; sulphate of ammonia, £327,000; superphosphates, £9,200; other manures, £104,000; total, £145,400. From United Kingdom (1913):—Basic slag, £262,000; sulphate of ammonia, £1,390,500; superphosphates, £166,300; other manures, £926,700; total, £5,745,500.

As regards exports of basic slag, Germany holds an overwhelmingly strong position in the Netherlands, Italy, and Russia. In New Zealand we do the larger part of the trade, but German competition is strong in the smaller Colonial markets. In Norway, Sweden, and Denmark we have most of the trade. We have a good share of the trade in France, Spain, and Portugal, but our share might well be increased in the United States.

Two-thirds of Germany's exports of sulphate of ammonia go to the Netherlands and Belgium. German and Austrian competition is keen in the Italian market, but elsewhere, particularly in Ceylon, France, Portugal, Spain, Dutch East Indies, and the United States, the United Kingdom holds a very strong position. There would appear to be opportunities for extending our sales of sulphate of ammonia in the Netherlands, Belgium, France, Italy, the Dutch East Indies, and Brazil. In the chief markets, with the exception of New Zealand, the British Dominions take more superphosphates from Germany than from the United Kingdom. In Spain, France, and Denmark we do a fair trade, which might be increased, but elsewhere, particularly in the Russian and United States markets, the United Kingdom is hardly represented. Most of the Austrian superphosphates go to Russia. The United Kingdom holds the bulk of the trade in other manures (bone meal, animal blood, artificial guano, etc.), with France, Portugal, United States, India, Ceylon, and the British Dominions generally. Germany has the bulk of the trade in Sweden, Switzerland, Russia, and Hawaii, while German competition is keen in Netherlands, Belgium, and the United States. Austria-Hungary takes the bulk of the trade in Italy and Roumania, and competes successfully in Russia.

Tri-ammonium citrate. Hall. See VII.

Composition and analysis of lime-sulphur sprays. Ramsay. See XIXB.

PATENTS.

Electrochemical process for producing nitrogen compounds. U.S. Pat. 1,118,993. See VII.

Insecticides for agricultural and horticultural purposes. Eng. Pat. 12,802. See XIXB.

XVII.—SUGARS; STARCHES; GUMS.

Cane sugar factory; Chemical control in the —, using boiling-house balances of both sucrose and total solids. H. Johnson. Report of Committee on Boiling-house Balances to the Hawaiian Sugar Planters' Assoc. Intern. Sugar J., 1913, 17, 27—31.

A BALANCE-SHEET of the total solids (using the apparent dry substance), as suggested by Deerr (this J., 1913, 802), may serve as a useful check upon the customary sucrose balance-sheet. In constructing it, the debit side is represented by the solids (soluble and insoluble) entering in the raw juice and in the lime added for defecation; while on the credit side appear the soluble and insoluble solids present in the sugars, the molasses, and the press-cake, together with the undeterminable loss of solids occurring during manufacture. The insoluble matter in the sugars, molasses, and juices may be ascertained periodically in average samples, and determinations made by members of the Committee have given the following results: Sugars, 0.1; molasses, 0.5; and mixed juice, 0.53%, which amounts are deducted from the value for the total solids found by the Brix hydrometer in the case of the juices and molasses, and by desiccation in that of the sugars. For the construction of the sucrose balance, and the determination of the sucrose, it is recommended that the method already adopted by the Hawaiian Sugar Planters' Association (Bull. No. 35; this J., 1911, 145) be retained until a more accurate one is devised.—J. P. O.

Carbohydrates; Determination of —. IV. Presence of free pentoses in plant extracts and the influence of other sugars on their determination. W. A. Davis and G. C. Sawyer. J. Agric. Sci., 1914, 6, 406—412. (See this J., 1913, 1024; 1914, 657).

PLANT extracts contain substances which are soluble in 80% alcohol, are not precipitated by basic lead acetate, are not fermented by ordinary yeasts, and possess a certain reducing power after all other sugars have been fermented; this reducing power (calculated as due to a mixture of arabinose and xylose) corresponds with a quantity of pentose practically identical with that calculated from the weight of phloroglucide obtained by subjecting the purified solution to the ordinary Kröber-Tollens distillation process (this J., 1901, 396; 1902, 875). These facts can only be explained by assuming that free pentoses are present. To determine small amounts of pentose in the presence of large quantities of other sugars, the latter should be fermented before applying the distillation process, since sucrose and certain hexoses yield small quantities of an insoluble phloroglucide. The pentose may, however, be determined with a fair degree of accuracy by the ordinary distillation process or by the reducing power after fermentation. Leaves of various plants (mangolds, turnips, carrots, potatoes, etc.) were found to contain from 0.3 to 1% of pentose, calculated on the dry material. —W. P. S.

Maltose; Hydrolysis of — by hydrochloric acid under the Herzfeldt conditions of inversion. W. A. Davis. J. Agric. Sci., 1914, 6, 413—416.

THE author and A. J. Daish have stated previously (this J., 1913, 1024) that maltose is hydrolysed

partially by hydrochloric acid, and, in reply to criticisms of this statement (Kluyver, *Biochem. Suikerbepalingen*, 1914, 223), results of experiments are now recorded showing that, using a 1% solution of maltose, about 2% of the sugar is hydrolysed by treatment with hydrochloric acid under Herzfeld conditions. In determining sucrose in plant extracts, where maltose is likely to be present, the inversion should therefore be made by boiling with citric acid, which is without effect on the maltose (*loc. cit.*).—W. P. S.

XVIII.—FERMENTATION INDUSTRIES.

Manganese: Non-poisonous nature of — [towards yeast]. T. Bokorny. *Chem.-Zeit.*, 1914, 38, 1290.

MANGANOUS salts, unlike those of the other heavy metals, are not toxic. The budding of yeast was found to proceed quite normally in nutrient liquids containing 1% of manganous sulphate, whereas it was completely arrested in presence of 1% of ferrous sulphate. Yeast which had been steeped for 24 hours in a 1% solution of manganous sulphate and then well washed, contained no manganese, but yeast which had been similarly treated with solutions of ferrous and cobalt salts could not be washed free from the respective metals. The innocuous character of manganous salts is attributed to the fact that, unlike the other heavy metals, manganese does not combine chemically with the protoplasm (see this J., 1915, 44).—J. H. L.

XIXA.—FOODS.

Cheese from "heated" milk; Manufacture of —. M. Benson. *J. Board Agric.*, 1915, 21, 878—889.

To obtain a typical cheddar cheese from pasteurised milk, the pasteurising temperature should not be higher than 190° F. (88° C.) when the milk is heated very rapidly, or 170° F. (77° C.) when the period of heating is from 15 to 30 mins. A blue-veined cheese of good quality was obtained when the milk was heated for about 15 mins. to 190°—200° F. (88°—93° C.). Cheeses prepared from heated milk contained: water, 33.61 to 36.22; fat, 32.36 to 34.53; insoluble nitrogen (probably unaltered casein), 2.49 to 2.91%. In the case of very rapid heating, the number of organisms in the milk was not effectively reduced below 170° F. (77° C.), but at this point the number was reduced to one-fiftieth of the total and at 180° F. (82° C.) to one eighty-eighth, whilst at 200° F. (93° C.) practically all the organisms were destroyed. There was a much greater reduction when the milk was maintained at 150° F. (66° C.) for 15 mins. than when it was heated very rapidly to 170° F. (77° C.).—W. P. S.

Margarine; Use of hydrogenised fish oil in the manufacture of —. J. Klimont and K. Mayer. *Z. angew. Chem.*, 1914, 27, 615—648.

THE chief objections against the use of hydrogenised fish oil in the manufacture of margarine are that the production of the crude fish oil is not under proper control, that the disagreeable odour may reappear when the hydrogenised oil is kept for a long time, that the hydrogenised oil may contain small quantities of nickel, and that it has a higher melting point than any of the fats hitherto used for foods and hence would probably not be easily digested. The authors were unable to detect nickel in samples of hydrogenised oil

examined by them; hence this test could not be relied upon for the detection of hydrogenised fish oil in oleomargarine. The following test is proposed:—2—3 grms. of the sample is melted, and dissolved in acetone to a total volume of 50 c.c. After standing for 12 hours at the ordinary temperature, the crystals which separate are filtered off, dried, and weighed. Oleomargarine yields 12—13% of crystals of m. pt. 45°—47° C. In the case of artificial mixtures of oleomargarine with hydrogenised fish oil and rape oil, the portion crystallising from acetone was in all cases considerably greater than 12—16%, which may be taken as the limits for genuine oleomargarine. It was possible by this test to detect 3.5% of hardened fish oil when this was added, together with 5.5% of rape oil, to oleomargarine.

By repeated fractional crystallisation of oleomargarine from acetone, an oil which became only semi-solid when cooled below 0° C. was obtained. This had an iodine value (51.6) lower than that of triolein, a result which is in accordance with the view that oleomargarine consists largely of mixed glycerides of oleic and other fatty acids.—A. S.

Feeding stuffs (oilcake and bran). Board of Trade Bulletin No. 76.

THE following statement shows, for a recent year, the value of feeding stuffs (oilcake and bran) exported from Germany, Austria-Hungary, and the United Kingdom, respectively, to all destinations:—*From Germany* (1912):—Oilcakes, oilcake meal, almond bran (dried and powdered residue of oil-extracted almonds), £1,702,900; bran and rice waste, £132,350; total, £1,835,250. *From Austria-Hungary* (1913):—Linseed and other oilcakes and solid residues from the manufacture of oil (including almond bran), £407,755; bran and rice offals, £201,235; total, £608,990. *From the United Kingdom* (1913):—Oilseed cakes of all sorts, £354,340; bran and other corn and grain offals (including rice meal and dust), £1,256,450; total, £1,610,790.

Each of the three countries exports a certain amount of these feeding stuffs to the other two. The extent of this trade in a recent year was as follows:—*From Germany* (1912):—To United Kingdom, £392,650; to Austria-Hungary, £146,150. *From Austria-Hungary* (1913):—To United Kingdom, £7,980; to Germany, £573,300. *From United Kingdom* (1913):—To Germany, £759,200; to Austria-Hungary, £400.

The bulk of the oilseed cake trade is concentrated in Western European countries. The United Kingdom leads in the French, Russian, and United States markets, and does a fair trade with Denmark and the Netherlands; but elsewhere the trade is in German hands, with the exception of the Italian market, which is almost entirely supplied by Austria-Hungary.

Presence of free pentoses in plant extracts and the influence of other sugars on their determination. Davis and Sawyer. See XVII.

Hydrolysis of maltose by hydrochloric acid under Herzfeld conditions of inversion. Davis. See XVII.

PATENTS.

Soya beans; Treatment of — and the production of a food preparation therefrom. J. Friedman, London. Eng. Pat. 121, Jan. 2, 1914.

To remove its unpleasant flavour, soya bean flour is heated to 120°—300° C. while being continuously agitated. Soya bean flour for bread-making, for example, is heated at 155° C. for about 70 minutes.—W. P. S.

Milk preparation; Dried — E. P. Carpenter. London. Eng. Pat. 1409, July 1, 1914.

SEPARATED milk is evaporated to a density of 16° (sp. gr. 1.121) and emulsified with an edible oil or fat, at a maximum temperature of 130 F. (55° C.). The evaporation is continued in a vacuum for 20 min. and the residue dried. The dry powder contains from 5 to 30% of fat.—J. H. J.

Milk; Apparatus for drying — J. D. McIntyre, New York. Assignor to W. de Shetley, Chicago, Ill. U.S. Pat. 1,122,142, Dec. 22, 1914. Date of appl. Aug. 1, 1913.

THE vessel containing the milk has a slot in the bottom admitting hot air. An agitator within the vessel is worked at a high speed, e.g., by a friction drive, during the evaporation of the milk to a doughy consistence, and later, during the conversion of the doughy mass into a granular condition, at a lower speed by a positive drive.—J. H. J.

Foodstuffs, beverages, and the like; Preservation of — J. Milburn, London. Eng. Pat. 9024, April 9, 1914.

FOODSTUFFS, beverages, etc., are treated with from 0.05 to 0.1% of their weight of a mixture of salicylic, benzoic, and boric acids, sodium sulphite, and sodium sulphocarbonate; borax or a borate may be used in place of the boric acid, and sulphurous acid or sodium bisulphite instead of sodium sulphite.—W. P. S.

Desiccated milk; Process of producing — A. A. Dunham, Bainbridge, N.Y., U.S.A. Eng. Pat. 27,015, Nov. 24, 1913. Under Int. Conv., April 11, 1913.

SEE U.S. Pat. 1,074,419 of 1913; this J., 1913, 1027.

Cooling hot or mollen fats and fatty emulsions and the like. Eng. Pat. 19,863. See XII.

XIXB.—WATER PURIFICATION; SANITATION.

Silicic acid in natural waters; Determination of — L. W. Winkler. Z. angew. Chem., 1914, 27, 511—512.

THE method depends upon the yellow coloration produced by silicic acid with ammonium molybdate in presence of hydrochloric acid: 100 c.c. of the water, contained in a beaker, is treated with 1 gm. of powdered ammonium molybdate and 5 c.c. of 10% hydrochloric acid, and in a second similar beaker, 105 c.c. of the water is treated with potassium chromate solution (0.530 gm. K_2CrO_4 in 100 c.c.), until the yellow colour matches that of the other solution. The number of c.c. of chromate solution used, when multiplied by 10, gives the quantity of SiO_2 in mgrms. per litre. The results are as accurate as those obtained by the tedious gravimetric process.—A. S.

Sulphurous acid in the atmosphere; Detection of — by means of mercury salts. Denigès. Bull. Soc. Pharm. Bordeaux, April, 1914. Ann. Chim. Analyt., 1915, 20, 10—11.

THE end of a glass rod is moistened with a solution of mercuric sulphate (5 grms. of mercuric oxide in 20 c.c. of sulphuric acid of sp. gr. 1.81 and 100 c.c. of water) and exposed to the atmosphere. In the presence of sulphurous acid a crystalline deposit of stellar formation is produced on the

rod. Or a solution of mercuric acetate (5 grms. of mercuric acetate in 100 c.c. of water and 1 c.c. of glacial acetic acid) may be used, the crystals produced being spherical masses. With mercurous nitrate (5 grms. of mercurous nitrate in a mixture of 5 c.c. of nitric acid of sp. gr. 1.39, and 50 c.c. of water) a brownish deposit consisting of a mixture of metallic mercury and mercurous sulphate, which only exceptionally is crystalline, is obtained.—C. A. M.

Lime-sulphur sprays; Composition and analysis of — A. A. Ramsay. J. Agric. Sci., 1914, 6, 476—483.

LIME-SULPHUR solution contains calcium disulphide in addition to the compounds mentioned previously (this J., 1914, 662). The solution may be analysed as follows: 50 c.c. of the concentrated lime-sulphur solution is diluted to 250 c.c.; 25 c.c. of this solution is titrated with N/10 iodine solution until the yellow colour is discharged, and the titration is continued until a faint yellow coloration is obtained. The second titration gives the quantity of thiosulphate present. The titrated solution is filtered, the filtrate is slightly acidified with hydrochloric acid, barium chloride is added, and the resulting barium sulphate collected and weighed; this gives the quantity of sulphur present as sulphate and sulphite. Free sulphur is determined by extracting 10 c.c. of the diluted solution with carbon bisulphide, and total sulphur by oxidising 10 c.c. of the diluted solution with sodium peroxide, acidifying the solution with hydrochloric acid, adding a small quantity of potassium iodide, and precipitating with barium chloride. The total lime is found by treating 10 c.c. of the diluted solution with iodine solution, separating the sulphur by filtration, and precipitating the lime as oxalate. The sulphur (a) present as hydroxyhydrosulphide and disulphide is found by subtracting the sum of the sulphur present as free sulphur, sulphate, sulphite, and thiosulphate from the total sulphur; the lime (b) occurring as hydroxyhydrosulphide and disulphide by subtracting that present as sulphate, sulphite, and thiosulphate, from the total lime. If x = lime in combination as hydroxyhydrosulphide, then $b-x$ = lime in combination as disulphide; $x \times 0.5714$ will be the sulphur in combination as hydroxyhydrosulphide, and $(b-x) \times 1.1428$ the sulphur as disulphide. The value of $b-x$ is found from the equations:

$$x \times 0.5714 + (b-x) \times 1.1428 = a,$$

$$\text{and } x = \frac{(b \times 1.1428) - a}{0.5714}.$$

—W. P. S.

PATENTS.

Filtering water; Apparatus for — M. Deacon and W. Gore, London. Eng. Pat. 27,885, Dec. 4, 1913.

IX sand filters for dealing with large volumes of water (see Eng. Pats. 14,487 of 1910 and 29,301 of 1911; this J., 1913, 221), the sand is divided into several units capable of being worked separately. Each unit has around its base a set of bifurcated pipes leading into a main pipe beneath the unit. Before entering the main, each branch pipe is bent round on itself and terminates in a nozzle delivering into an upright pipe connected to the main drain; at the bottom of the bend water under slight pressure is introduced to keep the sand in a state of flow. The dirty sand is withdrawn through these pipes and carried to a washing apparatus in the centre of the filter, where it is lifted by a bucket conveyor and fed into a hopper-mouthed pipe containing baffles. Here the falling sand meets the water to be filtered passing upwards and is washed by it. The washed sand and the water

travel along a pipe at the top of the filter and are delivered over the centre of each unit. The filtered water passes out through a number of perforated pipes in the base of each unit which are connected to a main collector.—J. H. J.

Water purification [removing gasoline, etc.]. C. Ellis, Montclair, N.J., Assignor to Ellis-Foster Co. U.S. Pat. 1,121,994, Dec. 22, 1914. Date of appl., Aug. 7, 1911.

WASTE water from garage washings, containing small quantities of gasoline or other inflammable oil, is passed through a bed of sawdust or other porous material impregnated with a non-volatile oil.—I. H. J.

Sewage disposal. R. W. Pratt, Cleveland, Ohio. U.S. Pats. 1,122,155 and 1,122,156, Dec. 22, 1914. Dates of appl., March 16 and June 30, 1914.

THE sewage passes through either an unobstructed channel at a regulated speed, or a channel with walls capable of being adjusted so as to give a constant rate of flow through the channel. The sludge collects in a chamber, which is heated and has a contracted upper portion forming an outlet, with a shelf inclined away from the outlet for receiving matter rising to the surface. The remaining sludge is run out on to a sand bed in a ventilated and heated chamber with a translucent roof.—J. H. J.

Dynamite fumes, gases and dust in the atmosphere caused by blasting, drilling, and the like in mines: Method for consuming by fire—W. Alderson, Kimberley, S. Africa. Eng. Pat. 20,258, Sept. 8, 1913.

TRUCKS or pans carrying fires are run on rails or wires through the working places in the mine before and after the shots are fired, to consume the dust and fumes arising from the drilling or explosion. Explosive mixtures of gas and air are first removed by ventilation.—W. H. C.

Suspended impurity in the air; Apparatus for measuring the amount of—J. S. Owens, London. Eng. Pat. 8725, April 7, 1914.

THE air is drawn by an aspirator through a small disc of filter-paper, held between two perforated plugs, and the quantity of impurity is determined by comparing the shade of the discoloration with a scale of standard discolorations.—O. E. M.

Insecticides for agricultural and horticultural purposes. W. Calderwood and A. E. Webb, London. Eng. Pat. 12,802, May 25, 1914.

THE insecticide consists of 60% of soft soap, 38% of anhydrous sodium carbonate, and 2% of powdered camphor, pyrethrum, bitter apples, aloes, gentian, quassia, hyssop, or senna, or mixtures of these.—W. P. S.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Synthetic drugs in Great Britain. [Preparation of phenacetin and β -eucaine.] J. F. Thorpe. Nature, Jan. 28, 1915, 593–591.

AT the request of the Admiralty, the Imperial College of Science and Technology has been engaged recently in the preparation of phenacetin and β -eucaine, which had not previously been manufactured in this country. To prepare phenacetin, acetanilide was nitrated, the *p*-nitro compound was treated with alkali to produce the sodium salt of *p*-nitrophenol, which was converted by means of ethyl bromide into *p*-nitrophenetol, and this was reduced and the product acetylated. β -Eucaine

was obtained by condensing acetone with oxalic acid and ammonia to form the hydrogen oxalate of diacetoneamine, condensing this with paraldehyde to produce the cyclic vinyl-diacetoneamine, reducing by means of sodium amalgam to a mixture of the *cis* and *trans* forms of the trimethyl-hydroxypiperidine, treating with sodium amylate to produce the *cis* form only of this compound, and treating with benzoyl chloride and finally with hydrochloric or lactic acid to obtain the corresponding salt of β -eucaine.

Apomorphine; Delicate reaction for—L. Grimbert and A. Leclère. J. Pharm. Chim., 1915, 11, 23–24.

THE characteristic blue coloration produced by the oxidation of apomorphine hydrochloride solutions by atmospheric oxygen can be intensified as follows: 5 c.c. of the solution is mixed with 5 drops of a saturated solution of mercuric chloride and 5 drops of 10% sodium acetate solution, boiled, cooled, and shaken with amyl alcohol, which dissolves the blue substances. One part of apomorphine in 500,000 can be detected in this way. (See also this J., 1915, 100.)—F. SHDN.

Tormentol, a principle extracted from Potentilla tormentilla Neck. A. Goris and C. Vischniac. Comptes rend., 1915, 160, 77–80.

A CRYSTALLINE principle, *tormentol*, $C_{33}H_{50}O_{10}$, has been isolated from the roots of the tormentil or septfoil. It crystallises in fine needles with 5 mols. H_2O , melts at 227° – 228° C., and is optically active ($[\alpha]_D^{20} = +10.78^{\circ}$ in alcoholic solution). It is saturated and neutral, possesses the properties both of an alcohol and an ester, but does not react with reagents for ketones. It is soluble in alcohol, acetone, and acetic acid, insoluble in water and ether. On saponification with alcoholic potassium hydroxide, tormentol yields an acid, m. pt. 280° C., and an alcohol, m. pt. 310° C.—G. F. M.

Cineol in oil of eucalyptus; Determination of—J. L. Turner and R. C. Holmes. Pharm. J., 1915, 94, 60–63.

THE determination of cineol in eucalyptus oils by means of its addition compound with arsenic acid (see Watson Smith, this J., 1902, 1096, 1194) is recommended. The procedure is analogous to that followed in the known phosphoric acid process, and the method is superior to the resorcinol method (this J., 1908, 90). It can be applied directly to all cineol-bearing oils and gives results agreeing within 2%. With oils containing less than 50% of cineol, a known volume of the latter should be added first; whilst if the oil be so rich in cineol that the arsenic acid addition compound sets to a hard mass, 5 c.c. of petroleum ether is added.

—F. SHDN.

Blue hydrocarbon: The—, occurring in some essential oils. A. E. Sherndal. J. Amer. Chem. Soc., 1915, 37, 167–171.

A CONNECTION is deduced between the green or blue colour of the essential oils of chamomile, wormwood, and cubeb, and the blue fraction yielded between 275° and 300° C. by many other oils when distilled. The addition of a little sulphuric acid to an acetic anhydride solution of oil of gurjun balsam produces an intensely blue oil which is volatile in steam. Blue or violet colours are similarly given by the oils of amyris and guaiac-wood, but not by those of santal and cedar-wood. The reaction is suggested as a test for adulterants in oils of the last type. A freshly steam-distilled blue fraction was shaken with 63% sulphuric acid, and from this solution the blue extract was transferred in turn to petroleum spirit, 85% phosphoric acid, and ether. The intensely

blue liquid thus obtained amounted to 0.28% of the original oil. It dissolved unchanged in most organic solvents and in strong inorganic acids, and was precipitated from the latter upon dilution with water. The substance, for which the name "azulene" is proposed, appears to be a highly unsaturated hydrocarbon of the formula, $C_{15}H_{18}$.
—J. R.

Dihydroxystearic and dihydroxybenic acids; Action of fused potassium hydroxide on—
H. R. Le Sueur and J. C. Withers. Chem. Soc. Trans., 1914. 105, 2800—2819.

DIHYDROXYSTEARIC acid when fused with potassium hydroxide yielded α -hydroxy- α -octylsebacic acid, $(CO_2H)_2C(OH)(C_8H_{17})$, $(CH_2)_7CO_2H$, m. pt. 111—112°C., and this when oxidised with potassium permanganate in acetone solution gave β -ketomargaric acid, $C_{18}H_{32}O_4$, CO_2H , $(CH_2)_7COOH$, m. pt. 78.5°C., and when heated alone above its melting point gave two unsaturated acids, $C_{18}H_{32}O_4$, which by addition of hydrogen were converted into α -octylsebacic acid, m. pt. 71.5—72.5°C. The constitution of β -ketomargaric acid and hence of α -hydroxy- α -octylsebacic acid was elucidated by converting its oxime into the corresponding amides by heating with concentrated sulphuric acid, and hydrolysing these by heating with hydrochloric acid, when *n*-nonoic acid, octylamine, azelaic acid and *n*-amino-*n*-octoic acid were obtained. Dihydroxybenic acid, obtained by the oxidation of crucic acid, yielded α -hydroxy- α -octyldodecanedicarboxylic acid, $(CO_2H)_2C(OH)(C_8H_{17})$, $(CH_2)_{11}CO_2H$, m. pt. 127—128°C., when fused with potassium hydroxide. On oxidation this gave μ -keloheneicosoic acid, m. pt. 89—90°C., the oxime of which gave two amides on heating with concentrated sulphuric acid. The amides, on hydrolysis, yielded *n*-nonoic acid, octylamine, brassylic acid, and λ -aminolauric acid. The intramolecular changes brought about during fusion with potassium hydroxide involve the migration of the group, C_8H_{17} , from one carbon atom to another adjacent to it. No previous example of such movement of a heavy group within a molecule has been recorded in an aliphatic compound.—T. C.

Sterile solutions of common salt for hypodermic injections; Rapid method of preparing—
Tege. Münch. med. Wochenschr., 1914, 1325.
J. Pharm. Chim., 1915. 11, 32.

A SOLUTION of hydrochloric acid is heated to boiling and neutralised by dilute sodium carbonate solution whilst still hot, using phenolphthalein as indicator.—F. SHDN.

Medicines, comprising drugs and medicinal preparations. Board of Trade Bulletin.

THE following statement shows for a recent year the value of drugs and medicinal preparations exported from Germany, Austria-Hungary, and the United Kingdom, respectively, to all destinations, so far as the particulars are available:—

Exported from Germany (1912): Opium, £24,500; Peruvian bark, rhubarb roots, and medicinal berries, leaves, flowers, etc., £237,100; quinine, quinine salts, and compounds, £261,600; collodion and celloidin, £7,700; chloroform, chloral hydrate, £18,500; liquorice juice, £18,600; artificial balsams, extracts, waters and the like, not sweet smelling, £35,000; juices of fruits and plants, for medicinal use, containing ether or alcohol, £150; prepared medicaments and other pharmaceutical products, not otherwise mentioned, £895,500; chemical products, not otherwise mentioned, for medicinal uses, £742,500; total, £2,244,150.

Exported from Austria-Hungary (1913):—Medicines, prepared, and all substances which by

inscriptions on their labels or wrappers, etc., purport to be medicines (including veterinary medicines), opium, etc., £191,600.

Exported from the United Kingdom (1913):—Cocaine and cocaine salts, £1,000; morphia and morphia salts, £193,400; opium, dried, and powdered in the United Kingdom, £12,400; quinine and quinine salts, £72,600; medicines, unenumerated, £2,072,300; total, £2,351,700.

Though the German and British exports of medicines, etc., are about equal in value, there are considerable differences in their distribution. Thus, while the United Kingdom holds a practically unchallenged position in the British Colonial and Chinese markets, Germany holds almost a similar position in the Russian and to a somewhat smaller extent in the Swedish, Swiss, and United States markets. In France and the South American markets we are holding our own, the two countries sending about equal amounts to the markets in question. In many of the other markets, however, Germany has established a long lead, particularly in Norway, Sweden, Denmark, Netherlands, Belgium, Switzerland, Spain, Italy, Roumania, the Balkan States, and Argentina. Exports of medicines from Austria-Hungary are insignificant when compared with those of Germany or the United Kingdom. The principal markets for Austrian medicines are found mainly in neighbouring countries, Switzerland, Italy, Russia, Roumania, Bulgaria, etc., though certain quantities are also sent to the United Kingdom and the United States.

In 1912 the principal German markets for opium were the United States, Russia, Holland, and Switzerland; for Peruvian bark, rhubarb roots, and medicinal berries, leaves, flowers, etc., the United States, Russia, the United Kingdom, France, and Switzerland; for quinine and its salts and compounds the United States, Russia, Italy, and the United Kingdom; for collodion and celloidin, France, Holland, and Russia; for chloroform and chloral hydrate, Russia, Argentina, Belgium, Australia, Japan, Italy, and the United Kingdom; for liquorice juice, Denmark, Holland, Sweden, Norway, and Belgium.

Volatile and essential oils. Board of Trade Bulletin No. 100.

THE value of volatile and essential oils exported from Germany in 1912 was £482,500; from Austria-Hungary (1913), £78,270; and from the United Kingdom (1913), £111,500. A considerable amount of trade in these oils is carried on between the three countries. Thus, Germany in 1912 exported volatile and essential oils to the value of £52,050 to Austria-Hungary and £51,400 to the United Kingdom. Similarly, Austro-Hungarian exports to Germany and the United Kingdom were valued at £50,170 and £3120, respectively, in 1913, while the value of the exports from the United Kingdom to Germany and Austria-Hungary in the same year amounted to £20,800 and £1800 respectively.

Excluding the trade referred to above, the value of the exports to 38 of the principal Colonial and neutral markets only, considered as a whole, reached the following amounts: from Germany (1912), £366,750; from Austria-Hungary (1913), £24,950; from the United Kingdom (1913), £86,600. The combined value of the German and Austro-Hungarian exports to these markets was about five times that of the exports from the United Kingdom. Only in the cases of Canada, Australia, and New Zealand do the exports from the United Kingdom exceed those from Germany. In all the other markets German or Austro-Hungarian exports are predominant, competition from the United Kingdom being greatest in France, Belgium, Switzerland, British India, and Japan.

The countries, formerly supplied by Germany and Austria-Hungary, which appear to offer the greatest scope for exploitation by United Kingdom manufacturers of essential and volatile oils are Russia, United States, France, Japan, Italy, South American countries, Mexico and Cuba, Scandinavia, British India, and Spain. In 1913 British trade was quite unrepresented in British West Africa, Portugal, Greece, Bulgaria, Servia, Egypt, Dutch East Indies, Philippines, Venezuela, Peru, Mexico, and Cuba.

Some properties of solutions of the boric acids in alcohol. Firth and Myers. See VII.

PATENTS.

Carbon tetrachloride; Process for making—C. J. Strosacker. Assignor to The Dow Chemical Co., Midland, Mich. U.S. Pat. 1,121,880. Dec. 22, 1914. Date of appl., June 20, 1911.

SULPHUR chloride is distilled with the fractions rich in carbon bisulphide, from crude carbon tetrachloride. Sulphur chloride and carbon bisulphide are added to the still residue, giving a fresh supply of distillate rich in carbon bisulphide. —O. E. M.

Ethyl acetate; Manufacture of—from acetaldehyde. Konsortium für Elektrochemische Industrie G. m. b. H. Ger. Pat. 277,188. June 13, 1913. Addition to Ger. Pat. 277,187.

In the preparation of ethyl acetate from acetaldehyde by the process described in the chief patent (see Eng. Pat. 26,826 of 1913; this J., 1914, 666), the aluminium alkyl oxide catalyst is used in solution, preferably in ethyl acetate. The aldehyde may be added to the solvent used for dissolving the catalyst. (See also Eng. Pat. 26,825 of 1913; this J., 1914, 666.)—A. S.

XXII.—EXPLOSIVES; MATCHES.

Explosion of picric acid; Report on the circumstances attending an—which occurred at the factory belonging to Messrs. Henry Ellison, Ltd., at Heckmondwike, on Dec. 2, 1914. A. Cooper-Key, H.M. Chief Inspector of Explosives. [Cd. 7774.]

As a result of the explosion ten men were killed and five injured. The factory comprised five buildings in which picric acid was manufactured by the wet process (nitration of sulphonated phenol) and four in which the acid was respectively dried, sifted, packed, and stored. The explosion originated in the sifting shed, in which there was also a mill for grinding crystals too large to pass through the revolving sieve. The quantity of picric acid in the sifting shed was about 700 lb., and the explosion was communicated sympathetically to the drying shed, 30 ft. distant, containing about 1 ton of picric acid. The packing shed and the portions of the magazine of lighter construction were also destroyed, but the picric acid contained therein did not explode or even take fire, although the hoops were stripped from the barrels. As a result of investigations in connection with previous explosions of picric acid (see this J., 1887, 835; 1900, 929), it had been decided that picric acid when free from metallic picrates would not explode without giving sufficient warning by fire to allow anyone in the vicinity to escape, and that a fire, in its initial stages, could be extinguished by water without much difficulty; also that provided suitable sprinklers were fitted to every building or compartment liable to contain dry picric acid, and that the quantity present did not

exceed 2000 lb., the danger of a fire developing into an explosion was negligible. It is concluded that in the case under report the ignition of the picric acid was probably due to the accidental presence in the grinding mill of a nail, stone, or other hard foreign substance, and that the explosion was one of dust rendered more than usually violent by the circumstance that the dust contained within itself all the elements necessary to form an explosion. There was evidence that much inconvenience was caused in the sifting and grinding room by dust; and on the day of the explosion a fairly strong wind was blowing almost directly into the door of the building, which, no doubt, was opened from time to time to clear the air.

In consequence of the explosion all licensed manufacturers of picric acid in the United Kingdom have been called upon to discontinue the process of dry grinding of large crystals and to take measures to prevent, as far as practicable, the formation of fine dust during sifting. Grinding of the crystals in water by means of edge-runners of granite working on a granite bed is suggested as a practical method; or the use of aluminium rollers or runners might be tried.

Attention is drawn to the risk of dust explosions in the manufacture of trinitrotoluene, for which, owing to the insensitive character of the substance, no licence is required. It is suggested, also, that the explosion of collodion cotton of low nitrogen content at the Pegamoid factory, Edmonton, in 1905 (this J., 1905, 690) was a dust explosion.—A. S.

Nitrocellulose from cotton and wood celluloses.

C. G. Schwalbe and A. Schrimpf. Z. angew. Chem., 1914, 27, 662—664. (See also this J., 1912, 954.)

COMPARATIVE nitration experiments were made with cotton and a series of typical wood celluloses. The commercial wood pulps were transformed into thin sheets of paper, which were dried at 95°—100° C. before nitration. The highest nitrate obtained from cotton contained 13.46% N, the highest from wood cellulose 13.34%. It was found possible to prepare from wood pulp a nitrocellulose with a solubility of 5—6% in ether-alcohol. Stabilisation by digestion with water under pressure produced a change in the constitution of the nitrocellulose, such that its solubility in ether-alcohol was materially increased; the ordinary technical method of stabilisation was therefore adopted. No difficulty was experienced in removing the unstable products from the nitrocelluloses prepared from wood-pulp; after suitable treatment these gave results conforming with the official specification by Bergmann and Junk's test (this J., 1905, 953), and were at least as stable as the cotton nitrocelluloses. In the nitration of thin paper, success depends on the structure of the latter: overbeaten fibres give bad results. In pulping nitrocotton, traces of copper, amounting in some cases to 0.050—0.058 %, may be absorbed from the beater-knives, but without appreciable effect upon the stability test. In celluloid manufacture the product is sometimes bleached after nitration and pulping; this operation was found to eliminate unnitrated cellulose and had a slight effect on the nitrogen-content, varying in either direction according to the origin of the material. Unstable sulphuric esters can be eliminated by boiling with dilute acid: 1% hydrochloric acid gave better results than dilute sulphuric acid, causing no decomposition of the nitrocellulose, and leaving a product of lower solubility and somewhat greater stability.—J.F.B.

Instrument for measuring flame velocities in gas and dust explosions. Morgan. See IIa.

PATENTS.

Combustibles for explosives; Manufacture of —. O. B. Carlson, Mansbo, Assignor to O. F. Carlson, Stockholm, Sweden. U.S. Pat. 1,122,072, Dec. 22, 1914. Date of appl., June 15, 1911.

NITRATED resin and a nitro-compound are heated together and the product nitrated.—O. E. M.

Explosives; Plastic—and method of manufacturing the same. C. V. A. Herlin, Vinter-viken, Sweden. Eng. Pat. 26,493, Nov. 18, 1913. Under Int. Conv., April 14, 1913.

SEE Fr. Pat. 465,771 of 1913; this J., 1914, 614.

Method for consuming by fire dynamite fumes, gases, and dust in the atmosphere caused by blasting, drilling, and the like in mines. Eng. Pat. 20,258. See XIXB.

XXIII.—ANALYTICAL PROCESSES.

Titanous chloride; Use of—in qualitative analysis. A. Monnier. Ann. Chim. Analyt., 1915, 20, 1—4. (See also this J., 1903, 232, 762, 825; 1904, 503; 1905, 1192; 1907, 1165.)

TITANOUS chloride (0.8% solution) reduces hot neutral or slightly acid solutions of platinum, palladium, or iridium chlorides, yielding the respective metals. It reduces cold solutions of auric chloride, forming a blue solution with red fluorescence and a grey-blue precipitate on standing. This test will detect gold in the presence of platinum or iridium, but free hydrochloric acid must be present to prevent precipitation of the latter. With alkali tungstates acidified with dilute hydrochloric or sulphuric acid, it gives an intense characteristic blue coloration, whilst with molybdates it produces a brown coloration changing to green or blue on standing or on heating. It decolorises acid solutions of alkali vanadates; the liquid becomes pale blue when heated. It reduces solutions of chromates to chromium salts, selenious acid to selenium, tellurous acid to tellurium, and sulphites and thiosulphates to sulphur. *Organic acids*:—Formates and acetates are reduced, with the formation of violet or violet-black basic salts. Alkali oxalates give a yellow coloration, and a yellowish-brown precipitate on boiling; succinates a voluminous violet-grey precipitate; and neutral tartrates a grey precipitate. The intense violet coloration given by solutions of alkali citrates is a sensitive and distinctive test. After a few hours the surface of the liquid is decolorised by oxidation, but at the bottom the colour persists for several days. Alkali lactates give a pale blue to violet-brown coloration, the intensity of which rapidly diminishes. Alkali benzoates give a voluminous brownish-green precipitate; salicylates a yellowish-green precipitate; and tannin (in aqueous solution) a voluminous red-orange precipitate. Citric acid can be detected in the presence of formic, acetic, succinic, lactic, and benzoic acids by the reagent, but oxalic and salicylic acids interfere.—C. A. M.

Tungsten; The separation of—from molybdenum. E. E. Marbaker. J. Amer. Chem. Soc., 1915, 37, 86—95.

To the boiling solution of sodium tungstate and molybdate a definite amount (20 c.c. for 0.15 gm. WO_3) of stannous chloride solution is added (50 grms. $\text{SnCl}_2 \cdot 2\text{H}_2\text{O}$ in 200 c.c. of concentrated

hydrochloric acid). After brief boiling, settling, and decantation of the clear supernatant liquid through a filter, the blue precipitate (W_2O_5) is washed by decantation with hot 5% hydrochloric acid until the washings fail to give the zinc and thiocyanate test for molybdenum. It is then drained upon the filter, which after a rough drying is gently ignited in a weighed porcelain crucible and the tungsten weighed as WO_3 . With large amounts of the metals the concentrated filtrate and washings are diluted to 250 c.c. and an aliquot part (50 c.c.) is treated with 20-mesh zinc (5 to 10 grms.) for about 10 minutes. The filtrate and washings from the precipitated tin contain the whole of the molybdenum as green Mo_2O_3 . The flask of a Jones reductor is charged with 20 c.c. of ferric ammonium sulphate solution (10%) and 20 c.c. of the "titrating solution" (90 grms. of manganous sulphate, 650 c.c. of distilled water, 175 c.c. of syrupy phosphoric acid, and 175 c.c. of concentrated sulphuric acid). The following solutions are then passed successively through the reductor into the flask: 50 c.c. of dilute hydrochloric acid (2.5% HCl by vol.), the molybdenum solution at 60°C., 150 c.c. of dilute hydrochloric acid, and 150 c.c. of hot distilled water. The ferrous iron in the mixture is finally titrated quickly with $N/10$ permanganate solution: the process is not hindered by the various colour changes which occur. Tungsten in sodium tungstate is determined by adding sodium chloride and proceeding as when molybdenum is present.—J. R.

Indicators, etc.; Notes on recent —. G. S. Walpole. Biochem. J., 1914, 8, 628—640.

THIS compilation of information on indicators, regulator mixtures, etc., includes a chart of hydrogen ion concentration data representing the sensitive ranges of all the indicators in general use, both in colorimetric and "end-point" processes. 2,5-Dinitroquinol (Henderson and Forbes, J. Amer. Chem. Soc., 1910, 32, 687) is green in dilute acid, yellowish at $P_H^+ = 3$, reddish brown at absolute neutrality, and purple at $P_H^+ = 9.5$, and thus is effective over the ranges of methyl orange, litmus, and phenolphthalein. The range of di-*o*-hydroxystyryl ketone, or lygosin (Ferez, this J., 1914, 1075) brownish yellow to green, is identical with that of α -naphtholphthalein ($P_H^+ = 7.3$ to 8.7). 1-Oxynaphthochinomethane (Nierenstein, private communication) is colourless at $P_H^+ = 2.7$, and shows a gradual increase of purple colour to $P_H^+ = 3.7$; it gives the sharpest colour changes of any indicator working in this region. 6-Sulpho- α -naphthol-1-azo-*m*-hydroxybenzoic acid (Mellet, this J., 1910, 1274; 1911, 1186) changes from orange to blue between $P_H^+ = 7$ and 8, and from violet to red between $P_H^+ = 12$ and 13. 2,6-Dinitroaminophenol, or isopiramic acid (Meldola and Hale, Chemical World, 1912, 1, 327) is pink in solutions more acid than $P_H^+ = 4.1$ and yellow in solutions more alkaline than $P_H^+ = 5.6$. Alizarinmonosulphonic acid (Knowles, this J., 1907, 489) is more sensitive than methyl orange between $P_H^+ = 3.7$ (yellow) and $P_H^+ = 4.2$ (pink). Extract of red cabbage (Walbum, Biochem. Zeits., 1913, 48, 29; Comptes rend. Lab. Carlsberg, 1913, 10, 227), which has a sensitive range from $P_H^+ = 2$ to 4.5, may be used in presence of proteins, neutral salts, toluene etc. The behaviour of the yellow dye from mimosa flowers (Robin, this J., 1904, 561) suggests its possible identity with turmeric. The hydrogen E.M.F.'s of the following

"regulator mixtures" have been determined: cacodylic acid-sodium cacodylate, acetic acid-sodium acetate, hydrochloric acid-sodium acetate. Lists of references to data on isoelectric points, optimum reactions for enzymes, and reactions of physiological fluids are given.—J. R.

Instrument for measuring flame velocities in gas and dust explosions. Morgan. See II A.

Determination of ash in coal and coke. Weisser. See II A.

Determination of hydrogen sulphide in coal-gas. Way. See II A.

Some properties of solutions of the boric acids in alcohol. A modified boiling point apparatus. Firth and Myers. See VII.

Rapid detection of cyanides, thiocyanates, ferro- and ferricyanides. Feigl. See VII.

Tri-ammonium citrate. Hall. See VII.

Determination of peroxide in commercial lead oxide. Dean. See VII.

Determination of sulphur in rubber. Gaunt. See XIV.

Note on the analysis of cube gambier. Bennett. See XV.

Chemical control in the cane sugar factory, using boiling-house balances of both sucrose and total solids. Johnson. See XVII.

Presence of free pentoses in plant extracts and the influence of other sugars on their determination. Davis and Sawyer. See XVII.

Hydrolysis of maltose by hydrochloric acid under Herzfeld conditions of inversion. Davis. See XVII.

Detection of sulphurous acid in the atmosphere by means of mercury salts. Denigès. See XIX B.

Determination of silicic acid in natural waters. Winkler. See XIX B.

Composition and analysis of lime-sulphur sprays. Ramsay. See XIX B.

Delicate reaction for apomorphine. Grimbert and Leclère. See XX.

Determination of cineol in eucalyptus oil. Turner and Holmes. See XX.

PATENTS.

Detecting, indicating, and recording the presence and proportions of gas in the atmosphere of mines. Eng. Pat. 29,094. See II A.

Apparatus for measuring the amount of suspended impurity in the air. Eng. Pat. 8725. See XIX B.

XXIV.—MISCELLANEOUS ABSTRACTS.

Clintonia borealis: Fruit of —. H. A. Slippery. Chem. News., 1915, 111, 2—3.

THE berries yielded 4.87% ash, and contained 1.05% nitrogen, 13.2% sugar consisting of glucose

and levulose, and over 4% of oil, as well as small amounts of citric and tartaric acids. The light yellow oil had a sweetish taste, and could not be easily saponified. Its sp. gr. was 0.897 at 15.5° C. and saponification equivalent 418.—R. G. P.

Trade Report.

Prohibited exports.

A ROYAL Proclamation, dated February 3rd, 1915, consolidates and supersedes all previous Proclamations or Orders of Council under Sect. 8 of the Customs and Inland Revenue Act, 1879, the Exportation of Arms Act, 1900, and the Customs (Exportation Prohibition) Act, 1914 (see this Journal, 1914, 810, 846, 896, 988, 1038, 1118, 1230).

The new Proclamation contains the following:—

(A) *The exportation of the following goods is prohibited to all destinations*:—Non-inflammable "celluloid" sheet (or similar transparent material non-soluble in lubricating oil, petrol or water); aeroplane dope; fusel oil (amyl alcohol); amyl acetate; aceto-celluloses; triphenyl phosphate; carbons, suitable for searchlights; cartridges, charges of all kinds, and their component parts; chemicals, drugs, dyes and dyestuffs, medicinal and pharmaceutical preparations, and tanning extracts, namely:—acetone; acetylsalicylic acid (aspirin); ammonium nitrate, perchlorate, and sulphocyanide; antipyrine (phenazone); anti-tetanus serum; barium chlorate; belladonna and its preparations and alkaloids; calcium acetate and all other metallic acetates; calcium nitrate; cantharides and its preparations; carbolic acid; chloral and its preparations, including chloramid; coal tar distillation products, namely, benzol and cresol and the fractions of the distillation products of coal tar between benzol and cresol; coal tar products for use in dye manufacture, including aniline oil and aniline salt; collodion; cresol, all preparations of (including cresylic acid) and nitro-cresol (except saponified cresol); cyanamide; diethylbarbituric acid (veronal) and veronal sodium; dimethylaniline; dyes and dyestuffs manufactured from coal tar products; emetin and its salts; ergot of rye, not including liquid extract or other medicinal preparations of ergot; eucaine hydrochlor.; gentian and its preparations; henbane and its preparations; hydroquinone; indigo, natural; ipecacuanha root; methylaniline; neosalvarsan; nitric acid; nitrotoluol; novocain; opium and its preparations and alkaloids; paraffin, liquid medicinal; paraformaldehyde and trioxymethylene; "Peptone Witte"; peroxide of manganese; phenacetin; picric acid and its components; potash salts, namely, chlorate, cyanide, nitrate, permanganate; protargol, not including silver proteinate; saccharin (including "saxin"); salicylic acid and salicylate of soda; salol; salvarsan; santonin and its preparations; sodium chlorate and perchlorate; sulphonal; sulphur; sulphuric acid; tanning extracts, viz., chestnut extract, oakwood extract; thorium nitrate; thymol and its preparations; trional; valonia; explosives of all kinds; brewers' and distillers' grains; brewers' dried yeast; cakes and meals; glass for optical instruments.

(B) *The exportation of the following goods is prohibited to all destinations abroad other than British Possessions and Protectorates*:—Chemicals, drugs, medicinal and pharmaceutical preparations, acetanilide, aconite and its preparations and alkaloids; alcohol, methyl; alumina and salts of aluminium; ammonia, liquified; antimony, sulphides and oxides of; benzoic acid (synthetic) and benzoates; bromine and alkaline bromides; coca and its preparations and alkaloids; copper,

suboxide of ; copper sulphate ; cresol (saponified) ; formic aldehyde ; fulminate of mercury ; glycerine, crude and refined ; hexamethylene tetramin (urotropin) and its preparations ; hydrobromic acid ; potash, caustic ; potassium bicarbonate, bichromate, carbonate, chloride, metabisulphite, prussiate, and sulphate (including kainit) ; chrome alum ; sodium nitrate ; tartaric acid and alkaline tartrates ; zinc sulphate ; ferro alloys, including ferro-chrome, ferro-manganese, ferro-molybdenum, ferro-nickel, ferro-titanium, ferro-tungsten, ferro-vanadium, spiegeleisen ; ferro-silicon ; graphite including foundry (moulding) plumbago and plumbago for lubricating ; the following metals and ores, viz. :—aluminium and alloys of aluminium ; antimony and alloys of antimony ; bauxite ; chrome ore ; cobalt ; copper and its alloys ; lead (including solder containing lead) ; lead ore ; manganese and manganese ore ; mercury ; molybdenum and molybdenite ; nickel and nickel ore ; scheelite ; selenium ; tungsten ; vanadium ; wolframite ; zinc and zinc ore (including zinc ashes, spelter, spelter dross, and zinc sheets) ; mica (including mica splittings) and micaite ; mineral jellies ; oil, blast furnace (except creosote and creosote oil) ; oil fuel, shale ; oil, mineral lubricating (including mineral lubricating grease and lubricating oil composed of mineral and other oils) ; oils, all vegetable (other than linseed oil, boiled and unboiled, unmixed with other oil, and not including essential oils) ; oil, whale, namely train, blubber, sperm or head matter, and seal oil, shark oil, and Japan fish oil ; oleaginous nuts, seeds and products, the following, namely :—castor beans, coconuts, copra, cotton seed, ground nuts (arachides), linseed, palm kernels, rape seed, sesame seed, and soya beans ; oleo oil, "Premier jus," and animal tallow ; petroleum, fuel oil (including turpentine substitute and paraffin oil) ; petroleum, gas oil ; petroleum spirit and motor spirit (including shell spirit) ; malt ; margarine ; sugar, refined and candy ; sugar, unrefined ; rubber (including raw waste and reclaimed rubber) and goods made wholly of rubber ; turpentine (oil and spirit) ;

(c) *The exportation of the following goods is prohibited to all foreign ports in Europe and on the Mediterranean and Black Seas, other than those of France, Russia (except Baltic ports), Belgium, Spain and Portugal* :—Asbestos ; camphor ; bismuth and its salts ; iodine and its preparations and compounds ; mercury, salts and preparations of ; nux vomica and its alkaloids and preparations ; india-rubber, sheet, vulcanised ; copper ore ; iron ore ; iron, hæmatite pig ; iron pyrites ; rosin.

Permits to import "enemy goods." Brit. and Col. Drug., Jan. 15 and 22, 1915.

THE Board of Trade has granted licences to import certain goods under Par. 8 of the "Trading with the Enemy Proclamation, No. 2," of Sept. 9, 1914 ; among the articles in respect of which licences have been given are :—

Chemicals (general) : Antimony fluoride, barium peroxide, beta-naphthol, carbolic acid crystals, chloral hydrate, chromium fluoride, chromium oxalate, formaldehyde, gallic acid, magnesium chloride, oxalic acid, paraldehyde, pyrogallol acid, tannic acid, tartar emetic, thorium hydrate. *Fine chemicals* : Acetanilide, aceto-salicylic acid, salicylic acid, salol, sodium salicylate, atophan, atropine, chlorophyll, eucaine hydrochloride, eucaine lactate, heliotropin, hexamethylene-tetramine, hydroquinone, para-amido-phenol, phenacetin, piperazine, safrol, scarlet red, salvarsan, neo-salvarsan, terpineol, thymol, vanillin. *Glassware, etc.* : Optical glass, chemical apparatus, glass for syphons, glass bulbs for X-ray work. *Lanoline. Potassium compounds* : Kainit and the following salts :—Salts (general), bichromate, bromide, carbonate, caustic, chlorate, cyanide, meta-bisulphite,

muriate, permanganate, prussiate, prussiate (yellow), sulphate. *Vegetable drugs* : Belladonna (root and leaves), colchicum (seeds and corms), dandelion, digitalis, henbane, insect flowers, juniper berry oil, valerian.

Applicants, who should address the Assistant Secretary, Commercial Department, Board of Trade, Whitehall, S.W., will have to prove that the articles they desire to import are practically the exclusive product of Germany, Austria-Hungary, or Turkey, and the goods would be imported through a "neutral" agent. The licence confers the right "to purchase, import, and contract for" the articles in question, and is subject to modification or revocation at any time in accordance with the condition of stocks or possible new production in this country.

Export of articles for the French Government. Board of Trade Announcement, Jan. 29, 1915.

APPLICATION for permission to export to France goods of which the export is prohibited by Proclamation, will receive special consideration if it can be clearly shown that the goods are destined for the use directly or indirectly of the French Government. Such applications must be made to the Commission Internationale de Ravitaillement, India House, Kingsway, W.C. Documents issued by provincial military or naval officers, other local authorities, or Government contractors in France will not be recognised as evidence of the destination of the goods unless formally approved in writing by the competent Department of the French Government.

Applications for permission to export goods which are ordered by firms or individuals in France for purely industrial purposes and which are not destined for the use of the French Government, will continue to be made in the ordinary manner to the Commissioners of Customs and Excise, Custom House, E.C.

Australia's trade with Germany.

A PAMPHLET has been issued from the offices of the Commonwealth of Australia, 72, Victoria Street, London, S.W., giving details of the trade between Australia and Germany. Among the exports from Australia to Germany in 1913 were the following :—Wool, £4,693,167 ; copper, £367,235 ; tannin bark, £23,653 ; lead, £37,094. The figures for "ores and concentrates" and "specie" for 1913 are not given, but for 1912 these amounted to £586,152 and £400,351 respectively. Australia imported the following from Germany in 1913 :—Ale and beer, £133,446 ; arms and explosives, £1,702,145 ; drugs and chemicals, £266,811 ; glass and glassware, £152,817 ; metal and metal manufactures, £2,030,674.

The pamphlet also contains a list of exporters of Australia's principal products.

New Customs and Excise Tariffs of the Commonwealth of Australia. Board of Trade J., Jan. 21, 1915. Suppl., price 3d.

THE new Tariff rates of the Commonwealth of Australia came into force on December 3 last. The duty on ale and other beer, cider, etc., containing more than 2% proof spirit is increased 6s. per gall., spirits and spirituous liquors not otherwise specified, amyl alcohol not denatured in accordance with departmental by-laws, essences, fruit ethers, tinctures, etc., containing more than 75% proof but not O.P., sulphuric ether containing 5% or more proof spirit, still wine containing more than 40% proof spirit, and other wines containing more than 50% proof spirit are now dutiable at 17s. per gall. (formerly 14s.). Other spirituous liquids are increased in a corresponding proportion. Fancy or medicated toilet soap is

increased from 4d. to 5d. per lb. or from 25% to 30% *ad val.*, whichever is higher, and other unspecified soaps, including compounded detergents and soap substitutes, but not including saponaceous disinfectants, have risen from 25% to 30% *ad val.* The duty on varnishes, oil and varnish stains, lacquers, liquid sizes, gold size, oil and wood finishes, lithographic varnish, printer's ink reducer, terebine, liquid driers, and liquid stains for wood is raised from 2s. to 2s. 6d. per gallon; paints, ground in liquid, rise from 4s. to 5s. per cwt. in respect of packages containing over 14 lb. and from 6s. to 7s. 6d. or 15% to 20% *ad val.* for smaller packages. Filters are changed from 15% to 20% *ad val.* Boric acid has been altered from 20% *ad val.* to 7s. per cwt.; opium extracts, which formerly were not specified, are now 60s. per lb.; artificial perfumes (synthetic) concentrated, containing less than 2% proof spirit, are now 3s. per fluid ounce, or free of duty when used for manufacturing purposes under departmental by-laws.

* New Books.

[The Roman numerals in thick type refer to the similar classification of abstracts under "Journal and Patent Literature" and in the "List of Patent Applications."]

I. *Gas and oil engines*, Care and repair of. N.Y., Industrial Press. c. 48 p. 8vo. pap. 1915. 25c.

Goodenough, G. A.: Thermal properties of steam. Illinois Univ. Bull. No. 75. 8vo. swd. Chapman and Hall. London. 1915. Net 1s. 9d.

Gould, G. B., and *Hubbard*, C. W.: The cost of power. N.Y., Fuel Engineering Co. of N.Y. c. 125p. il. pls. diags. 16mo. 1914. \$2.

IIA. *Fieldner*, A. C.: Notes on the sampling and analysis of coal. Wash. D.C., Gov. Pr. Off. 61 p. il. 8vo. (U.S. Bu. of Mines. Techn. pap. 76.) 1914.

Parr, S. W., and *Hadley*, H. F.: The analysis of coal with phenol as a solvent. Urbana. Ill. Univ. of Ill. 41 p. il. pls. tabs. (Eng. Exp. Stat. bull.) pap. 1914. 25c.

Williams, R. Y.: The humidity of mine air; with especial reference to coal mines in Illinois. Wash. D.C., Gov. Pr. Off. 69 p. tabs. pls. map. diags. 8vo. (U.S. Bu. of Mines. bull. 83.) 1914.

White, D. and *Thiessen*, R.: The origin of coal; with a chapter on the formation of peat, by C. A. Davis. Wash. D.C., Gov. Pr. Off. 10+390 p. pls. 8vo. (U.S. Bu. of Mines. bull. 38.) 1914.

Gas works directory and statistics. 1914-1915. Cr. 8vo. pp. 548. Hazell, Watson and Viney. London. 1915. Net 10s. 6d.

Oil and gas fields in 1913. U.S. Geological Survey. Base map of the United States, in scale of 1:2,500,000. In 2 sheets 40+50. Wash. D.C. Off. of Survey. pap. 1915. \$1.

IV. *Wahl*, A.: The manufacture of organic dyestuffs. auth. tr. by F. W. Atack. N.Y., Macmillan. 14+338 p. (bibls.) 12mo. 1915. \$1.60 n.

VII. *Calvert*, A. F.: Salt in Cheshire. 8vo. Spon. London. 1915. Net 21s.

Levy, S. I.: The rare earths, their occurrence, chemistry and technology. 8vo. pp. 360. E. Arnold. London. 1915. Net 10s. 6d.

Soddy, F.: The chemistry of the radio-elements. 2 parts in one vol. 8vo. pp. 212. limp. Net 5s. 6d.

Ditto. Part 1. new ed., revised and enlarged. Longmans. London. 1915. Net 4s.

IX. *Landini*, A.: Le costruzioni in cemento armato. Bologna. 8vo. fig. p. 288. Lire 10.

Searle, A. B.: Bricks and artificial stones of non-plastic materials: their manufacture and uses. 4to. Churchill. London. 1915. Net 8s. 6d.

X. *Park*, J. Prof.: A text-book of practical assaying. Revised and enlarged from third New Zealand edition. Authorised text-book for New Zealand Government Schools of Mines. With illustrations. Crown 8vo. Ch. Griffin. London. 1915. Cloth. 7s. 6d. net.

Wraight, E. A.: Assaying in theory and practice. N.Y., Longmans. 11+323 p. il. tabs. figs. O. 1915. \$3 n.

Wysor, H.: Metallurgy: a condensed treatise for those desiring a general knowledge of the subject. 2nd ed. Easton, Pa., Chemical Pub. c. 13+391 p. il. diags. 8vo. 1915. \$3.

XII. *Copeland*, E. B.: The cocoa-nut. N.Y., Macmillan. 13+212 p. il. 8vo. 1915. \$2.60 n.

XVIII. *Brannl*, W. T. ed.: A practical treatise on the manufacture of vinegar. 3 ed. rev. Phil. H. C. Baird and Co. 567 p. il. 8vo. 1915. \$6 n.

XIXB. *Barker*, A. H.: The theory and practice of heating and ventilation. N.Y., Van Nostrand. 656 p. il. tabs. 8vo. 1915. \$8 n.

Harrington, C.: A manual of practical hygiene for students, physicians, and health officers. Fifth edition. Revised and enlarged by M. W. Richardson in collaboration with officials connected with the Massachusetts State Board of Health. With 24 plates in colours and monochrome and 125 engravings. 8vo. Lea and Febiger. New York. 1914. Cloth. \$5.00 net.

Woodman, A. G., and *Norton*, J. F.: Air, water, and food from a sanitary standpoint. 4th ed., rev. and rewritten. N.Y., Wiley. c. 5+248 p. il. 8vo. 1915. \$2 n.

XXI. *Pizzighelli*, G.: I processi fotografici positivi. Milano. 16mo. fig. p. XVI. 398. 1914. Lire 4.

Photography, American Annual of, 1915. Vol. XXIX. Edited by P. Y. Home. 8vo. swd. Routledge. London. 1915. Net 3s. 6d.

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* Compiled by H. Grevel and Co., 33, King Street, Covent Garden, London, W.C., from whom all the works in the preceding list can be obtained.

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Sydney Section.

Meeting held at Sydney on Wednesday, November 18th, 1914.

PROF. C. E. FAWSITT IN THE CHAIR.

THE USE OF FLUE GAS FOR FIRE EXTINCTION AND FUMIGATION.

BY GEORGE HARKER, D.S.C.

The principles underlying the extinction of flames by gases have been clearly set forth by Clowes and Feilmann in two papers published about 20 years ago. The first paper (this Journal, 1894, 13, 1155) describes experiments carried out with the object of ascertaining the minimum proportions of carbon dioxide and nitrogen which would extinguish the flames of various combustible liquids and gases. The second paper (1895, 11, 315) gives the result of further experiments in which the composition of the residual atmospheres produced by the flames was investigated when the flames were allowed to extinguish themselves in a confined volume of air. These results, which confirmed those obtained in the previous experiments, are set forth in the annexed table:—

Composition of the residual atmosphere produced by flames.

Substance burnt.	Composition of residual atmosphere in which flame was extinguished.		
	O ₂ .	N ₂ .	CO ₂ .
	%	%	%
Alcohol	14.9	80.7	4.35
Methylated spirit	15.6	80.2	4.15
Paraffin oil	16.6	80.4	3.0
Cola and paraffin ..	16.4	80.5	3.1
Candles	15.7	81.1	3.2
Hydrogen	5.5	94.5	—
Carbon monoxide	13.4	74.4	12.2
Methane	15.6	82.1	2.3
Coal gas	11.4	83.7	4.9

It will be seen that the wick-fed flames, *i.e.*, the flames of the substances which make their own gas, are all extinguished when the proportion of oxygen falls to 15%, the percentage of carbon dioxide being from 3 to 5%. A coal gas flame goes out when the oxygen falls to 11.4% in spite of the fact that coal gas contains so large a proportion of hydrogen.

These results are of the highest importance from the point of view of the prevention and extinction of fire, and it follows from them that no fire can live in an enclosed space provided the ratio of oxygen to other gases present can be reduced below a certain minimum. It is also evident that a considerable proportion of oxygen can be present in a fire-extinctive atmosphere. In practice, the means employed to bring about this extinctive atmosphere consists in displacing the air in the enclosed space, either in whole or part, by some gas or vapour which is not itself a supporter of combustion. On shipboard, steam, carbon dioxide, and the gas from burning sulphur are applied for the purpose.

The difficulty in extinguishing basement fires and fire in ships' holds is well known. When water is used great damage is generally done

to the goods contained in the spaces. Many ships' cargoes retard the percolation of water, for example, coal, grain, cotton, wool, and jute. The application of water is, therefore, not only uncertain but may be dangerous if the conditions are favourable to the production of water-gas.

Steam is not a good extinguisher of fire, because it condenses readily and cannot therefore drive the air from a packed hold, unless supplied in such large quantity that the temperature of the whole cargo is raised considerably.

Fire extinctive gases are generally supplied on shipboard from a central plant situated in the engine room through pipes leading to the various holds. The capacity of these installations is sometimes based on the assumption that sufficient fire extinctive gas must be added to reduce the contained oxygen to 15% or some lower figure in order to render it fire extinctive. Much larger volumes must, however, be at disposal because, in the first place, the hold cannot be made gas-tight, and requires continued addition of gas to maintain the fire extinctive atmosphere, and secondly, because the heat must be removed from a hot mass of material even after combustion has been arrested before air can be admitted. As the specific heat of gases is very low, this cooling process takes time, and consequently to deal effectively with a fire in an enclosed space, it is essential that there should be at disposal a large volume of fire extinctive gas so that it may be supplied in a continuous stream of sufficient volume, which will not only render the atmosphere fire-extinctive in the shortest possible time, but will further cool the hot mass and while so doing prevent the ingress of air. The need for having at disposal large volumes of gas is a factor of the greatest importance, which cannot be too strongly insisted upon.

For this reason in particular, the application of the waste gases derived from the combustion of ordinary fuels, has a great advantage, because it makes use of an unlimited supply of gas which is always on hand on any steamship. When coke or coal is burnt in ordinary boiler furnaces, the flue gas contains usually only about 9% of oxygen. About 450,000 cubic feet of this gas are produced from every ton of coal burnt, and it has only to be cleaned and cooled to make it available. In common with other gases used for fire extinction, it is fatal to animal life and therefore provides an excellent means of fumigation. Its lethal action on rats is increased by the small amount (0.25 to 1.0%) of carbon monoxide generally present.

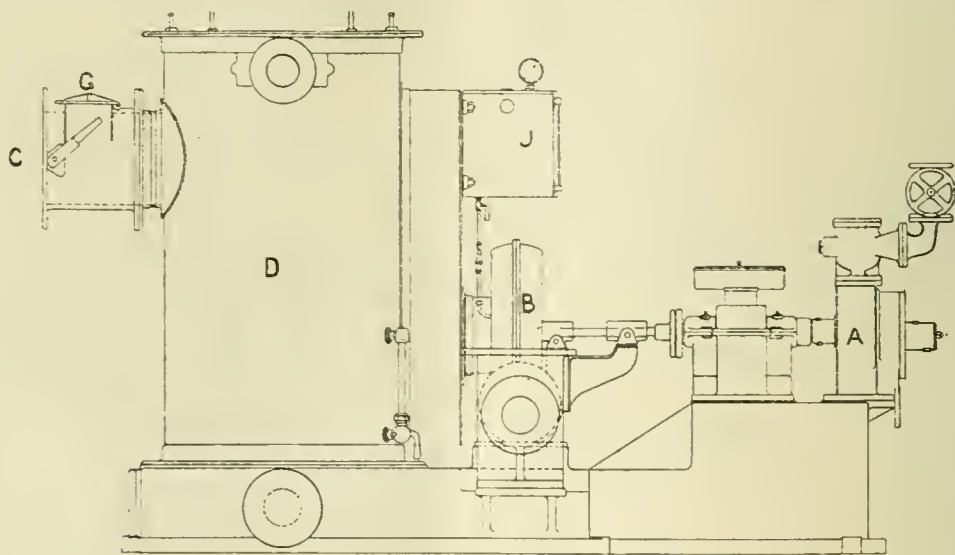
To clean and cool the flue gas an apparatus has been evolved consisting of a machine with a washer and cooler, a fan and steam turbine. By means of this the hot flue gas is drawn from the funnel, thoroughly cleaned and cooled, and then forced to the place of use. As the gas in this state has no germicidal value, means have been provided in certain of the plants now in operation for the introduction of formaldehyde, or other liquid disinfectant, into the stream of gas.

Fig. 1 shows a side elevation of the plant. A is the turbine driving the fan, B. C is a branch connected to the funnel provided with two valves, one opening to the funnel, the other being the valve, G, which can be opened to the atmosphere when the machine is being used for ventilation. D is the washer and cooler through which the gas passes on its way to the fan. The gas is delivered from the fan through the outlet, E. Water from one of the ship's pumps enters the washer at F, and is forced through nozzles and formed into fine

sprays. J is the tank for holding disinfectant liquids, should such be required. Fig. 2 gives a sectional elevation of the gas washer. The gas together with the water in the form of fine sprays passes down the tubes, M, into the spaces, N and O, from which it flows upwards through the spaces, S, being given a circular motion by means of the spiral plate. It then flows down through T and passes through the opening, V, to the fan.

The development of the flue gas process has until recently been very slow. One contributing cause no doubt has been the insistence laid on the need for plants of adequate gas capacity. Furthermore it has been necessary to devote much attention to the improvement of the design of the apparatus, and to find good methods for mixing with the cooled and cleaned gas the vapours of various liquids for disinfecting purposes where such are required.

of gas delivered under different conditions to the bottom of the holds, from which it was found that there is comparatively little diminution in the volume of gas delivered into a hold, whether it is filled with cargo or empty. Even with such a close-set cargo as fine coal, 1380 cubic feet of gas per minute were delivered instead of the 1500 cubic feet delivered into the hold when empty. Another series of tests carried out on the same vessel showed that once the atmosphere in a hold was made fire-extinctive, about 500 cubic feet of gas per minute was required to maintain it so, even when the hatches were on and covered by a tarpaulin and all ventilators tightly closed. This gives an idea of the loss of gas which can take place from large holds and the need that exists for installing plants of sufficient gas capacity, where gas is the medium used for fire-extinction. It may be of interest to state that a harbour



SIDE ELEVATION.

FIG. 1.

The first complete installation using the flue gas system for fire-extinction and fumigation was placed on a steamer of 4470 gross tonnage belonging to the Colonial Sugar Refining Co., and trading between Australia and Fiji. Besides being always available in case of fire, the plant on this vessel is in continuous use for fumigation, and has proved so satisfactory that another steamer required by the same Company is being provided with a similar installation. The machine is placed near the engine room and draws its supply of flue gas from the funnel through a twelve-inch pipe. By means of two main leads provided with branches, the cooled and cleaned gas is conducted from the machine to the various holds or other compartments of the vessel. The installation delivers 1500 cubic feet of gas per minute to any of the holds, these compartments being each of about 80,000 cubic feet capacity. Allowing for certain losses by diffusion and leakage, an empty hold can be filled with a fire-extinctive or lethal gas in one hour's time. If the hold is filled with cargo, as is generally the case when fumigation operations are being carried out, much less air has to be displaced, and consequently less gas is required. By means of Pitot gauges placed on the main leads, measurements were made of the volume

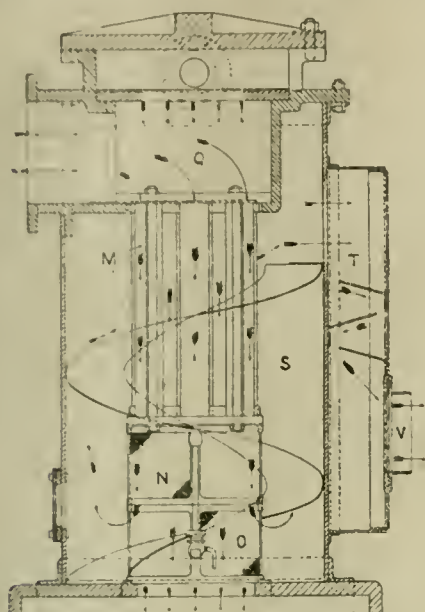
fire-float is shortly to be equipped with a flue gas plant of large capacity.

The United States Public Health and Marine Hospital Service has adopted the process for its quarantine work, and two of its service steamers have been equipped with the apparatus. In these installations the gases are drawn from the funnel of the steamer, cleaned and cooled, and then delivered through flexible hose to the vessel being fumigated. The percentage of carbon monoxide in these cases is generally from 1% to 1½%, coke being the fuel used. Formaldehyde is added to the gas, being produced from commercial formalin, which is introduced into the current of the gas in the form of a fine spray.

In addition to its cheapness, flue gas has a great advantage in containing no corrosive constituents. Vessels can consequently be fumigated with the cargo in the hold, and this permits of a more effective fumigation than when the cargo is first removed from the vessel and put on shore.

Considerable opposition to the use of flue gas has been met, and it has been frequently stated that the waste gases from the boilers would be useless for dealing with coal fires, as for example, in a ship's bunkers. A plant was recently installed in London for testing purposes, the tests being

carried out by Mr. F. Edwards, with the result that it has been conclusively proved that coal fires are extinguished.



**SECTIONAL ELEVATION
OF THE GAS WASHER.**

Fig. 2.

The result is interesting, because it bears indirectly on the question of the spontaneous combustion of coal and the extinction of coal fires, to which much attention has been directed. When a confined volume of air is left in contact with coal dust, a large proportion of the oxygen will be removed from the air after several days contact. In one experiment with a sample of bituminous Newcastle (N.S.W.) coal, in which a flask was filled with the finely ground coal and left to stand in a room at summer temperature for a fortnight, the gas in the flask on analysis showed only 4.86% of oxygen and less than 1% of carbon dioxide. The conclusion has been drawn by some authorities from experiments such as these, that in order to extinguish a mass of coal on fire, the atmosphere surrounding the coal must be entirely devoid of oxygen. But the absorption of oxygen by the bituminous compounds of the coal is quite a distinct process from the combustion of the coal accompanied by the rapid production of carbon dioxide and water. The difference between slow and rapid combustion is illustrated by the following experiment. Linseed oil placed on strips of paper was found to remove the oxygen completely from a confined volume of air in a flask after two days' exposure, no carbon dioxide being produced. The strips of paper soaked in oil and ignited were extinguished in an atmosphere containing up to 15% of oxygen, i.e., in air from which very little oxygen had been removed. In order to break up the constituents of linseed oil completely with production of carbon dioxide and water, oxidation must take place vigorously, necessitating a high ratio of oxygen in the atmosphere.

In the experiments conducted by Mr. Edwards, in which a large mass of glowing coal was extinguished, the proportion of oxygen in the flue gas was about 9%. Coal when burnt under specially

suitable conditions can produce a flue gas containing as low as 4% of oxygen, but, as pointed out by Professor H. E. Armstrong in the discussion on a paper by E. Kilburn Scott,* the application of a gas containing 10% carbon dioxide and only 10% oxygen instead of air with 21% of oxygen immediately slows down the combustion and produces a cooling effect.

The use of cooled flue gas will probably be found of value for the protection of large masses of storage coal, and in fact, its use in this direction is now being seriously considered.

DISCUSSION.

In reply to questions the author said that the percentage of oxygen in flue gas often varied considerably, especially in land installations. The CO_2 sometimes fell as low as 5% but this was only when the boilers were being badly fired. Under ordinary circumstances it was about 10%. The admixture of formaldehyde vapour did not make the gas explosive. Experiments showed that the introduction of carbon bisulphide to the extent of 5 lb. per 1000 c. ft. did not render the gas explosive. If the fires were completely drawn it was estimated the apparatus could be started in about an hour's time; if banked only, in much less time. Steamers in port nearly always kept one boiler under steam and hence a supply of gas was always available. The gas from oil fires was generally lower in oxygen and hence more effective. Tests of the apparatus were made by the U.S. Naval authorities, using boilers fired with oil, and the flue gas was quite effective. In an experimental gas washer arrangements were made for the flow of the gas and water both in the same and in opposite directions. When flowing in opposite directions a considerable resistance to the passage of the gas took place, which interfered with the efficiency of the plant. Boiler flue gas was entirely satisfactory for fumigation work, and hence there was no need for providing a special furnace.

Lecture.

BIOCHEMICAL SYNTHESIS OF GLUCOSIDES AND POLYSACCHARIDES. REVERSIBILITY OF ENZYME REACTIONS. By E. Bourquelot. *J. Pharm. Chim.*, 1914, 10, 361—375, 393—412.

(ABSTRACT.)

IN the course of the last fifteen years several authors, notably Croft Hill, have suggested that the action of hydrolytic enzymes, such as invertase, is reversible, but until 1911 the evidence in favour of this view was of an indirect nature, for the products of the supposed synthetic actions either were not characterised or were found to be different from what was expected. Researches carried out in the author's laboratory during the past three years have proved definitely that enzymes which hydrolyse glucosides or polysaccharides can reconstruct them from the products of hydrolysis.

Hydrolytic action of enzymes in alcoholic liquids and in indifferent liquids.

In the preparation of tinctures of certain vegetable materials with strong alcohol in the cold, alterations were found to have occurred which

* The use of gases on ships for fire extinction and fumigation. E. Kilburn Scott, *Trans. Inst. Marine Engineers*, Feb. 1913.

could only be attributed to the action of enzymes during extraction (this J., 1911, 1468), and further experiments proved that the activity of enzymes, at least of emulsin and invertase, was much less affected by alcohol than had generally been supposed. The varied activities of emulsin obtained from almonds can only be properly explained by assuming the presence of a number of enzymes, none of which, however, has yet been isolated; one of these (β -glucosidase) hydrolyses certain glucosides, another (lactase) acts on lactose, a third (β -galactosidase) on certain galactosides, and a fourth (gentiobiase) hydrolyses gentiobiose, and so on. It was found that emulsin exerts its hydrolytic action on glucosides not only in dilute methyl or ethyl alcohol, but also in the same alcohols of 70–90% concentration although the enzyme is not soluble therein (this J., 1911, 1468), and even when the emulsin is suspended in acetone or ethyl acetate containing the glucoside and the quantity of water necessary for hydrolysis. Invertase also retains its activity in alcohols, but it is noteworthy that whilst it can act in ethyl alcohol of 90% by volume, it is destroyed by methyl alcohol of 50% by weight (this J., 1913, 431). Similarly the glucosidase of emulsin remains active after several months contact with ethyl alcohol of 90 grms. per 100 c.c., whereas methyl alcohol of the same strength destroys it within a month. The glucosidase of air-dried bottom fermentation yeast (see further) is much more sensitive to the toxic action of alcohols. It is destroyed almost immediately by aqueous solutions containing 31–36 grms. of methyl alcohol, 36–38 grms. of ethyl alcohol, 20–22 grms. of *n*-propyl alcohol, or 6–8 grms. of butyl alcohol per 100 c.c., and slowly by solutions containing 16–18 grms. of methyl alcohol, 20–22 grms. of ethyl alcohol, 16–18 grms. of *n*-propyl alcohol, or 6 grms. of butyl alcohol per 100 c.c.

Synthetic action of enzymes in alcoholic liquids.

β -Alcohol glucosides.—Attempts to synthesise salicin from solutions of saligenin and dextrose in 85% alcohol, by the action of emulsin, gave rise not to the expected product, but to β -ethylglucoside, identical with that obtained in 1901 by Koenigs and Knorr from acetobromodextrose by purely chemical means (this J., 1912, 660). The β -ethylglucoside was obtained much more easily by allowing emulsin to act on a simple solution of dextrose in ethyl alcohol, and within a short time the method was applied to a large number of alcohols. The β -glucosides of the following fatty alcohols were thus prepared:—methyl, ethyl, propyl (this J., 1912, 739), isopropyl, butyl, isobutyl, isoamyl, allyl, geranyl (this J., 1913, 806), glyceryl (mono- and di-glucosides), α -hydroxypropyl (monoglucoside) and glyceryl (monoglucoside), besides the following of the aromatic series:—benzyl (this J., 1912, 949), phenylethyl (this J., 1913, 378), cinnamyl (*ibid.*), *o*- and *p*-hydroxybenzyl, *o*-methoxybenzyl, *m*-nitrobenzyl, naphthyl, cyclohexanyl, *o*-methyleyclohexanyl, thymotyl, and *o*-, *m*-, and *p*-xyleneglyceryl (monoglucosides, $C_6H_{11}O_5 \cdot O \cdot CH_2 \cdot C_6H_4 \cdot CH_2OH$). Nearly all these glucosides were isolated in a pure crystalline form. The only one at present known to occur in nature is geranylglucoside, which has been found in *Pelargonium odoratissimum* (this J., 1913, 806). As, however, many alcohols occur in the free state in distillates prepared from plants, they may possibly be derived from the hydrolysis of the corresponding glucosides. In experiments with cetyl, α -naphthyl, ethylphenylglycollic and caprylic alcohols, phenylglycollic nitrile, borneol, morphine, cholesterol, and dimethylethylcarbinol, synthesis was proved by changes in the optical rotation of the solutions, but no attempt was made to isolate the products. The glucosides of solid alcohols, insoluble or nearly insoluble in water,

were prepared by using as a solvent acetone mixed with varying proportions of water. Primary alcohols are converted into glucosides more readily than secondary alcohols and the latter more readily than tertiary alcohols. These results indicate that all compounds possessing alcoholic hydroxyl groups combine with dextrose under the influence of emulsin (β -glucosidase), forming β -glucosides, which contain the dextrose in the β -form ($[\alpha]_D = +23^\circ$), and which are levorotatory like all the natural glucosides hydrolysable by emulsin. The following facts have been ascertained respecting the influence of experimental conditions on the synthetical action of β -glucosidase:—(1) The rapidity of synthesis increases with the quantity of enzyme present. (2) The action is accelerated by rise in temperature provided the limit beyond which the enzyme is injured is not exceeded; whilst operations can be conducted at 30° or even 40° C. with ethyl alcohol, it is not safe to exceed 20° C. with methyl alcohol. (3) For equal concentrations of dextrose the proportion converted into glucoside increases with the alcoholic strength, and when the latter is kept constant the yield of glucoside is raised by increasing the concentration of dextrose up to a limit of 15–20% in 70% alcohol. To prepare β -methylglucoside, 12 grms. of emulsin are added to a solution of 600 grms. of dextrose in 1020 grms. of methyl alcohol and 440 grms. of water. After a month at the ordinary temperatures (16° – 19° C.) about 350 grms. of crude glucoside is obtained, which yields about 250 grms. of the pure product. For ethylglucoside it is better to work at 30° C. with alcohol of 90% by volume. A yield of 300 grms. of β -ethylglucoside is obtained in a month from 3 litres of alcohol, 450 grms. of dextrose, and 15 grms. of emulsin.

α -Alcohol glucosides. These differ from the β -glucosides in that they are dextrorotatory, and are not decomposed by emulsin. They correspond to the α -form of dextrose, ($[\alpha]_D = +106^\circ$). They are hydrolysed by an enzyme, α -glucosidase, present in maceration juice prepared from air-dried bottom fermentation beer yeast, and the same enzyme, added to a solution of dextrose in alcohols, effects their synthesis. It is necessary, however, to work with more dilute alcohols than in the case of emulsin (Aubry, this J., 1914, 1112). Methyl- (this J., 1913, 251; Aubry, 1914, 982), ethyl- (*ibid.*), propyl- and allyl- α -glucosides were thus obtained in a pure crystalline form, and α -glycerylmonoglucoside (this J., 1914, 40) in an amorphous form. Mixed $\alpha\beta$ -diglucosides were obtained by acting on α -glycerylmonoglucoside with dextrose and emulsin, and on salicin (the β -glucoside of saligenin) with dextrose and α -glucosidase. The α -glucosidase of bottom fermentation yeast is not identical with maltase, for top fermentation yeast ferments maltose and therefore contains maltase; but has no action on α -ethylglucoside (see also Aubry, this J., 1914, 880).

Specific synthetic action of α - and β -glucosidases.—It is well known that in aqueous and alcoholic solutions of dextrose, the α - and β -forms of this sugar ($[\alpha]_D = +106^\circ$ and $+23^\circ$ respectively) are present in certain definite proportions constituting an equilibrium mixture. If α -glucosidase be added to an alcoholic solution it attacks only the α -dextrose, but as fast as this is converted into glucoside there is a partial conversion of β -dextrose into α -dextrose to maintain the original proportion between these forms. Hence the solution behaves towards α -glucosidase as if it contained only α -dextrose, and similarly it behaves towards β -glucosidase as if it contained only β -dextrose (this J., 1914, 706). There is a similar reaction between galactose and α - and β -galactosidases (see below) and probably between all sugars exhibiting mutarotation and the corresponding

enzymes. Each enzyme is restricted in its influence to compounds of the same chemical constitution and stereochemical structure.

β -Alcohol galactosides.—The emulsin of almonds hydrolyses and synthesises not only β -glucosides but β -galactosides, and thus contains a β -galactosidase (this J., 1913, 112; 1914, 706). By the action of emulsin on solutions of galactose in different alcohols, ethyl-, methyl-, propyl-, benzyl-, allyl-, and isobutyl- β -galactosides were prepared, and also the monogalactoside of glycol. A good yield of β -methylgalactoside is obtained by maintaining at 30° C. for 2 months, an aqueous solution of 50 grms. of galactose and 300 grms. of methyl alcohol per litre with 8 grms. of emulsin. Higher concentrations of alcohol injure the enzyme. In the case of ethyl alcohol this is not to be feared, and by using 4–5% solutions of galactose in 80% ethyl alcohol, 69% of the sugar can be converted into galactoside in 7 months at the ordinary temperature. It is best to work at 40° C. and add further quantities of emulsin from time to time as the β -galactosidase is destroyed; at this temperature 53% of the sugar can be made to combine in 15–20 days. All the β -galactosides are laevorotatory and hydrolysable by emulsin. The author discusses the conflicting evidence as to the possible identity of β -galactosidase with lactase (see this J., 1913, 112).

α -Alcohol galactosides.—Infusions of air-dried bottom yeast were found to hydrolyse and synthesise α -methyl- and α -ethyl galactosides, but only very slowly (this J., 1914, 272). The synthetic products are dextrorotatory and hydrolysable by the same infusion of yeast employed to prepare them.

Synthetic action of enzymes in aqueous liquids.

Biochemical synthesis of hexobioses.—Unsuccessful attempts were made to synthesise glucosides of phenols, and also the bioses maltose and sucrose. In the latter cases changes in the optical and reducing properties of the solutions indicated that synthetic reactions had taken place, but it was not possible to isolate or characterise the products. Gentibiose, a sugar formed by the combination of two molecules of dextrose, and first prepared by the partial decomposition of gentianose, was readily synthesised by the action of gentiobiase, one of the enzymes of emulsin, which also hydrolyses it (this J., 1913, 1080). An extract of almonds was allowed to act on a concentrated solution of dextrose, and after no further change in the optical rotation of the solution occurred, the liquid was boiled and the unaltered dextrose fermented by top fermentation yeast (the necessity for this operation accounts for the lack of success in the attempted synthesis of maltose and sucrose). The liquid was then defecated and concentrated under reduced pressure, and the residue was taken up by 95% alcohol from which the gentiobiase crystallised rapidly after inoculation. Attempts to synthesise a galactobiose by a similar method were only partially successful; an amorphous product was obtained, possessing slight reducing action and small laevorotation, and hydrolysable by dilute sulphuric acid.

Proof of the reversibility of enzyme action.

Various facts indicate that hydrolysis and synthesis are the work of one and the same enzyme, and not of two enzymes existing side by side. The synthetic and the hydrolytic activities of the α -glucosidase of bottom fermentation yeast are destroyed together in aqueous methyl alcohol of more than 34–36%. Emulsin can hydrolyse and synthesise in presence of indifferent solvents such as acetone. The state of equilibrium in alcoholic solutions of sugars is independent of the quantity of enzyme employed, and of the tem-

perature of reaction provided it is not sufficiently high to injure the enzyme. It was further demonstrated for α - and β -ethylglucoside and β -methylglucoside that the same condition of equilibrium is reached from both directions, i.e., whether the original alcoholic solution contained dextrose or an equivalent quantity of glucoside (this J., 1912, 800; 1913, 456, 762); and if two such solutions, so chosen as to be equidistant from the condition of equilibrium, are treated with equal quantities of enzyme at the same time, they will approach the state of equilibrium (one by synthesis, the other by hydrolysis) at exactly equal speeds. This was experimentally verified for β -methylglucoside, by periodic observations of the optical rotation of the solutions.

Fermentative equilibria.

The equilibrium attained by enzyme action in alcoholic solutions of sugars, like ordinary chemical equilibrium in solutions, is the result of two opposed reactions (hydrolysis and synthesis) proceeding at equal rates. The speed of each of these reactions varies with the concentration of the participating substances, and therefore the point of equilibrium is displaced if, for example, sugar is removed (by fermentation) or added to the liquid (this J., 1914, 272). The ratio of combined sugar to that in the free state, corresponding to equilibrium, is designated the "equilibrium ratio." For solutions containing 20 grms. of ethyl alcohol and 1 gm. of (total) dextrose in 100 c.c., it is .326/.674 in presence of α -glucosidase, and .234/.766 in presence of β -glucosidase, and these ratios do not change perceptibly for concentrations of dextrose between 1 and 16%. When both enzymes are added to the same solution the quantity of dextrose in the free state when equilibrium has been attained, may be calculated by dividing the total amount of dextrose present, by the sum of the two "equilibrium ratios" increased by 1. This formula was deduced mathematically and verified by experiment. It was further proved that the same final condition is attained whether the second enzyme is added together with the first, or after the latter has produced a state of equilibrium. There can be no doubt that these simple laws regulate the complex and varied phenomena produced by enzyme reactions in living beings.

Conclusions. It is possible by the synthetical action of enzymes to prepare large quantities of certain compounds. The better known enzymes will become most valuable guides in the study of chemical processes in living organisms. Dextrose exists in all plants, and if an enzyme capable of decomposing glucosides is found in a plant it points to the presence of the corresponding glucoside. This has been verified for the *Ericaceae*, the *Gentians* and the *Orchidaceae*. Eighteen species of *Orchidaceae* (all that have been examined) contain one or more glucosides hydrolysable by emulsin. The same applies to many of the *Scrophulariaceae*, in particular to all species of the genus *Linaria*, and also to numerous *Leguminosae*, *Proteaceae*, etc. Owing to the peculiarly specific properties of enzymes, they are amongst the most delicate and certain reagents for investigating the constitution of certain organic compounds. Thus every glucoside hydrolysable by α -glucosidase is a derivative of α -dextrose, whereas β -glucosidase detects compounds derived from β -dextrose. In living organisms biochemical synthesis is a predominating factor in the accumulation of reserve food materials, for certain organic compounds insoluble in water form soluble compounds with dextrose; and this sugar, present in all organisms, appears as the principal liquefying agent, which can prevent the formation of certain concretions, and dispose of dangerous compounds so long as conditions remain suitable. On the other hand,

reversibility ensures the maintenance of the equilibria necessary for life. In organs where life is active, the liquid media are particularly favourable to hydrolysis and the utilisation of the food materials. In reserve organs, such as seeds, the medium, as it becomes less aqueous, is more favourable to synthetic processes.—J. H. L.

PRESENTATION TO MR. WATSON SMITH.

On February 23rd. Mr. Watson Smith was entertained at dinner by members of the Council and Publication Committee. Opportunity was taken to present to him, as a souvenir of his 33 years' service as Editor of this Journal, an album containing a short address, signed by the President and all available Past Presidents, Members of the Council and Publication Committee, and the abstractors. At the request of the President, the presentation was made by the *doyen* of the Chemical Press, Sir William Crookes, O.M., F.R.S.

Obituary.

RUSSELL FORBES CARPENTER.

Mr. R. Forbes Carpenter died at Hampstead on February 1st, at the age of 68. He was the son of Prof. W. B. Carpenter, F.R.S., and was educated at University College School and University College. On leaving college he was appointed assistant to Professor Graham, Master of the Mint, and later went to Bristol, where he joined the staff of the Netham Chemical Company. He was compelled to relinquish the latter appointment on account of

his health, and to take a prolonged rest. Then, early in 1882, he was appointed a Sub-Inspector under the Alkali Act, in 1884 he was made Inspector, and in 1885, on the retirement of Mr. A. E. Fletcher, he became Chief-Inspector, a position which he held until ill-health compelled him to retire in April, 1910. Throughout his long tenure of office his exceptional organising powers were of the greatest value, especially in connection with the consolidation of the Alkali Acts of 1881 and 1892; in spite of the conflicting interests that had to be reconciled, he finally succeeded in overcoming the difficulties, with the result that the Alkali, etc., Works Regulation Act of 1906 was passed. The value of his work may be gathered from a perusal of his annual reports, full abstracts of which have appeared in this Journal. Mr. Carpenter was an original member of this Society and served as a Member of its Council from 1885 to 1888, and from 1896 to 1899, and as a Vice-President from 1888 until 1891, and also from 1899 to 1902. In 1894 he was elected Chairman of the Manchester Section, but resigned on his appointment as Chief Inspector in the following year. His earlier contributions to the Society's Journal include his address to the Manchester Section (this J., 1894, 13, 1026), papers on "Conditions affecting the Oxidation of Nitrous Acid," and "The Solubility of Silver Chromate in Ammonium Nitrate" (see this J., 1886, 5, 286, 287), and "Notes on Acetylene" (1895, 14, 115). More recently, in collaboration with Mr. S. E. Linder, he carried out valuable researches on the estimation of acidity in the gases from the chamber process of sulphuric acid manufacture (this J., 1902, 1490; 1903, 577), and on the Claus kiln reaction (this J., 1903, 457; 1904, 577; 1905, 63).

Journal and Patent Literature.

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I.—GENERAL PLANT; MACHINERY.

PATENTS.

Agglomerating and sintering materials of all kinds: Process for — by means of flameless surface combustion. G. Polysius, Eisengiesserei und Maschinenfabrik. Ger. Pat. 277,854, Feb. 18, 1913.

A SILO containing the material to be treated is mounted above a rotating plate or roller on the surface of which flameless combustion is produced in the known manner. The material is withdrawn automatically from the lower end of the silo by the rotating plate or roller. When a plate is used as the seat of the flameless combustion, it may be fixed and the silo rotated, or both plate and silo may be stationary and the material withdrawn by the action of a rotating scraper. Two plates loosely joined together may be used, one above the other, the

upper one receiving the material from the silo and the lower one serving as the seat of the flameless combustion. The hot combustion gases are passed through the material in the silo or through tubes embedded therein.—A. S.

Catalytic reactions [hydrogenation]: Process for effecting —. Soc. L'Oxyliithe, and J. Walter. Fr. Pat. 471,108, Apr. 18, 1914. Under Int. Conv., Apr. 19, 1913.

To facilitate separation of the catalytic agent after the hydrogenation, catalysts are employed which are either magnetic in themselves, or may be rendered temporarily magnetic after the reaction, or rest upon magnetic supports, and therefore may be retained within the vessel by subjecting this to the action of a magnetic field when the hydrogenated product is withdrawn. Various devices for carrying out the process are described.—C. A. M.

Gases; Process for the purification of —. Soc. L'Air Liquide. (Soc. anon. pour l'Etude et l'Exploit. des Proc. G. Claude). Fr. Pat. 471,162, July 2, 1913.

WATER partially saturated with lime is used under pressure to remove carbon dioxide and like impurities from gases which are to be liquefied; the greater part of the carbon dioxide dissolves in the liquid and the remainder is fixed chemically by the lime.—W. F. F.

Cooling hot liquids; Apparatus for — and crystallising the substances dissolved therein. G. Graef. Ger. Pat. 277,181. March 22, 1912.

A DOUBLE-WALLED drum, having a helical groove on its outer surface, rotates in a trough. A cooling agent flows through the space between the walls of the drum in one direction and the liquid to be cooled flows around the outer surface of the drum in the opposite direction. The crystals which separate are removed by a scraper operating in the helical groove.—A. S.

Mixing gases and liquids; Apparatus for —. G. Calvert. London. U.S. Pat. 1,123,092, Dec. 29, 1914. Date of appl., Feb. 18, 1914.

SEE Fr. Pat. 468,426 of 1914; this J., 1914, 973.

Deodorising oils and distilling and vaporising liquids. Eng. Pat. 367 of 1914. See XII.

IIA.—FUEL; GAS; MINERAL OILS AND WAXES.

Coal; Constituents of —. [Vacuum tar.] A. Pietet and M. Bouvier. Chem.-Zeit., 1914, 38, 1025.

FROM the "vacuum tar" obtained as previously described (this J., 1913, 1098; 1914, 70) the authors have further isolated new saturated hydrocarbons, C_8H_{18} and $C_{12}H_{24}$, besides hexahydro-*p*-cresol and other cyclic alcohols. By boiling Saar coal, from the Maybach mine, with benzene, an extract very similar to "vacuum tar" was obtained, consisting mainly of hydro-aromatic hydrocarbons with small quantities of alcohols and bases. This mixture was optically active, $[\alpha]_D = +0.27^\circ$.—J. H. L.

Coke. V. B. Lewes. J. Gas Lighting, 1915, 129, 201—201.

THE author advocates carbonising coal at about $1050^\circ C$. and diluting the rich gas so made by passing "blue" water-gas into the foul main. In this way it is claimed that the maximum quantity of gas of about 560 B.Th.U. per cubic foot will be obtained, together with a fair quantity of tar of good quality, the highest yield of ammonia, and a coke containing from 5 to 6% of volatile matter. The coke will stand transport, will ignite and burn easily, and should be very suitable for domestic use.—W. H. C.

Industrial gas calorimetry. C. W. Waidner and E. F. Mueller. U.S. Bureau of Standards. Tech. Paper No. 36.

THE object of the work was to furnish information as to the accuracy attainable with the leading types of calorimeters used for gas-testing purposes, to indicate the sources of error to which they are liable, and to suggest precautions to be observed in their use. The calorimeters investigated were the Junkers (original type), Junkers (new type), Hinman-Junkers, Sargent, Simmance-Abady (English and American types), Boys, Doherty, and Parr. The following definitions, in connection with gas calorimetry, are considered

as sufficiently precise for engineering and industrial use. The total heating value of a gas expressed in the English system of units, is the number of British thermal units produced by the combustion, at constant pressure, of the amount of gas which would occupy one cubic foot at $60^\circ F$. if saturated with water vapour, and under a pressure equivalent to that of 30 inches of mercury at $32^\circ F$. and under standard gravity, with air of the same temperature and pressure as the gas when the products of combustion are cooled to the initial temperature of gas and air, and when the water formed by combustion is condensed to the liquid state. The net heating value differs from the total heating value only as regards the final condition of the water produced by the combustion of the gas, which is regarded as remaining in a state of vapour. The net heating value is thus less than the total heating value by an amount of heat equal to the latent heat of vaporisation, at the initial temperature of the gas and air, of the water produced by the combustion of the gas. This figure may be taken as being equal to 580 calories per grm., corresponding to 2.3 B.Th.U. per c.c. The observed heating value is the value obtained by multiplying the mass of water which flows through the calorimeter during a test, by the corrected rise in temperature of the water, and dividing by the volume of gas burned (referred to standard conditions of temperature and pressure). It is stated that the general practice of regarding the observed heating value as being identical with the total heating value is inaccurate, as with a perfect flow calorimeter these two values would necessarily differ by 2% or more under certain atmospheric conditions, and with some of the calorimeters tested, the difference might amount to about 4%.

The principles of flow calorimetry and the method of making determinations of the total and net heating values are given, and a convenient record form is suggested for entering the necessary data obtained in performing a test. An investigation of the laboratory type of gas meters showed the importance of careful levelling of the meter and accurate adjustment of the water in the meter. From a series of experiments it was found that the volume of gas delivered per revolution at rates varying between 2 and 10 cubic feet per hour was constant to within about 0.1%; at higher rates, viz., 20 and 30 cubic feet per hour, the amount of gas delivered was increased by 0.5 and 1.0% respectively. The use of fractional revolutions is not recommended, as serious errors are possible by so doing. In any case, should such measurement be necessary, the fractional calibration of the meter dial should be made. The factors affecting heating value determinations with flow calorimeters are dealt with comprehensively, and the authors summarise their work in this connection as follows:—There is little probability of error due to incomplete combustion if the calorimeter is not operated at too high a rate of gas consumption. Care is necessary in measuring the rise of temperature of the water; standardised thermometers should be used and the thermometric corrections and stem corrections should be applied. If the calorimeter is operated with the inlet water at room temperature, if the burner is provided with radiation shields and is properly mounted within the calorimeter, if the calorimeter is operated at the normal rate and the correction for effect of atmospheric humidity is applied, the remaining heat losses will, for most calorimeters, introduce no significant error, while if such losses are significant for the calorimeter used, a correction may be applied. If the inlet water is not at room temperature the corrections necessary on this account may be readily applied. The flow of water and of gas can readily be made sufficiently constant. By waiting until the calorimeter is in

thermal equilibrium (from 5 to 30 minutes, depending on the calorimeter used) no significant error due to its lag will be introduced unless there are considerable variations in the heating value of the gas being tested, in the rate of flow of gas or water, etc. With a properly designed calorimeter, the drainage from which is uniform, the measurement of the condensed water offers no difficulty. Care is necessary in manipulating the change-over device, since large accidental errors may be introduced in this operation, although no significant constant error need be introduced. The weighing or measuring of the water with sufficient accuracy presents no difficulties. Great care must be exercised in calibrating the gas-meter and in making the necessary adjustments in its subsequent use. The other operations incidental to the measurement of gas volumes need introduce no significant error. If tests are made regularly for leakage of gas, the effects of leakage may easily be reduced to negligible proportions. With a standardized mercury barometer the accuracy required in gas testing is easily attainable. Errors may be introduced on account of changes in the character of the gas, due to various influences, the effect of which, however, may be easily avoided. It appears, therefore, that the accuracy attainable in heating value determinations with flow calorimeters is mainly limited by errors in adjusting the gas-meter, in measuring the temperature rise of the water, and in manipulating the change-over device, since the errors due to other factors may, by proper procedure, be made nearly, if not quite, negligible.

Comparative tests of heating value were made with flow calorimeters (Junkers and Hinman-Junkers) and Berthelot's bomb type of calorimeter, a correction being made to allow for differences between combustion at constant pressure and constant volume. The results with natural gas and hydrogen agreed within the limits of experimental error. With illuminating gas the results differed by about 1%, those obtained with the bomb type being lower than those obtained with the flow calorimeter. This difference has not yet been satisfactorily explained, but it is suggested that it may be due to the character of the gas.

The last section of the work deals with the details of construction of the different calorimeters tested. In most cases by making slight alterations, such as raising the burner, affixing radiation shields to the latter, providing a mixing device, where necessary, in the outlet water tube, results were obtained in agreement, within the limits of experimental error, with those obtained by a Junkers (original type), which in turn had been found to yield results agreeing with those obtained from a calorimeter of the bomb type. In the hands of the authors, the Boys calorimeter was found not to be so efficient as the other forms of calorimeter tested. The Doherty and Parr calorimeters are described as not adapted to the determination of net heating value, although, like the remaining types tested, they gave satisfactory total heating values.—E. R. A.

Hydrogen sulphide in gas; Lead acetate test for —.
R. S. McBride and J. D. Edwards. Technol. Paper No. 41, U.S. Bureau of Standards, Aug. 19, 1914. 46 pages.

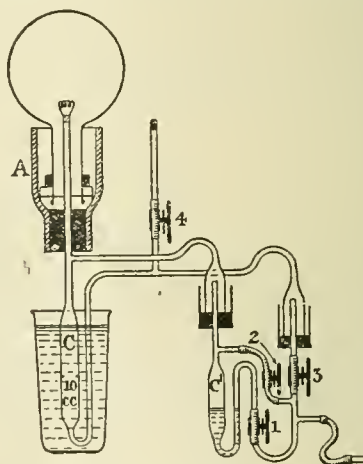
AN investigation to determine the effects of variations in the paper, strength of lead acetate solution, time of exposure, humidity and rate of flow of gas, and form and size of apparatus used, upon the sensitiveness of the test. The sensitiveness is independent (of the strength of lead acetate solution 2–12%), and a 5% solution is recommended. The best and most concordant results are obtained with paper having a smooth (not

shiny) surface, dipped, blotted, and used moist; by this means and with test periods of not more than 3 minutes' duration, the results are practically independent of the humidity of the gas; treatment of the moist paper with ammonia or carbon dioxide has no influence on sensitiveness. Increases in rate of gas flow produce less effect than proportional increases in the duration of test; a rate of between 4.5 and 5.5 cub. ft. per hour is recommended. Differences in intensity and direction of the gas currents within different forms of apparatus are largely responsible for variations in the results obtainable, as indicated by the greater sensitiveness of tests in which the gas impinges on, or passes through, the paper;

hence the importance of conforming to specifications in regard to apparatus and procedure. The apparatus recommended (see fig.) consists of a glass chimney, 20 cm. long and 4.5 cm. wide, having a perforated stopper at each end; the tube of a gas burner from which the lava tip has been removed is inserted through the lower stopper, above which a watch-glass, 2.5–3 cm. in diameter, is supported on three glass pegs, 1–3 cm. high, to prevent the gas from impinging directly on the test-paper. The latter, 2 by 6 cm., is hung on a glass hook attached to the upper stopper, which is also provided with a flat flame burner passing 5 cub. ft. per hour under ordinary gas pressure. Apparatus of the "penetration" type is not recommended for general inspection work.—W. E. F. P.

Sulphur in motor spirits; Determination of —.
W. A. Bradbury and F. Owen. Chem. News, 1915, 111, 39–41.

WITH the modification here shown of the apparatus previously described (this J., 1914, 1001), the sulphur in motor spirits may be determined volu-



metrically within about 2 hours. The combustion chamber is an inverted round-bottomed flask (see fig.), upon the shortened neck of which is fitted a disc of tinned copper ($2\frac{1}{2}$ in. diam.) with small holes round the circumference. Rings are soldered on each side of the disc, the lower one resting upon the constricted portion of the absorption vessel, A, whilst the space between the neck and the ring is fitted with a cork. The air for the combustion is supplied by a water blower connected with the carburetors, C, C', and mercury joints; replace the rubber connections of the former apparatus. Ten

c.c. of the spirit to be tested is placed in C, and pure benzene in C', whilst the absorbing vessel is charged with 50 c.c. of about N/10 sodium carbonate solution and 20 c.c. of neutral (10 vol.) hydrogen peroxide. When the pure benzene is burning with a small blue flame, the flask is lowered over it until the disc is covered by the absorbing liquid. The taps are then turned as described (*loc. cit.*) and the motor spirit burned with a small blue flame, while the platinum coil above the gauze cap of the burner is maintained at its maximum state of incandescence. When the products of combustion are bubbling steadily through the liquid, the water in the beaker is very gradually heated from 27° C. to about 13° to 49° C., and when only about 1 c.c. of the spirit is left, 1 c.c. of absolute alcohol is introduced through the tube, 4. After two washings with alcohol in this way the air supply is reduced to a gentle current, which is continued until the chamber is cold. The absorbing liquid and washings are boiled, and the excess of sodium carbonate titrated with standard sulphuric acid, using laemoid as indicator. Tests with this apparatus proved that in burning spirit in a lamp with a wick, the amounts of sulphur consumed varied greatly at different periods of the combustion, but that no selective action occurred during the spontaneous evaporation of benzene (containing sulphur) through the wick of an unlighted lamp. In the distillation of a sample of benzene, 49% of the sulphur was contained in the first fraction of 20%.—C. A. M.

Bituminous shales of Sicily and their industrial importance. G. Ponte. L'Ind. Chim., Min., e Met., 1915, 2, 31—31.

DEPOSITS of bituminous shale occur in various parts of the province of Messina and are easily accessible without costly excavation. In a laboratory trial with about 150 kilos., distilled in an iron retort with the aid of superheated steam at 2 atmospheres pressure, there were obtained 7—9% of crude oil of sp. gr. 0.928 at 15° C., 5—6% of ammoniacal liquor (0.9—1% NH₃), and 3—4% of gas containing only traces of carbon dioxide. The crude oil contained 3.4% S, and yielded 29—31% of light oil of sp. gr. 0.820, and up to 12% of crude

produced. A concession for the working of the deposits has been granted.—A. S.

Lubricating oils and greases. Board of Trade Bulletin No. 45.

THE value of the exports of lubricating oils and greases to all destinations from Germany in 1912 was:—Mineral train-oil (lubricating oil, paraffin oil, vaseline oil, vulcan oil, etc.), £329,650; other lubricants manufactured with fats or oils (including axle-grease), £157,700; total, £187,350; from Austria-Hungary (1913):—Mineral oil, refined or half-refined, heavy, the density of which exceeds 880°, also lubricating oils, mixed or not with animal or vegetable oils or greases, £855,800; axle-grease mixed or not with mineral oil or mineral grease, £1580; total, £860,380. The Austrian figures appear to cover a somewhat larger field than the German; lubricating oils, etc., are not separately recorded in the export returns of the United Kingdom.

Germany's largest market for lubricating oil, etc., in 1912, was British India. The United Kingdom, Scandinavia, the Netherlands, Italy, and South America also took large consignments of this commodity from Germany.

Austrian exports of lubricating oils, etc., go chiefly to European countries, the principal purchasers being Sweden, Denmark, Belgium, France, Switzerland, United Kingdom, and Italy.

The exports of lubricating oils and greases which might be replaced by similar British products are as follow:—(A) In the United Kingdom:—German trade (1912): mineral train oil (lubricating oil, etc.), £43,550; other lubricants, £15,250; Austrian trade (1913): mineral oil and lubricating oils, etc., £46,700. (B) In Colonial and neutral markets:—German trade (1912): mineral train oil (lubricating oil, etc.), £256,500; other lubricants, £95,350; Austrian trade (1913): mineral oil and lubricating oils, etc., £338,950; axle-grease, £4380.

Petroleum imports of the United Kingdom. Petroleum Review, Jan., 1915.

The imports of petroleum products into the United Kingdom during 1914 are classified as follows, quantities being given in gallons:—

Country.	Illuminating.	Lubricating.	Residuals.	Gas oil (Solar).	Benzine.	Fuel oil.	Other descriptions.	Totals.
Belgium	—	538,100	2,000	—	32,230	—	1,350	573,680
Canada	—	21,300	88,510	—	—	—	—	109,810
Dutch Indies	90	—	—	—	52,125,000	83,800	1,750,240	53,958,130
Germany	29,250	1,471,510	—	—	—	—	7,430	1,508,190
Holland	—	12,230	—	182,000	5,063,430	280	13,690	5,271,630
Mexico	12,364,790	256,800	—	—	2,434,380	15,031,040	995,010	31,082,020
Roumania	13,933,980	—	961,440	—	6,412,480	2,348,570	—	22,755,570
Russia	4,574,390	6,454,480	5,400	—	10,202,600	—	630	21,237,500
U.S.A.	116,595,460	54,846,900	2,570,740	83,470,250	40,766,060	18,748,300	735,410	317,703,710
Other countries	4,170	260,810	—	1,460	3,423,970	8,900	1,843,230	5,542,540
Totals	146,601,230	63,862,130	3,628,090	83,653,710	120,460,150	36,200,890	5,346,900	453,744,780

paraffin. If the shale were distilled in Pumpherson retorts, the gas produced would suffice for heating the retorts without any extra fuel. During the purification of the light oil with sulphuric acid, some ichthyolsulphonic acid, soluble in water, was

Mineral oil exports from the United States. U.S. Dept. of Commerce, Jan., 1915.

THE figures given below represent about 98% of the shipments from all ports in the United States during 1913 and 1914:—

	1913.		1914.	
	Gallons.	\$	Gallons.	\$
Crude oil	184,991,667	8,174,767	123,590,451	4,927,525
Illuminating oil	1,118,096,475	71,935,201	1,008,403,576	63,942,789
Lubricating and paraffin oils	205,825,151	20,289,805	190,888,017	25,916,336
Naphthas, gasoline, etc.	178,971,302	26,927,474	199,754,001	24,437,062
Residuum, gas oil, fuel oil, etc.	420,480,849	10,846,917	701,612,276	19,158,282
Total	2,103,365,444	147,174,164	2,224,248,324	138,381,934

Naphthalene; Recovery of—*from pastes for the manufacture of artificial coal [briquettes]*. M. Mayer. *Annali Chim. Appl.*, 1914, 2, 357-360.

ARTIFICIAL coal is made by mixing sawdust from soft wood with silica, coal tar, and water, moulding the resulting mass into cylinders, and carbonising the latter after drying. The cylinders are dried under cover for about 10 days, and a yellowish deposit is produced on the roof of the drying chamber: this deposit proved to be nearly pure naphthalene. The author recommends that the drying be effected in closed chambers by hot air or waste gases and that a cooling chamber be provided for recovery of the volatilised naphthalene. In laboratory experiments with pastes containing the normal quantity (20-25%) of tar, satisfactory drying was effected in 50 hours at 40-60° C. by a current of air, and 0.7-0.95% of naphthalene (referred to the weight of the paste) was recovered. —A. S.

PATENTS.

Coal washing; Process of and apparatus for—C. Burnett, Durham. Eng. Pat. 4687, Feb. 23, 1914.

COAL is delivered from a hopper on to an inclined movable belt or trough, and washing water is supplied from two jets behind the hopper; two additional sprays are provided behind the washing jets to recover fine coal from the dirt, the part of the belt under these sprays being inclined at a greater angle than the remainder.—W. F. F.

Gas retorts. H. J. Toogood, and R. Dempster and Sons, Ltd., Elland, Yorks. Eng. Pat. 9923, April 22, 1914.

AN installation of retorts is heated by gas supplied from a single producer, through a number of lines, each provided with an auxiliary air supply so that it may be converted into a temporary combustion chamber when cold retorts are to be brought into use. The hot combustion gases are led to the retort-heating compartments through a passage controlled by a damper, and when the compartments are heated to such a degree that explosions are no longer to be feared, the auxiliary air inlet is closed and the usual secondary air inlets opened. —W. F. F.

Vertical gas retorts. A. G. Glasgow. Fr. Pat. 471,112, April 20, 1914.

To avoid leakage of gas at the base of the retort, the horizontal door carries a fuel-supporting platform nearly fitting the retort. Gas is withdrawn from the space between the door and the platform so that the gas pressure therein is insufficient to cause leakage. Alternatively the door and platform may be independent.—W. F. F.

Coal-gas-generating apparatus. H. A. Carpenter, Sewickley, Pa., and D. D. Barnum, Worcester, Mass., Assignors to Ritter-Conley Manufacturing Co., Pittsburgh, Pa. U.S. Pat. 1,122,683, Dec. 29, 1914. Date of appl., Sept. 17, 1911.

THE horizontal gas retorts are each provided with a mouthpiece and adjacent to this, with a conduit leading to a common vertical uptake. The conduit is provided with a valve and the mouthpiece may be closed by a door, so that the whole length of the conduit may be accessible from the mouthpiece for cleaning.—W. F. F.

Gas furnace with inclined retorts. M. de Brouwer and C. Meitzler. Fr. Pat. 470,359, March 25, 1914.

THE retorts are slightly tapering inclined tubes, the coke being discharged by gravity at the larger lower end, and the gas at the upper end. Heating is effected by burners fed with gas from a producer

situated below the retorts and surrounded by recuperators through which secondary air for the burners passes in zigzag passages in the opposite direction to the hot combustion gases.—W. F. F.

Distillation ovens; Process and apparatus for introducing compressed coal into—E. Heide- rich. Fr. Pat. 470,216, March 28, 1914. Under Int. Conv., Sept. 15, 1913.

THE coal is compressed into a block by two vertical plates mounted above the oven, which alternately approach and recede from one another. The compressed block is dropped through a vertical conduit into the oven.—W. F. F.

Gas producers. H. J. Green, Birkenhead. Eng. Pat. 17,687, July 27, 1914.

THE fuel is fed in small regulated charges by a reciprocating ram into the high temperature zone of the producer, and is rotated by a rotary grate. Secondary air inlets arranged about the high temperature zone may be used with inferior fuel, and the upper part of the producer may be rotated in the same direction as the grate, suitable water seals being provided between the fixed and movable parts.—W. F. F.

Gas-washing. H. A. Brassert and C. J. Bacon, Chicago, Ill. U.S. Pat. 1,123,232, Jan. 5, 1915. Date of appl., Oct. 15, 1913.

A GAS-WASHING tower contains a number of superposed, horizontal dishes each provided with a perforated annular plate through which water passes, and gas apertures are arranged alternately within and without the perforated annulus in adjacent dishes, so that the gas in passing upwards from one dish to the next traverses the water stream. A spiral is placed in the gas outlet of the uppermost dish in order to impart a rotary motion to the gas and thus remove suspended particles of water. —W. F. F.

Gaseous fuel; Production of—*from liquid fuel.* A. W. Southey, London. Eng. Pat. 5331, March 2, 1914.

LIQUID hydrocarbons of high flash point are sprayed into the base of a vertical chamber, into which sufficient air is introduced for partial combustion. Air to be carburetted is drawn through the heated spray at a point above that at which the flame is extinguished by lack of air. (See also Eng. Pat. 4006 of 1913; this J., 1914, 411.) —W. F. F.

Methane; Production of—*from a gaseous mixture such as water-gas, by the action of steam in the presence of lime [or other catalysts]*. L. Vignon. First Addition, dated July 8, 1913, to Fr. Pat. 469,907, June 2, 1913.

WATER-GAS mixed with steam is passed over catalysts such as iron filings, copper turnings, silica, magnesia, or alumina at 550°-1200° C., in place of lime, whereby methane (3.3-4.3%) is produced, the proportion of carbon monoxide reduced, and that of hydrogen increased.—W. F. F.

Gas; Process and apparatus for purifying and cooling—Poetter. G. m. b. H. Fr. Pat. 471,007, April 16, 1911.

THE gas to be washed travels first against and then with cooling and washing water sprayed from a central distributor, being directed in its path by partitions attached respectively to the horizontal casing and to the central shaft and a sleeve thereon. The partitions attached to the shaft and the sleeve are connected by longitudinal rods, forming two or more cylindrical cages, of which adjacent ones revolve in opposite directions.—W. F. F.

Sulphur and cyanogen: Extraction of — from the gases resulting from coal distillation. E. Ciselet and C. Deguide. Fr. Pat. 471,231, April 22, 1911. Under Int. Conv., May 2 and Aug. 6, 1913, and March 13, 1914.

THE hydrogen sulphide and cyanogen compounds are removed from the gas by means of ferric hydroxide suspended in a liquid, the ferric hydroxide being subsequently regenerated by a current of air. When regeneration in this way is no longer effective, the purifying material is treated with sulphuric or hydrochloric acid, which dissolves all but free sulphur and ferrocyanides. Sulphur is recovered from the residue by dissolving the ferro- and ferri-cyanides in an alkali, while ferric hydroxide is recovered from the liquor by precipitation with ammonia and used over again. Ammonia may be recovered from the alkaline ferro- and ferri-cyanide solution by treatment with lime.—W. F. F.

Hydrocarbon oils: Process for the treatment of heavy —. [Making gasoline.] T. Myers. Bournemouth. Eng. Pat. 19,391, Aug. 27, 1913.

HEAVY hydrocarbon oil is agitated with lime-water and a relatively small amount of an aluminium salt, such as alum, the mixture is allowed to settle, the aqueous layer drawn off, and the residual oil filtered.—F. SODX.

Hydrocarbon liquid suitable for use in internal combustion engines: Method of making a —. D. R. McArthur, Assignor to E. W. Tait, Bradford, Pa. U.S. Pat. 1,119,971, Dec. 8, 1914. Date of appl., June 28, 1913.

COMPRESSED natural gas and a higher paraffin which has been atomised or vaporised and compressed at a greater pressure than the natural gas, are maintained at a suitable temperature by utilising the heat of compression, and then mixed together, the mixture being cooled to obtain a liquid of lower specific gravity than that of the higher paraffin employed.—F. SODX.

Hydrocarbons: Production of light — from heavy hydrocarbons. F. Bergius. Fr. Pat. 470,551, April 6, 1911. Under Int. Conv., May 5, 1913.

HEAVY hydrocarbons (e.g., petroleum oils, tar oils, residues, etc.) are subjected to the action of hydrogen, nitrogen, carbon monoxide, or methane under pressure (e.g., 100 atmospheres), while heated to below 420° C.—W. E. F. P.

Shale oils: Process of desulphurising sulphur-bearing —. W. A. Hall, New York. Eng. Pat. 26,756, Nov. 21, 1913.

OIL from Kimmeridge and like shale is charged with sulphur dioxide and distilled, and suspended sulphur is separated from the distillate, for example by filtration. The sulphur still present in the distillate can now be largely or wholly removed by known methods, for example by the Frasch process.—F. SODX.

[Hydrocarbon] oil: Treating [removing water from] —. J. A. Dubbs, Los Angeles, Cal., Assignor to National Hydrocarbon Co. U.S. Pat. 1,123,502, Jan. 5, 1915. Date of appl., Nov. 20, 1909.

EMULSIFIED hydrocarbon oil, containing at least 5% of water, is passed continuously, under pressure, first through a relatively constricted conduit, and then through a larger one, in each of which the temperature is raised approximately to the boiling point of water under such pressure. The pressure is produced solely by the vapours generated from the oil under treatment. The stream of oil is then cooled, relieved of pressure, and submitted to a

gravity-separating operation. The steam and oil vapours, evolved during the heating, are condensed, and the floating layer of oil is removed and added to the main bulk.—B. N.

Petroleum: Decolorisation and deodorisation of —. Soc. Le Terebinto. Fr. Pat. 471,253, July 5, 1913.

PETROLEUM is treated successively with sulphuric acid, a mixture of the latter and sulphuric anhydride in equal parts, powdered aluminium chloride, calcium chloride, and a dilute solution of sodium hydroxide.—W. E. F. P.

Briquettes: Manufacture of — from suitable briquette materials. C. Fohr, Munich, Germany. U.S. Pat. 1,123,719, Jan. 5, 1915. Date of appl., July 24, 1913.

SEE Ger. Pat. 263,158 of 1912; this J., 1913, 901.

Temperature of combustion: Process of regulating the —. A. G. Glasgow, Richmond, Va., U.S.A. From J. M. Rusby and J. H. Taussig, Philadelphia, U.S.A. Eng. Pat. 12,256, May 18, 1914.

SEE U.S. Pat. 1,110,991 of 1911; this J., 1914, 1001.

Gas producers. H. F. Smith, Lexington, Ohio, U.S.A. Eng. Pat. 11,247, May 6, 1914.

SEE U.S. Pat. 1,098,059 of 1914; this J., 1914, 782.

Gas: Process for purifying —. A. G. Glasgow, Richmond, Va., U.S.A. From C. J. O'Donnell and A. F. Kunberger, Philadelphia, U.S.A. Eng. Pat. 12,463, May 20, 1914.

SEE U.S. Pat. 1,105,578 of 1914; this J., 1914, 911.

Ammoniacal liquors from gas-works: Treatment of —. Berlin-Anhaltische Maschinenbau A. G. First Addition, dated March 2, 1914, to Fr. Pat. 470,117, Feb. 28, 1914. Under Int. Conv., Oct. 24, 1913.

SEE Ger. Pat. 272,985 of 1913; this J., 1914, 685.

Ammonia: Separation of — from gases [coal gas, etc.]. J. Marr. Fr. Pat. 470,696, April 8, 1914.

SEE Eng. Pat. 6291 of 1913; this J., 1914, 472.

Manufacture of hydrogen [from water-gas, producer-gas, etc.]. Eng. Pat. 6476. See VII.

Purification of petroleum and its distillates [and lignite tar oils]. Ger. Pat. 277,288. See III.

Process of obtaining fertiliser [from the products of combustion from gas engines]. U.S. Pat. 1,122,923. See XVI.

Drying and gasification of sludge from the clarification of waste liquids. Fr. Pat. 470,848. See XIX.

II.B.—DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Liquids of constant boiling-point, for use in constant temperature heating baths. A. Golodetz. Chem.-Zeit., 1911, 38, 1253.

IN the following list two classes of liquids with constant boiling-points are included:—(1) mixtures in definite proportions of two, or three, miscible

liquids; (2) heterogeneous mixtures (in any proportion provided two liquid phases are present) of two immiscible liquids. The boiling points given are the temperatures of the vapours when the liquids are in ebullition.

B. pt. °C.	Composition of liquid.
33	Water and ether (heterogeneous)
36.5—37.5	Alcohol (3) and ethyl bromide (97)
38	Carbon bisulphide (87) and methyl alcohol (13)
39—40	Carbon bisulphide (71) and methyl acetate (29)
42.5	Carbon bisulphide (91) and alcohol (9)
53.5—54.5	Methyl alcohol (12) and chloroform (88)
55.5	Methyl alcohol (20.6) and carbon tetrachloride (79.4)
58	Methyl alcohol (38.4) and benzene (61.6)
59—59.5	Alcohol (6) and chloroform (94)
62	Methyl alcohol (47) and ethyl acetate (53)
64.8	Benzene (74.1), alcohol (18.5) and water (7.4)
68	Alcohol (32.4) and benzene (67.6)
71.5	Alcohol (31) and ethyl acetate (69)
74.8	Carbon tetrachloride (77.15) and alcohol (22.85)
79.5	Benzene (90.5) and isobutyl alcohol (9.5)
84.5	Water and toluene (heterogeneous)
87.7	Water (28.3) and propyl alcohol (71.7)
91—91.5	Propyl alcohol (53) and toluene (47)
92.5	Water (41) and pyridine (59)
94—94.5	Water and turpentine (heterogeneous)
95	Water (7) and chloral (93)
98.5	Water and ethylaniline (heterogeneous)
99	Water and diethylaniline (heterogeneous)
104	Toluene (70) and acetic acid (30)
113—113.5	Acetic acid (27) and xylene (73)
121—122	Amyl alcohol (30) and ethylene dibromide (70)
125—126	Amyl alcohol (52) and <i>m</i> -xylene (48)

—E. W. L.

Carbons for electric lighting. Board of Trade Bulletin No. 82.

THE value of carbons for electric lighting exported from Germany, Austria-Hungary, and the United Kingdom, to all destinations was as follows:—From Germany (1912): carbon sticks for electrical arc lamps, £451,400; electrode carbons, carbon threads for electrical illuminating appliances, carborundum articles other than grinding, polishing and whet stones, and other articles of plastic carbon or gas carbon (retort graphite), £90,200; total, £541,600. From Austria-Hungary (1913): carbons for lighting purposes, less than 1 kilo. per metre. etc., £48,175; from the United Kingdom (1913): electrical carbons, £19,061. The figures for Germany include the value of carbons exported to the United Kingdom (£90,650), and to Austria-Hungary (£45,400), and those for Austria-Hungary include exports to Germany (£21,500), and to the United Kingdom (£9,200). British exports of carbons to Germany and Austria-Hungary are negligible. The principal destinations of German carbons were the United States, France, Belgium, Italy, Norway, Argentine, Russia, and Holland, and of Austrian carbons, Italy, Roumania, Belgium, and France.

In view of the large quantities of coal annually carbonised in the United Kingdom at gasworks and coke ovens, there would seem to be a distinct possibility of diverting a large portion of this trade to the United Kingdom. The maximum amount of the export trade in carbons for electric lighting which, under present circumstances, might be diverted to British manufacturers is about £100,000 in the United Kingdom market and about £123,000 in Colonial and neutral markets.

PATENTS.

Glower for electrical incandescent lamps. O. M. Thowless, Newark, N.J. U.S. Pat. 1,123,625, Jan. 5, 1915. Date of appl., Jan. 20, 1911.

FILAMENTS composed of metallic particles and a volatile binding material, are subjected to a

gradually increasing temperature until the binding material is eliminated and the metallic particles are fritted together. They are then heated electrically above the softening point of platinum in a vessel exhausted of air, and a mixture of tungsten hexachloride vapour and hydrogen is admitted. A coating of tungsten, by means of which the resistance is equalised, is deposited on the filaments.—B. N.

III.—TAR AND TAR PRODUCTS.

Tars, [tar] oils, and pitches; Determination of the specific gravity of—. J. M. Weiss. J. Ind. Eng. Chem., 1915, 7, 21—24.

For oils a standardised hydrometer is recommended: for creosote oil and, if great accuracy is not required, also for light oils, the value at 15.5° C. is calculated from that obtained at a higher temperature by the formula: sp. gr. at 15.5°/15.5° C. = sp. gr. at X°/15.5° C. + 0.0008 (X°—15.5°). For values obtained with a pycnometer, sp. gr. bottle, or Westphal balance, the temperature correction formula is: sp. gr. at 15.5°/15.5° C. = sp. gr. at X°/X° × sp. gr. water at X°/15.5° C. + 0.0008 (X°—15.5°). For smaller quantities of oil than 100 c.c. a Westphal balance is recommended, with a special plummet for quantities less than 20 c.c. In the case of tars and pitches, a platinum pan with supporting wires joined together at their upper ends and formed into a hook is used, and is suspended from the balance by a waxed silk thread. It is weighed in air and in water at 15.5° C., first empty and then filled with

the sample. The sp. gr. = $\frac{c-a}{(b+c)-(a+d)}$, where *a* and *b* are the weights of the pan in air and in water respectively and *c* and *d* are the corresponding weights of the pan plus sample. Selected pieces of pitch may be used or the sample may be melted and cooled slowly under slight pressure to prevent the formation of voids in the interior.—A. S.

Toluene in commercial toluol; Determination of the percentage of—. H. G. Colman. J. Gas Lighting, 1915, 129, 196—198.

FROM a large number of distillations of mixtures of known amounts of pure benzene, toluene, and xylene, the following process has been worked out. A standard Engler 100 c.c. distillation flask is used, having the following dimensions:—diam. of bulb 6.5 cm., length of neck 15.0 cm., diam. of neck 1.6 cm., length of side tube 10.0 cm. and angle of side tube 75°. The flask and condenser are first rinsed out with a little of the sample and allowed to drain, and then 100 c.c. of the sample is poured from a graduated 100 c.c. cylinder into the flask. An accurate thermometer registering from 50° to 150° C. and divided into $\frac{1}{2}$ degrees is fixed in the neck of the flask with the top of the mercury bulb just below the level of the side tube. The flask is heated by a naked flame provided with a wire gauze screen to protect the bulb of the retort and the flame from draughts. The side tube is connected with an 18-in. Liebig condenser and the distillation is carried out at the rate of two drops per second from the end of the condenser. The distillate is received in a graduated 100 c.c. cylinder and the number of c.c. distilling respectively below 105° C., between 105° and 117° C., and above 117° C., are noted. As each point is reached the flame is removed and the condenser is allowed to drain before reading the volume. The total distillate should measure at least 99.5 c.c. The percentage of toluene is found from the accompanying table.

The figure corresponding with the number of c.c. distilling below 105° C. is found in the bottom horizontal line and that corresponding with the number of c.c. distilling above 117° C. in the outer vertical column. The number which is found at the intersection of vertical and horizontal lines from these points represents the percentage of toluene in the sample. The table only holds good for samples containing between 50 and 75% of toluene. Other samples must be mixed with benzene, toluene, or xylene before distillation. In the case of samples yielding less than 5% below 105° C., 90 c.c. is mixed with 10 c.c. of pure benzene; with those yielding less than 5% above 117° C., 90 c.c. is mixed with 10 c.c. of xylene boiling at 136 to 143° C.; with those yielding less than 5% both below 105° and above 117° C., 80 c.c. is mixed with 10 c.c. of benzene and 10 c.c. of xylene; with those yielding more than 50% above 117° C., 80 c.c. is mixed with 20 c.c. of pure benzene, and with samples yielding more than 50% below 105° C., 80 c.c. is mixed with 20 c.c. of pure toluene. If the sample contains traces of paraffins, 100 c.c. is fractionated from a round flask provided with a Young twelve-bulb "pear" column and the sp. gr. of the portion distilling between 107° and 115° C. is determined. For every 0.001 that the sp. gr. found is below 0.868, a reduction of 0.75% is made in the percentage of toluene found.—W. H. C.

Toluene; Supply of—J. Gas Lighting, Feb. 9 and 16, 1915.

SPEAKING at a meeting of representatives of the gas industry, held in Manchester on Feb. 5th, Mr. Macintosh Williams said that he was present on behalf of the War Office Committee on the Supply of High Explosives. The Government was requesting the larger gas undertakings to wash the toluol contents out of their gas, and, in case of need, replace the toluol contents with benzol to preserve the illuminating and the calorific power. The War Office proposed, at first, to seek the assistance of those who were carbonizing 80,000 or 90,000 tons of coal per annum. The Government suggested that they should supply the plant, and pay for the cost of erection and all expenses in connection with it; that a small percentage on the working expenses connected with extracting the toluol should form the profit, and that their profit should increase in proportion to the percentage of toluol supplied, having regard to the total percentage of toluol which might exist in the particular gas. The Government proposed a minimum of 5% on the working expenses for up to 70% of the total toluol contents, and a further 2½% on the working expenses for each 5% additional. The Birmingham Corporation had made some experiments already with regard to the matter, the results of which were open for any who were willing to take the matter up for the Government. They thought that if the wash-oil employed for washing or scrubbing the gas was first of all pre-benzolized, then the wash-oil would only take up the toluol contents of the gas and leave the benzol contents of the gas to a certain extent intact. If the oil were pre-benzolized to the extent of 5%, it was possible to extract nearly 80% of the toluol, and leave over two-thirds of the benzol still in the gas.

Dr. W. B. Davidson, of Birmingham, has sketched a plant suitable for use in a works carbonising about 800 tons of coal per day. The debenzolised oil from the crude still is mixed with a small quantity of benzol (say 4 to 5% by vol.), and pumped at the rate of about 1300 galls. per hour through scrubbers (two sets of three in series.) The oil now runs to the store-tank whence it is pumped continuously at the rate of about 1300 gallons an hour through a heater, where heat interchange takes place between the cold

oil and the hot oil leaving the crude still; then through an exhaust steam-heater and a super-heater (containing a closed high-pressure steam-coil) to the crude still, where it falls from a tray to tray to the lowest compartment, meeting a current of high temperature steam, which deprives it of its crude benzol. The hot debenzolized oil is drawn off, preferably by gravity, and caused to flow first through the heater, and afterwards through a water condenser to the store-tank. The crude benzol vapours and steam are condensed in a second water condenser. The condensate flows to a receiver, whence it passes through a separator. A charge of about 1600 gallons of crude benzol is pumped daily into the intermediate still (either of the Heckmann or the Savalle type), where it is distilled by steam with the production, firstly, of commercial benzol; secondly, commercial toluol; thirdly, residual xylol and heavier oils. The commercial benzol is mixed with the wash oil, together with an additional quantity corresponding to the amount of toluol, etc., permanently removed from the gas. The commercial toluol is re-distilled in a second still of the Heckmann or Savalle type, in a central works, for the production of pure toluol. If the wash oil contains much naphthalene, it may be necessary to return the xylol to the gas, to prevent naphthalene stoppages in the district services. Gas oil will probably prove the most suitable oil for washing purposes, as it is generally ready to hand, contains no naphthalene, and readily absorbs crude benzol. The oil may be worked up to a high degree of saturation without appreciable loss of toluene; a considerable proportion of the benzene, which is more difficult to catch, going forward in the gas.

Phenol from chlorobenzene; Preparation of—K. H. Meyer. Chem.-Zeit., 1914, 38, 1040.

PHENOL is formed when chlorobenzene is treated with strong alkalis in an autoclave under a pressure of 200 to 300 atmospheres, the yield being about 96% of that required by theory.—W. P. S.

Nitro-compounds: Precautions in the industrial preparation of—[in Germany]. Chem.-Zeit., 1914, 38, 1248. (See also this J., 1914, 376, 712).

THE following provisions are to be officially enforced in the construction of all German works for the manufacture of nitrobenzene and similar products: (1) Undue accumulation of material and crowding of the working staff must be avoided. (2) Large quantities of the raw materials must not be brought into reaction simultaneously; the nitrating apparatus should be examined methodically each time before use, since, for instance, the unsuspected presence of acid may lead to accidents. (3) Isolation of the various parts of the apparatus is desirable. (4) The nitrating apparatus must be provided with an outlet capable of conducting the appreciable amount of hydrocarbon which may be generated to a sufficient height above the roof. (5) Precautions must be taken not to introduce the acid until the stirrer has been set in motion. (6) Some device must be adopted to show that the liquid is in motion. (7) In continuous working, i.e., when measured quantities of nitrating acid and hydrocarbon are allowed to interact, certain modifications of these rules are permissible.—J. R.

Comparative toxicity of coal tar creosote and creosote distillates and of individual constituents for the murine wood borer, Xylotrya. Shackell. See IX.

Recovery of naphthalene from pastes for the manufacture of artificial coal. Mayer. See 11A.

PATENTS.

Petroleum and its distillates (and lignite tar oils): Purification of—especially to separate aromatic and unsaturated heavy hydrocarbons. Allgemeines Ges. f. Chem. Industrie m. b. H. Ger. Pat. 277,288, Nov. 15, 1912. Addition to Ger. Pat. 216,159.

THE process of refining petroleum or its distillates by treatment with liquefied sulphur dioxide, described in the chief patent (this J., 1910, 111) is, according to the present patent, applied to lignite tar or tar oils. By treating in this way the fraction from lignite tar known as gas oil, the aromatic hydrocarbons are removed, and a residue is left which gives a larger yield of gas of better quality than that obtained from the untreated oil. In a similar manner the solar oil fraction yields a product which requires much less sulphuric acid when treated for the production of colourless vaseline oil. —A. S.

Treating (hydrocarbon) oil [to remove water]. U.S. Pat. 1,123,502. See II.A.

Process for obtaining light hydrocarbons from heavy hydrocarbons. Fr. Pat. 470,551. See II.A.

IV. COLOURING MATTERS AND DYES.

British dyes.

A circular has been issued by the Committee appointed by users of dyes (see this J., 1915, 73), giving fuller details of the modified scheme for the manufacture of dyestuffs in Great Britain (see this J., 1915, 133). The capital will be issued in shares of £1 each, of which 2s. 6d. will be payable on application and 2s. 6d. on allotment. The subscription of the share capital is invited from users of dyes and all others directly or indirectly interested. Calls will, if found necessary, be made from time to time, at intervals of not less than three months, and of not more than 5s. per share, but it is believed that, with the Government assistance, payments beyond the 5s. payable on application and allotment will not be needed for some time. The terms of the agreement with users have now been modified so that no user signing it will be obliged to take the company's products unless they are "of good quality and suitable for the purposes of the customer's business and at reasonable prices," while in the event of dispute as to what are "reasonable prices," the question shall be referred to a referee, who shall "have regard to all the circumstances, including the fair current prices at which dyes are being sold by other suppliers." It is believed that these modifications will remove the opposition to the agreement previously submitted for signature. The directors will, in the first place, consider the purchase of the business of Read Holliday and Sons, Ltd., for which an option has been obtained, and they will continue negotiations with other dye-producing firms. Negotiations have taken place with the Société pour l'Industrie Chimique à Bâle and the Clayton Aniline Co. (which is owned by the Société), and it is believed that arrangements can be made to purchase from the latter undertaking and to secure a supply of dyes from Switzerland on a considerable scale, which will go far in relieving the situation.

The Articles of Association of the company will contain powers to appoint a committee of experts conversant with the dyeing trade and its wants, to advise the directors what dyes are to be made, and where, and in what quantities. The agreements for the company to take over existing dye undertakings will provide for the retention of their respective chemists and staffs

by the new company. Until the company is in a position to supply all the dye requirements of the country, those dyes which it can manufacture will be primarily appropriated for supplying the wants of those shareholders who have entered into contracts to take the dyes. A print of the revised form of agreement is appended to the circular. The offices of the Committee are at 7, Norfolk Street, Manchester.

PATENTS.

Colouring matters of the Diamine Green class: Process for preparing new—. L. Cassella and Co. Fr. Pat. 470,390, June 13, 1913.

DYESTUFFS of the Diamine Green series, not affected in shade by copper, are produced from diamines, such as benzidine and tolidine, employing 2-naphthylamine-4,8-disulphonic acid as middle component.—G. H. F.

Vat dyestuffs of the naphthalene series. Badische Anilin und Soda Fabrik. Fr. Pat. 470,560, April 6, 1914. Under Int. Conv., June 13 and 25, 1913.

SEE Ger. Pat. 276,357 and 276,358 of 1913; this J., 1914, 1915. Halogen derivatives of these dyestuffs are obtained by using halogenated naphthalene-1,8-dicarboxylic acid imines or the products obtained by treating halogenated acenaphthenequinones with hydroxylamine, or by treating with halogens the dyestuffs already described.

Vat dyestuffs of the naphthalene series. Badische Anilin und Soda Fabrik. First Addition, dated April 7, 1914, to Fr. Pat. 470,560, April 6, 1911. Under Int. Conv., Oct. 9 and 20, 1913.

SEE Ger. Pat. 276,956; this J., 1914, 1081. The dyestuffs may be halogenated, yielding new vat dyestuffs producing yellowish red shades.—G. H. F.

Ureas and thiourcas of 3-aminobenzoylorthobenzoic acid and of acids of the anthraquinone series, and their derivatives. Act.-Ges. f. Anilinfabrik. Fr. Pat. 470,562, April 6, 1914. Under Int. Conv., June 30 and Oct. 13, 1913.

SEE Eng. Pat. 8917 of 1914; this J., 1914, 826. The corresponding thiourcas are obtained by substituting carbon bisulphide or thiophosgene for the phosgene.

Blue [sulphide] dyestuffs for wool: Manufacture of—. Kalle und Co. A.-G. Fr. Pat. 471,230, April 22, 1914. Under Int. Conv., June 17, 1913, and March 21, 1914.

COLOURING matters dyeing wool blue from an acid bath are obtained by fusing 1-aminonaphthalene-4,8-disulphonic acid, or 1-aminonaphthalene-4,6,8-trisulphonic acid, with sulphur in presence of an alkali. The reaction product is treated with water, and reducing substances (sulphides, etc.) are removed by precipitation or by a current of air after acidifying. The colouring matter is then separated by making the solution neutral or alkaline, heating, and treating with a current of air.—G. H. F.

Azo dyestuffs: Production of new—. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 471,281, April 23, 1914. Under Int. Conv., May 3, 1913.

NITROAMINES or monoacydyl derivatives of diamines, or their substitution products or sulphonie acids are diazotised and combined with α -naphthylamine or its derivatives, the products are rediazotised and combined with resorcinol, and the acyl group is removed by saponification or the nitro group is reduced. The dyestuffs thus obtained dye cotton blue shades fast to light and rendered fast to washing by after-treatment with formaldehyde.—G. H. F.

Condensation products from the arylamides of 2,3-hydroxynaphthoic acid and formaldehyde, and azo dyestuffs therefrom, and process of making same. A. Zitscher, F. Kunert, and E. Acker, Offenbach on the Maine, Assignors to Chem. Fabr. Griesheim-Elektron, Frankfurt on Maine, Germany. U.S. Pat. 1,122,564, Dec. 29, 1914. Date of appl., April 17, 1914.

SEE Eng. Pat. 3314 of 1914; this J., 1914, 855.

Vat colouring matters and process of producing them. E. Münch, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen, Germany. U.S. Pat. 1,122,790, Dec. 29, 1914. Date of appl., Aug. 13, 1912.

SEE Eng. Pat. 2316 of 1912; this J., 1912, 1025.

Anthraquinone derivatives [dyestuffs]; Badische Anilin und Soda Fabrik. Fr. Pat. 471,117. April 18, 1914. Under Int. Conv., Aug. 11, 1913.

SEE Eng. Pat. 21,027 of 1913; this J., 1914, 544.

Wool dyestuffs; Red —. W. Tropp, Assignor to Farb. vorm. Meister, Lucius, und Brüning, Hoechst on Maine, Germany. U.S. Pat. 1,123,430, Jan. 5, 1915. Date of appl., Feb. 18, 1914.

SEE Fr. Pat. 468,218 of 1914; this J., 1914, 957.

Azo dyestuffs; Manufacture of new —. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 470,670, April 8, 1914. Under Int. Conv., May 2 and Aug. 4, 1913.

SEE Ger. Pats. 276,140, 276,141, and 276,142 of 1913; this J., 1914, 855.

Dyestuffs derived from coal tar; Process for preventing the volatilisation of powdered —. L. Cassella und Co. Fr. Pat. 471,243, July 4, 1913.

SEE Ger. Pat. 274,642 of 1914; this J., 1914, 827.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Paper, pasteboard and cardboard. Board of Trade Bulletin. No. 90.

THE value of the exports of paper, pasteboard, and cardboard from Germany in 1912 was £5,272,300; from Austria-Hungary (1913), £1,054,860; and from United Kingdom (1913), £2,758,700. German exports of paper, cardboard, etc., to Austria-Hungary in 1912 were valued at £256,600, and to the United Kingdom £1,286,600. Austrian exports in 1913 to Germany were valued at £229,500, and to the United Kingdom at £43,300, while the exports of the United Kingdom in the same year to Germany and Austria-Hungary were valued at £81,600 and £7100, respectively. The exports to the principal Colonial and neutral markets were: from Germany (1912), £3,602,850; from Austria-Hungary (1913), £770,055; and from United Kingdom (1913), £2,488,357.

The German exports (1912) to the principal Colonial and neutral markets included: glazed board (pressing board) and other highly glazed pasteboard, imitation leather-board, and other fine pasteboard, £28,200; vulcanised fibre, £6200; pasteboard of wood-pulp (imitation leather-board), straw-board, wrapper-board, peat-board, and other coarse pasteboard, not otherwise mentioned, £151,300; pasteboard impregnated with asphalt, etc., for roofing, also tubes thereof, carton-pierre, ship felt for caulking, £102,650; pasteboard of all kinds coated with white or colours with paper pasted on, varnished, bronzed, coated with wool flocks, etc., with impressed patterns (Lignonur),

etc.; painters' boards, £51,600; packing paper of all kinds, including tissue paper weighing more than 30 grms. per sq. metre, and yellow straw paper, £707,450; printing paper, undyed or dyed in the pulp, £630,100; cardboard (thin cardboard), except drawing cardboards, £274,800; parchment paper, £66,900; paper and cardboard, covered with spun material, or with foundation or layers of such or of wire gauze, £28,750; wall-paper, wall-paper borders of paper, £375,000; slate paper and slates thereof, not combined with other materials, smoothing and polishing paper, £45,100; gelatin paper, tracing paper, blue paper, fly-paper, moth-paper, ozone-paper, test (litmus and other chemical) paper, etc., £108,250; tissue paper (except that used for packing), £97,700; crude photographic paper, not treated with baryta; felt paper, and wall-paper, £272,650; coloured paper, including paper coated with chalk, etc., or with metal impressions, £410,350; lacquered paper, paper coated with scales of mica or glass, pounce, wool flock and the like; paper provided with metallic coatings, such as gilt or silver edged paper, £70,150; paper and cardboard, punched or stamped out, £145,700.

The Austro-Hungarian exports (1913) to the principal Colonial and neutral markets included: pasteboard, common, weighing 300 grms. or more per sq. metre: pasteboard of wood-pulp, £177,300, other common pasteboard, including rough rag pasteboard and strawboard, £4010; pressing boards, slate board, glazed boards of pasteboard, £955; fine cardboard (cartons), £3250; all other cardboard (mainly tarred cardboard and carton-pierre), £8415; packing paper, weighing 30 grms. or more per sq. metre, not dyed, £173,485, dyed in the pulp or tarred, £41,995; drawing paper, artists' boards, copper-plate printing paper, £4485; coloured paper, also lacquered and white-coated paper, plain, £31,410, with impressed designs, marbled, or goffered, £1455; parchment paper, £985; lace paper and similar perforated paper, £1185; wall-paper, £1595; printing paper, plain, ungummed, £110,680; cigarette papers in sheets, plain, £98,070, ribbed £28,810.

The United Kingdom does the bulk of the trade in our big Colonial markets, though German competition is noticeable in Australia and British India. In the latter market Austrian competition is also in evidence. In France, China, and Japan the exports of the United Kingdom are about equal to those of Germany and Austria-Hungary combined. Elsewhere the position of the United Kingdom is generally inferior to that of Germany, particularly in the western European markets, Switzerland, Spain, Italy, Russia, Brazil, Argentina, United States, Mexico, and Cuba, while in Italy, the Balkan States, Turkey, and Egypt British trade is markedly inferior to that of Austria-Hungary.

PATENTS.

Artificial silks; Manufacture of —. H. Davoine. Fr. Pat. 470,606, April 7, 1911.

CELLULOSE obtained from *Hedychium coronarium* is employed for the manufacture of artificial silks. —J. F. B.

Cellulose esters and acetates and articles, such as films, prepared therefrom; Manufacture of —. Fabrik van Chemischen Producten. Fr. Pat. 470,384, April 1, 1914.

AIR-DRY cotton, 106 grms., is treated with a mixture containing approximately 240 grms. of acetic anhydride, 400 of acetic acid and 15 of acetylsulphuric acid (see Fr. Pat. 461,539; this J., 1914, 219). When the combined acetic acid

amounts to 56–62% of the dry weight of the product, the mixture is treated with 40 c.c. of 10% aqueous sulphuric acid and any sulphuric acid remaining in combination with the ester is eliminated by digesting at 40° C. for about 12 hours. The product should be a mixture of cellulose tri- and di-acetates, giving viscous solutions with acetone and capable of withstanding 200° C. without decomposition.—J. F. B.

Nitrocellulose and cellulose acetate; Manufacture of products for rendering — plastic. C. Shrager and R. D. Lance. Fr. Pat. 470,726, June 21, 1913.

The products consist of mixtures of one or more metallic resins, insoluble in water, and one or more glyceryl esters, which, when incorporated with a cellulose ester, give a plastic composition the properties of which can be varied according to the proportions and nature of the resins employed. Example: 170 grms. of rosin are dissolved in 500 c.c. of benzene and the solution is shaken for several hours with 17 grms. of zinc oxide and 3 of aluminium oxide. To the solution of mixed resins, 30 grms. of triacetin is added and the solvent is evaporated. A mixture of equal parts of the plastic product and nitrocellulose possesses properties analogous to those of camphor-celluloid.—J. F. B.

Cellulose acetate and its transparent derivatives; Application of — [in aviation and aeronautics]. M. M. J. Bouffort. Fr. Pat. 470,897, June 26, 1913.

The portions of the structure of aviation and aeronautical apparatus which are usually opaque are, where possible, constructed of a transparent composition having a cellulose acetate basis, in order to enlarge the field of vision and render the machine less visible.—J. F. B.

Cellulose acetates; Manufacture of infusible —. Verein f. Chem. Ind. in Mainz. Fr. Pat. 470,963, April 11, 1914. Under Int. Conv., April 14, 1913.

CELLULOSE acetates characterised by their infusibility and the exceptional viscosity of their solutions are prepared by the acetylation of perfectly anhydrous cellulose: 30 kilos. of cotton is digested in a mixture of 60 kilos. of acetic anhydride and 100 of glacial acetic acid at 50°–100° C. for several hours or at the ordinary temperature for a few days; when the moisture is completely eliminated, a catalytic agent is added, preferably dissolved in a further quantity of acetylating mixture, and acetylation is performed in the usual manner.—J. F. B.

Wood pulp, straw pulp, and the like; Process for bleaching and removing resin from mechanical —. Aflenzer Graphit- und Talksteingewerkschaft G. m. b. H. Ger. Pat. 277,385, Oct. 21, 1913.

THE material is treated cold with finely-divided talc in vessels provided with agitators.—A. S.

Fibres; Treatment of — to increase their coefficient of friction. W. E. Muntz. Fr. Pat. 470,957, April 6, 1914. Under Int. Conv., April 8, 1913.

SEE Eng. Pat. 8278 of 1913; this J., 1914, 546.

Manufacture of lacquers containing cellulose derivatives Fr. Pat. 471,104. See XIII.

Preparation of nitrocellulose rich in nitrogen and easily stabilised. Fr. Pat. 470,743. See XXII.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Dyeing; Theory of —. IV. W. D. Bancroft. J. Phys. Chem., 1915, 19, 50–64. (See also this J., 1914, 107, 349, 589.)

THE general conclusion reached by the author is that adsorption, rather than the formation of definite compounds, plays the chief part in the practice of dyeing. Tannin is adsorbed in acid solution by wool and cotton, the amount of adsorption depending upon the specific nature and the concentration of the acid. Similarly, oil mordants are adsorbed by cotton without the formation of definite compounds. Alizarin is adsorbed by chromium mordant, and the balance of the experimental evidence indicates similar behaviour towards ferric mordant. Alumina adsorbs Crystal Ponceau at the ordinary temperature, although at 90° C. a definite compound appears to be formed. Alumina also adsorbs Fast Green, Acid Green, Acid Violet, Croceine Orange, Alizarin Yellow, and Fast Blue: the presence of sodium sulphate decreases the amount of adsorption in these cases. The same mordant adsorbs the blue form of Congo Red, and possibly stabilises the red form (cf. Blucher and Farnau, this J., 1914, 1085). Although a definite crystalline copper eosinate has been prepared (Gilbert, this J., 1914, 1199), the lakes given by Eosin with copper salts, magnesia, etc., are undoubtedly adsorption products. Silica, according to its previous treatment, adsorbs differing amounts of Methylene Blue, and various basic dyes are adsorbed by tannin. In general, the mordanting of basic colours by acid colours, and *vice versa*, and the formation of colour lakes are examples of adsorption, although definite compounds may sometimes be produced under special conditions. In most cases, also, fixing agents are regarded as colloids of opposite sign to the mordants. Tin phosphate and ferric arsenate, respectively, are not formed when stannic acid is treated with phosphoric acid and when ferric oxide is treated with sodium arsenate; and it is probable that aluminium phosphate, silicate, oleate, etc., are not produced under the ordinary conditions which prevail in practice. The nature of the action of lime on alizarin with alumina mordant is doubtful, but the lime probably inhibits the peptonisation of the alumina. Adsorption occurs between tannin and antimony salts and probably also between oil mordants and iron salts, although definite oleates are sometimes produced.—J. R.

PATENTS.

Mercerising, dyeing, or bleaching of cotton in the sliver or roving. The British Cotton and Wool Dyers' Association, Ltd., Manchester, and J. H. Robson, Huddersfield. Eng. Pat. 708, Jan. 10, 1914.

A STOUT thread or string is wound spirally around the sliver or rovings to be mercerised, dyed, or bleached, or the sliver may be coiled around the thread, so that the fibres may be fully extended without injury.—B. N.

Dyeing coarsely or finely powdered vegetable or animal materials; Process for —. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 470,408, April 1, 1914. Under Int. Conv., April 25, 1913.

SAWDUST, leather waste, or powdered cork is dyed by projecting a strong solution of dyestuff on to the material while in motion, e.g., in a rotating drum.—G. H. F.

Hank dyeing; Process of——. H. Krantz. Fr. Pat. 470,734, April 9, 1914. Under Int. Conv., April 10, 1913.

HANKS are dyed in a vat connected with a pump by which the liquor can be circulated alternately in opposite directions. The hanks are suspended freely on rods, the middle portion resting on the rod, with the ends hanging down in loops on either side, and a wooden board is placed a short distance above to keep the hanks in position when the liquor is circulated upwards through the vat.—G. H. F.

Dyeings on the fibre; Production of——by the single bath method. Chem. Fabr. Griesheim-Elektron. Fr. Pat. 471,123, April 18, 1914. Under Int. Conv., Aug. 25, 1913.

THE material is padded or printed with a solution of an arylamide of 2,3-hydroxynaphthoic acid together with a salt of a nitrosamine. With or without previous drying, the colour is developed by passing through a dilute acid bath or through a dilute solution of a bichromate. Fast red shades are produced.—G. H. F.

Furs; Process for decolorising——. A. Lafon. Fr. Pat. 470,940, June 27, 1913.

SKINS are coated on the flesh side with vaseline or the like, and the fur is brushed over with a mordant consisting of copper sulphate, tartaric acid, and potassium bichromate (three parts of each per thousand of water), and after drying, treated with hydrogen peroxide, first of 20-vol., then of 12-vol. strength. The skins are dried until they have acquired the desired shade, washed with water, and freed from grease by means of mahogany sawdust at 35°–40° C. —G. H. F.

Cotton fabrics; Treatment of——to impart thereto a character resembling wool and also pattern effects. Heberlein und Co., Wattwil, Switzerland. Eng. Pat. 12,559, May 21, 1914. Under Int. Conv., Dec. 5, 1913.

SEE Fr. Pat. 468,821 of 1914; this J., 1914, 959.

Dyeings on cotton; Process of producing——. H. Eichwede, Assignor to Farb. vorm. Meister, Lucius, und Brüning, Ilsecht on Maine, Germany. U.S. Pat. 1,123,263, Jan. 5, 1915. Date of appl., April 8, 1913.

SEE Fr. Pat. 455,493 of 1913; this J., 1913, 940.

Finishing, weighting, coating, or sizing [textiles]. L. Lilienfeld. First Addition, dated March 20, 1914, to Fr. Pat. 436,087, Nov. 8, 1911. Under Int. Conv., April 8, 1913.

SEE Eng. Pat. 7317 of 1914; this J., 1914, 747.

[Perborate] washing [and bleaching] compounds. Eng. Pat. 21,625. See VII.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

German sulphuric acid industry; Effects of the war upon the——. K. Rensch. Chem.-Zeit., 1914, 38, 1241–1243.

THE export of sulphuric acid, sulphuric anhydride, and sulphurous acid from Germany is now prohibited. The total German production of sulphuric acid in 1912 was 1,649,681 metric tons, calculated as monohydrate; and in 1913 the imports exceeded the exports by 65,289 metric tons, most of the imports being from Belgium. Of the requisite

pyrites, over 80% was imported, mainly from Portugal, Spain, and France. The working of the considerable German deposits might present difficulty owing to scarcity of labour. Norway is indicated as a further possible source of supply. Very similar conditions exist for zinc blende, of which about 60% was imported from Australia alone. The importation of native sulphur from Italy is at present costly. No data are available respecting the amounts of nitre and nitric acid used in the manufacture of sulphuric acid, but in 1911 the contact process was employed in 7 works, the chamber process in 86, and both processes in 17. The price of nitre has risen, and in discussing sources of such material, reference is made to the Norwegian production and the present strenuous German efforts to convert ammonia into nitric acid on a large scale. In view of the increased demand for sulphuric acid in manufacturing explosives the price has risen slightly, and it is recommended that some economy should be made in the superphosphate industry, for which 600,000 metric tons of acid was used in 1909: such economy would be facilitated by the increased output of Thomas slag due to the expansion of the iron industry. A further economy is possible through the diminished activity of the dye, glass, and other factories.—J. R.

Alums; Separation of——into their components. B. Haas. Chem.-Zeit., 1914, 38, 993.

TAKING potassium chrome alum as an example, the solution is stirred gradually into a paste of an equivalent amount of finely-divided calcium carbonate with boiling water; the reverse method of mixing is, however, preferable if an acid-proof vessel is available. When effervescence has ceased the finely-divided precipitate of calcium sulphate and hydrated chromic oxide is allowed to settle for 2 hours, and the supernatant solution of potassium sulphate decanted. After one washing with water the chromium is removed from the precipitate by treatment either with acid or alkali. Alternatively, a dry mixture of alum and calcium carbonate may be heated and extracted with water.—J. R.

Sodium metasilicate-caneahydrate, a well-defined, crystallised sodium silicate. K. A. Vesterberg. Z. anorg. Chem., 1914, 88, 341–348.

CRYSTALLOGRAPHIC measurements of the hydrate, $\text{Na}_2\text{SiO}_3 \cdot 9\text{H}_2\text{O}$, previously described (this J., 1912, 874), show it to be identical with the product obtained by Fritzsche by adding silica to concentrated caustic soda solution (Pogg. Ann., 1838, 43, 135). The salt is now made commercially in Sweden.—F. SODN.

Ammonium perhaloids. F. D. Chattaway. Chem. Soc. Trans., 1915, 107, 105–108.

AMMONIUM perhaloids were prepared by adding two equivalents of halogen to a concentrated aqueous solution of a normal ammonium salt and crystallising in a desiccator over sulphuric acid. Ammonium tribromide, dichloride, and chlorobromo-iodide are described as remarkably stable substances which can be kept without change for years, but when heated in air, or exposed over lime in a vacuum, they are converted into the monohalogen salt. In this property, and in their extreme solubility in water they differ entirely from the diazonium trihaloids and they cannot be regarded as possessing an analogous constitution. The latter are N-trihalogen derivatives of the hydrazines, $\text{C}_6\text{H}_5\text{Nhal} \cdot \text{Nhal}_2$, whilst ammonium trihaloids may be provisionally regarded as having the constitution, $\text{NH}_4 \cdot \text{hal} \cdot \begin{matrix} \text{hal} \\ \parallel \\ \text{hal} \end{matrix}$. —G. F. M.

Iron and free sulphuric acid; Reduction of ferric sulphate in acid solution by means of cadmium amalgam for titration of —. [Analysis of mine waters.] J. H. Capps and O. W. Boies. J. Phys. Chem., 1915, 19, 65—75.

FREE sulphuric acid in mine water cannot be determined directly owing to gradual hydrolysis of the ferric salt during the titration. Electrolytic reduction of the ferric salt invariably resulted in the liberation of measurable amounts of hydrogen; this source of error was avoided by reducing with cadmium amalgam in an atmosphere of hydrogen. A portion of the mine water (50 c.c.) was first titrated with potassium permanganate (1 c.c. = 0.005258 gm. Fe) for ferrous iron. A small separating funnel and a three-way tap were sealed to the central tube and side tube, respectively, of a Drexel gas-washing bottle, and after introducing a convenient amount of the mine water and exhausting, the bottle was well shaken; hydrogen was admitted and the bottle again shaken till equilibrium resulted. The process was repeated twice, the amalgam run in, and the bottle shaken vigorously until the attainment of complete reduction, i.e. till a drop of the solution gave no colour with potassium thiocyanate (about two minutes). One aliquot part of the solution (50 c.c.) was then titrated with N/10 sodium carbonate for free acid, and another portion (50 c.c.) with permanganate for total iron. Methyl orange indicator was employed in the former operation, the end-point being ascertained by comparison with a standard neutral tint. The absolute end-point of the standard was ascertained by conductivity measurements made during titration of a similar solution in presence of methyl orange; the resulting tint was permanent when the solution was enclosed in a sealed bulb of clean glass. An artificial "mine water" containing 0.429 gm. of ferric iron, 0.774 gm. of ferrous iron, and 3.85 grms. of sulphuric acid per litre, also traces of aluminium, calcium, magnesium (as sulphates) and sodium (as chloride) gave, respectively, on analysis by the above method 0.427 gm., 0.769 gm., and 3.825 gm. Similar solutions of ferric iron in sulphuric or hydrochloric acids, after reduction (4 to 5 minutes) in the same way with cadmium amalgam gave extremely concordant results upon subsequent titration with permanganate and bichromate, respectively. In these cases the preliminary expulsion of oxygen from the solutions was unnecessary, but the air in the apparatus was displaced by carbon dioxide. Zinc amalgam effected a rapid reduction (0.5 minute), but the results were vitiated by the simultaneous displacement of appreciable amounts of iron from the solutions.—J. R.

Conductivity of solutions of certain electrolytes in organic solvents; The electrical —. J. N. Pearce. J. Phys. Chem., 1915, 19, 14—19.

ELECTROLYTES dissolved in aniline exhibited three kinds of behaviour upon progressive dilution. With silver nitrate, aniline hydrobromide, aniline hydrochloride, ammonium thiocyanate, and lithium iodide the molecular conductivity decreased to a minimum and then increased normally; the values for mercuric iodide increased normally; and tetra-ethylammonium iodide showed an increase to a maximum, followed by a rapid decrease to a minimum and a final normal increase. With the first three solutions the temperature coefficients also decreased with dilution of the solutions and reached a minimum value at the dilutions corresponding to the minimum molecular conductivities; ethylaniline hydrochloride, on the contrary, showed a maximum temperature coefficient at this point; and the temperature coefficient of mercuric iodide increased and that of tetra-ethylammonium iodide decreased with increasing dilution. In quinoline, which has a higher

dielectric constant than aniline, higher molecular conductivities were given by silver nitrate and aniline hydrobromide, and the minimum values were displaced toward the region of higher concentration. It is suggested that, generally, in dilute solutions of the kind examined, the molecular conductivity and hence the dissociation of the electrolyte increases with increasing dielectric constant of the solvent. Similar measurements made for fourteen metallic salts in pyridine solution resulted in the following being classified as "strong," i.e., as possessing large dielectric constants and ionizing tendencies; silver nitrate, lithium iodide, sodium iodide, potassium and ammonium thiocyanates, and copper nitrate. The "weak" salts were lithium chloride, lithium bromide, mercuric chloride, bromide, and iodide, cupric chloride, cobalt chloride, and cadmium nitrate. Twelve of these salts gave minimum values for the temperature coefficients: copper nitrate gave steadily increasing and lithium chloride steadily decreasing values upon dilution. Negative temperature coefficients were observed for solutions of sodium iodide, lithium bromide, cobalt chloride, and cadmium nitrate. The mercuric salts gave minimum values for the molecular conductivity; but in all the other cases the values increased steadily with increasing dilution.—J. R.

German Potash Syndicate; Sales of the — during 1914. Board of Trade J., Feb. 11, 1915.

ACCORDING to the "Börsen-Zeitung" (Berlin) of Jan. 22nd, the sales of the German Potash Syndicate in 1914 amounted to about £78,000,000 as compared with £96,000,000 in the previous year. It was hoped that the total for 1914 would amount to £105,000,000. The general expenses of the works, including raw materials, have risen considerably, and competent workmen are difficult to obtain.

Bromine; Solutions of — in water, nitrobenzene, and carbon tetrachloride. A. F. Joseph. Chem. Soc. Trans., 1915, 107, 1—7.

THE molecular solution volume of bromine in water, nitrobenzene, and carbon tetrachloride in concentrations up to 60 grms. per litre increases in each case to a maximum, the value of which increases in the order named. The colour intensity in the three solvents also increases in the same order; the colour of the carbon tetrachloride solution is the same as that of bromine vapour of the same concentration, of the nitrobenzene solution about two-thirds of this, and of the aqueous solution from one-half to one-third. Bromine evaporates from aqueous solution about twelve times as fast as from carbon tetrachloride and about twenty-four times as fast as from nitrobenzene.—G. F. M.

Nitrogen; Spectroscopic investigations in connection with the active modification of —. IV. A band spectrum of boron nitride. W. Jevons. Roy. Soc. Proc., 1915, A, 91, 120—134. (See also this J., 1913, 750; 1914, 548.)

Boron trichloride, prepared by passing chlorine over heated, amorphous boron, was collected in a cooled vessel containing mercury, and purified by fractionation. The interaction of active nitrogen and boron trichloride or methyl borate developed a band spectrum extending from λ 6371 to at least λ 2140. The spectrum consisted of two distinct systems; in the less refrangible one, each band consisted of four heads, whilst the more refrangible system had single heads like the silicon nitride spectrum. The origin of the spectrum was found to be boron nitride, the bands of the latter, like those of cyanogen, being also produced in the electric arc spectrum of boron in air or nitrogen,

where they occurred together with bands of the oxide. Boron, carbon, and silicon compounds all develop nitride spectra in the nitrogen after-glow.—O. R.

Lead acetate test for hydrogen sulphide in gas. McBride and Edwards. See II A.

Hermann's phenomenon. Walpole. See XI.

PATENTS.

Nitric and sulphuric acids; Process of producing —. C. C. Meigs, Charleston, S.C. U.S. Pat. 1,120,960, Dec. 15, 1914. Date of appl., Oct. 18, 1913.

A MIXTURE of nitrogen and sulphur dioxide is produced by burning sulphur, the nitrogen is combined with hydrogen to form ammonia, and the latter is oxidised to dilute nitric acid. The sulphur dioxide is oxidised to sulphuric anhydride, which is introduced into the dilute nitric acid to give concentrated nitric acid and dilute sulphuric acid, and the nitric and sulphuric acids are separated.—F. SODN.

Ammonia; Process of producing —. S. Peacock, Chicago, Assignor to International Agricultural Corporation, New York. U.S. Pat. 1,092,167, April 7, 1914. Date of appl., Dec. 10, 1912.

A HIGHER hydride of iron (e.g., FeH_3), which may be prepared by treating spongy iron with hydrogen, is exposed, preferably in a thin layer, to the action of nitrogen, free from oxygen or readily reducible oxygen compounds, at a temperature at which nascent hydrogen is produced from the hydride and combines with the nitrogen to form ammonia, which is collected, and hydrogen is simultaneously supplied, to re-convert the lower hydride of iron continuously into the higher hydride.—F. SODN.

[Perborate] washing [and bleaching] compounds. J. T. Freestone, and W. and F. Walker, Ltd., Liverpool. Eng. Pat. 24,625, Oct. 30, 1913.

A COMPRESSED tablet coated with wax and containing a perborate which evolves oxygen when added to warm water. Suitable ingredients are soap (35%), sodium carbonate (50), sodium perborate (8), ammonium carbonate (5), and paraffin wax (2%).—F. SODN.

Cream of tartar; Manufacture of —. J. B. Moszczenski, New York. Assignor to Tartar Chemical Co., Jersey City, N.J. U.S. Pat. 1,120,839, Dec. 15, 1914. Date of appl., Jan. 28, 1911.

MATERIAL containing potassium bitartrate is treated at a high temperature with a solution of a salt, e.g., sodium acetate, which increases the solvent action of water for the bitartrate, and the solution is cooled to effect crystallisation.—F. SODN.

Salt; Method and apparatus for mining —. C. S. Bradley, New York. U.S. Pat. 1,121,225, Dec. 15, 1914. Date of appl., Nov. 18, 1913.

SALT solution is circulated from the surface to the salt deposit through pipes, arranged in the form of a heat exchanger, and the solution in the salt deposit is heated by means of steam introduced through a separate bore-hole. Means are provided for cooling the solution at the surface to induce crystallisation of the salt.—F. SODN.

Salt; Production of blocks of —. T. Lichtenberger and G. Kassel. Ger. Pat. 276,666, April 24, 1913. Addition to Ger. Pat. 265,586 (see Eng. Pat. 8903 of 1913; this J., 1913, 867).

ONE of the side walls of the melting furnace does not extend to the base, but rests on a metal

angle plate, the vertical portion of which is in contact with the bath of fused salt. The salt is tapped off through an opening in this plate.—A. S.

Potash; Extraction of — [as nitrate] from salt deposits and saline solutions. M. E. Pichard. Fr. Pat. 471,237, July 4, 1913.

POTASSIUM nitrate is obtained from solutions containing potassium chloride by the action of sodium nitrate at about 0° to 3° C. The theoretical yield is obtained by adding, during the cooling, a quantity of anhydrous sodium sulphate, which withdraws water from the solution and renders the potassium nitrate insoluble.—B. N.

Rare-metal [vanadium] oxides; Process for securing the precipitation of the —. R. S. Davis, Newmire, Colo., Assignor to Primos Chemical Co., Primos, Pa. U.S. Pat. 1,119,929, Dec. 8, 1914. Date of appl., Feb. 19, 1913.

AN acidified and heated solution of a rare metal, such as vanadium, is subjected to pressure, for example, to a pressure of about one ounce above that of the atmosphere.—F. SODN.

Zinc oxide; Continuous process of obtaining —. E. Hunebelle. Fr. Pat. 470,321, June 12, 1913.

IMPURE zinc oxide, industrial zinc residues, etc., are treated with hydrochloric acid, any lead, iron, or metals precipitable by calcium carbonate are separated, and zinc oxide or carbonate is precipitated from the filtrate by the addition of magnesium oxide or carbonate. The filtered solution is concentrated until $\text{MgCl}_2 \cdot 6\text{H}_2\text{O}$ separates, and this is heated first to 250° C., and then in a current of steam to about 600° C., the resulting vapours of hydrochloric acid being condensed, while a residue of pure magnesium oxide is left.—C. A. M.

Nitrogen; Method of fixing — [to form a cyanogen compound]. J. E. Bucher, Coventry, R.I., Assignor to Nitrogen Products Co., Providence, R.I. U.S. Pat. 1,120,682, Dec. 15, 1914. Date of appl., Nov. 7, 1913.

A POROUS mass of briquetted material, containing carbon, an element capable of acting as the base of a cyanogen compound under the prevailing conditions, and another element capable of dissolving carbon, the latter being disposed so as to present an extended catalytic surface, is heated preferably to about 1000° C. throughout a reaction zone, and a current of gas containing free nitrogen is passed through the pores of the material. The formation of gas channels in the reacting material may be prevented by applying pressure to it.—F. SODN.

Nitrogen compounds; [Electrical] production of —. A. Classen. Fr. Pat. 470,916, March 28, 1914. Under Int. Conv., March 29 and 31, June 14, and Oct. 21, 1913.

THE process relates to the direct synthesis of compounds of nitrogen with hydrogen or with oxygen, by submitting mixtures of these gases to the silent electric discharge in the presence of finely-divided contact materials, between 25° and 100° C. The ammonia or nitrogen oxides formed are dissolved in water. The contact material consists of colloidal metals or alloys, containing also metallic oxides, produced by the action of gelatose, glue, albumin, etc., upon metallic salts, and deposited upon asbestos, infusorial earth, sawdust, etc. The apparatus is formed of two concentric non-conducting tubes, between which the gas is passed. The positive terminal is connected to the space between the tubes, whilst the outer tube is placed in water

connected to the negative pole. The contact material, surrounding the inner tube, is enclosed in a fabric, a space being left between the material and the inner wall of the outer tube, and the inner tube may also be provided with a platinum wire which is rendered incandescent for the formation of nitrites; the air inlet tube may be divided into several branches. The inner tube may be of metal and act as an electrode, in which case it is covered with contact material and iron wire gauze; owing to the continuous discharge of sparks in the form of brushes between the gauze and the tube, the latter becomes covered with colloidal metal in a fine state of subdivision, and this acts as the contact material.—B. N.

Nitrogen compounds; Manufacture of—O. Bender. Ger. Pat. 277,435, Jan. 26, 1913.

WATER is delivered continuously to the porous walls of a hermetically-closed generator-furnace. The steam, or its elements, diffuses through the walls into the furnace where the nascent oxygen and hydrogen combine with the nitrogen present in the combustion gases, whereupon the gases are suddenly cooled. The pressure within the furnace is preferably one or several atmospheres above normal, and the air used for combustion may be replaced by a mixture of oxygen and nitrogen in varying proportions according to the product desired. The process is applicable to the production of nitric oxide, ammonium nitrite and nitrate, etc.—A. S.

Marine alga; Treatment of—to extract their constituents [iodine, etc.]. M. P. P. Gloess, L. P. J. and E. R. Darrasse. First Addition, dated Feb. 20, 1914, to Fr. Pat. 470,943, June 27, 1913 (this J., 1914, 920).

MARINE alga are treated with an oxidising agent such as hydrogen peroxide in neutral or acid solution, and the iodine is extracted from the liquid by known means. The salt solution remaining is either evaporated to obtain the mineral salts, or added to the extracted plant residue containing mineral salts, mucilaginous material, cellulose, etc., and evaporated, dried and ground. The residue may be used as a manure. As an alternative, the plants may be treated with an oxidising gas, e.g., ozone or chlorine, and heated to volatilise the iodine, the extracted plant residue being afterwards dried.—B. N.

Hydrogen [from water gas, producer gas, etc.]; Manufacture of—J. L. Buchanan, Bromborough, and E. B. Maxted, Rock Ferry. Eng. Pat. 6476, March 14, 1914.

GASES containing carbon monoxide are passed with steam over heated catalytic material containing a lixiviated alkali ferrite, prepared, for example, by roasting a mixture of sodium carbonate and burnt pyrites at about 1000° C., and lixiviating with hot water to recover the greater portion of the caustic alkali formed.—F. Sobx.

Persulphuric acid and its salts; Manufacture of—Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 470,264, March 30, 1914. Under Int. Conv., April 17 and Sept. 12, 1913.

SEE Ger. Pat. 271,642 and Eng. Pat. 24,931 of 1913; this J., 1914, 481, 749.

Sodium carbonate; Process for producing—M. Spazier, Los Angeles, Cal. U.S. Pat. 1,122,323, Dec. 29, 1914. Date of appl., June 23, 1913.

SEE Eng. Pat. 20,827 of 1913; this J., 1914, 749.

Magnesium perborate; Process of manufacturing—W. Weber, Assignor to Henkel und Co., Dusseldorf, Germany. U.S. Pat. 1,124,081, Jan. 5, 1915. Date of appl., Feb. 9, 1914.

SEE Eng. Pat. 3388 of 1911; this J., 1911, 961.

Chlorides of the alkali metals; Treatment of—to obtain useful products therefrom. J. A. Kendall, London. U.S. Pat. 1,124,143, Jan. 5, 1915. Date of appl., Nov. 22, 1913.

SEE Eng. Pat. 26,896 of 1912; this J., 1914, 22.

Seaweeds; Treatment of—to extract their constituents. M. P. P. Gloess, L. P. J. and E. R. Darrasse. Fr. Pat. 470,943, June 27, 1913.

SEE U.S. Pat. 1,103,283 of 1914; this J., 1914, 920.

Extraction of sulphur and cyanogen from the gases resulting from coal distillation. Fr. Pat. 471,231. See 11A.

Process of recovering alkalis from flue-gases [of cement kilns]. U.S. Pat. 1,121,532. See 1X.

VIII.—GLASS; CERAMICS.

Fireproof bricks, retorts, crucibles, etc. Board of Trade Bulletin.

EXPORTS from Germany in 1912 of fireproof bricks of all kinds (Chamotte, Dinas, bauxite, etc.): (a) rectangular, each weighing less than 5 kilos. net, amounted to £322,900; (b) rectangular, each weighing 5 kilos. or more net, and other than rectangular, without regard to weight, £261,200; other fire-proof products of clay and clayey substances: retorts, £26,500; crucibles, muffles, capsules, tubes, cylinders, and other hollow articles, other than retorts; slabs and other products, except bricks; crucibles of magnesia, cement, or soapstone, £33,100; total, £643,700; from Austria-Hungary (1913)—fire-proof bricks: Dinas, magnesite, bauxite, and graphite bricks, weighing up to 5 kilos. each, £149,300; weighing over 5 kilos. each, £74,500; other, weighing up to 10 kilos. each, £15,800, weighing over 10 kilos. each, £7,000; retorts, crucibles, muffles, capsules, nozzles, brewers' stirring-rods and similar articles for technical purposes of fire-proof material (other than graphite) or common stoneware, £1700; total, £248,300. Similar particulars for the United Kingdom are not available.

The principal markets (mainly European) supplied by Germany, and the amount sent to each market in 1912, were:—Russia (£156,100); France (£135,650); Belgium (£84,400); Italy (£52,000); Netherlands (£39,900); and Switzerland (£28,600). The United Kingdom took from Germany £13,800 worth of these products in 1912.

Austria's exports of fireproof bricks, etc., go principally to Russia (£42,710); France (£23,850); Italy (£17,050), United Kingdom (£16,520), and Belgium (£7430).

The maximum amount of German and Austrian trade in fireproof bricks, retorts, crucibles, etc., which might be diverted to British manufacturers under present circumstances is as follows:—In the United Kingdom market:—German trade (1912): fireproof bricks of all kinds, £8900; other fireproof products of clay, etc.: retorts, £2700; crucibles, muffles, capsules, tubes, cylinders, etc., £2200; Austro-Hungarian trade (1913): fireproof bricks—Dinas, magnesite, bauxite, and graphite bricks, £16,500; retorts, crucibles, muffles, capsules, nozzles, etc., £20. In Colonial and neutral markets:—German trade (1912): fireproof

bricks of all kinds, £518,600; retorts, £22,900; crucibles, muffles, etc., £24,850; Austro-Hungarian trade (1913): fireproof bricks—Dinas, magnesite, bauxite, and graphite bricks, £102,200; other fireproof bricks, £14,650; retorts, crucibles, etc., £220.

PATENTS.

Glasses; Process for the manufacture of a new series of economic — C. Merkl. Fr. Pat. 470,882, March 7, 1914. Under Int. Conv., March 7, 1913.

EASILY fusible glasses of great fluidity are produced by incorporating fluorine compounds in the mixture and by increasing the number and quantity of the earthy and metallic bases. During fusion the materials are kept uncovered and directly exposed to heat rays, and the surface of the fusing mass is extended and its depth diminished by using a capsule-shaped vessel, lined with a resistant material or suitably cooled to minimise the corrosive action of the melt. Double pots, one inside the other, may be used, the inner being of material which is only slightly attacked, and the outer of any suitable material, e.g. metal. Porous glass is obtained by incorporating materials which develop gases or vapours during the fusion process, or by injecting gas or vapour into the melt. Alkali sulphates may be used in place of the carbonates in either coloured or colourless glasses, and volcanic rocks, either alone or mixed with other materials, may be used as raw materials.—W. C. H.

Glass-melting pots; The heating of — [in pot arches]. C. King. Stourbridge. Eng. Pat. 5711, March 6, 1914.

GLASS-MELTING pots are heated in a closed chamber or muffle surrounded by heating flues leading from a furnace situated beneath the muffle.—W. C. H.

Magnesium silicate; Use of hydrated natural — for the manufacture of ceramic ware, tracing chalk, and heat insulators, fired or unfired. I. J. B. Darget. First Addition, dated April 4, 1914, to Fr. Pat. 456,459, June 25, 1912 (this J., 1913, 1011).

THE addition of natural hydrated magnesium silicates to clay gives a light-coloured ceramic body which works well, does not crack or contract, and yields pottery which is only slightly porous and need be glazed only when the articles are to contain liquids.—W. C. H.

Opacifying agents for white enamel; Process of manufacturing — I. Kreidl. Vienna. U.S. Pat. 1,123,760, Jan. 5, 1915. Date of appl., May 29, 1912.

SEE Addition of June 6, 1912, to Fr. Pat. 429,665 of 1911; this J., 1912, 1181.

IX.—BUILDING MATERIALS.

Timber; Report of Committee on specifications for the preservation of treatable — Amer. Wood-preservers' Assoc., Chicago, Jan. 1915. [Advance proof.] 17 pages.

Seasoning.—Practically all woods can be air-seasoned except in low, humid localities. Gum wood requires very favourable conditions and, like beech, should be seasoned only in very open piles and watched very carefully for dry rot; "bluing" of sap pine during seasoning is not necessarily an indication of decay. Hardwood track sleepers should be seasoned for at least 8 (preferably 12) months, yellow pine for 4—6, and hemlock, tamarack, and jack-pine for 12

months; over-seasoning may prove detrimental with some species. For efficient subsequent treatment, air-seasoned wood should not contain more than 20% of moisture, calculated on the oven-dry weight. When artificial seasoning is necessary, the pressure in the steaming process should not exceed 20 lb. per sq. in., nor the temperature of the oil in the boiling process 220° F. (105° C.). *Preservatives.*—With coal-tar creosote, the full-cell treatment (Bethel process), absorbing 20—10 lb. of creosote per cub. ft. according as the wood is subject to attack by marine borers or only to ordinary processes of decay, is recommended for piling and other marine timbers and for permanent structures not subject to mechanical wear but situated in unfavourable localities; and the empty-cell treatment (Rueping and Lowry processes) for track sleepers used under conditions giving a mechanical life of 11—15 years, and for structures of limited life or subject to superficial mechanical wear and exposed mainly to the destructive action of the weather: the depth of penetration should be the same in both treatments, but in the latter the impregnated portion of the wood should retain not less than 5 lb. of preservative per cub. ft. Treatment with zinc chloride is suggested for woods resistant to creosote, and, in dry climates, for track sleepers, etc., having a life of not more than 11 years. This preservative should only be used in cases where the treated timber is to be subject to mechanical wear or to be in contact with water; when employed it should be applied by the standard method known as "Burnettizing," the timber being sufficiently impregnated to ensure the retention of at least $\frac{1}{2}$ lb. (preferably $\frac{3}{4}$ lb.) of the dry salt per cub. ft. In the absence of data showing the value of the combination as compared with the single preservatives, no recommendations are made regarding the use of zinc chloride and creosote in admixture (Card, Allardyce, and Rutger processes). As regards the use of coal tar-creosote mixture, it is stated that refined coal tar (under the restrictions specified by the American Railway Engineers' Assoc.) does not reduce the efficiency of creosote and, in quantities up to 30%, should not be considered an adulterant of the latter.—W. E. F. P.

Coal tar creosote, creosote distillates and individual constituents; Comparative toxicity of — for the marine wood borer, *Xylobrya*. I. F. Shackell. Amer. Wood-preservers' Assoc., Chicago, Jan., 1915. [Advance proof.] 9 pages.

THE toxicity of creosote fractions diminishes with rise of b. pt., the light oils being very toxic even in the extremely small proportions in which they dissolve in sea water. Naphthalene and anthracene are practically non-toxic, but the tar acids are extremely toxic; α -naphthol is many times more poisonous than phenol. The toxicity of creosote and its fractions is reduced by the loss of volatile constituents at ordinary summer temperature. —W. E. F. P.

Wood under treatment; Temperature changes in — G. M. Hunt. Amer. Wood-preservers' Assoc., Chicago, Jan. 1915. [Advance proof.] 15 pages.

SLEEPERS of maple, red oak, loblolly pine, and hemlock, each 8½ ft. long and 6 by 8 in. in cross section, were treated with saturated steam at atmospheric pressure (212° F., 100° C.), and at 20 lb. per sq. in. (259° F., 126° C.), and with creosote at 212° F. (100° C.) and 185° F. (85° C.). The heating was continued until the rise in temperature within the sleeper was not more than 1–8° F. (1° C.) in 10 mins., and in most cases considerably beyond this point; at the close of the

heating period a vacuum of 26 in. was applied for 1 hour. The results obtained are shown in a series of time-temperature curves. The interior temperature of the sleepers did not rise appreciably during the first 30 or 40 mins., and in no case quite attained that of the heating medium, the rate of increase being greatest with steam at 20 lb. pressure, least with creosote at 185° F. (85° C.), slightly greater with steam at 212° F. (100° C.) than with creosote at the same temperature, and apparently independent of the kind of wood. With steam at 20 lb. pressure, the time required for the interior of the sleepers to reach 212° F. (100° C.) varied from 2½ to 5 hrs., average 4½ hrs.; the interior temperature fell very rapidly upon the application of the vacuum. Seasoned sleepers heated more rapidly than green ones, the latter being badly "checked," and the former not seriously affected, by treatment with steam at 20 lb. pressure.—W. E. F. P.

Paring blocks; The bleeding and swelling of [wood]— C. H. Teesdale. Amer. Wood-preserveders' Assoc., Chicago, Jan. 1915. [Advance proof. 26 pages.

BEFORE treatment with preservative, all blocks, air-seasoned or not, should be well steamed so that absorption may be less rapid and more uniform, that a greater pressure may be applied for a longer period, and that seasoned blocks may expand by absorbing moisture and thus become less liable to swell after laying. For the latter reason green is preferable to seasoned material, and treated blocks should not be allowed to become dry before laying. A vacuum treatment is desirable after the steaming period and also after removal of the oil from the impregnating cylinder; if tar mixtures be used, the final vacuum should be followed by steaming to remove carbon and dirt from the surface of the blocks. Swelling is not appreciably decreased by increasing the absorption of oil above 10 lb. per cub. ft., and is only slightly retarded by the use of tar mixtures; bleeding tends to increase when the amount of oil absorbed is more than 10 lb. per cub. ft. In framing specifications for treating blocks, much less consideration should be given to the water-proofing effect of the oil or treatment than to the use of sufficient oil of good grade to penetrate the wood thoroughly by methods that will not cause the blocks to bleed; swelling can be prevented by treating the blocks in the green condition and so laying them that water will not penetrate to the bottom.—W. E. F. P.

PATENTS.

Tiles, roof sheets, and the like; Manufacture of — E. R. Sutcliffe, Leigh, Lancs. Eng. Pat. 22,423, Oct. 4, 1913.

SLABS or sheets made from sand and lime, with which asbestos fibre is incorporated, are subjected to mechanical pressure during the process of induration by treatment with steam.—W. C. II.

Cement [from felspar]; Process of making hydraulic — H. E. Brown, Kingston, N.Y., Assignor to W. R. Warren, New York. U.S. Pat. 1,124,238, Jan. 5, 1915. Date of appl., Nov. 16, 1914.

FELSPAR is fused, under non-reducing conditions, with sufficient calcium chloride to furnish enough chlorine to combine with the potassium, and sufficient calcium carbonate to raise the lime content of the product to 40%–55%. The volatilised potassium salt is collected, and the molten reaction product is treated with one or more salts capable of forming Sorel cement or salts of alkali-forming metals in solution, capable

of increasing the hydraulic properties of the product, to produce hydraulic cement in which the lime content is between 40% and 55%.

—W. C. II.

Alkalis from flue gases [of cement kilns]; Process of recovering — S. B. Newberry, Baybridge, Ohio, Assignor to J. R. Morron, New York. U.S. Pat. 1,121,532, Dec. 15, 1914. Date of appl., Oct. 5, 1911.

FLUE dust is leached with water and the resulting solution passed over an extended surface, in contact with a counter-current of flue gases, so as to concentrate the solution to the crystallisation point by absorption of salts from the gases and by evaporation. The deposited salts are separated from the cooled solution and the mother liquor is again brought in contact with the gases.—F. SODN.

Cement; Slow or semi-slow setting hydraulic — A. C. Vournasos. Fr. Pat. 470,962, April 10, 1914.

"SANTORIN EARTH" is mixed with fat lime to form a slow-setting cement, or with lime and a quick-setting cement to form a semi-slow-setting cement.—W. C. II.

Hydraulic cementing material or cement or plaster; Manufacture of — W. A. Oakley, Bondi, N.S.W. Eng. Pat. 16,243, July 15, 1913.

MATERIAL for cementing sand and the like is prepared by adding hydrochloric acid to magnesium or calcium carbonate or oxide, with which kaolin or clay is mixed, the mass being dried and ground, and mixed with from 1 to 3 parts of magnesium oxide.—W. C. II.

Impregnating wood, etc.; Apparatus for — F. Moll, Berlin-Südende, Germany. U.S. Pat. 1,122,407, Dec. 29, 1914. Date of appl., July 23, 1913.

SEE Fr. Pat. 463,630 of 1913; this J., 1914, 356.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Slag inclusions in molten steel; The alleged solubility of — F. Giolitti and G. Tavanti. Annali Chim. Appl., 1914, 2, 360–366.

SPECIMENS of an acid steel and a basic steel were examined after being suddenly cooled from the fused condition, after annealing, and after slow cooling, respectively. In both cases the appearance, number, and size of the slag inclusions were not appreciably modified by the different treatments, and this result excludes the possibility of the slag being dissolved by the molten steel as affirmed by Ziegler (this J., 1911, 1214). Steinberg (Rev. Mét., May, 1914, Abstracts, 313), in experiments with artificial inclusions of sulphides of iron and manganese, found that inclusions in specimens of steel quenched from the liquid state were many times smaller than in similar specimens annealed after such quenching. This result, entirely at variance with the results obtained by the author in the case of "reaction slags," indicates that the latter are not, as commonly supposed, composed mainly or entirely of manganese sulphide.—A. S.

Tungsten; Analytical examination of [commercial] — II. H. Arnold. Z. anorg. Chem., 1914, 88, 333–340. (See this J., 1914, 924.)

SILICON is determined by converting the tungsten into tungstic acid and evaporating with hydrofluoric acid, using a deep crucible which is covered

whilst expelling the last trace of acid; or, the tungstic acid is fused with 6–8 times its weight of potassium bisulphate, the cooled mass treated with water, tungstic acid dissolved in ammonium carbonate, and the residual silicic acid ignited and evaporated with hydrofluoric acid; or, an alkaline solution of 5 grms. of the tungstic acid is mixed with 7 c.c. of tartaric acid, the mixture acidified with formic or oxalic acid, the solution evaporated to dryness in a platinum dish, and the residue dried at 120° C. for some hours, treated with hot water, and digested on the water-bath, the silica being filtered off, ignited, weighed, and evaporated with hydrofluoric acid. **Phosphorus and arsenic.**—Phosphoric acid is precipitated from the tungstic acid solution with molybdic acid by Finkener's method, in the presence of tartaric acid, the precipitate is dissolved in 2.5% ammonia (see Hinrichsen; this J., 1910, 955), and the boiling solution precipitated by magnesia mixture containing about 5% $MgCl_2$ and 15% NH_4Cl (Jørgensen; Z. anal. Chem., 1906, 45, 273); or, the solution is precipitated first with magnesia mixture, the precipitate dissolved in nitric acid, tartaric acid added, and the solution precipitated by Finkener's method. To determine arsenic when phosphorus is present, about 10 grms. of the tungstic acid is dissolved in 100 c.c. of 20% caustic soda, the solution boiled for half-an-hour, precipitated with boiling magnesia mixture as above, allowed to stand for at least 12 hours, and arsenic separated as the trichloride by distilling with hydrochloric acid and cuprous chloride, the distillation being repeated after treating with alkali (Hilpert and Dieckmann; this J., 1913, 215), unless the proportion of tungsten in the precipitate is small. The arsenic may be weighed as silver arsenate, precipitated in acetic acid solution (Schürmann and Böttcher; Chem.-Zeit., 1913, 37, 49). Phosphorus, in presence of arsenic, is determined by heating the magnesium precipitate (which may be filtered off soon after settling) on the water-bath with bromine-hydrochloric acid, to volatilise the arsenic, and then precipitating by Finkener's method from nitric acid solution. **Sulphur** is determined by precipitating the concentrated tungstate solution with barium chloride in the presence of tartaric acid, adding a few drops of oxalic acid solution or ammonia, if the proportion of sulphur be small, so as to carry down the sulphate with the precipitated barium oxalate or tungstate. After ignition, the precipitate is treated with dilute hydrochloric acid and then with ammonia or caustic soda to extract the co-precipitated tungstate. Finely divided metallic tungsten is best treated by the method of Müller and Diethelm (this J., 1910, 1386), the oxides of sulphur being preferably absorbed by caustic soda and bromine. **Carbon.**—With finely divided metal, the method of Müller and Diethelm (*loc. cit.*) is adopted; but compact pieces are dissolved electrolytically in ammonia (this J., 1914, 924), without an oxidising agent, the current being so regulated that no gas is evolved at the anode; after filtering through asbestos, the carbon is determined by moist combustion with chromic acid.—F. SOPH.

Cerium and cerium alloys; Determination of carbon and phosphorus in —. H. Arnold. Z. anal. Chem., 1914, 53, 678–682. Chem.-Zeit., 1914, 33, Rep., 576.

TOTAL carbon is determined by means of chromic and sulphuric acids according to the method of Corleis, the reaction being moderated by preliminary treatment of the metal with copper sulphate solution. Free carbon is determined by treating the metal with cupric chloride solution, and then adding ferric chloride and hydrochloric

acid and warming on the water-bath until the carbide is completely decomposed. The residue is collected on an asbestos filter and the carbon determined with chromic and sulphuric acids. Phosphorus is determined by precipitating the oxalates of the rare-earth metals from the neutralised nitric acid solution of the metal, evaporating the filtrate, decomposing the oxalic acid therein by means of concentrated nitric acid, and applying the molybdate method.—J. R.

Cobalt; Physical properties of the metal —. H. T. Kalmus and C. Harper. J. Ind. Eng.-Chem., 1915, 7, 6–17.

THE cobalt examined was reduced from the oxide by the method described previously (this J., 1914, 261). The pure metal (Co 99.1–99.9%) resembles nickel in appearance but when electro-deposited and polished it has a slightly bluish cast. The specific gravity, referred to water at 4° C., is 8.7918 at 17° C. for the unannealed metal, 8.8105 at 14.5° C. after annealing, and 8.9253 at 16.5° C. after swaging. The Brinell hardness, determined in a standard Olsen machine, with a load of 3500 lb., was about 124 for cobalt cast in an iron mould, that of nickel cast under similar conditions being about 83 and of cast iron about 102. The presence of 0.06–0.37% C had less effect on the hardness of cobalt than slight variations in heat treatment. If the melting point of nickel be taken as 1452° C. (Burgess and Waltenberg, this J., 1913, 830) pure cobalt melts at 1478° ± 1.1° C. It has a tensile strength of about 34,400 lb. and a compressive strength of about 122,000 lb. per sq. in. as cast, the corresponding figures after annealing being 36,980 lb. and 117,200 lb. per sq. in. respectively. Cast cobalt containing 0.06–0.3% C has a tensile strength of about 61,000 lb. and a compressive strength above 175,000 lb. per sq. in. Both the tensile and compressive strengths are greater than those of pure iron or nickel cast and tested under similar conditions. The reduction of area and elongation are low for pure cobalt, but rise to above 20% in the case of "commercial" cobalt (96.5–99.6% Co) containing carbon and other impurities. Pure cast cobalt can be machined in a lathe and, if the casting be cooled under high pressure, can subsequently be rolled or swaged at 500°–600° C. Commercial cobalt is easily machined and can be rolled or swaged at red heat without any special preliminary treatment. The specific electrical resistance of cobalt wire of high purity is 89.64×10^{-7} ohms per cm. cube, and is largely influenced by the presence of occluded gas, being increased by annealing in an inert gas at low temperatures and diminished by annealing *in vacuo*. The electrical resistance of commercial cobalt is 231×10^{-7} to 103×10^{-7} ohms per cm. cube, and is greatly reduced by annealing *in vacuo*. The specific heat of pure cobalt between 0° and 890° C. is given by the formula: $0.1058 + 0.0000457t + 0.000000066t^2$. The paper is accompanied by 11 photomicrographs.—A. S.

German iron and steel production in 1914. Engineering, Feb. 12, 1915.

THE Union of German Iron and Steel Industries states that the production of pig-iron within the German Customs Union for December, 1914, amounted to 853,881 tons, against 1,611,250 tons for December, 1913, whilst there was an improvement as compared with November, 1914, for which the figure was 788,956 tons. The production of pig-iron per day, since the war began, averaged:—August, 18,925 tons; September, 19,336; October, 23,543; November, 26,299; December, 27,545 tons. The production for December comprised:—Poundry pig, 118,881 tons; Bessemer pig, 8778;

Thomas pig, 512,808; steel, etc., 128,317; puddle, 25,097 tons. The aggregate production of the different brands for the last two years was:—

	1914.	1913.
	Tons.	Tons.
Foundry pig	2,194,527	3,657,326
Bessemer pig	237,988	368,840
Thomas pig	9,289,989	12,193,336
Steel, etc.	1,906,786	2,599,887
Puddle	379,257	489,783
	14,389,547	19,309,172

The reduction in the production was most marked in Lorraine, Luxemburg, Rhineland, and Westphalia, whilst less pronounced in Silesia.

Reduction of ferric sulphate in acid solution by means of cadmium amalgam for titration of iron and free sulphuric acid. Capps and Boies. See VII.

PATENTS.

Magnetic material [iron and steel]; Enhancing the permeability of—E. Wilson, London. Eng. Pats. 194, Jan. 3; 2197, Jan. 27; 5012, Feb. 26; and 5814, March 7, 1914.

THE magnetic properties of iron and steel are improved by protecting the articles from the earth's field whilst they are demagnetised by means of a gradually diminishing alternating magnetising force; cooled from the temperature at which they are non-magnetic; warmed from the temperature of liquid air; or, when it is desired to increase the permeability for large values of flux, subjected to a strong magnetising force. The necessary protection is given by a casing of iron, or by a cage of current-carrying conductors adapted exactly to neutralise the earth's field. As an example of the adaptation of the principle, a wireless telegraph detector is described in which the active part of the core is shielded as mentioned above, and is demagnetised as it enters the shielding box.—T. St.

Magnetic body [alloy of iron, silicon, aluminium, and manganese]; Process for improving the magnetic qualities of a—R. A. Hadfield, Sheffield. England. U.S. Pat. 1,122,385, Dec. 29, 1914. Date of appl., March 21, 1907; renewed May 26, 1911.

AN iron-silicon-aluminium-manganese alloy is heated to a relatively high temperature, below its melting point (e.g., to 900°–1000° C.), and cooled rapidly, so that the changes effected by heating are retained substantially unaltered. The alloy is then reheated to substantially the same temperature as before and cooled slowly.—T. St.

Iron or steel: Production of stains or colours on—for sclerometric purposes. Rudge-Whitworth, Ltd., and H. L. Heathcote, Coventry. Eng. Pat. 910, Jan. 13, 1914.

ARTICLES of hardened steel or iron are placed collectively, after cleaning, in an etching solution for from 10 to 60 seconds, then washed by immersion in hot water, and dried in sawdust or the like. By examining the stains thus produced on the brightened surfaces, any imperfectly hardened articles can be detected. The etching solution is preferably composed of substantially 10 vols. each of industrial methylated spirit and water and 1 vol. of commercial nitric acid of sp. gr. 1.39, but other acids (picric, chromic, sulphuric, sulphurous, or acetic acid) may also be used. The solution is non-inflammable at normal temperatures. To indicate small differ-

ences of hardness it is necessary to restrain the action of the etching fluid; this is conveniently done by adding to the solution as described about 5% of a 1% solution of iodine in industrial methylated spirit.—T. St.

Steel; Alloyed—J. Churchward, Mount Vernon, N.Y., Assignor to Churchward International Steel Co., New York. U.S. Pat. 1,122,861, Dec. 29, 1914. Date of appl., March 18, 1911.

AN alloy composed of steel (with C 0.10 to 1.00%) 92.1, Ni 3.50, Cr 2.00, W 1.00, Mn 0.50, Si 0.25, V 0.35 to 0.75%.—T. St.

Manganese steel; Heat treatment of—W. S. Potter, Pittsburgh, Pa. U.S. Pat. 1,123,093, Dec. 29, 1914. Date of appl., April 17, 1914.

THE steel is heated to a maximum temperature (slightly above 825°–850° C.) not more than 125° C. above the upper limit of the critical range for the re-solution of the constituents which have separated from the mixed crystals. The maximum temperature is maintained until equilibrium is established, and the steel is then rapidly cooled.—T. St.

Steel articles; Manufacture of—H. M. Howe, Bedford Station, N.Y., Assignor to Taylor-Wharton Iron and Steel Co., High Bridge, N.J. U.S. Pat. 1,123,193, Dec. 29, 1914. Date of appl., July 17, 1909; renewed July 9, 1914.

ARTICLES composed of an alloy of manganese, iron, and carbon, and designed to resist wear and shock, are treated to produce an austenitic condition in the interior, and a martensitic condition for a depth of about 1/16 inch on the wearing surface.—T. St.

Converter process. [Manufacture of steel.] O. Thiel. Ger. Pat. 277,764, March 1, 1914.

THE charge in the converter is increased during a blow, so that the bath of iron and slag is maintained at a given height and the pressure conditions kept constant. In this way the output of the converter can be increased, on the average, by more than 30%.—A. S.

Scrap iron; Treatment of tinned and galvanised—scrap zinc, and old tinned and galvanised utensils. W. A. Hills, London. Eng. Pat. 933, Jan. 13, 1914.

TINNED and galvanised scrap iron, etc., is melted in an electric or other suitable furnace in which the requisite high temperature, and a neutral or reducing atmosphere, can be obtained. The non-ferrous metals are volatilised and are either recovered in the metallic form in suitable condensers, or are oxidised and the oxides recovered. The form of condenser preferred is one in which the vapours are mixed with a spray of water or other suitable liquid, created by the rapid revolution of a vertical wheel in a closed vessel. Salts of the metals may be produced by the use of acid and alkali solutions. After the volatile metals have been removed, fluxes are added to the molten bath to produce marketable forms of iron or steel.—T. St.

Alluvial ores and alluvial gold; Apparatus for concentrating—J. F. Lobb, Wood Green, and A. B. L. Williams, Highbury. Eng. Pat. 21,858, Sept. 27, 1913.

AN inclined sluice, pivoted at its upper end and mounted on springs, is given a rapid vertical reciprocating motion by a tappet wheel acting on

a roller placed on the under side near the lower end. Ore and alluvium are washed down the sluice with water, the ore being retained at weirs and in classifiers from which it is discharged without stopping the action. In line with the sluice is a fixed inclined launder provided with a settling well and a ridge for the removal of tailings. At the outlet of the launder and operated by the effluent is a water-wheel which, through suitable gearing, actuates the tappet wheel. When the ore contains gold, mercury baths are provided behind the weirs and suitable riffles.—T. St.

Copper; Apparatus for use in discharging — from refining furnaces. E. John. Landore, Glam. Eng. Pat. 28,575, Dec. 11, 1913.

MOLTEN copper is run from the refining furnace into a forehearth composed of a metal casing lined with firebrick, and thence into moulds below through openings in the bottom of the forehearth controlled by stoppers actuated by levers placed in front. (Reference is directed, in pursuance of Sect. 7. Sub-section 4, of the Patents and Designs Act, 1907, to Eng. Pat. 8314 of 1901).—T. St.

Sulphides; Separation of metallic —. L. Bradford. Broken Hill, N.S.W. Eng. Pat. 19,841 of 1914; date of appl., Sept. 18, 1913. Under Int. Conv., July 19, 1913.

IN the separation by flotation of mixed sulphides, such as blende and galena, a solution of an alkali sulphite or thiosulphate, or sulphurous acid is added to the "wetting medium" to retard the flotation. The tendency of the sulphides which rise to the surface to carry up the other sulphides is thus reduced.—T. St.

Sulphide ores; Separation of mixed —. Minerals Separation and De Bavay's Processes Australia Proprietary, Ltd., Melbourne, Australia. Eng. Pat. 22,145, Nov. 6, 1914. Under Int. Conv., Nov. 13, 1913.

MIXED sulphides are subjected to a flotation separation with agitation and aeration in water to which an alkali permanganate, but no frothing agent, has been added. When mixtures of galena and blende are so treated, a float concentrate relatively rich in galena is obtained.—T. St.

Zinc furnace with integral condenser; Electric —. C. V. and M. Thierry. Paris. U.S. Pats. (A) 1,122,663 and (B) 1,122,664, Dec. 29, 1914. Date of appl., May 21, 1913.

(A) THE furnace is heated by a carbon resistor supported directly above a sump, with its side surfaces partially retained by spaced plates. The ore charge is introduced through vertical tubes into a series of enclosed pockets disposed transversely to the sides of the resistor, and the volatilised products are passed into the resistor, and thence upwards through a series of superimposed filter-chambers filled with carbon, which are wider than and partially supported by the resistor. Liquid zinc is collected in reservoirs on either side, above the plane of the resistor, whilst uncondensed fumes and gas are passed upwards and out into the atmosphere. (B) The carbon resistor is arranged longitudinally in the furnace, and the reaction takes place along one of its vertical sides, the opposite side being connected with a parallel filter-chamber by a number of interposed condenser tubes filled with carbon, so that the volatilised products are passed directly from the resistor into the tubes. The furnace is provided with an open space above the tubes, so that the rate of radiation of heat may be regulated.—B. N.

[Metallic] catalysts; Method of making — [from formates]. W. O. Snelling, Pittsburgh, Pa. U.S. Pat. 1,122,811, Dec. 29, 1914. Date of appl., July 19, 1913.

A POROUS carrier is impregnated with a solution of a metallic formate, e.g., copper formate, and is then heated in an atmosphere of hydrogen to the lowest temperature at which the formate is reduced.—T. St.

Metals; Electrolytic deposition of — from solutions. N. V. Hybinette, Christiania, Norway. U.S. Pat. 1,123,299, Jan. 5, 1915. Date of appl., May 22, 1913.

THE electrolyte, which contains considerable quantities of ferric salts in addition to the metal to be recovered, is circulated through the anode chamber, but circulation from the anode to the cathode chamber is prevented by a permeable partition. The metal to be recovered, having a greater rate of diffusion than the ferric salt, passes into the cathode chamber and is deposited on the cathode.—B. N.

Tin; Electrolytic refining of — applicable to any conducting material containing tin. G. Michaud and E. Delasson. Third Addition, dated March 26, 1914, to Fr. Pat. 435,936, Nov. 4, 1911 (this J., 1912, 395, and 1913, 240).

THE anodes, consisting of movable baskets of conducting material carrying the tin-plate scrap, are immersed in the electrolyte between two cathodes, formed of perforated plates of copper. Each plate is supported between two movable scrapers, which cause the tin to fall to the bottom of the vat, where it is gathered up by scrapers mounted on an endless chain and removed from the bath.—B. N.

Electrolytic cell. H. Bittner. Fr. Pat. 471,078, April 17, 1914.

THE cell may be employed for the electro-deposition of all metals, but more particularly for the electrolytic recovery of tin from tin-plate scrap. A continuous circulation is maintained from the lower part of each cathode to the upper portion of the corresponding anode, in the opposite direction to the migration of the cathode ions. The circulation is maintained by means of a pump, or a thermo-siphon heated by suitable burners, according to whether a cold or hot bath is used. The cathodes are burnished continuously by means of glass balls or tubes, of slightly higher density than the electrolyte, these being disposed around the cathode and given an ascending and descending movement by means of a current of gas at a convenient pressure in the cathode chamber, or by the electrolytic gas. A cathode with sloping surfaces may be used, against which are disposed glass rubbing tubes. When copper is used for the cathode, it is first treated with iodine vapour, whereby whilst the electrical conductivity of the plate is maintained, the adherence of metallic deposits is prevented.—B. N.

Metals; Precipitating — from solutions. L. D. Mills, Johannesburg, South Africa, Assignor to Merrill Metallurgical Co. U.S. Pat. 1,123,778, Jan. 5, 1915. Date of appl., May 14, 1913.

A HOMOGENEOUS mixture of the metal-bearing solution and a mobile precipitant is maintained at the surface of a filter medium through which the solution is drawn, whereby the solid matter is deposited as a homogeneous and uniformly permeable layer. The heavier settled particles of the precipitant and precipitate are collected, and the mixture containing these heavier particles is circulated near to the filter medium.—T. St.

Ores; Nodulising —. N. S. Borch, Copenhagen, Denmark. U.S. Pat. 1,123,672, Jan. 5, 1915. Date of appl., May 7, 1913.

THE ore, mixed with carbonaceous material, is passed through a rotary kiln, in the first part of which the charge is heated in a reducing atmosphere nearly to the sintering temperature. The mass is then subjected to an oxidising action, whereby the temperature is raised suddenly through the degree required for nodulisation without a corresponding rise in the temperature of the wall of the kiln.—T. St.

Roasting furnaces; Rabblers for mechanical —. O. Spinzig and W. Hommel. First Addition, dated April 7, 1914, to Fr. Pat. 460,127, July 3, 1913. Under Int. Conv., April 9, 1913.

THE rabble is provided with two rows of blades or scrapers so arranged that, during operation, those in one row move the material into the zone traversed by the next row. The material is thus moved progressively across the hearth and prevented from accumulating at the sides.

—W. E. F. P.

Calamine and other carbonate ores; Process and furnace for calcining finely divided —. A. Mercier-Pageyrat. Fr. Pat. 470,204, June 9, 1913.

A MIXTURE of the ore with sufficient coal to effect complete calcination is treated in a bucket-shaped furnace, mounted on trunnions, and having a perforated false bottom or grate below which is an air-pressure chamber. A small quantity of ignited fuel is placed on the grate, charging commenced, and the blast started, the latter being gradually increased until, when charging is finished, a pressure of about 12 cm. of water is attained.

—W. E. F. P.

[Bearing metal] alloy. E. Flügel. Fr. Pat. 470,693, April 8, 1914.

AN alloy (bearing metal), prepared from brass or bronze of known composition, and containing Zn 34, Al 5, Sn 5, and Pb 3%, the permissible variation being 10% for each constituent.

—W. E. F. P.

Tungsten and its alloys; Manufacture of wires of —. K. R. R. Siefert. Fr. Pat. 471,116, April 18, 1914. Under Int. Conv., April 21 and July 30, 1913.

SEE U.S. Pat. 1,103,382 of 1914 (this J., 1914, 870). The bar of compressed metallic powder is heated to the sintering temperature (minimum, 900° C.) by means of two electrodes situated at opposite sides of the die and forming the holders or clamps between which the metal is stretched.—W. E. F. P.

Metals; Process for obtaining oxidisable —. A. Zavelberg. Ger. Pat. 277,679, Aug. 5, 1913. Addition to Ger. Pat. 226,257.

THE process described in the chief patent (this J., 1910, 1460) is divided into two stages, about 55% of the metal being recovered in the first stage and the hot charge then transferred to a second chamber or shaft in which the reaction is completed. By working in this manner, wider shafts and larger charges can be used.—A. S.

Steel; Manufacture of —. W. R. Walker, New York. Re-issue No. 13,861, Jan. 5, 1915, of U.S. Pat. 1,014,125. Date of appl., Oct. 9, 1914. SEE this J., 1912, 192.

Ingot-iron and the like; Process for improving the properties of —. H. Goldschmidt and H. Biewend, Essen on the Ruhr, Germany. Assignors to Goldschmidt Thiermit Co., New York. U.S. Pat. 1,122,272, Dec. 29, 1914. Date of appl., May 31, 1912.

SEE Fr. Pat. 443,652 of 1912; this J., 1912, 993.

Ferro-chromium; Process of manufacturing —. H. Goldschmidt and O. Weil, Essen-on-the-Ruhr, Germany. Assignors to Goldschmidt Thiermit Co., New York. U.S. Pat. 1,122,907, Dec. 29, 1914. Date of appl., May 22, 1913.

SEE Addition of April 26, 1913, to Fr. Pat. 453,205 of 1913; this J., 1913, 1072.

Sulphides; Separation of metallic —. L. Bradford, Broken Hill, N.S.W. Eng. Pat. 21,104, Sept. 18, 1913. Under Int. Conv., Sept. 19, 1912.

SEE Fr. Pat. 462,580 of 1913; this J., 1914, 319.

Metals, such as copper or iron, or coal, or fabrics made of organic materials; Treatment of —. J. A. McLarty, Toronto, Canada. Eng. Pat. 25,013, Nov. 3, 1913. Under Int. Conv., Nov. 20, 1912.

SEE U.S. Pat. 1,079,787 of 1913; this J., 1914, 31. The process may also be applied to coal and to fabrics.

Zinc from zinc-coated material; Process of removing —. J. Weber, Essen on the Ruhr, Germany, Assignor to Goldschmidt Detinning Co., New York. U.S. Pat. 1,122,340, Dec. 29, 1914. Date of appl., June 25, 1910.

SEE Fr. Pat. 415,856 of 1910; this J., 1910, 1316.

Copper from ores; Process of extracting —. N. V. Hyybinette, Christiania, Norway. U.S. Pat. 1,122,759, Dec. 29, 1914. Date of appl., May 22, 1913.

SEE Eng. Pat. 22,715 of 1913; this J., 1914, 359.

Iron and nickel; Separation of — from copper in the treatment of cupriferos sulphide ores and metallurgical products (matres). V. von Hartogensis. Fr. Pat. 470,404, April 1, 1914. Under Int. Conv., July 31, 1913.

SEE Ger. Pat. 271,595 of 1913; this J., 1914, 488.

Tin or tin compounds; Production of — from pyritic or other tin ores, tin-ore concentrates, tin waste, tin-plate waste, stanniferous slag, tin-slag and the like. J. Rueb, The Hague. U.S. Pat. 1,124,174, Jan. 5, 1915. Date of appl., Jan. 2, 1913.

SEE Eng. Pat. 27,148 of 1912; this J., 1913, 795.

Tungsten; Treatment of — [to render it ductile]. C. Gladitz. Fr. Pat. 470,651, April 8, 1914.

SEE Eng. Pat. 12,421 of 1913; this J., 1914, 793.

Alloy of nickel and copper; Hard —. P. J. A. Douglass. Fr. Pat. 470,659, April 8, 1914. Under Int. Conv., April 9, 1913.

SEE Eng. Pat. 8331 of 1913; this J., 1914, 87.

Process for agglomerating and sintering materials of all kinds by flameless surface combustion. Ger. Pat. 277,854. See I.

XI.—ELECTRO-CHEMISTRY.

Hermann's phenomenon. [Production of free acid or alkali on passing an electric current between solutions of a neutral salt of different concentrations.] G. S. Walpole. Roy. Soc. Proc., 1915, A 91, 134—147.

HERMANN (Göttinger Nachrichten, 1887) noticed that when an electric current passed from a dilute to a more concentrated aqueous solution of the same neutral salt, acid was liberated at the boundary layer between the two fluids, and that when the current was reversed, alkali was liberated at the same place. In general, alkali is liberated if a

current passes from a better to a worse conducting solution, and acid is liberated if a current passes in the opposite direction. The amounts may be calculated from the potential gradients in the solutions on each side of the boundary, the time for which the difference of potential is maintained, the resistance constant of the vessel employed, the dissociation constant of water, and the known migration velocities of hydrogen and hydroxyl ions.—O. R.

Electrical conductivity of certain electrolytes in organic solvents. Pearce. See VII.

Electrolytic separation of zinc, copper, and iron from arsenic. Balls and McDonnell. See XXIII.

PATENTS.

Insulating material. F. Bölling, Oberursel, Assignor to "Prometheus" Fabrik Elektrischer Koch- und Heizapparate Ges. m. b. H., Frankfurt on Maine, Germany. U.S. Pat. 1,123,985, Jan. 5, 1915. Date of appl., May 31, 1913.

See Eng. Pat. 21,445 of 1912; this J., 1913, 290.

[*Electrical*] *production of compounds of nitrogen.* Fr. Pat. 470,916. See VII.

Enhancing the permeability of magnetic material [iron and steel]. Eng. Pats. 194,2197, 5012, and 5844 of 1914. See X.

XII.—FATS; OILS; WAXES.

Sesamé oil in olive oil; Pharmacopœia test for —. C. E. Sage. Pharm. J., 1915, 94, 128.

CERTAIN pure Tunisian and Spanish olive oils give a coloration in the Baudouin test indicating the presence of 1 to 5% of sesamé oil, and would therefore be condemned by the new B.P. Villavecchia and Fabri's modification of the test (shaking the oil with HCl and one drop of 1% furfural solution) will distinguish between such genuine olive oils (pink layer changing to lilac in an hour) and those adulterated with sesamé oil (pink colour persisting for an hour).—C. A. M.

Fats; Action of hydrazine hydrate on —. P. Falciola and A. Mannino. Annali Chim. Appl., 1914, 2, 351—356.

By the action of hydrazine hydrate on olive oil, a nitrogenous substance was produced, which was separated by extraction with alcohol, and after two crystallisations from this solvent melted at 110°—112° C. and solidified at 105° C. The solubility in 95% alcohol was 0.5% at 30° C. and 1.6% at 50° C. The substance was nearly insoluble in ether and in cold petroleum spirit, carbon bisulphide, and chloroform; slightly soluble in hot chloroform, and soluble in hot benzene and acetic acid. It was more soluble in acetone than in alcohol, but the white crystals which separated from the solution melted at 65°—67° C. Similar white or light-coloured products of high melting point were obtained from tung, linseed, cod-liver, arachis, walnut, chrysalis, castor, bone, and henbane seed oils and from tallow. They may be used alone or mixed with naphthalene or anthracene for the manufacture of candles. By the action of excess of 90% hydrazine hydrate on triolein, a white substance was obtained of m. pt. 110°—112° C., containing C 74.32—74.47, H 13.56—13.64, and N 9.03—9.07%. When recrystallised from acetone it gave a substance of m. pt. about 76° C., but this when again recrystallised from alcohol gave a product melting at 106°—108° C. Tristearin and hydrazine

hydrate gave a substance, m. pt. 112° C., containing C 73.1, H 13.4, and N 9.1%, and tripalmitin gave a substance melting at 108°—109° C.

—A. S.

Kapok oil; Detection of —. A. A. Besson. Chem.-Zeit., 1914, 38, 982.

THE red coloration produced by kapok oil with Halphen's reagent is about twenty times more intense than that given by cottonseed oil; the presence of 0.05% of kapok oil in other oils may be detected by this test. Kapok oil may be differentiated from cottonseed oil by shaking a solution of the oil in chloroform with a 2% solution of silver nitrate in absolute alcohol; kapok oil almost immediately gives a coffee-brown coloration whilst cottonseed oil yields a yellow coloration only after a few hours: 1% of kapok oil may be detected in cottonseed oil, and 0.25% in olive, sesamé, and earthnut (arachis) oils by this test. The fatty acids of kapok oil readily yield anhydrides (lactones) when boiled with water (see this J., 1902, 1336; 1903, 306); whilst the saponification value of the oil may be found to be 196, the fatty acids may show an acid value of only 135.

—W. P. S.

Fatty acids; Influence of hydroxy-acids and lactones upon determinations of the chemical constants of —. C. A. Browne. J. Ind. Eng. Chem., 1915, 7, 30—34.

THE effect of lactone-forming hydroxy-acids (especially γ -hydroxy-acids) on the determination of the chemical characters of fatty acids is discussed. When the mixed fatty acids contain lactones, as shown by a difference between the neutralisation and saponification values (Tortelli and Pergami, this J., 1902, 1187; Lewkowitsch, "Oils, Fats, and Waxes," 4th Ed., Vol. 1, 419—421), the mean molecular weight (m) of the original lactone-free acids is given by the formula:
$$m = \frac{56108 + 18.016(s-a)}{s}$$
 where a is the neutralisation value and s the saponification value of the mixed acids. In regard to the acetyl value, the view is expressed that since lactones are formed from pre-existing hydroxy-acids, the acetyl value of Benedikt and Ulzer, i.e., the ester value of the acetylated acids, is a truer measure of the original hydroxyl content of fatty acids than the acetyl value of Lewkowitsch, i.e., the mgrms. of potassium hydroxide necessary to saponify the combined acetyl in the acetylated acids. γ -Hydroxystearic acid, for example, can be acetylated when combined as a glyceride, but the separated acid would show no acetyl value on account of the formation of stearylactone. The true original acetyl value, referred to the acetylated hydroxy-acids before lactone formation, may be calculated from the acetyl value determined on a mixture of fatty acids containing lactones by the formula:

$$1 + 0.00107(\epsilon - \xi)$$
 where ϵ is the observed acetyl ester value (Benedikt-Ulzer) and ξ the acetyl value (Lewkowitsch). The formation of small quantities of acid anhydrides or lactones and the slight acetylation of pre-existing lactones are mentioned as possible causes of irregularities in the normal process of acetylation, and a combination of the Benedikt-Ulzer and Lewkowitsch methods of determining the acetyl value is recommended as throwing most light on the chemical changes which take place in insoluble fatty acids as a result of oxidation.—A. S.

Spermaceti; Solidifying and melting points of —. R. Meldrum. Chem. News, 1915, 111, 37—39.

By Dalican's method spermaceti showed the same solidif. pt. (15.75° C., with a rise of 0.05° C.)

after being repeatedly melted and re-melted, and rapidly or slowly cooled, and no differences were observed by varying the method of stirring or the use of tubes of different diameter (1½ in. to ¾ in.). Apparently the rate of crystallisation, change of viscosity, and rapid changes in density had no determining influence, the lowest (stationary) temperature depending on the solidified layers of the wax increasing the non-conductivity of the wall of the tube. The critical point at which opacity began on cooling and ceased on heating ranged from 45.8° to 45.9° C. The m. pt. of the wax by the thermometer bulb method was 45.3° to 45.5° C. and by the open capillary tube method 45.1° to 45.1° C., whilst the closed capillary tube method gave 45.9° to 46.0° C., and the opacity method 46.0° to 46.4° C. The presence of impurities (0.1% water, glycerin, or oleic acid) had no effect on the m. pt. or solidif. pt. The addition of 20% sperm oil lowered the m. pt. by 1.65° C., and the results were not affected by repeated melting and cooling, or by heating the mixture for a long time above its m. pt. With mixtures containing 95% sperm oil no solidif. pt. was observed on cooling to 14.5° C., but the opacity method gave the m. pt. as 23° C. and solidif. pt. as 26.5° C. In the case of such extreme dilutions no stationary point can be observed, and this accounts for discordant results obtained with mixtures of low m. pt.—C. A. M.

Fat analysis: Proposed uniformity in methods of — [for the leather industry]. W. Fahrion. J. Amer. Chem. Assoc., 1915, 10, 7—18.

A REPORT of the work of a commission appointed by the Internat. Assoc. of Leather Trades Chemists to study analytical methods for oils and fats used in the leather industry. Each member received samples of nine oils. The concordance in results was not so good as was expected. The acid values agreed well except in the case of cod oils, which after during keeping. Mixtures of alcohol and petroleum ether, and alcohol and ether, were tried as solvents, using either aqueous or alcoholic alkali for titration. The results were the same as with the usual method. The author recommends titrating 5 grms. of oil in alcohol with N/5 or N/2 alkali. Saponification values are greater the longer the boiling, and the larger the quantity of water in the alkali. The author recommends using at least 3 grms. of oil, and alkali containing less than 10% water, and claims that saponification is complete with five minutes' boiling after a clear solution is obtained. Iodine values by the Hübl, Wijs, and Hanus methods were reported. Results by the Wijs method were in excellent agreement, whilst the Hübl results showed differences up to 26. The author recommends the abandonment of the Hübl method. The values by the Hanus method lie between the results given by the other two methods. In the determination of unsaponifiable matter the author washes the solution of soap in petroleum ether with 50% alcohol, which does not dissociate the soap. Unsaponifiable matter from fish oils should not be dried above 100° C. The results obtained in the analysis of dégras show good concordance.—F. C. T.

Soaps. Board of Trade Bulletin No. 20.

THE exports of soap from Germany in 1912 were: common soft soaps, oils and liquid greases (for cleansing), Turkey red oil, creoline and similar cleansing, etc., materials, liquid soap substitutes, £117,200 (£8800 to the United Kingdom); hard soap, creoline and similar cleansing and polishing materials, greasy lye-meal, soap substitutes not included under the following heading, £32,400 (£8,000 to the United Kingdom); soaps, etc., shaped for use or in boxes, bottles, etc., liquid soap other than that specified above, soap powder,

soap in leaves (soap-paper), soap substitutes not otherwise specified, moulded soap wares, £301,600 (£23,300 to the United Kingdom); total, £451,200. From Austria-Hungary (1913): Turkey red oil, £1500; other common soaps, £14,300; fine soaps, i.e., scented soaps or soaps in tablets, balls, boxes, jars, £92,400 (£1100 to the United Kingdom); total, £108,200. From the United Kingdom (1913): soft soap, £31,400; household and laundry soap in bars or tablets, £1,598,500; polishing and scouring soap, £14,000; soap powder, £28,000; toilet soap, £112,500; unenumerated soap (including cotton-seed oil soap), £8,300; total, £2,092,700.

As regards household and laundry soap the exports from the United Kingdom are already so large that it would seem that there is little to be gained in this line, but there is scope for increasing the exports of the finer kinds of soaps. The exports of this class of soaps from Germany and Austria-Hungary in a recent year were: from Germany (1912): soaps shaped for use, etc., soap powder, moulded soap wares, etc., Australia, £12,000; China, £12,400; Japan, £10,200; Turkey, £5000; Dutch East Indies, £37,500; Argentina, £14,100; Brazil, £5100; United States, £7000; from Austria-Hungary (1913): fine soaps, India, £23,000; Bulgaria, £3000; Italy, £1500; Roumania, £1100; Turkey in Europe, £7700; Turkey in Asia, £3400; China, £18,000; Japan, £2600; Egypt, £5100; U.S.A., £900.

Candles. Board of Trade Bulletin No. 89.

THE total value of candles of all kinds exported from Germany in 1912 was £56,600; from Austria-Hungary (1913), £11,060; and from United Kingdom (1913), £435,000. The exports of the three countries to the principal Colonial and neutral markets reached the following amounts: Germany, £43,600 in 1912; Austria-Hungary, £10,095 in 1913; and the United Kingdom £95,415 in 1913. The United Kingdom holds a particularly strong position in the Argentine, South African, Canadian, Portuguese, Chinese, Chilean, and Colombian markets. Germany, however, does the bulk of the trade with Denmark, Switzerland, Russia, Mexico and Brazil, while the German competition is much in evidence in Norway, Netherlands, Spain, Italy, Turkey, Egypt, United States, and Cuba. Austrian competition is chiefly confined to the Balkan States, Russia, Turkey, and Egypt, and in these latter markets the share of the United Kingdom in this trade leaves considerable room for expansion. It would appear that the maximum value of the export trade in candles to the markets specified which might be diverted to British manufacturers from their German and Austro-Hungarian rivals was:—German trade (1912), £43,600; Austro-Hungarian trade (1913), £10,095.

Report on the work of the Kautschuk-Zentralstelle. April 1913—April 1914. [Manihot seed and kapok seed oils.] Frank and Markwald. See XIV.

Determination of unsaponifiable matter, applicable to ether extracts, fats, oils, and waxes. Rather. See XIXa.

Lubricating oils and greases. Board of Trade Bulletin. See IIa.

PATENTS.

Oils: Method of and apparatus for deodorising—and distilling and vaporising liquids. J. T. Bateman. London. Eng. Pat. 367, Jan. 6, 1914.

THE oil is heated in a tubular heater, and then conveyed to a deodorising vessel, which may form one of a series of superposed chambers, each of

which contains a perforated, dome-shaped diaphragm. The oil flows downwards through gutters coiled around the diaphragm, and superheated steam, admitted beneath the dome, escapes through perforations directly into the gutters, thus ensuring intimate contact with the oil. The steam is then deflected to the bottom by a dome-shaped cover surrounding the diaphragm, and rises outside the cover and passes beneath the diaphragm of the chamber next above, and so on, until it escapes from the top chamber, carrying with it the volatilised fatty acids and aldehydes. Thence it passes through a chamber containing a turbine or the like with curved vanes, to separate any oil spray, and afterwards through the tubular heater to heat the incoming oil. The deodorised oil is drawn off from the bottom chamber and cooled. —C. A. M.

Grease; Apparatus for purifying waste —. G. E. Thomas, Swansea, G. L. Evans, Lampeter, and T. A. Goskar, Swansea. Eng. Pat. 3422, Feb. 10, 1914.

WASTE "hot-neck" grease is melted in an open vessel, and, after separation of heavier impurities, is passed, at a higher temperature and under pressure, in a thin uniform stream over a magnet, which may be provided with means for automatic cleaning. It is then cooled while still under pressure and forced into receptacles at atmospheric pressure. If necessary, the grease is thinned with a suitable solvent, which is subsequently distilled and condensed. —C. A. M.

Unsaturated fatty acids and their glycerides; Process for the catalytic hydrogenation of —. C. und G. Müller Speisefettfabrik A.-G. Fr. Pat. 470,364, March 28, 1914. Under Int. Conv., June 20 and Sept. 29, 1913.

A CATALYST consisting of a nickel salt of an inorganic acid not volatile at the temperature of hydrogenation (e.g. nickel borate or silicate) is mixed with the fatty acids, etc., and the mixture heated in a current of hydrogen. The nickel salts are preferably heated in a current of hydrogen before use. —C. A. M.

Unsaturated oils and fats; Hydrogenation of liquid or liquefied substances and especially — and their rapid transformation into hard saturated products. J. David. Fr. Pat. 470,392, June 14, 1913.

HYDROGEN under pressure is forced into the lower part of the first of a series of connected cylinders containing the mixture of melted fat and catalytic agent. The fat is thus intermittently projected upwards and falls from depending plates, preferably of nickel, into the current of gas, whilst a hot-air jacket maintains the temperature at 150°–200° C. The hydrogen passes through several of the cylinders before being returned to the gas-holder to be purified, compressed, and used again. —C. A. M.

Lubricating and like oils and fats; Process and apparatus for purifying used —. L. J. Noel, Eprenay, France. Eng. Pat. 4428, Feb. 20, 1914. Under Int. Conv., May 19, 1913.

SEE Fr. Pat. 458,049 of 1913; this J., 1913, 1021.

Ozone; Treatment of liquids, oils, and melted fats with nascent —. Soc. Electricité et Ozone. Fr. Pat. 470,316, March 30, 1914. Under Int. Conv., April 10, 1913.

SEE Ger. Pat. 273,935 of 1913; this J., 1914, 798.

Process for effecting catalytic reactions [hydrogenation]. Fr. Pat. 471,108. See I.

[*Perborate*] *washing [and bleaching] compounds.* Eng. Pat. 24,625. See VII.

Method of making [metallic] catalysts [from formales]. U.S. Pat. 1,122,811. See X.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Linoleum and oilcloth. Board of Trade Bulletin.

EXPORTS of linoleum and oilcloth from Germany during 1912 were as follows: oil-cloth, £109,650; tissues coated with celluloid, etc. (pegamoid, etc.), £10,900; floor coverings of linoleum or similar materials: (a) made from a monochrome mass, not printed, £165,800, printed, £65,250; (b) made from a mass of more than one colour, £385,050; wall hangings, linocrusta, etc., of linoleum or similar substances, £21,650; total, £785,300; from Austria-Hungary (1913): floor coverings of oilcloth, linoleum, kamptulicon, and similar compositions, £20,070; oilcloth, not specially mentioned, also waxed muslins and waxed taffeta, and goods in the piece with designs for cutting into lengths, £76,440; total, £96,510; from the United Kingdom (1913): oilcloth for floor coverings, £1,870,000; oilcloth for furniture coverings, £666,000; oilcloth for all other purposes, £96,300; total, £2,632,300.

The largest markets to which Germany exports linoleum and oilcloth are Scandinavia (£135,650) and United States (£108,600), whilst large exports are sent to South America, France, United Kingdom, and Japan.

The exports of oilcloth, etc., from Austria-Hungary are much smaller than those from Germany, and go largely to South-Eastern Europe and the Levant, whilst other principal markets are the United Kingdom, Argentina, and Sweden.

The exports of oilcloth from the United Kingdom to the principal German and Austrian markets are three times as large as the combined exports from these two countries. At the same time, an opportunity is now afforded for British exporters of this commodity to extend their business in several markets, notably in the case of Scandinavia, South America, Japan, and the United States—whilst the £53,220 worth of linoleum and oilcloth formerly purchased from Germany and Austria-Hungary by the United Kingdom should be replaced by British-made goods.

PATENTS.

[*Lead oxide*] *pigments; Process of making* —. C. D. Holley, St. Louis, Mo., Assignor to Acme White Lead and Color Works, Detroit, Mich. U.S. Pat. 1,123,743, Jan. 5, 1915. Date of appl., Oct. 25, 1910.

FINELY-DIVIDED lead is moistened with water containing nitric acid equal in amount to about 1% of the weight of lead, and the mass is allowed to undergo spontaneous oxidation by air to form hydrated oxides, which are afterwards heated to obtain an oxide—litharge, massicot, or red lead. —E. W. L.

Films of oil or oil paint; Preparation of —. Oel- und Farbfilm A.-G. Fr. Pat. 471,158, Apr. 20, 1914. Under Int. Conv., Dec. 9, 1913.

THICK, lightly-sized paper is coated on one side with varnish and on the other with an alkaline solution (e.g. water-glass). The drying oil or paint is applied to the alkaline surface, and the film, when dry, can be readily detached and transferred to any other surface, where it will adhere without the addition of an adhesive agent. —C. A. M.

Condensation products of formaldehyde and phenol with coal tar, turpentine, and other organic substances; Hard —. K. Tarassoff. Fr. Pat. 470,810, Apr. 11, 1914.

THE condensation is effected in the presence of "sulpho-aromatic fatty acids" or of sulphonated fats or fatty acids, or of sulphonic acids obtained by the sulphonation of petroleum, petroleum distillates, or other hydrocarbon oils. In presence of the sulphonated derivatives mentioned, homogeneous, hard condensation products can be obtained from mixtures of such substances as coal tar, wood tar, turpentine, fatty oils, etc., with phenol and formaldehyde. (See also Eng. Pat. 528 of 1914; this J., 1914, 557.)—C. A. M.

Lacquers containing cellulose derivatives; Manufacture of —. F. Lehmann. Fr. Pat. 471,104, Apr. 18, 1914. Under Int. Conv., Apr. 21, 1913.

CELLULOSE esters are dissolved in appropriate solvents containing a solution of coumarone resin (see Fr. Pat. 469,925; this J., 1915, 25) and the mixture is diluted with alcohol, benzene, petroleum spirit, etc.—J. F. B.

Lacquers and varnishes from paracoumarone and para-indene; Manufacture of —. R. Lender. Ger. Pat. 277,605, Feb. 8, 1913.

PARACOUMARONE or para-indene, or a mixture of the two, with or without addition of an animal or vegetable oil, is heated with sulphur or sulphur chloride at atmospheric or higher pressure, and the product is dissolved in a volatile solvent.—A. S.

Pigments; New — and products for the manufacture of the same. Badische Anilin und Soda Fabrik. Fr. Pat. 470,682, April 8, 1914. Under Int. Conv., May 17, 1913.

SEE Eng. Pat. 20,106 of 1913; this J., 1914, 652.

Process of obtaining zinc oxide. Fr. Pat. 470,321. See VII.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Rubber; Diffusion of carbon dioxide through —. V. Rodt. Chem.-Zeit., 1914, 38, 1219—1251.

A VULCANISED rubber tube, filled with carbon dioxide and closed at both ends, will collapse, owing to the escape of the gas through the rubber, in a comparatively short time (say 12—21 hours), and the collapse is hastened very much by immersing the tube in water. If, however, the dry tube is filled with dry carbon dioxide, and kept in a dry atmosphere (over phosphorus pentoxide), no collapse takes place in a month, although little carbon dioxide remains in the tube at the end of that time. Carbon dioxide is not absorbed by vulcanised india-rubber to any appreciable extent even in a moist atmosphere. A sample of rubber thread left in an atmosphere of moist carbon dioxide for 25 days showed an increase in weight of 6.3%, of which 6.12% was due to water, and only 0.08% to carbon dioxide. The rapid diffusion of carbon dioxide through a rubber septum is attributed to the relatively high solubility of the gas in water, combined with the "hygroscopic" nature of rubber. A solution of the gas in the absorbed water is formed on the inner side of the septum, and this, diffusing to the outer side—the region of lower concentration of carbon dioxide—through the pores of the rubber, yields up its carbon dioxide to the air.—E. W. L.

Kautschuk-Zentralstelle; Report on the work of the — for the year April 1913—April 1914. F. Frank and E. Marckwald. Chem.-Zeit., 1914, 38, Rep., 587.

THE nitrogenous substance in raw rubber and in the latex is a true protein, showing all the characteristic reactions, and yielding, on complete hydrolysis, monoaminoacids, aromatic and heterocyclic aminoacids, diaminomono-carboxylic acids and, almost certainly, monoaminodicarboxylic acids and cystin. The fruits of the baobab tree were found to contain considerable quantities of malic acid and of pectin. *Manihot* seed yielded husks, 55, and kernels, 45%; the kernels yielded about 55% of a drying oil, free from injurious bitter principles, suitable for varnish making and probably also as an edible oil. *Kapok-seed oil* (see this J., 1913, 874, 917) appears to be suitable for soap and factice manufacture, and might also replace cottonseed oil in food products; the oil-cake would probably be a useful fodder. The manuring of rubber trees has so far had no effect upon the quality of the rubber, but has increased the girth and yield of the trees. A further warning is given against the use of vegetable juices for coagulating *Manihot* rubber, and growers are again advised not to wash their rubber before shipment. A "blue rubber" from the Cameroon was improved in colour and freed from mould by the use of "Purub" (hydrofluoric acid). A *Ficus* rubber from New Guinea, otherwise normal, contained an exceptionally low percentage (4.1) of resins.—E. W. L.

Rubber wares (other than machinery belting, tyres for cycles, motor cycles and motor cars, and toys). Board of Trade Bulletin No. 81.

THE value of rubber wares (other than machinery belting, tyres for cycles, motor cycles and motor cars, and toys) exported in a recent year was: from Germany in 1912, £3,679,300; from Austria-Hungary (1913), £418,150; and from the United Kingdom (1913), £2,948,900.

The German exports to Austria-Hungary and United Kingdom (1912) amounted to £1,139,150; Austro-Hungarian exports to Germany and United Kingdom (1913), £139,240; and United Kingdom exports to Germany and Austria-Hungary (1913), £248,400.

The value of rubber goods exported from each of these countries to markets common to each was: from Germany (1912), £2,540,150; from Austria-Hungary (1913), £278,910; from United Kingdom (1913), £2,700,500.

The rubber wares included in the exports from Germany (1912) were: rubber solution, £14,100; soft rubber paste; rolled sheets of the same; cuttings and strips of rubber, unmanufactured; gutta-percha paper, £172,200; cut sheets (patent sheets) of rubber, not vulcanised, unmanufactured, £10,750; rubber threads, £16,400; rubber tubing (other than motor car, motor cycle, and cycle tyres), £413,700; rubber boots and shoes, £8550; rubber tyres for wheels of vehicles, £615,950; wares of soft rubber, not elsewhere mentioned; rubber sheets combined with spun materials, etc., £1,003,500; rubber print cloths for factories; card cloths for carding factories, £8100; spun wares with rubber or rubber threads; rubber wares with spun materials, £367,550; hardened rubber paste for dental purposes, £11,700; hardened rubber in plates and bars, rough-pressed goods, etc., of hardened rubber, not further worked, £89,900; tubes of hardened rubber not further worked, £10,000; other wares of hardened rubber, except surgical instruments, £469,100; so-called rubber linen (collars and such like) of tissues coated with celluloid or similar materials, £163,200; clothes and cloaks coated or impregnated with rubber, £66,500; other sewn articles,

also saddlers' and bagmakers' goods coated or impregnated with rubber, £178,100.

The principal wares included in the Austrian exports (1913) were: rubber paste, £23,850; sheets of rubber or gutta-percha, unvulcanised, cut, coated, rolled (patent sheets), £14,100; wares made of patent sheets, not specially mentioned, vulcanised or not, combined or not with fine or common materials, £11,700; insulating material of patent sheets, vulcanised or not, £5130; rubber threads not covered with varn (also flat, not more than 3 mm. wide), £6,200; tubing of or combined with rubber, with or without layers of tissues or inlaid wire, £26,000; boots and shoes of rubber, combined or not with textiles or with other materials, £56,100; wares of soft rubber, not specially mentioned, combined or not with ordinary or fine materials, £114,200; woven and knitted materials, covered, impregnated or coated with rubber, or with internal layers of rubber, £21,900; elastic tissues, knitted wares, and haberdashery consisting wholly or partly of silk, floss silk, or artificial silk, £25,400; shoe elastic, £34,860; other elastic tissues, knitted wares, and haberdashery, £19,100; hardened rubber (solid or hard as leather) in sheets, rods, and tubes, polished or not, but not further worked, £6800; wares of hardened rubber, not specially mentioned, rough pressed, the pressing seams being visible, £5800; other wares of hardened rubber, not specially mentioned, combined or not with common or fine materials, £24,200; fittings for technical and electro-technical purposes, of hardened rubber, £6700; clothing or other articles made with woven or knitted materials coated or impregnated with rubber, or with elastic tissues, etc., £13,200.

The United Kingdom exports in 1913 to the principal markets served by Germany and Austria-Hungary were: apparel, waterproofed, £927,125; rubber boots and shoes, £123,545; tyres, other than motor-car, motor-cycle, and cycle tyres, £124,626; rubber manufactures, other sorts, £1,431,074.

The United Kingdom holds a strong position in the markets of British South Africa, British India, New Zealand, Canada, Straits Settlements, and Australia, though German competition is now felt somewhat in the last two. In the Western European markets generally the German and British shares of the trade are roughly equal, though in Norway the United Kingdom takes the lead, while in Switzerland, Italy, and Russia the German products quite dominate the market. In the Balkan States, the bulk of the trade falls to Germany and Austria-Hungary. Germany takes the lead in supplying Persia and the Dutch East Indies, while the United Kingdom does the same in China and Japan. German competition in American markets is particularly keen, especially in Brazil, Argentina, Chile, the United States, and Mexico.

PATENTS.

Rubber and rubber products; Dyeing of —. D. Spence, Akron, Ohio, Assignor to The B. F. Goodrich Co., New York. U.S. Pat. 1,122,653, Dec. 29, 1914. Date of appl., Feb. 10, 1913.

RUBBER is treated with an aqueous solution of an aromatic amine, and the absorbed amine is afterwards diazotised and combined with a suitable dye-component, so that an azo dye is obtained directly combined with or fixed upon the rubber. —E. W. L.

Rubber; Art of treating [vulcanising] —. L. C. Warner, Naugatuck, Conn., Assignor to The Beacon Falls Rubber Shoe Co., Beacon Falls, Conn. U.S. Pat. 1,122,824, Dec. 29, 1914. Date of appl., March 17, 1913.

RUBBER articles to be vulcanised are placed on forms in a heated vulcanising chamber, the

chamber is closed, and the pressure inside is reduced, in order to facilitate the escape of liquid and gaseous matter within and upon the articles. The pressure is subsequently raised and the articles vulcanised by heating to a higher temperature. —E. W. L.

Rubber; Process for vulcanising —. J. Bastide. Fr. Pat. 470,883, June 24, 1913.

To ensure a more uniform distribution of the sulphur in a rubber mixing, and so reduce the amount of sulphur necessary for vulcanisation as nearly as possible to that actually combined in the vulcanised rubber, a suitable solvent of sulphur is added to the mixing before vulcanisation. Examples of such solvents are the methylene and ethylene compounds of fatty and aromatic amines, notably methylethylenylphenylenediamine-1.2.3, methylenediphenyldiamine, and phenylimino-methane. The following examples of mixings are given:—(1) Good quality rubber, 55; zinc oxide, 40; lampblack, 1.5; solvent, 2; and sulphur, 1.5%. (2) Para rubber, 83; mineral red, 12; solvent, 2.5; and sulphur, 2.5%. These mixings can be vulcanised under the same conditions of temperature and pressure as similar mixings containing 5 to 8% of sulphur but no solvent. —E. W. L.

Rubber; Purification by dialysis of raw and reclaimed — and other materials soluble in hydrocarbons. H. Debaugé. Third Addition, dated April 9, 1914, to Fr. Pat. 426,457, Feb. 3, 1911. (See this J., 1911, 968; 1912, 35 and 1043.)

THE rubber, which has been soaked in cold xylene, is introduced into a vertical steam-jacketed dialysing vessel, together with sufficient xylene to produce ultimately a 5–10% solution of rubber. The vessel is divided, by a sheet iron partition, into a central space, in which a vertical shaft, provided with long vertical blades, runs at a high speed, and an annular space surrounding it which contains the porous dialysing tubes. A small screw at the base of the central shaft causes the rubber and solvent to circulate downwards through the centre compartment and upwards around the dialysing tubes, through which a slow constant flow of solvent is kept up. The grinding action between the rubber particles, the walls of the centre compartment, and the blades, greatly assists the solution of the rubber and removal of the dialysable impurities. —E. W. L.

[Rubber] latex; Apparatus for the treatment of —. H. A. Wickham. Fr. Pat. 471,231, April 22, 1914. Under Int. Conv., Jan. 31, 1914.

SEE Eng. Pat. 2627 of 1914; this J., 1915, 40.

Rubber substitute for waterproofing and similar operations and process of making the same. G. d'Almeida. Fr. Pat. 470,372, April 1, 1914.

SEE Eng. Pat. 11,665 of 1912; this J., 1913, 799.

XV.—LEATHER; BONE; HORN; GLUE.

Chrome leather; Analysis of — and of materials used in its manufacture. L. Balderston. J. Amer. Leather Chem. Assoc., 1915, 10, 45–52.

A COMMITTEE appointed by the American Leather Chemists' Association recommends that the methods given in Procter's "Leather Industries Laboratory Book" for the determination of chrome and acid in chrome liquors, and the methods of Levi and Orthmann for the determination of chrome in chrome leather be incorporated in the printed methods of the Association. The methods of Levi and Orthmann are:—(a) The ash

from 3 grms. of leather is mixed with 4 grms. of a mixture of equal parts of sodium carbonate, potassium carbonate, and powdered borax glass, and fused for 30 minutes. The product is dissolved in hot water with sufficient hydrochloric acid to make the solution acid, and the solution is filtered, any insoluble matter being incinerated and treated as before with 1 gm. of the fusion mixture. The united solutions are diluted to 500 c.c., and 100 c.c. is treated with 5 c.c. of hydrochloric acid, and the chromium determined as described by Procter (*loc. cit.*). (b) When it is not desired to determine iron or aluminium, the ash from 3 grms. of leather is fused with 3 grms. of sodium peroxide in an iron crucible for 10 mins., and the crucible, after cooling, immersed in 300 c.c. of water, which is boiled for 30 mins. The solution is diluted to 500 c.c., filtered, and 100 c.c. treated with hydrochloric acid (5 c.c. excess), and the chromium determined by Procter's method.—A. S.

Tanning materials; Available tannin in various—. J. H. Yocum and T. A. Faust. J. Amer. Leather Chem. Assoc., 1915, 10, 26—41.

A RECORD of experiments in which tanning materials were leached and the resulting liquors and spent tans analysed. The total tannin in liquors and spent materials was always less than the tannin in the original material, by an amount between 8% and 14%, calculated on the original tannin.—F. C. T.

Celavina and babla. Their properties, reactions, classification, and practical [tanning] value. H. G. Bennett. J. Amer. Leather Chem. Assoc., 1915, 10, 19—26.

CELAVINIA (pods supposed to be derived from *Caesalpinia tinctoria*) contains about 32% tannin and 19% soluble non-tannins, and gives a leather remarkably light in colour. It belongs to the sumac sub-group of pyrogallol tannins, but differs from sumac in containing no flavone, ellagitannic acid, or reducing agent capable of bleaching leather. No known qualitative reaction will distinguish celavina tannin from gallotannic acid.

Babla is a vague term applied to the pods of various acacias. The tannin resembles sumac in many reactions, but gives a precipitate with bromine water and no reaction with nitrous acid. The positive deal-shaving reaction for phloroglucinol distinguishes it from other mixed tannins. Babla contains about 30% tannin and 17% soluble non-tannins, and gives a mellow, light-coloured, but rather spongy leather. In practical effect babla resembles gambier.—F. C. T.

Pentoses; Determination of— in tanning materials. J. L. van Gijn and H. van der Waerden. Collegium, 1914, 711—714. J. Amer. Leather Chem. Assoc., 1915, 10, 70. H. C. Reed and A. Schubert. J. Amer. Leather Chem. Assoc., 1915, 10, 61—63. (See this J., 1914, 151, 152, 558, 839.)

THE observation by Reed and Schubert that a cold water extract of quebracho wood gives methylfurfural on distillation with hydrochloric acid, could not be confirmed by van Gijn and van der Waerden. It is agreed that methylpentoses are not decomposed into pentoses by heating under pressure, and that methylpentoses are extracted more readily than pentoses from tanning materials. On this ground, Reed and Schubert maintain that the method of extraction influences the test. The addition of organic acids to mangrove extract does not give rise to furfural on distillation with hydrochloric acid, nor, as Moeller maintains, can methylfurfural be found in the distillate from the evaporation of mangrove extracts.—F. C. T.

Tanning materials [mangrove]; Determination of— in admixture. F. H. Snall. J. Amer. Leather Chem. Assoc., 1915, 10, 41—45.

THE determination of mangrove in admixture by the estimation of methylfurfural, after digesting the tanning extract with hydrochloric acid and distilling (this J., 1914, 151, 152), is not satisfactory. The yield of methylfurfural is variable in parallel experiments, and the temperature of extraction in manufacture has great influence. The treatment of sulphited extracts with iodine before analysis is useless. (See also preceding abstract.)—F. C. T.

Sulphite-cellulose extracts; Analysis of—. J. Paessler. Chem.-Zeit., 1914, 38, 974.

SULPHITE-CELLULOSE extracts analysed by the Official Method of the Internat. Assoc. of Leather Trades Chemists, gave results varying within 10% according to the strength of the solution used for analysis, although such strengths were within the official limits of 0.35 to 0.45% of tanning matter. In control experiments with vegetable tanning materials variations in the strength of the solution taken for analysis within these limits, had no influence on the results. The German Section of the Association has decided that the strength of the solution of sulphite-cellulose for analysis should be 20 grms. of extract per litre.—T. C.

Sulphite-cellulose; Detection of— in tanning extracts and in leather. W. Appellus and R. Schmidt. Ledertechn. Rundschau, 1914, 6, 225—226. Z. angew. Chem., 1914, 27, Ref., 691.

BOTH catechol- and pyrogallol-tannins give, with cold cinchonine sulphate solution, precipitates which redissolve on warming. Sulphited extracts give a precipitate which is not completely soluble on warming unless the extract is first boiled with hydrochloric acid and filtered before adding the cinchonine sulphate. The precipitate obtained with sulphite-cellulose extract and cinchonine sulphate forms, on heating, a characteristic insoluble brownish-black mass which is quite distinctive, even in solutions of vegetable tannins or in leather infusions containing only little sulphite-cellulose extract. Neradol D also gives with cinchonine sulphate a precipitate insoluble on warming, which, however, does not form a brownish-black mass, but more resembles a silver chloride precipitate.—T. C.

Sulphite-cellulose; Use of cinchonine for the detection of— [in tanning extracts]. W. Appellus and R. Schmidt. Collegium, 1914, 706—707. J. Amer. Leather Chem. Assoc., 1914, 10, 64—65.

THE test described previously (see preceding abstract) depends upon the fact that the presence of tannin prevents the precipitate given by sulphite-cellulose and cinchonine from being dissolved on heating. In the case of pure sulphite-cellulose extracts, tannin solution must be added before making the test.—F. C. T.

Wood gum (xylan); Determination of— in chestnut wood extract. L. Pollak. Collegium, 1914, 715—716. J. Amer. Leather Chem. Assoc., 1915, 10, 65.

XYLAN is found in many woods, especially in beech, and is extracted by dilute acids or caustic soda, but not by water. It was extracted from chestnut wood by Wheeler and Tollens' method (this J., 1890, 309), the wood being freed from tannin by three extractions of 24 hrs. each with 2% ammonia, then extracted with 5% caustic soda for 48 hrs., and the sodium compound of the

gum decomposed by hydrochloric acid. The xylan was purified by dissolving in water and precipitating with alcohol. From 5.1 to 7.9% was obtained from four chestnut woods, the highest yield being from red Corsican wood and the lowest from a light-coloured wood which yielded the best liquors for clearing.—F. C. T.

Sulphuric acid in leather: Determination of free —. J. Paessler. Collegium, 1914, 567—592.
J. Amer. Leather Chem. Assoc., 1915, 10, 67—70.

Two small pieces of leather, one about twice the weight of the other, are placed in equal quantities of water (200—300 c.c.) and frequently agitated during 6 hrs., and the acid which has diffused into the water is then titrated with *N*/10 barium hydroxide. The free acid originally in the leather can be calculated by the aid of the equation: $C_1/C_2 = C_3/C_4$ where C_1 and C_3 are the concentrations of acid remaining in the pieces, and C_2 and C_4 the concentrations of diffused acid. The method is based on the fact that under the experimental conditions the ratio of the amount of acid remaining in the hide to that which diffuses into the water is constant. (See also this J., 1914, 365.)—F. C. T.

Chrome soap in chrome leather: The presence of —. G. Hugonin. Collegium, 1914, 716—717.
J. Amer. Leather Chem. Assoc., 1915, 10, 64.

A CHROME soap prepared from chromic chloride was found to be soluble in pure benzene. Various chrome leathers were extracted with benzene, but none of the extracts contained any chromium, and it is concluded that chrome leather contains chrome soap only when it is insufficiently washed or partially neutralised after tanning.—F. C. T.

Mangrove bark in the Federated Malay States.
Board of Trade J., Feb. 11, 1915.

THE Commissioner of Trade and Customs at Kuala Lumpur draws attention to the possibilities of the development of an import trade in cutch from the Federated Malay States. There is an area of about 250 square miles of mangrove forest on the coast of the States of Perak and Selangor. The predominant species are *Rhizophora conjugata*, *Rhizophora mucronata*, *Bruguiera gymnorhiza*, *Bruguiera caryophylloides*, *Bruguiera parviflora*, and *Ceriops candolleana*. The whole forest is now a Government reserved forest and is systematically worked for firewood. No attempt has been made to work the mangrove bark for cutch. All the bark is at present a waste product, with the exception of a small quantity used locally in dyeing fishing nets and sails. The forests are intersected with innumerable creeks and streams, which render transport easy.

Proposed uniformity in methods of fat analysis [for the leather industry]. Fahrion. See XII.

PATENTS.

Skins; Process for unhairing —. R. Vidal.
Fr. Pat. 470,577, June 18, 1913.

SKINS are immersed in an emulsion of a hydrocarbon and a dilute solution of an alkali or alkaline-earth sulphide for a period up to two days, according to their weight.—F. C. T.

Skins; Treatment and preservation of — before tanning. Clarendon Yocum Co. Fr. Pat. 470,774, April 10, 1914. Under Int. Conv., April 17, 1913.

SALT stains are avoided by the use of a mixture such as 97% of sodium chloride and 3% of normal

sodium sulphite, which is applied to the fresh skins.—F. C. T.

Egg-yolk; Process for replacing — in tanning. O. Röhm. Fr. Pat. 470,594, April 7, 1914.
Under Int. Conv., April 8, 1913.

THE skins, before or after tanning with alum or with vegetable tanning materials, are treated with sulphonated oils or fats, which have been freed from soaps, *e.g.*, by dialysis, and mixed with volatile substances (toluene, ethyl acetate) soluble in oil.—F. C. T.

Leather; Treatment of — to obtain greater durability and impermeability. A. Chesneau.
Fr. Pat. 471,283, April 23, 1914.

THE leather is immersed for ten minutes in a mixture of stearine, paraffin wax, beeswax, and rosin at 80° C.—F. C. T.

XVI.—SOILS; FERTILISERS.

Swamp rice soils; The gases of —. W. H. Harrison and P. A. Subramania Aiyer. Mem. Dept. Agric. India, 1914, 4, 1—17.

INVESTIGATION of the action of the film of algæ present on the surface of swamp rice soil (see this J., 1913, 1165) on the swamp gases, showed that the film utilises the gases in such a manner as to bring about an increased output of oxygen from the film, leading to an increased root aeration. The film contains bacteria capable of oxidising methane and hydrogen and of assimilating directly methane and carbon dioxide. The changes result, directly or indirectly, in the production of carbon dioxide, which is in turn assimilated by the green algæ with the evolution of oxygen. The film acts as an oxygen concentrator producing a maximum oxygen concentration in the water entering the soil. The practice of green manuring, by increasing the output of the soil gases, brings about an increased activity of the film, resulting in an increased production of oxygen and root aeration. The oxygen concentration of the water entering the soil through the combined action of drainage and transpiration appears to be one of the main factors regulating the growth and yield of the rice crop.
—W. P. S.

Aluminium salts; Physiological action of — on plants. E. Kratzmann. Chem.-Zeit., 1914, 38, 1040.

THE colouring matter of red cabbage shoots was changed to blue when the plants were grown in Knop's medium containing 0.01% of aluminium nitrate. Aluminium salts diminished the starch content of *Elodea*, but not of *Spyrogyra* and *Lemna* as recorded by Fluri; there was no decrease in the starch content of roots growing in solutions containing aluminium salts. The diminution in starch content is due to the condensing (synthesising) enzymes being restrained whilst the hydrolytic enzymes are rendered more active, and to a weakening in assimilative powers (general poisoning). When starch-free leaves were placed in a 20% sucrose solution and kept in the dark, considerable quantities of starch were formed within a few days, but the formation of starch was inhibited completely when the sugar solution contained 1% of aluminium nitrate. The growth of higher plants was retarded by the presence of 0.05% of aluminium salts, but very small amounts of the latter (0.0001%) had a slight stimulating action. *Aspergillus niger* grew freely on a glycerol medium containing from 0.005 to 0.1% of aluminium sulphate (anhydrous) or aluminium chloride, but growth ceased when the medium consisted of

glycerol and peptone alone. Aluminium salts also had a distinct stimulating action on the growth of the prothallium of *Equisetum arvense*.—W. P. S.

Nitrogen [in fertilisers, etc.]; Comparison of the Gunning-Cooper method with the Kjeldahl-Gunning-Arnold method for the determination of —. O. F. Jensen. J. Ind. Eng. Chem., 1915, 7, 38—39.

THE Gunning-Cooper method, which was adopted in 1908 by the Association of Official Agricultural Chemists (U.S.A.), differs from the Kjeldahl-Gunning-Arnold method only by the use of 0.1–0.3 gm. of crystallised copper sulphate in place of metallic mercury. A comparison of the two methods with bone meal, dried blood, cyanamide, and linseed meal, showed that with either method digestion for 1–1½ hours gives a quantitative yield of ammonia, except in the case of dried blood, for which digestion for 2–3 hours is necessary with the Gunning-Cooper method. The latter method possesses several manipulative advantages over the Kjeldahl-Gunning-Arnold method, and is to be preferred especially when many determinations have to be made. (See also this J., 1910, 1412; 1913, 1131.) —A. S.

Phosphoric acid in superphosphate; Comparison of a few methods for total —. C. A. Peters and A. G. Weigel. J. Ind. Eng. Chem., 1915, 7, 39–40.

THE gravimetric method of the Official Association of Agricultural Chemists (U.S.A.), in which the phosphoric acid is precipitated first as phosphomolybdate and subsequently as ammonium magnesium phosphate, gives high results unless the solution is evaporated to dryness to remove silica before precipitation. The volumetric process of Pemberton, and the direct precipitation of the phosphoric acid as ammonium magnesium phosphate in presence of ammonium citrate or of citric acid (Wiley, "Principles and Practice of Agric. Chemistry," II., (1908), pp. 160, 88, and 98 respectively) all give results as accurate as those obtained by the modified official process and in about half the time.—A. S.

PATENTS.

Fertilizer; Process of obtaining — [from the combustion products from gas engines]. W. H. Heine, Honolulu, Hawaii. U.S. Pat. 1,122,923, Dec. 29, 1914. Date of appl., May 28, 1913.

PRODUCTS of combustion from a gas engine are cooled and brought into contact with lime-water, which is circulated in contact with the gases until the desired amount of fertilising substances has been absorbed.—W. P. S.

Treatment of marine plants for the extraction of their constituents. Addition to Fr. Pat. 470,943. See VII.

XVII.—SUGARS; STARCHES; GUMS.

[Beet] sugar factory products; Determination of dry substance in —. O. Fallada. Oesterr.-Ungar. Zeits. Zuckerind., 1914, 43, 695. Chem.-Zeit., 1914, 38, Rep., 568. (See also Fallada and Kulp, this J., 1912, 549.)

THE following conclusions are drawn from determinations made on 44 different products by various methods:—The Abbe refractometer and the modified instrument of Schönrock and Herzfeld (this J., 1914, 154) give practically identical results (cp. Pellet, this J., 1914, 1165). The

values obtained by drying, in air at 100° C.; in a vacuum oven at 108° C.; and in air at 100° C. and afterwards *in vacuo* at 108° C., often differ considerably, but the last method accords best with the refractometer. The refractometric method is the simplest and most trustworthy, provided the correct temperature (20° C.) is maintained, and a good source of light (e.g., the Nernst microscope lamp) is used.—J. H. L.

[Reducing sugars;] The volumetric Fehling method [for the determination of —] using a new indicator. A. M. Breckler. J. Ind. Eng. Chem., 1915, 7, 37–38.

TEN c.c. of mixed Fehling solution [(1) 34.639 grms. of crystallised copper sulphate, and (2) 173 grms. of Rochelle salt and 50 grms. of sodium hydroxide, per 500 c.c.] is placed in a large test-tube and the sugar solution (0.2 to 0.4 gm. of dextrose, or its equivalent, per 100 c.c.) run in, starting with 8.5 c.c. After the first addition the solution is boiled for 1 min., counting from the time a bubble of steam first traverses the whole column of liquid. The sugar solution is now added 2 c.c. at a time, boiling for 15 seconds after each addition, until the copper solution is only faintly blue, whereupon a drop of it is added to two drops of sodium sulphide solution (4 grms. of crystallised monosulphide in 100 c.c. of water) on a tile. The tile is given a slight rotary shake and the colour of the spot noted: the black copper sulphide settles at once, leaving a yellow supernatant liquid. The sugar solution is now added in gradually decreasing quantities, boiling for 15 seconds after each addition, until the supernatant liquid in the spot test, immediately after settling, is colourless. The experiment is then repeated with a second 10 c.c. of Fehling solution, adding enough water to make the final volume about 30 c.c. and 97–98% of the sugar solution required in the previous trial. After boiling for 1½ minutes, the titration is completed as described. Proteins and metals which form coloured sulphides interfere with the spot test: the former may be removed by adding alumina cream to the boiling sugar solution, cooling, and making up to a definite volume, the clear liquid being used after settling or filtering.—A. S.

Starch. Board of Trade Bulletin No. 95.

THE value of starch of all kinds exported from Germany in 1912 was £555,200; from Austria-Hungary (1913), £46,010; and from the United Kingdom (1913), £88,200. The German exports to Austria-Hungary in 1912 were valued at £31,650 and to the United Kingdom at £226,900; Austro-Hungarian exports in 1913 to Germany were valued at £10,130, and to the United Kingdom at £8150; while the exports of the United Kingdom in 1913 to Germany were valued at £1300. No starch was exported to Austria-Hungary from the United Kingdom in 1913. The value of the exports to the principal Colonial and neutral markets was: Germany (1912), £288,350; Austria-Hungary (1913), £27,580; United Kingdom (1913), £72,610.

The United Kingdom exports to British South Africa, India, Canada, and Australia considerably exceed those of Germany. In Brazil, Portugal, Egypt, and Turkey the share of the United Kingdom compares very favourably with that of Germany, but elsewhere it is distinctly inferior. Valuable openings exist for the sale of British-made starch in many markets hitherto mainly supplied by Germany or Austria-Hungary, particularly in Norway, Sweden, Denmark, Netherlands, France, Switzerland, Spain, Italy, Servia, Russia, Argentina, Chile, Uruguay, the United States, and Mexico. Of the total German exports,

potato starch, green fecula (wet starch), and dry potato starch powder (potato meal) accounted for £220,350; dextrine, roasted starch, adhesive and surface dressing substances containing starch, gluten and gluten powder, £187,100; rice starch, £117,750; and starches of maize, wheat, etc., £30,000. More than half of the total Austrian exports consisted of paste, size, and similar starch-containing sticking and dressing substances, and rice starch and rice starch meal.

Determination of sugar in small quantities of blood.
Lewis and Benedict. See XXIII.

PATENTS.

Sugar; Preparation of —, and apparatus for use therein. E. Shaw, and G. S. and G. R. Baker. London. Eng. Pat. 22,656 of 1914; date of appl., Nov. 25, 1913.

SYRUP or juice is sprayed by a blast of hot air into a heated enclosed chamber, whereupon graining takes place, the sugar being removed by scrapers, and the vapour drawn off through openings. The enclosed chamber is heated by a jacket, and the temperature of the syrup or juice, of the air, and of the chamber, are regulated according to the density of the syrup or juice, and the pressure of the air according to the size of grain desired.—J. P. O.

Sugar beets; Extraction of juice from fruits and roots, especially from —. O. Mengelbier. Fr. Pat. 470,980. April 15, 1914. Under Int. Conv., May 15, 1913.

THE beetroots, crushed, or sliced into fairly large pieces, are pressed between two or more rollers, the greater part of the juice being thus extracted. The residue is macerated with water or juice, and again passed through roller-presses, the temperature throughout being kept sufficiently low to prevent decomposition.—J. P. O.

Gum from carob seeds [locust beans]; Process for obtaining — in the form of a dry powder.
A. Pinel. Fr. Pat. 470,899. June 26, 1913.

SEE Eng. Pat. 13,504 of 1914; this J., 1915, 43.

XVIII.—FERMENTATION INDUSTRIES.

Malt; Melanoidines and their occurrence in kilned —. W. Ruckdeschel. Z. ges. Brauw., 1914, 37, 430—432, 437—440. Z. angew. Chem., 1914, 27, Ref., 681.

EXPERIMENTS made by the author confirm the view that the formation of colour and aroma during the kilning of malt is due to the production of melanoidines (see Maillard, this J., 1912, 144) by interaction between dextrose or other sugars and amino-acids or bases (cp. Ling, this J., 1908, 1034). With the exception of tyrosine, allantoin, and betaine, all the amino-acids which might occur in malt, and also the bases, ammonia, mono- and tri-methylamine, and choline, interact in this way with sugars. Polypeptides also yield deep brown products, but without specific aroma. The behaviour of aqueous extracts of green malt when evaporated, corresponds closely with that of solutions of amino-acids and sugars, as regards the rate of darkening, the stage at which an aroma is perceptible, the production of carbon dioxide, the increase of acidity, and phenomena arising from the colloidal nature of the melanoidines. The curing of malts is accompanied by a decrease in their content of amino-acids and polypeptides, owing doubtless to interaction with dextrose.

—J. H. L.

[*Malt*] *extracts.* L. Briant and H. W. Harman. J. Inst. Brew., 1915, 21, 34—48.

THE influence of various factors on the quality and yield of extract from malt is discussed. Separate investigation of the fractions of malt grist, viz., husks, grits, and flour, showed that whilst the flour yields the highest proportion of extract, with the highest specific rotatory power, the grits possess the greatest diastatic activity. The husks yield the largest proportion of soluble nitrogenous matter and possess the highest proteolytic activity, whereas in both these respects the flour is lowest. Laboratory worts made from the different fractions were hopped in proportion to their gravities, concentrated to equal gravities, and fermented. The beer from the grits was by far the best; that from the flour was very soft and somewhat characterless in flavour, though full in palate, and it retained its head well, but attenuation was backward. The beer from the husk fraction was thin and almost acid in flavour, and showed symptoms of unsoundness when stored. The efficiency of any form of modern grinding of malt depends largely on its capacity to reduce the interior of the grain to grits without undue disintegration of husks. The advantage of fine grinding lies not only in a higher yield of extract, but in its more rapid solution, which enables the mashing process to be curtailed, thus avoiding the lowering of quality of the extract by more undesirable matters dissolved during the later stages of a prolonged mashing. The limits of fineness of grist imposed by ordinary mash-tun practice may be obviated by the use of the mash filter. The authors discuss the production of flavour in malt, the use of coloured malts, raw grain adjuncts, brewing sugars, and hops, and the influence of carbonates in brewing waters (see Miskovsky, this J., 1914, 504). By using raw grain adjuncts it is usually possible to produce beers containing more extract, and better able to stand heavy priming, than beers from malt alone, yet when used in excess they may interfere with mash drainage and confer a "dry" flavour on beer. The high ash-content of certain grades of brewing sugars, which amounts to 4—5% or in other cases 7.5—8.5%, consisting largely of chlorides, probably affects the flavour and stability of beer and produces a fictitious increase in the gravity, since 1% of ash in solution corresponds nearly to 1 saccharometer lb. of gravity (cp. Baker and Hulton, this J., 1910, 644). For the treatment of waters of high carbonate-content, neutralisation with lactic acid gives satisfactory results, especially in the preparation of beers of soft palate; enzyme action is stimulated and the yield of extract usually increased by about 2 lb. per quarter.—J. H. L.

Barley; Respiration of —. H. W. Harman. J. Inst. Brew., 1915, 21, 48—65.

THE author investigated the effect of respiration upon barley during germination and withering, the minimum amount of air necessary, and the effect of replacing it at certain stages by inert gases. The steeped barley (1912 and 1913 Chevallier) was enclosed in a horizontal glass cylinder through which a current of purified moist air or other gas was passed, and the quantity of carbon dioxide formed was determined. The current of air employed was equivalent to 20 cubic feet per minute for 30 quarters of barley, i.e., about 1/100 of that commonly employed in drum malting and about 20 times more than theoretically required for the quantity of carbon dioxide produced. Before being analysed the malt was dried in very thin layers for 48 hours at 100° F. (38° C.). The results of the main series of experiments are epitomised in the table, columns A and B referring to the same (1912) barley, and

the remaining columns to another (1913) barley. Columns A and B show that with restriction of the air the increase in the yield of malt is not equivalent to the lessened production of carbon dioxide and rootlets. Under the conditions of column E, root growth was very small and the yield of malt correspondingly greater; the long withering process did not stimulate the diastatic activity, and the resulting malts were unequally modified and remarkably rich in soluble nitrogen. Column F shows that warm steeping may give rise to diminished root formation and bad modification, and these conclusions were confirmed by practical maltings. From further experiments it was found that at the withering period forced conditions are enormously increased by rise of temperature and even more by the presence of carbon dioxide, *i.e.*, when the grain is allowed to stew and no respiratory current permitted; and this forcing of the malt depresses rather than increases the diastatic activity. The general conclusions drawn are as follows:—Slow but steady respiration is desirable throughout the whole germination, and under these conditions complete modification can be obtained with about

Wine; Determination of pentoses and methyl-pentoses in—. F. Schaffer. Chem.-Zeit., 1914, 38, 981.

METHYLPENTOSSES occur in the unfermentable carbohydrates present in wines, but pentoses largely predominate, especially in natural wines. The pentoses may be expressed as arabinose and the methylpentoses as rhamnose; the ratio of arabinose to rhamnose is much narrower in the case of wines from grape marc and raisin wines than with natural wines. The phloroglucide method may be used for the determination of pentoses and methylpentoses in completely fermented wines; the small quantities of pentosans and methylpentosans present do not appreciably affect the results. When a wine contains more than 3 grms. of reducing substances per litre, it must be fermented previous to the estimation. The pentoses and methylpentoses may also be determined colorimetrically.—W. P. S.

Vinegar cels; Methods of destroying—. J. F. Sacher. Chem.-Zeit., 1914, 38, 1021—1022.

OUT of 25 samples of table vinegar taken from retail shops in Düsseldorf, 23 contained

100 parts by weight of dry barley gave the following parts by weight.

	A.	B.		C.		D.		E.		F.	
	Con- tinuous air. Average	Intermittent air 1 hour in 24. Temp. 60° F. (15.5° C.)		Con- tinuous air. Temp. 50°-68° F. (10°-20° C.)	Oxygen.	Con- tinuous air. Temp. 48°-58° F. (9°- 14.5° C.)	Con- tinuous nitro- gen.	Air, 5 days. Nitro- gen, 7 days.	Air, 8 days. Nitro- gen, 4 days.	Warm steep, 80°-85° F. Continu-	Cold steep, 65° F. ous air.
Dry malt	89.5	90.6	90.3	87.6	87.2	88.5	96.9	91.8	90.0	91.5	89.8
Dry roots	4.2	0.4	0.4	4.9	2.6	4.0	nil	1.6	2.8	1.8	4.2
Carbon dioxide produced—											
In 10 days	7.28	2.92	2.94	5.62	5.84	4.74	1.36	4.85	6.35	6.46	7.32
In 12 days	—	—	—	—	—	—	—	5.31	7.00	—	—
In 14 days	—	—	—	—	—	8.46	1.76	—	—	—	—
In 16 days	—	4.88	4.92	—	—	—	—	—	—	—	—
Diastatic power on dry malt	127°	90°	90°	98°	68°	109°	25°	105°	97°	71°	91°
Total matter soluble in cold water containing:—	22.0	10.18	11.20	20.60	15.30	18.40	4.40	18.80	19.60	12.20	17.70
Uncoagulable proteins ..	3.19	2.09	2.24	3.13	2.36	3.02	1.05	4.95	3.87	2.19	2.85
Reducing sugars expressed as dextrose	6.13	2.94	2.66	6.45	4.49	5.81	0.56	6.69	6.10	3.78	6.72
Sucrose	5.32	1.11	4.82	5.19	4.09	3.83	0.50	—	3.85	2.34	4.00

1/100 of the quantity of air commonly used in drum malting, and with no actual "withering" process. The effect of excessive aeration in increasing the malting loss is due much more to the greater root growth than to increased production of carbon dioxide, which is partially compensated by a gain in weight by oxidation. High temperatures during germination give rise to much greater respiratory losses than excessive aeration. The enormous excess of air commonly used in drum malting may be responsible for a lack of tenderness which characterises much of the malt so made. The rootlets are the primary controlling factors in modification and their healthy growth is in proportion to proper respiration at sufficiently low temperatures. The arospire can be forced up the corn with little or no root, yet modification may still be incomplete. The action of withering should be confined to the removal of moisture and consequent shrinking back of the roots, at low malting temperatures. Moisture has no more specific influence on respiration than other general vital conditions; a deficiency may arrest modification by causing the roots to wither, whereas an excess will delay the natural withering process. The diastatic power appears to reach its maximum quite early (*e.g.*, within 5 days) when the temperature of germination is high, whereas at low temperatures its formation is gradual and progressive.—J. H. L.

Nematoidea (vinegar eels). They can be killed and removed by heating the vinegar for a few minutes at 45° C. and filtering. Exposure to bright sunlight for several hours or complete exclusion of air for several weeks is also fatal, but carbon dioxide appears to be innocuous. In presence of 1% of sodium chloride, 2.5% of sodium sulphate, or 1% of sodium nitrate, the organisms succumb within a few days, but potassium and calcium salts have no effect. Acids are toxic in proportion to their degree of ionisation; 0.1% of hydrochloric acid proves fatal within a few days, whereas an equivalent quantity of boric acid has no action. It has been proposed to destroy the organisms by treating the vinegar with 0.1% of calcium peroxide or 0.2% of magnesium peroxide, but according to Wüstenfeld much larger quantities (0.5—2%) are required. Alcohol at low concentrations is not very toxic.—J. H. L.

PATENTS.

Drinks; Manufacture of—. J. H. Brodrick, Bromsgrove. Eng. Pat. 15,533, Jan. 5, 1914.

TABLETS from which beverages (*e.g.*, of the type of ale, stout, etc.) can be prepared, are claimed, consisting of non-fermentable dextrinous malt flour (made from a specially prepared form of starch by heating to a high temperature), and 20—50% of dried extract from malt worts,

together with glucose, saccharin and flavouring matters, and preferably one or more ferments such as desiccated yeast. (See also Eng. Pats. 15,004 of 1896, 25,149 of 1898, 15,079 of 1905, 25,304 of 1909, and 27,572 and 27,573 of 1911; this J., 1897, 627; 1906, 491; 1912, 657, 1091.)

—J. H. L.

Wines; Manufacture of sparkling—and all gaseous or fermented beverages, and their sterilisation by oxygen under pressure. A. Chaussepied. Fr. Pat. 470,539, June 17, 1913.

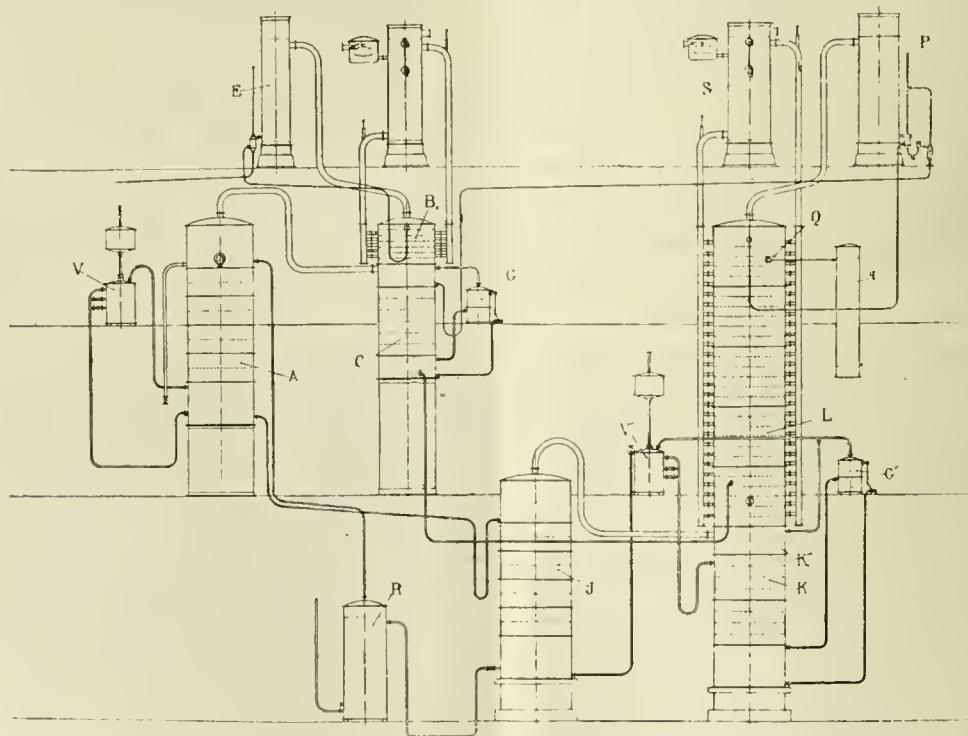
THE liquid is fermented, out of contact with air or metals, in a large closed vessel, and is agitated by injection of fermentation gases collected from above the liquid. The temperature is regulated by means of a coil within the closed vessel. When fermentation is complete, the liquid is sterilised by injection of oxygen under pressure. Before racking, the liquid is strongly cooled, so that the suspended matters form a compact deposit not drawn off with the liquid; the low temperature also prevents disengagement of gas during racking. The apparatus comprises a vat, open at the top, but completely encased in a hermetically closed vessel insulated against loss of heat and capable of sustaining a high internal pressure. The outer vessel extends above the vat, in a constricted form, thus providing a chamber in which the fermentation gases collect. Air or other gases can be forced through the liquid by means of a vertical tube, which extends nearly to the bottom

Yeast; Manufacture of—from [beet] molasses. G. Roth. Fr. Pat. 470,925, March 30, 1914. Under Int. Conv., April 2, 1913, and March 12, 1914.

BET molasses is diluted to 35° Balling (sp. gr. 1.154), treated with 4% by vol. of sulphuric acid, boiled for several hours, and allowed to subside. The clear liquid is drawn off, diluted to 20° Balling (sp. gr. 1.083), treated with sulphuric acid to make the total acidity 6–10% by vol., aerated, filtered, and mixed, in the fermentation vats, with suitable nutrient salts or vinasse from a previous operation. A modification consists in forming lactic acid by treating the clarified solution contained in the fermentation vats with nutrient salts or vinasse, diluting to 14° Balling (sp. gr. 1.057), inoculating with lactic acid bacteria, and adding the yeast when the desired degree of lactic acidity is reached. Before starting the fermentation, suspended matter must be entirely removed from the solution, preferably without pressure, by the use of a filter having a large surface.—J. P. O.

Distillation and rectification of wines and fermented musts, methyl alcohol, etc.; Apparatus for the continuous— E. Barbet et Fils et Cie. Fr. Pat. 470,242, June 10, 1913.

THE apparatus (see fig.) combines efficiency of rectification, with the fuel economy associated with direct rectifying plant, the rectifying column



of the vat, and the immersed portion of which is made of glass. By means of a pump the gas in the upper part of the outer vessel may be withdrawn and forced into the liquid through the same tube. The attenuating coil inside the closed vessel is not in contact with the liquid. The liquid is racked through a vertical pipe which projects to an adjustable extent above the bottom of the vat, and provision is made for counterpressure racking.—J. H. L.

being fed with alcoholic vapours direct from the wine and not with condensed distillates. The wine from the heater, R, passes downwards through the purifying column, A, where it is freed from head products, which pass into the accessory column, B, C, the more volatile part, after dephlegmation in B, being condensed in E, whilst the reflux from B is again freed from the more volatile constituents in C, and then passed into the main rectifying column, L. The wine, thus freed from head

products in A, passes downwards through the de-alcoholising column, J, and the alcoholic vapours are led into the rectifying column, K, L, the lower portion of which, K, serves to de-alcoholise the reflux from the upper portion. The plates in L (those in B are similar) form the subject of a separate patent application; they are cooled by water which circulates automatically through the pipes shown and the cooler, S, the whole system constituting a thermo-siphon. The alcohol vapours leave the column L at Q, and rectified alcohol is condensed in q; a certain quantity of head products escapes from the top of the column, and, after being condensed in P, is returned to the column B, C. The admission of steam at the bottom of the column, K, is automatically controlled by the differential regulator, G', so that the pressure of vapour above the plates (at K'') is about equal to that of the vapours entering the column from J. G is a similar differential regulator, and V and V' control the supply of steam to the bottom of the respective columns A and J. In a subsidiary apparatus (not shown) the fractions rich in amyl alcohol, drawn from the rectifying column, are washed by being allowed to rise slowly against a regulated downward current of water in a tall cylindrical vessel packed with porcelain balls. The wash waters are afterwards introduced into the rectifying column to recover any alcohol present.—J. H. L.

Enzymes of animal and vegetable origin; Separation of—. M. Schoen, and Comp. Française du Diamalt. Fr. Pat. 471,238, July 4, 1913.

ANIMAL and vegetable juices are treated with tannin and the enzymes thus precipitated are filtered off and, if necessary, dried. The products may be subsequently dissolved by means of alkaline salts, and the purified enzymes recovered by precipitating the tannin, filtering, and evaporating the filtrates.—J. H. L.

Glycerin from distillery vinasses; Extraction of—. E. A. Barbet. First Addition, dated June 10, 1913, to Fr. Pat. 449,961, Jan. 6, 1912 (see this J., 1913, 503).

For the recovery of the glycerin by distillation under reduced pressure (*loc. cit.*), a new form of retort is claimed which permits a reduction in the amount of inert matter mixed with the vinasse to prevent frothing, so that a residue richer in nitrogen is obtained. The retort, of shallow cylindrical shape, with floor and roof bulging outwards for greater strength, is heated by direct fire with the interposition of an arch of refractory material. Caramelisation of the vinasse is prevented by a continuous sweeping of the floor of the retort by a number of scrapers projecting downwards from two horizontal arms attached to a vertical rotating shaft which passes upwards through a stuffing-box in the centre of the roof of the retort.—J. H. L.

[Lactic] acid fermentation; Process of promoting—. A. Pollak, Maisons Alfort, France. U.S. Pat. 1,123,920, Jan. 5, 1915. Date of appl., July 15, 1913.

SEE Fr. Pat. 459,548 of 1913; this J., 1913, 1166.

Alcohol; Manufacture of—. F. Thatcher and L. M. Stiles. Fr. Pat. 470,298, March 31, 1911.

SEE U.S. Pat. 1,096,965 of 1914; this J., 1914, 659.

Brewing; Process of—. E. W. Kuhn. Fr. Pat. 470,475, April 3, 1914. Under Int. Conv., April 15, 1913, and Jan. 3, 1914.

SEE Eng. Pats. 9170 of 1913 and 7156 of 1914; this J., 1914, 608.

Vinegar; New process for the manufacture of—using a new mycoderma. H. Boulard. Fr. Pat. 470,937, June 27, 1913.

SEE Eng. Pat. 25,289 of 1913; this J., 1914, 881.

XIXA.—FOODS.

Milks; The freezing point of some abnormal—. J. B. Henderson and L. A. Meston. Proc. Roy. Soc., Queensland, 1914, 26, 85–90.

Two samples of mixed milk were found to be low in solids-not-fat (7.74 and 7.79%, respectively), but at the same time had normal freezing points (-0.55° and -0.51° C.). The animals were badly fed and in poor condition. Analyses of the milk yielded by each cow (eight in all), showed that in only one case was this of normal composition, although here also the freezing points of the samples were within the normal limits, -0.54° to -0.56° C. The ashes of the milks contained abnormally high proportions of chlorine (up to 31%) and it is evident that the freezing point of the milks was adjusted to the norm l by the power of the mammary glands to regulate the osmotic pressure by the extraction of an increased quantity of sodium chloride from the blood in order to compensate for the deficiency in other constituents.—W. P. S.

Goat's milk in cow's milk; Detection of—. J. Pritzker. Chem.-Zeit., 1914, 38, 982–983.

THE test described depends on the different behaviour of the casein of the two milks towards ammonia. 22 c.c. of the milk is centrifuged at 1400 revolutions per minute for 5 to 10 mins., the separated cream removed, the skim milk then shaken with 2 c.c. of 25% ammonia, the mixture kept at 45° C. for 30 mins., again centrifuged for 5 mins., and the volume of the precipitate noted. In the case of goat's milk, this varies from 8 to 12 c.c.; cow's milk yields no precipitate, whilst mixtures of the two milks yield precipitates varying in volume according to the proportion of goat's milk present. Goat's milk which has been kept for 24 hours, or more, gives a smaller quantity of precipitate than does the fresh milk, but the addition of 0.1% of formaldehyde prevents this decrease.—W. P. S.

Unsaponifiable matter; New method for the determination of—applicable to ether extracts, fats, oils, and waxes. J. B. Rather. Texas Expt. Stat. Bull. 169. J. Ind. Eng. Chem., 1915, 7, 34–35.

PREVIOUS work by Fraps and Rather (cf. this J., 1912, 1092; 1913, 1021) having shown the need of a rapid method for the determination of unsaponifiable matter in ether extracts of fodders and the like, the following method was devised. About 0.4 gm. of the sample is boiled with 20 c.c. of 2N alcoholic sodium hydroxide for one hour under a reflux condenser, the mixture is evaporated nearly to dryness, treated with 3.5 c.c. of glacial acetic acid, and warmed with 50 c.c. of redistilled ether. After adding 25 c.c. of water and again warming for a minute, the mixture is transferred to a 500 c.c. separating funnel, the flask being rinsed with five successive 20 c.c. portions of ether. The aqueous layer is drawn off, the ethereal solution shaken gently with 10 c.c. of warm sodium hydroxide solution (1:2), and after allowing to settle, 25 c.c. of warm water is added, and the funnel rotated whilst held vertically. The clear aqueous layer is drawn off, and the operation repeated with five successive 30 c.c. portions of cold water. The ethereal solution is

finally evaporated and the residue dried at 100° C. With samples containing 25% or more of unsaponifiable matter, the quantity of fatty acids remaining dissolved in the ethereal solution is about 2 mgrms. and is balanced by a corresponding quantity of unsaponifiable matter in the aqueous soap solution. In the case of samples with high contents of fatty acids and very low contents of unsaponifiable matter, it may be assumed that 16 mgrms. of fatty acids remains dissolved in the ethereal solution; if more accurate results are desired, the ethereal solution, before evaporation, is washed with 20 c.c. of N/5 hydrochloric acid, and the evaporation residue, after weighing, is dissolved in 20 c.c. of alcohol and titrated with N/10 sodium hydroxide in presence of phenolphthalein, a control titration being made with the alcohol alone. The corrected number of c.c. of alkali multiplied by 0.028 gives the weight of fatty acids in grms., and this is subtracted from the weight of the evaporation residue of the ethereal solution. Results obtained by the method with a number of plant and animal products are tabulated.—A. S.

Fibrin. A. W. Bosworth. J. Biol. Chem., 1915, 20, 91—94.

PURE fibrin was prepared from ox-blood by repeated precipitation and solution, the product being finally washed with alcohol and ether and dried over sulphuric acid under reduced pressure; it consisted of a light, white powder containing 0.03% of ash, 17.21% N, and 0.95% S. It combines with bases to form a series of three acid salts containing one, two, and three equivalents of base, respectively, whilst a fourth salt, containing four equivalents of base, is neutral to phenolphthalein. All the compounds of fibrin with sodium, potassium, and ammonium are soluble. Calcium fibrinates containing three and four equivalents of calcium are soluble, but those containing one and two equivalents are insoluble. Fibrin combined with one equivalent of acid is insoluble and combined with more than one equivalent of acid is soluble. Unlike casein, fibrin is not capable of decomposing calcium carbonate. Carbon dioxide precipitates fibrin from a solution of calcium fibrinate, but not from a solution of sodium, potassium, or ammonium fibrinate. The molecular weight of fibrin is about 6666. (For analogous casein compounds, see this J., 1914, 609).—W. P. S.

Serum-albumin and glutin; Precipitation of — by alkaloidal reagents. P. J. Hanzlik. J. Biol. Chem., 1915, 20, 13—24.

THE precipitation of dialysed horse serum and glutin by tannin is different from that brought about by other common alkaloidal reagents (iodine, potassium ferrocyanide, potassium mercuric iodide, sodium phosphotungstate, and sodium phosphomolybdate). With these a certain concentration of free acid is necessary for the formation of the complex insoluble compounds. Tannin behaves like certain hydroxy compounds, e.g., resorcinol, phenol, quinol, and propyl alcohol, the maximum of precipitation with both serum-albumin and globulin corresponding with the isoelectric point. Precipitation of serum is not influenced by wide differences of concentration or by the presence of neutral salts such as potassium chloride and potassium thiocyanate.—W. P. S.

The Folin-Farmer method for the colorimetric determination of nitrogen. Bock and Benedict. See XXIII.

Determination of sugar in small quantities of blood. Lewis and Benedict. See XXIII.

PATENTS.

Milk; Manufacture of vegetable — and its derivatives [from soya beans]. W. J. Melhuish, Upper Parkstone, Dorset. Eng. Pat. 24,572, Oct. 29, 1913.

FOR the production of about 100 litres of the milk, 15 kilos. of soya beans ground to a fine meal is mixed at 90° C. with 100 litres of previously boiled water and 20 grms. of potassium phosphate, this temperature being maintained with constant stirring for about $\frac{1}{2}$ hour. After passing the liquor through a filter-press, the oil, which imparts an unpleasant taste to the liquid, is eliminated by means of a cream separator. Sesamé or other tasteless oil (about 3.6 kilos.) and butyric and other acids such as are usually found in cream, are next emulsified with the milk and 1875 grms. of dextrose, 2500 grms. of dextrin, and 625 grms. of sucrose, or 1500 grms. of maltose, 2500 grms. of dextrin, and 1000 grms. of sucrose, or 1250 grms. of lactose, 1000 grms. of maltose, 2500 grms. of dextrin, and 250 grms. of sucrose are added. The milk is mixed with 100—130 grms. of sodium bicarbonate, 50—70 grms. of sodium chloride, and 50 grms. of citric acid, and in order to impart a characteristic taste and aroma, and to cause it to separate into curds and whey at the end of a certain time, it is inoculated with a "cream starter," and allowed to stand until 100 c.c. require 4.5—7.5 c.c. of N/10 alkali for neutralisation. The milk is subsequently pasteurised, cooled to atmospheric temperature, and passed through a filter-cloth, being then bottled for use. Instead of treatment with the "cream starter," lactic bacteria cultivated in a small amount of the artificial milk may be used.—J. P. O.

Milk; Clarification of —. B. R. Wright, Poughkeepsie, N.Y., Assignor to The De Laval Separator Co., New York. U.S. Pat. 1,122,457, Dec. 29, 1914. Date of appl., July 21, 1913.

MILK is delivered into the centre of a rotating centrifugal drum and passes through narrow passages to a peripheral space where the heavier impurities are deposited. The milk is then returned, in the form of a number of sheet-like streams, through other narrow passages towards the centre of the drum and the outlet. Clarification is thus effected without materially changing the distribution of the butter fat globules in the milk.—W.P.S.

Coffee extract; Water-soluble —. M. C. Whitaker and F. J. Metzger, New York. U.S. Pats. (A) 1,123,827 and (B) 1,123,828, Jan. 5, 1915. Date of appl., July 19, 1912.

(A) ROASTED coffee is distilled with dry steam, and the residue extracted with an organic solvent to remove caffeine, and afterwards with water. The aqueous extract and the distillate are evaporated, and the residues are mixed to form a solid coffee extract. (B) Roasted coffee is distilled with dry steam, the distillate is extracted with ether, and the ethereal solution is mixed with a concentrated aqueous extract of the residual coffee; the mixture is then heated to remove the ether.—W. P. S.

XIXB.—WATER PURIFICATION; SANITATION.

Reduction of ferric sulphate in acid solution by means of cadmium amalgam for titration of iron and free sulphuric acid. Capps and Boies. See VII.

PATENTS.

Sludge from the clarification of waste liquids; Drying and gasification of — R. Nübling and A. Krauss. Fr. Pat. 470,848, April 14, 1914. Under Int. Conv., April 30, 1913.

THE process is carried out in a plant erected as a part of or alongside an illuminating gas plant or a destructor furnace, in order that the hot gases may be used as the source of heat required in the process. The sludge to be treated must not contain more than 25% of moisture. It is placed in horizontal, vertical, or inclined retorts, preferably mounted in a gas furnace or a destructor furnace as mentioned above. The gases from the carbonisation of the sludge are either led back to the retorts to be burned or are carried forward to the adjoining gas plant. The residual coke is used for mixing with town refuse as an aid to burning in the destructor.—J. H. J.

Sewage or other impure waters; Purification of — W. Jones, and Jones and Attwood, Ltd., Stourbridge. Eng. Pat. 729, Jan. 10, 1914.

THE sewage is purified in presence of air and cultivated sludge in an annular tank. Transverse depressions are formed in the floor of the tank at intervals and in each depression a plate is suspended so that the circulating sewage has to pass underneath the plate in each depression. Circulation is brought about by admitting compressed air at the bottom of each depression in such a way as to mix with the sewage on one side of the plate only. The upper part of the plate is so formed as to deflect the rising current horizontally towards the next depression.—J. H. J.

Waste waters; Clarification of — A. Hölken. Ger. Pat. 277,702, Sept. 6, 1913.

THE sludge separated from the waste liquid is incinerated and the residue lixiviated with water to obtain crude potassium carbonate, and then treated with acid to obtain a precipitant for the waste liquid. Before treatment with the precipitant the waste liquid is rendered alkaline with the potassium carbonate recovered from the sludge, together, if necessary, with potassium carbonate from other sources.—A. S.

Sewage, garbage, and the like; Treatment of — J. J. Smith, Brookline, Mass., Assignor to W. Nash, Marblehead, Mass. U.S. Pat. 1,123,414, Jan. 5, 1915. Date of appl., April 14, 1913.

THE drained solids from sewage or garbage are deodorised by mixing with charcoal and earth, and then dried by heating—J. H. J.

Water purifier. Maschinenbau-Anstalt Humboldt. Fr. Pat. 471,079, April 14, 1914. Under Int. Conv., Sept. 26, 1913.

THE water flows from an upper tank through a siphon into a lower one, where it is heated by the admission of live steam, and then through another siphon into a filter. The purifying reagent is placed in a box in the upper tank, and admitted as required. The whole action is regulated automatically by floats and valves.—J. H. J.

Sterilising liquids hermetically closed in bottles; Apparatus for — L. Giommi, Milan, Italy. Eng. Pat. 30,048, Dec. 31, 1913. Addition to Eng. Pat. 9912 of 1912 (this J., 1913, 622).

THE sterilising chamber is jacketed, and the jacket is divided into sections, means being provided for establishing different temperatures in the sections according to their level. A heating chamber is arranged concentrically within the sterilising chamber.—J. P. O.

Sewage and the like; Process for the treatment of — J. C. Butterfield, London, Assignor to E. A. Paterson, Port Arthur, Ont., Canada. U.S. Pat. 1,122,474, Dec. 29, 1914. Date of appl., March 24, 1913.

SEE Eng. Pat. 5921 of 1913; this J., 1914, 804.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Santal oil; Solubility of — in alcohol. M. Baniog and P. van der Wielen. Pharm. Weekblad, 1914, No. 49. Perfumery and Essent. Oil Rec., 1915, 6, 8—9.

INSTEAD of determining the solubility of santal oil in a definite quantity of alcohol, it is preferable to determine the temperature at which the solution of oil becomes turbid. With solutions of 1 part by weight of genuine santal oil in 4 parts and 5 parts by weight of 70% alcohol, this temperature was 24° C. and 18° C. respectively. Admixture of cedar, turpentine, and camphor oils raised the temperature at which the solution became turbid.—T. C.

Essential oil of Santolina Chamæcyparissus. L. Francesconi and Granata. Gaz. Chim. Ital., 1914, 44, II., 150. Perfumery and Essent. Oil Rec., 1915, 6, 24. (See also this J., 1911, 1332; 1912, 202.)

THE oil contains two optically inactive, isomeric ketones, α - and β -santolinone, which can each be separated into two antipodal forms by means of camphorsulphonic acid, and a levorotatory γ -ketone giving an oxime, γ -santolinoneoxime, $C_{10}H_{17}ON$, forming large rounded prisms, m. pt. 116° C., $[\alpha]_D^{20} = +41^\circ$, m. pt. of hydrochloride, 148°—151° C. None of these ketones combines readily with either sodium bisulphite or hydrazine or yields crystalline products with phenylhydrazine or bromine.—T. C.

Oils of digger pine, lodgepole pine, and red fir; The leaf and twig oils of — Oils of the Coniferae. IV. A. W. Schorger. J. Ind. Eng. Chem., 1915, 7, 24—26.

THE oil from the digger pine, *P. Subiniana*, Dougl. (yield 0.078—0.102%) had the sp. gr. 0.8517—0.8566 at 15° C.; $\alpha_D^{20} = -20.93^\circ$ to -38.36° ; $n_D^{20} = 1.4670$ — 1.4708 ; acid value, 1.47—2.05; ester value, 6.77—11.98; after acetylation, 25.86—37.16. It contained: *l*- α -pinene, 58—59; *l*-limonene, 18; free alcohols (as *l*-borneol), 6; bornyl esters (as acetate), 3.5; *n*-heptane, 3; and "green oil" (b.pt. 265°—290° C.), 2—3%. The small quantity of heptane probably originated from the twigs: the oils from the oleoresins of the digger pine and the Jeffrey pine (*P. Jeffreyi*) consist almost exclusively of *n*-heptane. The oil from the lodgepole pine, *P. contorta*, Lond. (yield 0.234%) had the sp. gr. 0.8690 at 15° C.; $\alpha_D^{20} = -17.84^\circ$; $n_D^{20} = 1.4831$; acid value, 0.90; ester value, 6.02; after acetylation, 32.30. It contained: *l*- β -pinene, 49—50; *l*-phellandrene plus dipentene, 19; cadinene, 7; free alcohols (as *l*-borneol), 7.5; *l*-camphene, 5—6; *l*- α -pinene, 3; and bornyl esters (as acetate), 2%. The fractions boiling at 205°—235° C. from the digger pine and lodgepole pine oils, when saponified and oxidised, yielded anisic acid, derived probably from methylchavicol. The oil from the red fir, *Abies magnifica*, Murr. (yield 0.154%) had the sp. gr. 0.8665 at 15° C.; $\alpha_D^{20} = -16.70^\circ$; $n_D^{20} = 1.4861$; acid value, 0.75; ester value, 9.93; after acetylation, 36.22. It contained: *l*-phellandrene, 52; *l*- β -pinene, 16—18;

"green oil" (b.pt. 255°—260° C.), 13; free alcohols (as l-borneol), 7.5; and bornyl esters (as acetate), 3.5%. The lodgepole pine and red fir oils contained traces of furfural.—A. S.

Cholesterol into coprosterol; Conversion of——
A. Windaus. Chem.-Zeit., 1914, 38, 1040.

WHEN cholesterol is reduced in the presence of finely-divided nickel, a mixture is obtained consisting of two isomeric dihydroxycholesterols and two isomeric coprosterols; from these, coprosterol may be separated by means of the saponin reaction. Platinum or palladium cannot be used as the catalyst in place of nickel.—W. P. S.

Alcohol for use in manufacture of ether, chloroform and chloral in Australia. Board of Trade J., Feb. 4, 1915.

AN Australian Commonwealth Customs Order (No. 1760), dated 27th November, 1914, lays down certain regulations for denaturing spirits for use in certain manufactures in the Commonwealth. Spirits for the manufacture of anæsthetic ether, chloroform, chloral, and chloral hydrate may be cleared without payment of duty, subject to denaturation to the satisfaction of the Collector of Customs. The following methods of denaturation may be permitted in the case of:—(1) Spirits for the manufacture of ether: (a) By the admixture of 10 gallons of ordinary ether with 100 gallons of rectified spirit; and in the case of alcohol charged into the still along with sulphuric acid: (b) By admixture of at least 50 parts of concentrated sulphuric acid with the rectified spirit used in the charge. (2) Spirits for the manufacture of chloroform, chloral, and chloral hydrate may be denatured by the addition of 0.05% of bone oil, which must conform to a certain prescribed standard. The following alternative method for denaturing spirits for the manufacture of chloroform may be permitted: 50 oz. of chloroform to be added to each 100 gallons of spirit together with the addition of a few pounds of calcium hypochlorite required for the process of manufacture. The denaturation must be performed under the supervision of an officer.

Perfumery and cosmetics. Board of Trade Bulletin.

THE values of the exports of perfumery and cosmetics from Germany in 1912 were as follows:—Perfumed greases, ointments, pomades, oils (fatty, animal), £98,900; eau-de-Cologne, £163,550; other perfumes and cosmetics, extracts and toilet waters, all containing ether or alcohol; toilet vinegar, £176,500; head, mouth and tooth wash containing ether or alcohol, £66,400; perfumed waters, not containing ether or alcohol; perfumed toilet powders, toilet paints, tooth powder, and other perfumery and cosmetics, not otherwise mentioned, £115,550; total £620,900; from Austria-Hungary (1913): vinegar, fats and oils, perfumed, in packages, £225; alcoholic aromatic essences, £2450; articles of perfumery (and all substances or mixtures which by their wrappers, labels, directions for use, etc., purport to be articles of perfumery), cosmetics (a) not containing alcohol (rouge, perfumed face-powder, hair-oil, pomades, tooth paste, fuming pastilles), £41,900; (b) containing alcohol, £25,200; total, £69,775; from the United Kingdom (1913): perfumery, containing spirits (not made in bond), £168,400; perfumery, other sorts, £204,150; total, £372,550.

Of the German exports in 1912 the United Kingdom took £72,200 worth, including eau-de-Cologne to the value of £52,250. The other important markets supplied with perfumery, etc., by Germany and the amount taken by each were, Dutch East Indies (£45,200); British West

Africa (£41,450); Netherlands (£41,300); Russia (£39,800); Australia (£32,050); Italy (£24,500); Argentine (£19,500); British India (£19,400); Belgium (£14,900); Turkey (£14,100); Switzerland (£12,000); and Mexico (£11,550). The total export trade of Germany in perfumery, etc., with British Possessions, in 1912, amounted to £127,750.

The Austro-Hungarian export trade in perfumery, etc., is a small one, amounting to less than £70,000 in the aggregate. Her principal markets in 1913 and the amount sent to each were: British India (£13,565); Russia (£7745); Roumania (£7450); Turkey (£4390); France (£4020); and Italy (£4310).

There are several important markets now thrown open to British manufacturers of perfumery and cosmetics, the principal being the Dutch East Indies, Netherlands, Russia, Italy, Turkey, Switzerland, Belgium, Mexico. There is also room for considerable expansion of the present trade with British South and West Africa, Australia, France, Roumania, Brazil, Argentina, and the United States.

Precipitation of serum albumin and gluten by alkaloidal reagents. Hanzlik. See XI.A.

PATENTS.

Methyl chloride; Manufacture of——. B. S. Lacy, Perth Amboy, N.J., U.S.A. Eng. Pat. 16,194, July 7, 1914. Under Int. Conv., July 7, 1913.

SEE U.S. Pat. 1,111,842 of 1914; this J., 1914, 1075. The reaction is carried out at about 400° C.

Lecithin; Process for obtaining preparations containing free——. H. Martin. Fr. Pat. 470,527, April 4, 1914. Under Int. Conv., April 8, 1913.

EGG yolk is mixed with alcohol (96%) and heated for ½ hr. at 80° C.; the alcohol is distilled off and the residue mixed with powdered sugar and a little flavouring material, compressed into tablets, and rapidly dried. A small quantity of alcohol may be left in the material until it is formed into tablets.—J. H. J.

Aluminium acetate; Manufacture of compounds of——soluble in water, even after evaporation. Kalle und Co. Akt.-Ges. Ger. Pat. 277,149, May 23, 1913. Addition to Ger. Pat. 272,516.

AN aqueous solution of formaldehyde and ammonia may be used instead of the solid hexamethylenetetramine specified in the chief patent (this J., 1914, 568).—A. S.

Vaccine; Preparation of a——. W. Fornet, Halensee-Berlin, Germany. U.S. Pat. 1,122,379, Dec. 29, 1914. Date of appl., Aug. 4, 1913.

SEE Ger. Pat. 264,300 of 1912; this J., 1913, 1087.

Nicotine; Process of preparing——. W. Halle, Budapest, Austria-Hungary. U.S. Pat. 1,123,522, Jan. 5, 1915. Date of appl., May 29, 1913.

SEE Ger. Pat. 268,453 of 1913; this J., 1914, 221.

Esters of tertiary alcohols; Production of——. P. Neumann and J. Zeltner, Charlottenburg, Germany. U.S. Pat. 1,123,572, Jan. 5, 1915. Date of appl., Nov. 6, 1913.

SEE Fr. Pat. 466,804 of 1913; this J., 1914, 845.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

PATENTS.

Photographs in natural colours : Production of —. F. J. Norman, F. Willmot, T. F. Dawe, and W. Buchanan-Taylor, Westminster. Eng. Pat. 21,778, Sept. 26, 1913.

To produce cinematograph or other films in natural colours, three negatives are taken through red, green, and blue screens respectively, and transparent positives are prepared from them. The positive from the red-screen negative is toned blue with a chromium salt, ferricyanide, or cobalt chloride, and fixed: it is then coated with a gelatin emulsion sensitised with potassium bichromate, dried, and exposed under the positive from the green-screen negative, in register, washed in running water, stained with an appropriate red dye, fixed with tannic acid, and dried. The process is repeated, the freshly-coated film being next exposed under the positive from the blue-screen negative, and the film afterwards stained with a suitable yellow dye, and fixed. Or the yellow may be added to the film by preparing a separate gelatin film by exposure under the positive from the blue-screen negative, staining it with a suitable yellow dye, and placing it, while still wet, in contact with the red-dyed surface of the final colour film, allowing the latter to absorb the yellow dye.—E. W. L.

Colour photography. G. S. Whitfield, Watford. Eng. Pat. 24,566, Oct. 29, 1913.

In making a picture on a support such as paper which is expanded by water, correct registration of the finished result is obtained by keeping the support fully expanded with water during all the processes, including exposure and binding up with the viewing screen (see also Eng. Pat. 5144 of 1912; this J., 1913, 541).—B. V. S.

Colour photography. J. H. Christensen, Hølte, Denmark. Eng. Pat. 13,260, May 29, 1914. Addition to Eng. Pat. 25,419 of 1913 (this J., 1911, 1226).

A COLOURED positive is produced from a coloured negative (e.g., an autochrome plate before reversal) by exposing through the negative and a specially prepared film containing developer, on to a sensitive film which is coated on a coloured film; the developer film and sensitive film are in contact. The printing light is filtered to the colour of one of the elements of the negative, and the colour of the back film is complementary to this; one exposure is required for each coloured element of the negative. During the exposure the sensitive film is developed and the colouring matter is transferred through the developed film to the developer film; the developer film, or a specially prepared part of it, constitutes finally the coloured positive. If a separate negative is used for each colour, registration is necessary for the second and subsequent exposures; otherwise the negative and developer film are kept bound together. Fast Green Extra Bluish (Bayer), Fast Acid Fuchsin G and Pinatype Yellow (Höchst) are mentioned as suitable dyes, and methods of hardening the films and mordanting the dyes are suggested.—B. V. S.

Colour photography. F. E. Ives, Woodcliffe on Hudson, N.J. U.S. Pat. 1,122,935, Dec. 29, 1914. Date of appl., Aug. 5, 1912.

SEE Fr. Pat. 461,078 of 1913; this J., 1914, 44.

XXII.—EXPLOSIVES; MATCHES.

Precautions in the industrial preparation of nitro-compounds [in Germany]. See III.

PATENTS.

Nitrocellulose rich in nitrogen and easily stabilised : Preparation of —. A. Voigt. Fr. Pat. 470,743, April 10, 1914.

THE nitrocellulose is freed from the nitrating acid, and chopped up in a cutting machine, such as a forage or meat chopper, a paper cutter, or a planing machine, instead of or in conjunction with the usual treatment in beating engines.—J. F. B.

Trinitrotoluene : Preparation of pure — from the crude product. Oberschlesische A.-G. für Fabrikation von Lignose, Schiesswollfabrik für Armee und Marine. Ger. Pat. 277,325, Aug. 29, 1913.

CRUDE trinitrotoluene is recrystallised from *o*-nitrotoluene. The same apparatus as is now used for recrystallisation from alcohol can be employed, and with the same working costs from four to five times as much of the crude trinitrotoluene can be purified by means of *o*-nitrotoluene, in a shorter time, and with a higher yield of the pure substance. The lower nitro-derivatives present as impurities accumulate in the *o*-nitrotoluene, which is afterwards used as raw material for the preparation of a further quantity of crude trinitrotoluene.—A. S.

Percussion-caps ; Manufacture of compositions for —. Rheinisch-Westfälische Sprengstoff A.-G. Ger. Pat. 277,566, Feb. 15, 1913.

NITROGEN sulphide is used in conjunction with oxidising agents, such as lead peroxide, barium nitrate, lead nitrate, potassium permanganate, etc., and the usual components of cap compositions. The gases produced on detonation are harmless and do not attack the rifling of the barrels.—A. S.

Explosives ; Manufacture of —. Ver. Köln-Rottweiler Pulverfabriken. Ger. Pat. 277,594, Aug. 23, 1913.

HEXANITROETHANE is used alone or mixed with other substances. It cannot be exploded alone by percussion or friction, but requires a detonator. It can be used to improve the ballistic properties of nitrocellulose and nitroglycerin powders.—A. S.

Explosive and process of making the same. W. J. Hoynes. Fr. Pat. 470,209, March 28, 1914.

SEE Eng. Pat. 6755 of 1914; this J., 1914, 1227.

Explosive. S. Adde. Fr. Pat. 470,592, April 7, 1914.

SEE Eng. Pat. 13,373 of 1911; this J., 1913, 453.

Explosives ; Gelatinised —. A. E. Vergé. Fr. Pat. 470,765, June 23, 1913.

SEE Eng. Pat. 17,025 of 1913; this J., 1914, 913.

XXIII.—ANALYTICAL PROCESSES.

Arsenic ; Detection of — [in animal organs, urine, etc.]. O. Billeter. Chem. Zeit., 1914, 38, 981—982.

FROM 20 to 50 grms. of the substance is oxidised by sulphuric and nitric acids in the usual way and the resulting solution, freed from nitric acid, is diluted to contain about 80% H₂SO₄ and introduced through a tap-funnel into a distillation

flask containing 4 grms. of sodium chloride, 1 gm. of potassium bromide, and 0.2 gm. of hydrazine sulphate. The gases evolved are passed through a condenser and collected in a receiver containing a small quantity of hypochlorous acid solution, the contents of the flask being finally warmed while a current of air is drawn through the apparatus. The distillate is then treated with an excess of hypochlorous acid, evaporated to dryness, the residue dissolved in dilute sulphuric acid, and the solution transferred to the Marsh apparatus. In the case of urine, 200 c.c. is neutralised with sodium hydroxide, evaporated to dryness, the residue is mixed with 2 grms. of potassium perchlorate and 5 grms. of potassium sulphate, and the mixture transferred in small quantities at a time to a heated platinum crucible. The fused mass is then distilled with sulphuric acid, 0.8 gm. of potassium bromide, and 0.4 gm. of hydrazine sulphate, as described above.—W. P. S.

Arsenic; Electrolytic separation of zinc, copper, and iron from—. A. K. Balls and C. C. McDonnell. *J. Ind. Eng. Chem.*, 1915, 7, 26—29.

ZINC, copper, and iron, and small quantities of lead may be separated electrolytically from arsenic in alkaline solution, provided the arsenic be in the quinquevalent form and a sufficient excess of alkali be used, *e.g.*, 10–20 grms. per 100 c.c. of electrolyte. Potassium hydroxide is preferable to sodium hydroxide, and in the case of copper and iron, tartaric acid is added to prevent the formation of a precipitate in the alkaline solution. The quality of the deposited zinc is improved by addition of a small quantity of glycerin, or a mixture of glycerin and alcohol, to the electrolyte. The current must be kept below 1.7 ampères per 100 sq. cm. when depositing iron, to prevent contamination of the deposit by carbon; preferably a current below 1 ampère per 100 sq. cm. is used. Deposition of iron oxide can be prevented by addition of a few c.c. of alcohol. To obtain good deposits of copper the anode must be rotated at 1000–1600 revolutions per minute and about 2 grms. of potassium nitrate added to the electrolyte (100 c.c.).—A. S.

Alkalimetric solutions; Standardisation of—. F. D. Dodge. *J. Ind. Eng. Chem.*, 1915, 7, 29—30.

THE use of the acid phthalate of potassium, $\text{KHC}_8\text{H}_4\text{O}_4$, for standardising alkali solutions for volumetric analysis, is recommended. It is prepared by half-neutralising a solution of phthalic anhydride and purified by recrystallising from water. It crystallises in the anhydrous form in hexagonal plates, is stable and non-hygroscopic, and is soluble in 10–11 parts of water at the ordinary temperature and in about 400 parts of alcohol. The corresponding sodium salt crystallises in transparent prisms with $\frac{1}{2}$ mol. H_2O , which is lost on heating at 100° – 110°C . the crystals becoming opaque.—A. S.

Nitrogen; The Folin-Farmer method for the colorimetric determination of—. J. C. Bock and S. R. Benedict. *J. Biol. Chem.*, 1915, 20, 47—59.

To determine nitrogen in small quantities of material, it is converted into ammonia as in the Kjeldahl method, and the ammonia carried by a current of air into an acid solution and determined colorimetrically by Nessler's reagent in a Duboscq colorimeter (Folin and Farmer. *J. Biol. Chem.*, 1912, 11, 493). The authors point out several sources of error in the method; the accuracy of the colorimeter and of the measurement of the quantity of material taken for the analysis is limited to about 1% of the nitrogen present, the reagents employed are seldom free from ammonia,

and ammonia may be absorbed from the atmosphere during the operations. Analyses of some 70 samples of urine by the method gave results usually agreeing within 3% with those found by the Kjeldahl method, but sometimes the difference may amount to from –11.8 to +4% of the quantity of nitrogen present. When the ammonia is removed by distillation without a current of air, the error amounts to about 5% of the quantity of total nitrogen. The Folin-Farmer method may be employed with advantage in cases where the quantity of nitrogen is very small (as in the determination of the non-protein nitrogen of blood), *i.e.*, where a large percentage error is not of great importance.—W. P. S.

Sugar in small quantities of blood; Determination of—. R. C. Lewis and S. R. Benedict. *J. Biol. Chem.*, 1915, 20, 61—72.

THE method depends on the red coloration produced when a dextrose solution is heated with picric acid and sodium carbonate, and due probably to picramic acid. Two c.c. of blood is mixed with 5 c.c. of water and 15 c.c. of saturated picric acid solution, diluted with water to 25 c.c., mixed, and filtered. Eight c.c. of the filtrate is treated with 2 c.c. of picric acid solution and 1 c.c. of 10% sodium carbonate solution, boiled until precipitation commences, 3 c.c. of water is then added and the boiling continued until the precipitate dissolves, whereupon the solution is cooled, diluted to 10 c.c., and filtered. The coloration obtained is compared at once with that obtained in a similar manner with 0.64 gm. of dextrose, 5 c.c. of picric acid solution, and 1 c.c. of 10% sodium carbonate solution. A standard solution, prepared by boiling together 0.064 gm. of picramic acid and 0.1 gm. of sodium carbonate in 50 c.c. of water and diluting the mixture to 1 litre, may also be used for the comparison. The method is accurate within 2% of the quantity of sugar present. The normal sugar content of blood was found to vary from 0.09 to 0.11%.—W. P. S.

Lead acetate test for hydrogen sulphide in gas. McBride and Edwards. *See* IIA.

Determination of sulphur in motor spirits. Bradbury and Owen. *See* IIA.

Determination of the percentage of toluene in commercial toluol. Colman. *See* III.

Determination of the specific gravity of tars, [tar] oils and pitches. Weiss. *See* III.

Reduction of ferric sulphate in acid solution by means of cadmium amalgam for titration of iron and free sulphuric acid. Capps and Boeis. *See* VII.

Analytical examination of commercial tungsten. Arnold. *See* X.

Determination of carbon and phosphorus in cerium and cerium alloys. Arnold. *See* X.

Pharmacopœia test for sesam! oil in olive oil. Sage. *See* XII.

Detection of kapok oil. Besson. *See* XII.

Proposed uniformity in methods of fat analysis [for the leather industry]. Fahrion. *See* XII.

Determination of pentoses in tanning materials. Van Gijn and van der Waerden, and Reed and Schubert. *See* XV.

Determination of tanning materials [mangrove] in admixture. Small. See XV.

Analysis of sulphite-cellulose extracts. Paessler. See XV.

Detection of sulphite-cellulose in tanning extracts and in leather. Appelius and Schmidt. See XV.

Analysis of chrome leather and of materials used in its manufacture. Balderston. See XV.

Determination of free sulphuric acid in leather. Paessler. See XV.

Comparison of a few methods for total phosphoric acid in superphosphate. Peters and Weigel. See XVI.

Comparison of the Gunning-Cooper method and the Kjeldahl-Gunning-Arnold method for the determination of nitrogen. Jensen. See XVI.

Determination of dry substance in [beet] sugar factory products. Fallada. See XVII.

The volumetric Fehling method [for the determination of reducing sugars], using a new indicator. Breckler. See XVII.

Determination of pentoses and methylpentoses in wine. Schaffer. See XVIII.

Detection of goat's milk in cow's milk. Pritzker. See XIXa.

New method for the determination of unsaponifiable matter, applicable to ether extracts, fats, oils, and waxes. Rather. See XIXb.

Trade Report.

France. Prohibited exports. Board of Trade J., Feb. 11, 1915.

A FRENCH Presidential Decree, dated the 4th February, prohibits, as from the 5th, the exportation and re-exportation of the undermentioned articles:—Lactic acid; catechu, crude (*en masse*); celluloid, crude, in lumps, and plates, sheets, rods, tubes, sticks, scrap, waste; codeine; calcium cyanamide; digitalin; emetin and emetic; extracts of quinine; fulminate of mercury; graphite; residual oils from the distillation of alcohol; vegetable oils and whale oils; volvic stone (volvic lava); molasses; ores of molybdenum, titanium, vanadium; morphine; oleo-margarine and similar substances; paraffin; sodium peroxide; phosphorus; pine and fir resin; beetroot saline; salol; ammoniacal salts; copper sulphate and "*verdets*"; "*bonillies*" and cupreous powders; terpene; infusorial earths; trioxymethylene. (See also this J., 1915, 191.) Exemptions from these prohibitions may, however, be accorded, under conditions to be laid down by the Ministry of Finance.

Switzerland. Prohibited exports. Board of Trade J., Feb. 11, 1915.

A DECISION of the Swiss Political Department, dated the 28th January, provides that, as from the 1st February, the prohibition of exportation established by the Decree of the 18th September, 1914, in respect of *medicaments and disinfectants* shall be held to apply to the following articles:—Acetanilide (antifebrine); acetone; acetylsalicylic acid; citric acid; salicylic acid and salicylate of

soda; tartaric acid; adrenaline, natural or artificial, and other extracts of the suprarenal glands (suprarenine, paraneprine, epinephrine, etc.); agar; aloes; aluminium acetotartate; antipyrine; apomorphine; arecoline and its salts; atropine and its salts; balsam of Peru, natural or artificial; bismuth and its salts; bromine and its salts; caffeine and its salts; chloroform for narcosis; cocaine and its salts and combinations; codeine and its salts; collo-dion; cresol and soapy solutions thereof; diethylmalonyl urea and its salts; veronal; dimethylaminoantipyrine, pyramidone; dionine; sulphuric ether, pure or unrefined; formalin liquid; glycerin, pure; heroine; castor oil; iodine and its salts; iodoform; ipecacuanha root; lanoline (wool grease); mastic; mercury and its salts; morphine and its salts; naphthalene; novocain; opium and powders of opium, extracts, tinctures; paraffin, solid or liquid; paraformaldehyde; permanganate of potash; phenacetin; phenol (carbolic acid), pure; paprika; quinine hydrochlorate and sulphate; cinchona bark; rhubarb root; salol; saltpetre; salvarsan, neosalvarsan; santolin; scopolamine (hyoscyne); ergot of rye; semen contra; sulphate of copper; tannin; theobromine and its salts and combinations; tropacocaine and its combinations; vaseline. Medicaments and disinfectants other than those specified above are allowed to be exported until further notice.

Books Received.

PROPOSED NEW CUSTOMS AND EXCISE TARIFFS OF THE COMMONWEALTH OF AUSTRALIA. Suppl. to the Board of Trade J., Jan. 21, 1915. Price 3d.

STANDARD METHODS OF GAS TESTING. Circular No. 48 of the U.S. Bureau of Standards. Aug. 1, 1914. Government Printing Office, Washington.

THIS circular covers 180 pages, and contains suggestions as to location and equipment of gas-testing laboratories, a description of some of the accepted forms of apparatus, directions for making the various tests, and recommendations as to the interpretation of experimental results. The methods of testing included are those which have been found satisfactory in the laboratories of the Bureau or by experienced gas testers elsewhere.

APPENDICES TO THE THIRTY-EIGHTH ANNUAL REPORT OF H.M. INSPECTORS OF EXPLOSIVES, 1913. Wyman and Sons, Fetter Lane, London, E.C. Price 3s. 6d.

THE contents of this volume include lists of explosives authorised to be manufactured or imported, and of principal explosives used at mines and quarries; lists of railways, canal companies, and harbours and docks for which by-laws have been made or where traffic in explosives is prohibited; copies of various circular letters sent out by the Home Office; reports of ignitions of fire-damp and coal-dust caused by permitted explosives and of certain accidents by fire or explosion; and reports of prosecutions and convictions during 1913 under the Explosives Acts or Railway By-laws.

MINES AND QUARRIES. GENERAL REPORT, WITH STATISTICS, FOR 1913, BY THE CHIEF INSPECTOR OF MINES. PART II.—LABOUR. [Cd. 7721.] Wyman and Sons, Fetter Lane, E.C. Price 1s. 4d.

THIS publication contains a general report and statistics relating to persons employed and

accidents at mines and quarries in the United Kingdom, and to the enforcement of the Mines and Quarries Acts.

MINES AND QUARRIES: GENERAL REPORT, WITH STATISTICS, FOR 1913, BY THE CHIEF INSPECTOR OF MINES. PART III.—OUTPUT. [Cd. 7741.] Wyman and Sons, Fetter Lane, E.C. Price 1s. 4d.

THIS return contains statistics of the quantity and value of various minerals raised in the United Kingdom. (See this J., 1915, 87.)

MINES AND QUARRIES: GENERAL REPORT AND STATISTICS FOR 1912. PART IV. COLONIAL AND FOREIGN STATISTICS. [Cd. 7732.] Wyman and Sons, Fetter Lane, E.C. Price 1s. 7d.

THIS part of the Report includes statistics relating to persons employed, output, and accidents at mines and quarries in the British Colonies and in foreign countries during 1912 (see this J., 1915, 141.)

BORAX AND BORACIC ACID IN LEATHER MANUFACTURE. Borax Consolidated, Ltd., 16, Eastcheap, London, E.C.

THIS small booklet (6½ by 5 in.) covers 92 pages, in addition to an index. It deals with various phases of leather manufacture under the headings of soaking, deliming and leaching, chrome tanning, and currying, and contains a number of recipes and formulæ. Extensive quotations are made from Fleming's "Practical Tanning" and from Watt's "Leather Manufacture."

TABLES ANNUELLES DE CONSTANTES ET DONNÉES NUMÉRIQUES DE CHIMIE, DE PHYSIQUE ET DE TECHNOLOGIE. Vol. III. 1912. Gauthier-Villars et Cie., Paris; Akadem. Verlagsges. m. b. H., Leipzig; J. and A. Churchill, London; Univ. of Chicago Press, Chicago. 1914. Price 28s. net.

THIS volume is similar in general arrangement to Vols. I. and II. (this J., 1912, 562 and 1913, 714) and covers 595 pages, 11 by 9½ ins. It is published by a committee nominated by the Seventh International Congress of Applied Chemistry, the members of which are: Prof. M. Bodenstein (Hanover), Prof. G. Carrara (Milan), Prof. E. Cohen (Utrecht), Prof. W. C. McC. Lewis (London), Dr. C. Marie, General Secretary (Paris). Following the general table of contents, is an alphabetical list of technical materials with references to all data of technical interest contained in the various sections of the volume; and in certain chapters of a rather complex nature, special tables of contents are given. At the end of the volume are lists of errata relating to Vols. I., II., and III. respectively. It is noted in the introduction that the chapters on spectroscopy, radioactivity, electricity, magnetism and electrochemistry, metallurgy and engineering, mineralogy, and biology have also been published separately this year.

AMERICAN SOCIETY FOR TESTING MATERIALS, affiliated with the International Association for Testing Materials. Year-book, 1914, containing the standard specifications. Edited by the Secretary-Treasurer and published by the Society. Office of the Secretary-Treasurer, Univ. of Pennsylvania, Philadelphia, Pa., U.S.A. 1914. Price \$5.

THIS volume, 9½ by 7 ins., covering 500 pages, contains all the standard specifications adopted by the Society in their latest revised form; also some tentative specifications; selected specifications from miscellaneous sources; regulations

governing the form of specifications, standard methods of tests, etc.; and an alphabetical index. Abstracts of some of the specifications have been already published (see this J., 1914, 1208; 1915, 31, 32, 33, 38, 81). Copies of single specifications may be purchased at 25 cents each.

THE RUBBER INDUSTRY. Edited by J. TORREY, Ph.D., and A. STAINES MANDERS. The International Rubber and Allied Trades Exhibition Ltd., 75, Chancery Lane, London, W.C. 1914. Price 15s. 6d. net.

THIS volume (10½ by 7 ins.) contains 516 pages of subject matter comprising the official report of the Fourth International Rubber Congress held in London in 1914, together with the papers read, and the discussions thereon; also the principal papers read at the Rubber Congress, New York, 1912. As an introduction to the volume is given a historical and descriptive paper by D. Spence, accompanied by synoptic tables of all the known brands of rubber, showing their botanical and geographical origin, their loss on washing, and their resin extract. Abstracts of many of the papers in the volume will shortly appear in the Journal.

THE EXTRA PHARMACOPOEIA OF MARTINDALE AND WESTCOTT. Revised by W. HARRISON MARTIN DALE, Ph.D., and W. WYNN WESTCOTT, M.B. Lond., D.P.H. Sixteenth Edition. In two vols. H. K. Lewis, 136, Gower Street, London, W.C. 1915. Price. Vol. I., 14s.; Vol. II., 7s. net.

THE work is similar in general arrangement to the preceding edition (see this J., 1912, 848). Vol. I. covers xl.+1113 and Vol. II., viii.+469 pages (6½ by 4½ ins.). In Vol. I., following a series of tables of weights and measures, atomic weights, etc., is a section on "Materia medica, official and non official, alphabetically arranged," covering 795 pages; also a table showing the antiseptic powers of some chemicals and disinfectant preparations; a list of poisons and antidotes; and a general index and posological table. In the chapter on radium, the various units of radioactivity are defined and compared, and a revised list of radioactive substances is given. Vol. II. deals largely with analytical tests and methods, and includes sections on the effects of chemical constitution on physiological action of synthetic drugs; the approximate composition of some proprietary medicines; the antiseptic power of chemicals; the action of acids on the common metals and their oxides, and also an organic analysis chart, and glossaries of words and phrases in foreign prescriptions.

MUTER'S SHORT MANUAL OF ANALYTICAL CHEMISTRY. Edited by J. THOMAS, B.Sc. Tenth Edition. Baillière, Tindall, and Cox, 8, Henrietta Street, London, W.C. Price 6s.

THE tenth English edition of Muter's Manual does not differ in general character and scope from its predecessors; such changes as have been made are mainly those necessitated by alterations in the new British Pharmacopœia. The scope of the work may be gathered from the fact that it occupies 232 pages, and deals with qualitative and quantitative analysis, inorganic and organic. The first part of the volume describes the detection of metallic and acidic radicals, and alkaloids and certain other organic substances commonly used in medicine. Part 2 contains chapters on volumetric and gravimetric methods of quantitative analysis, ultimate organic analysis, special methods for water, air, food, drugs, urine, and urinary calculi, and the analysis of gases, polarisation, and spectrum analysis. The book is intended primarily for pharmaceutical students.

Journal of the Society of Chemical Industry.

No. 5, Vol. XXXIV.

MARCH 15, 1915.

No. 5, Vol. XXXIV.

Birmingham Section.

Meeting held at Birmingham University, on
Thursday, February 4th, 1915.

MR. HARRY SILVESTER IN THE CHAIR.

FACED PEARL BARLEY.

BY J. F. LIVERSEGE, F.I.C., AND HERBERT HAWLEY,
M.Sc., F.I.C.

Published references to pearl barley appear to be scanty. In Church's "Foods" it is stated that 100 lb. of barley yields about 37 lb. of pearl barley, the percentage composition of which is given as:—water 14.6, albuminoids and nitrogenous compounds 6.7, oil 1.3, starch, etc., 75.5, cellulose 0.8, and mineral matter 1.1%. In 1905 Matthes and Muller reported on twenty-five samples of pearl barley. Sixteen were free from talc, five contained less than 0.2%, and the remainder up to 0.63% (Analyst, 1905, 206). Dr. Hanull's report to the Local Government Board in 1909 on faced rice, stated that the practices of polishing and like treatment "appear now to be extending to other cereals, such as pearl barley, hitherto sold in their natural condition without mineral admixture."

Recently there appears to have been an increase in this form of adulteration, some samples we have examined showing as much as 0.82% of mineral facing. The total ash was usually determined on 10 grms., and the ash insoluble in acid by treating this ash with hydrochloric acid of about normal strength. The following table gives particulars of 73 samples which have been examined in the City Analyst's laboratory since 1910. A number of samples which are known to be duplicates have been excluded.

No. of samples.	Insoluble ash.	Total ash.
	%	%
50	0.00-0.04	0.64-1.18
10	0.05-0.09	0.82-1.10
7	0.10-0.19	0.79-1.17
1	0.22	1.32
1	0.38	1.51
2	0.40	1.32-1.46
1	0.76	1.62
1	0.82	1.61

It will be seen that a large proportion of the samples (50 out of 73) contained less than 0.05% of insoluble ash, and of these only one contained more than 1.10% of total ash. We consider that 0.1% of insoluble ash is a very reasonable allowance, and that samples containing a larger proportion than this should be considered adulterated with mineral facing. The total ash should not exceed about 1.1%.

Last year, as a result of convictions elsewhere, we examined a number of samples which had been faced with rice in quantities varying from 0.5 to 2.0%. Two other samples had been faced with both rice and mineral facing, the total amount of the adulteration being 0.5 and 1.0% respectively. The samples faced with talc usually yielded no dust when shaken on a No. 20 sieve. Those faced with rice vary considerably in this respect. One sample of rice-faced pearl barley yielded 2% of dust which was largely rice, and on rapidly washing 10 grms. of the sieved barley in a small glass

dish, with five separate quantities of 10 c.c. of water, and evaporating the washings to dryness, 0.5% of residue was obtained. Another sample yielded 0.2% of dust, chiefly rice, and 3.6% of dry solids was removed by washing. Part of the washings was cleared by means of a centrifuge, and the soluble part was found to be 0.7%—showing that the sample contained 2.9% of facing not removed by the sieve.

Microscopical examination of the washings showed that about 75% of the facing was rice. In these two cases prosecutions were instituted, but as the retailers were ignorant of this novel form of adulteration the magistrates only ordered the vendors to pay costs.

Twenty-three samples not faced with rice or mineral matter were shaken on the sieve. Thirteen of them yielded less than 0.2% of dust, nine samples yielded from 0.21 to 0.50%, and the remaining sample 1.27%.

We understand that millers assert that facing is necessary to protect pearl barley from weevils and mites. As far as rice is concerned this seems a strange statement, as millers have maintained that rice itself requires facing with talc. On careful examination, some samples of pearl barley were found to contain a hole, and were either grey, brown, or black. These grains had been attacked by weevils. Eleven out of 21 samples, or 52%, of unfaced pearl barley had been attacked in this way; in the worst sample about one grain in three thousand had been attacked by the insects; seven out of twelve, or 58%, faced samples had been similarly affected; in the worst of these one grain out of 270 was attacked. Two of these had been faced with talc, three with rice, and two with both rice and talc. These numbers are not large, but they give no evidence of the protecting power of the facing.

We have not succeeded in detecting mites in samples that are free from dust. If the dust from samples containing mites is put into water, small brown particles can be seen by the naked eye, and the majority of these on microscopical examination are found to be mites. Of the four samples of pearl barley containing mites, two were faced with rice, and two were not faced. The amount of dust varied from 0.17 to 2.0%.

It seems probable that the real object in facing pearl barley is to improve the appearance. To produce a satisfactory, uniformly white pearl barley entails a fair amount of waste. If the grains are not uniform in size, or the milling is not carried sufficiently far to remove the brown coat of the grain, the pearl barley is not uniform in appearance, and we have proved that rice flour stuck on to such pearl barley by means of glucose effects a decided improvement. Facing may therefore be considered in the words of the Sale of Food and Drugs Acts, "intended to conceal the inferior quality thereof."

DISCUSSION.

The CHAIRMAN asked by what method the authors determined the talc. Mr. E. W. T. Jones had devised a simple and expeditious one for the estimation of talc on faced rice in which the rice was heated with ether, which was decanted, and then with water which was also decanted, thus removing the whole of the talc. Evaporation of the liquids and weighing of the ignited residue gave the quantity of talc used for facing the rice.

Mr. A. E. JOHNSON said that he had found Mr. Jones' process simple and efficient.

Mr. E. W. MANN said that the suggested limit of 0.1% insoluble ash seemed quite reasonable.

The faced samples were quoted at the highest price in the market. There was no organisation in the food trade for stopping these products from getting to the retailer. The grocer might receive his first intimation of the occurrence of such an adulteration in the form of a police-court summons.

Mr. F. H. ALCOCK said that if a thing were artificially faced it must not necessarily be assumed to be adulterated. For example, rhubarb was faced with powdered rhubarb to improve its appearance. He did not think that would be adulteration.

Mr. J. C. MANN asked what became of the 70% which was stated to be lost in the process of facing? What would be the food value of the barley without facing?

Mr. LIVERSEEGE, in reply, said that Mr. Mann's statement as to the prices of faced barleys proved that the facing was done to cover an inferior barley and give it an inflated price. He thought glucose or oil would be needed to make the facing adhere. As to whether facing a food or drug with its own powder constituted adulteration, he mentioned that in America if pearl barley had been faced with barley it would have to be described as "coated with glucose and starch." The Americans did not consider it legitimate to cover pearl barley even with barley.

The question of whether the ash insoluble in acid represented the mineral facing had been discussed several times. Krizian had described an elaborate process for examining faced rice, which gave exactly the same results as their own method. Church's figures showed that the wastage from the pearl barley was about two-thirds. He did not think that the food value of barley was very different from that of pearl barley. The improvement was in appearance only.

Newcastle Section.

Meeting held at Bolbec Hall on Wednesday, 16th December, 1914.

PROF. H. LOUIS IN THE CHAIR.

SOME METAL FAILURES IN PLANT.

BY S. EVANS, M.Sc., A.M.S.T., A.M.I.M.M.

This paper contains an account of a few problems a little wide of the usual routine, which have come under the author's personal observation. As far as possible, an attempt has been made to classify the various examples. In almost every engineering works, the "metallurgical" failures must naturally take first place in number and importance, and cases under this heading are dealt with first. Secondly, one or two cases of corrosion are noticed, and finally, a collection of smaller matters, which, though as a rule quite simple in themselves, yet are of more or less importance in the economics of a large works, as their comparative insignificance renders them liable to be overlooked.

Case 1. Several "Durana" metal bolts, about 1 inch diameter, were returned fractured from the continent, where they were used for bolting together the portions of a small magnetic circuit.

The composition of the metal was Cu 59.55%, Zn 39.00%, Fe 0.91%, P 0.84%.

The sketches (see Fig. 1) show the positions of the microscopic sections cut.

In section No. 1, three small cracks were visible, though the structure was quite normal and uniform. In section No. 2, no flaws of any description were visible, but flow lines due to forging were visible under the microscope.

Mechanical tests showed good tensile strength and elongation. The bolts therefore showed no weakness in structure or properties and had evidently been tightened up beyond their elastic limit. It was afterwards ascertained that they did actually break in the process of erection.

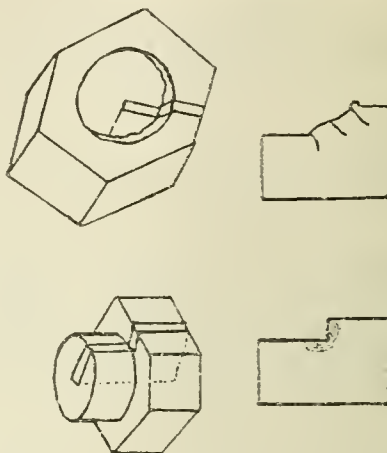


FIG. 1.

Case 2. This was a nickel steel sparking plug for a vertical gas engine. Sheet mica washers are threaded on the plug, bolted up tight, and the mica turned off to a cylindrical form. The plugs are bolted in to the cylinder head. This particular plug failed near to the plug head. Sections were cut adjacent to the fracture and the other extremity.

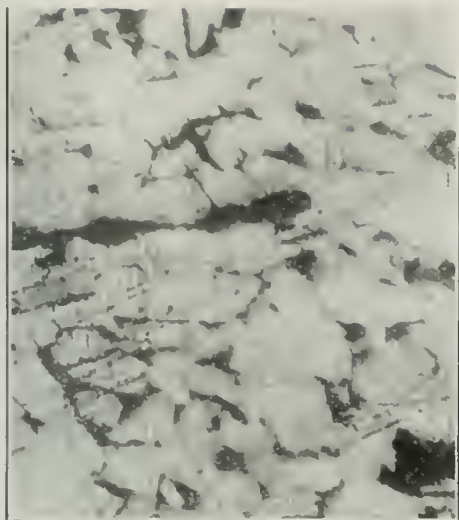
The cold end of the plug showed the typical close grained structure of nickel steel; at the hot end which failed, the heat had caused the segregation of the cementite. The plug would naturally be under tension all the time and it is evident that the segregation was the cause of fracture.

Case 3. Of two 2½ inch connecting-rod bolts from a 750 H.P. vertical gas engine, one snapped off short, whilst the other bent double. Test pieces from both bolts were good in every respect. In the longitudinal section from the fractured bolt (taken near the fracture) high carbon streaks were visible to the naked eye.

The sulphur and phosphorus were quite low. The microscopic examinations for both bolts, and the two inch black bar from which they were forged, are tabulated on page 205.

Case 4. Fractured chain links (two links of ¾ inch and ½ inch wrought iron) showed a coarsely crystalline fracture. The fractures were cut off and preserved, micro-specimens were cut and sections in the two principal planes prepared.

The links were divided, and one half of each was annealed for ½ hour embedded in sand from 700° C. to 800° C. On fracturing the usual tough fibrous structure of wrought iron was evident. Small test pieces were cut from the two halves and a marked difference in ultimate stress, elastic limit, and elongation observed. In the case of the small link the fracture had occurred at the old weld surface, which was oxidised, and had evidently been imperfectly joined. The large amount of slag present in the material undoubtedly helped to weaken the link, but the primary cause of fracture was not actual lack of annealing, of which the chain received plenty, but annealing at too low a temperature. The coarsely crystalline structure is said to be produced in iron containing less than 0.11% carbon by heating to below 700° C.



No. 1. Connecting-rod Bolt $\times 450$.



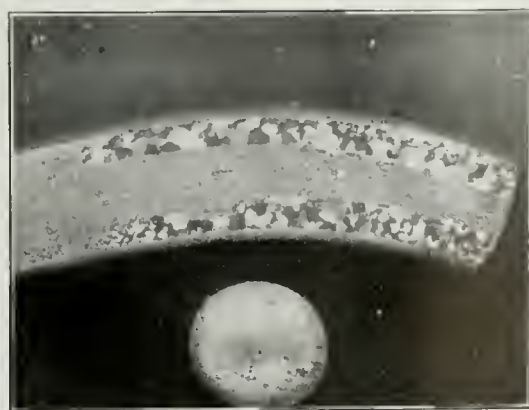
No. 2.—Connecting-rod Bolt $\times 150$.



No. 3.—Brass Gauge Cock $\times 150$.



No. 4.—Steel Crosshead $\times 150$.



No. 5.—Soft Iron Rod.

for some time. The crystal grain in the slaggy layers was much larger than in the slag-free layers; this may be accounted for by the fact that the latter are more continuous and flexible and will respond to any vibratory motion, which will be absorbed in the rigid and discontinuous slaggy layers with the consequent increase in vibration

0.016% S, 0.15% Mn, and 0.075% P. The un-etched microscopical section showed some honey-combing. When etched the phosphorus and sulphur were quite evenly distributed, but the distribution of the carbon showed that the material had not been annealed, and this was the cause of fracture (see photomicrograph No. 4).

Etched with :	Section.	Bolt bent double.	Bolt snapped.	3½ inch black bar.
Picric acid	Longitudinal	Sulphur and carbon badly segregated.	Very badly segregated. High S visible to naked eye. C badly segregated.	Sulphur segregated. Carbon uniform.
	Transverse.	Sulphur and carbon fairly uniform.	Sulphur and carbon badly segregated.	Sulphur segregated. Carbon uniform.
Nitric acid	Longitudinal.	Sulphur and phosphorus badly segregated.	Sulphur and carbon badly segregated.	—
	Transverse.	Sulphur and phosphorus fairly uniform.	Sulphur and carbon badly segregated.	—

Photomicrographs. No. 1. 3½ inch black bar with streak of MnS but uniform carbide areas.
No. 2. Fractured bolt showing segregation of carbide.

in these layers. A similar phenomenon was observed in case 11, and would seem to indicate the greater susceptibility to "fatigue" of slaggy iron and hence the importance of removing all slag.

Case 5. The entrance to a condenser pump delivery was covered with copper sheathing, which was beaten over a former before being placed in position. In spite of frequent annealing by heating to redness and quenching, the material cracked under the hammer. Under the microscope the copper oxide pellets were visible and this led to the belief that the copper was probably a little underpoled. No arsenic eutectic was visible. By annealing in a reducing atmosphere the copper worked satisfactorily under the hammer and this treatment overcame the difficulty.

Case 6. A number of brass gauge cocks for a Babcock and Wilcox boiler leaked slightly and it was found impossible to stop the leakage. The maker's opinion was that the boiler water was attacking the metal and eating its way through. An examination of one or two of the cocks showed that there was practically no corrosion of the metal, but that several small blow-holes were visible on the inside surface. Microscopical examination showed that the metal was badly blown, and it was evident that the castings were faulty. On inquiry it was found that similar consignments from the same makers had given no trouble. The micrograph (No. 3) shows one of these blowholes.

Case 7. In a surface condenser in which one of the phosphor-bronze stays failed, the cause proved to be a crack, which, when opened out, was ½ inch deep and 8 inches long, the sides of which were badly oxidised. The forging had evidently been finished at too low a temperature.

Case 8. The mild steel pull-rod on a brake snapped. The rod was about 2 inches by ½ inch, containing 0.15% C, 0.015 Si, 0.60% Mn, 0.065% S, and 0.063 P. Test pieces cut from both sides of the fracture proved to be quite normal. Microscopical examination of sections cut from either side of the fracture revealed in one case a large segregation of MnS. The fracture occurred a little to one side of the point where the head was welded on to the rod. The weld itself was quite good under the microscope, but evidently the heating had caused the manganese sulphide to segregate, and this segregation had caused incipient cracking, due to vibration, which had gradually extended until the rod failed.

Case 9. A steel crosshead on a gas engine failed. The analysis was 0.37% C, 0.27% Si,

Case 10. A portion of a water turbine bucket from Christiania which had fractured. The analysis was 0.095% C, 0.18% Si, 0.06% S, 0.31% Mn, and 0.014% P. Crystallisation had set in, and the fracture was like grey cast iron. The peculiarity about the fracture was that the grain was by far the largest along the centre plane of the metal and became gradually smaller towards the surfaces. This seemed to indicate that the crystallisation, probably the result of vibration, had commenced where the two sets of waves from the surfaces had interfered (*i.e.*, on the central plane) and had gradually spread from this plane outwards.

CASES OF CORROSION.

Case 11. Complaints were received of excessive corrosion of a mixed pressure turbine, the metal naturally being blamed by the user of the machine and the water being blamed by the constructional engineers. The machine was one of a set of two, installed in a salt works, the engine room being adjacent to a room containing six vacuum evaporating pans and the salt bins. The other conditions were similar to those in various parts of the United Kingdom under which machines were running satisfactorily. On opening the machine out, it was found that the outside wheel on the high pressure side and the outside wheel on the low pressure side were coated with red Fe_2O_3 , whilst all the intermediate wheels were coated, as is usually the case, with a thin adherent skin of black Fe_3O_4 . This showed that the cause of the trouble was common to both extreme ends of the rotor, and since one end used high pressure steam and the other low pressure steam, the only condition common to both ends was when the machine stopped and air was drawn in through the glands. The evaporating pans in the adjacent room were totally enclosed, but the open bins containing the damp salt were in the same building. The conditions now resolve themselves as follows:—

On stopping the machine, all the diaphragms would be dripping water, and as the gland pressures dropped, air would be drawn through them into the machine, and would pass through the first diaphragm blades, where the slight trace of salt, left in after passing the glands, would be extracted. This naturally would give rise to progressive oxidation; the outer cast iron casing of the machine was also rusted for some distance from both ends. The remedy suggested was to keep the glands sealed by low pressure steam during the time the machine was standing.

Case 12. In this turbine "excessive corrosion" was reported to have taken place in two months, and again acidity of the water was cited as the possible cause. The water contained total solids, 210 grains per gallon; NaOH, 14.5; Na_2CO_3 , 31.2; Na_2SO_4 , 79.8; NaCl, 67.2; CaCO_3 , 2.87; organic matter, 15.68 grs. per gall., and was found to be neutral to litmus.

Portions of the machine were returned for examination, and then the cause was evident. The effect was most marked in the first portions of the machine and showed itself as a series of smooth grooves, up to $\frac{1}{4}$ inch deep on the outer casing and the shrouding on the stator blading, also on the edges of all blades, and the inside faces of the rotor diaphragms.

Microscopical examination of the mild steel, nickel steel, and bronze used in the construction showed no abnormal structures. Some weeks afterwards it was discovered that the drainage valve had been left closed from the commencement and none of the water (condensed) in the machine could get away. Thus the start up every day would take place in the presence of an appreciable quantity of water, until the machine became warm enough to evaporate it.

Case 13. The lower portion of the outer cast iron casing of a feed water heater became pitted. The cold water entered at the bottom, and as it ascended became heated by exhaust steam. The pitting was simply due to the electrical action set up between the metals and the gas bubbles liberated from the water by the heat. Above the "gas liberation" line no pitting took place.

MISCELLANEOUS CASES.

Case 14. Iron castings, which were too hard to drill, were generally found to have a high phosphorus content. In many cases the drill would enter but "flake" pieces of iron off, on the under side, as it emerged. The phosphorus was from 1.3% to 1.4%. The author has often used dilute hydrochloric acid as an aid to drilling, in order to save a large casting from being scrapped.

Case 15. The removal of the sand from the interior of intricate castings (in this case a turbine nozzle box) was effected by dilute (1:4) hydrofluoric acid, on the assumption that it dissolved the silica. This cost about 10s. per casting. Chipping with bars cost about £1 per casting. The author substituted dilute commercial hydrochloric acid, which dissolved the iron (and therefore loosened the sand) better, and cost about 1s. 6d. per casting.

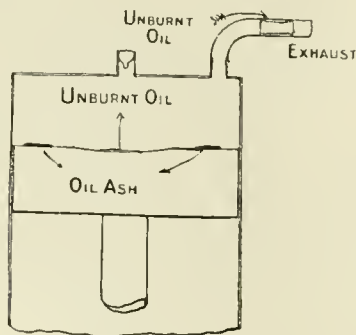


FIG. 2.

Case 16. In this case the effect of the oil ash on a Diesel engine was noticed. On a cast iron cylinder 18 inches diameter, an enlargement of 0.028 inch had taken place in 2 months. The

enlargement was near the cylinder head and was evidently due to the polishing action of the oil ash. The position and character of the deposits on opening out the cylinder are shown in Fig. 2.

The cylinder irons used showed on analysis:—

	G.C.	C.C.	Si.	S.	Mn.	P.
No. 1 ..	1.89	.82	2.18	.04	1.72	1.55
No. 2 ..	2.15	.68	1.54	.07	.34	.42

Assuming $\frac{1}{2}$ lb. oil per B.H.P. then a 450 B.H.P. engine would take 225 lb. oil per hour, or in 2 months made up of 10 hour days it would need about 100,000 lb. of oil, representing 110 lb. ash.

What happens is that a certain amount of ash is carried away in the exhaust and the amount remaining in the cylinder will be practically constant. Of this ash, it is evidently the nature and not the amount which is the important factor.

Case 17. A large number of small meter cases, which were stamped to form, from an American rolled brass, and then dipped in ordinary cold lacquer, were found to corrode rapidly. The lacquer attacked the rolling marks on the brass and turned them black, and any accumulation of lacquer in screw holes, corners, etc., became rapidly coloured with a green copper salt. This entirely spoiled the appearance of the meters. Separation of the copper salt and determination of the melting point of its fatty acid gave 170° C. corresponding to abietic acid. The acidity of the resin was equivalent to 49% of caustic potash on the dry resin. Thirteen samples of resin lacquers (both hot and cold) gave acidities varying from 6% to 81% (KOH) equivalent on the dry resin. Finally a celluloid lacquer was substituted as being the only suitable material.

Case 18. Two explosions occurred in the crank case of a 1000 B.H.P. vertical gas engine of the 8-cylinder, tandem type. The fan attached to the crank case was designed to remove the air three times per minute. The outlet was 6 inches diameter originally, but was at the time only 2 inches and subsequently increased to 3 inches. The explosions blew off the crank case and a dark red flame issued from the casing. A sample of the oil from the crank case was almost black and compared with the original oil as follows:—

	K.V.	F.P.
Original oil	0.46	235° to 240 C.*
Old oil	2.76	170° C. (frothy)

The spray of oil in the crank case had ignited by some means and the formation of an explosive mixture was made possible by the reduction in diameter of the fan delivery. It is doubtful whether there may not have been a slight leakage of gas into the crank chamber, but the actual explosion was an oil explosion and it would have been advisable to test the crank case oil for flash-point at intervals.

Case 19 was a cracked gas engine casing. Fig. 3 is an outline of the casing showing the position of the cracks.

The water jacket was practically full of deposit consisting of CaCO_3 , 65.29%; organic matter, 27.31%; moisture, 1.20%. The cooling water used contained 46.4 parts per 100,000 of total solids. Other contingent sources were:—

Source.	Total solids.	NaCl.	CaCO ₃ .
	parts	per 100,000.	
River	35.8	—	20.9
Mill pond	34.5	4.1	19.1
Borehole	45.3	9.36	25.8
Well	126.7	49.7	40.87

Apart from the cracking the loss of cooling efficiency must soon be enormous with these hard waters, and it is much more economical to soften the waters before use.

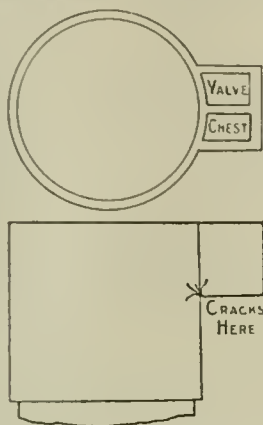


FIG. 3.

The above examples are very simple in their treatment, but perhaps serve to show how the chemist may be of service in an engineering works, where at present, it is to be regretted, he is often looked upon as somewhat of a luxury.

DISCUSSION.

Dr. J. E. STEAD said that the conclusion the author had come to, *viz.*, that soft iron crystals developed into large ones by heating at about 700° C., was one which he (the speaker) had himself advanced years ago, but the researches of Sauveur had shown that they did not grow to a very great size, unless the material were previously strained when cold, or when at a temperature below redness. It had been proved that distortion, if either excessive or slight, did not lead to crystal growth on annealing; that there was a limited range of strain, which led to this development. The influence of strain, within and under the critical range, was illustrated in the photograph, No. 5. It represented a longitudinal section of a soft iron rod, bent when cold and afterwards case hardened at a temperature below Ac₃. There was no distortion at the right-hand portion but the bending increased towards the right. Although the central part must have been strained, the crystals there were no larger than they were in the straight undistorted portion at the left, a proof that slight straining did not lead to crystal growth. It also proved that tensional and crushing strains, within the critical range, had the same effect in their tendency to make the iron liable to crystallise into large crystals. The outside envelope was carburised and fine grained. The smaller photograph represented a cross section, and showed that the big crystals did not surround the bar, but were confined to the parts distorted within the critical strain range. The specimen had been discovered by Mr. H. S. Kopling and sent to him (Dr. Stead). The black area with a jagged boundary in the brass gauge-cock did not appear to him to be a blowhole, as blowholes were always more or less spherical. He had noticed similar dark patches in brass and bronze, but these had been found to be slag inclusions or cavities from which slag had

fallen out during polishing. The author suggested that manganese sulphide segregated when the steel was heated, but one peculiarity of this substance was that it was the most fixed of any part of steel, and did not move about, neither did it diffuse. He had noticed in badly made welds, silicate of iron, which might possibly be taken to be manganese sulphide. It was, however, easy to determine which it was by the Baumann acid silver paper test. He quite agreed that for most purposes, soft steel might contain as high as 0.075% phosphorus. It was important when referring to the annealing of steel to state the temperature of heating. In former times it was customary to heat steel to a dull red heat, to take out internal strain. Steel castings, if annealed at 700° to 750° C., had not their coarse crystalline structure removed. It was necessary to heat sufficiently to cause a complete change of the mass from the α to the γ allotropic condition, and that heating was now usually called heat-treatment. Some makers, however, still retained the word "anneal," but qualified it by giving the temperature at which the steel was heated. The Widmanstätten structure of a steel which the author said was evidence that the steel had not been annealed, only showed that it had not been heated to above the critical point Ar₃. It might have been heated or annealed at a dull red heat, but not heated sufficiently highly, or, to about 900° C. Graphitisation was a kind of corrosion, but required more study before a definite general conclusion could be arrived at as to its cause. He had met with many cases in gas meters, but sometimes, under like conditions, graphitisation in similar gas meters did not occur. He was doubtful whether acid as a lubricant for drilling phosphorettic metal, attacked the phosphide of iron, as that substance was left insoluble on treating such iron by dilute acid. With regard to the growth of the upper part of a steam cylinder referred to, he asked whether the cylinder had been measured externally as well as internally, for it was known that metal "grew" or expanded permanently when subjected to the influence of superheated steam.

The AUTHOR said, in reply, that in many cases conclusions were necessarily drawn from somewhat scanty information. The nature of the circumstances made this almost compulsory. The information in most cases was supplied by the engineer, the author's opinion was given, and if the treatment suggested overcame the difficulty, he confessed that the particular case was soon dismissed from mind. He had never produced the coarsely crystalline structure in low carbon iron, by heating below 700° C., as his duty was to remove it. He regretted that the brass gauge-cock mentioned was not available; but the depth of the hole and its irregular shape, taken in conjunction with the "porosity," rather inclined him to the belief that it was primarily a cavity. As regards the shape, he suggested that during the formation of the cavity, the metal might still have been in movement, and that the irregularity might have been due to this. He had not intended to discriminate between blowholes and cavities in that connection. He had not applied the silver-paper test for sulphide in case 8. He had seen large manganese sulphide segregations with dark bands across the dove-coloured sulphide, which he took to be slag. Thus when the large segregations mentioned showed the "typical" dove colour, he jumped to the conclusion that they were sulphide. Despite the insolubility of iron phosphide in hydrochloric acid, he had saved many large, highly phosphoric castings in the manner suggested, whichever constituent was dissolved. He was afraid that outside measurements of the cylinder mentioned had not been supplied to him, and he thought such a small enlargement would be very difficult to measure except between machined faces.

Nottingham Section.

Meeting held at Nottingham, on Wednesday,
January 27th, 1915.

MR. J. T. WOOD IN THE CHAIR.

NOTE ON THE ADDITION OF FAT TO TANNIN EXTRACTS.

BY PURAN SINGH

(Chemical Adviser, Forest Research Institute,
Dehra Dun).

Some of the cheaper tannin extracts, such as mangrove, have two great defects, viz., their deep red colour and harsh tannage. The best way to overcome the colour difficulty lies in the judicious mixture of pure, unadulterated extracts with light-coloured tanning materials in the tannery. But very little seems to have been done by the tannin extract manufacturers to overcome the defect of harsh tannage. The last portion of this paper embodies the results of experiments carried out to overcome this defect. The suggestion came from the work carried out in connection with the fat content in tan barks which forms the first part of this paper.

The probable rôle of fat in tan barks.

It has been noticed that well-known tanning materials giving soft tannage contain naturally more fat than others giving harsh tannage, as is shown in the following table. The air-dried barks were finely powdered and extracted with hot petroleum spirit till they were free from fat. The following were the results obtained:—

Name.	Moisture.	Tannin.	Total petroleum spirit extract.
	%	%	%
<i>Materials giving harsh tannage—</i>			
Sal bark (<i>Shorea robusta</i>)	10.60	6.55	0.14
<i>Terminalia tomentosa</i> bark	6.70	10.76	0.18
Mangrove extract	13.43	70.20	0.03
<i>Materials giving soft tannage—</i>			
Mangrove (<i>Rhizophora mucronata</i>) bark	10.31	23.42	0.26
Gambier, 1st sample	12.42	* 42.48 † 16.40	0.82
Gambier, 2nd sample	13.0	—	1.58
Oak (<i>Quercus incana</i>) bark	9.3	13.94	0.26
Babul (<i>Acacia arabica</i>) bark	10.20	11.17	0.36
Do. do. pods	9.80	16.96	0.42
<i>Cassia auriculata</i>	10.8	16.86	1.08
Myrobalans	8.75	51.69	0.25

* Catechin.

† Tanuin.

It is thus seen that the tan barks which are known to give harsh tannage contain less fatty matter than those giving soft tannage. nevertheless the ability of certain tanning materials to give soft tannage may be influenced by several factors, of which fat may be only one. Whether the fat in the bark has any influence on the hide during tanning can be gathered by observing whether the fat emulsified into the tan liquor gets absorbed by the leather, and whether the hide when partially tanned and kept in prolonged contact with bark actually absorbs fat from the finely powdered tanning materials in contact. Repeated extraction with water does not remove fat from the bark. The following table gives the fat contents of the materials mentioned above when their tannin has been removed by repeated extraction with water, and after drying the residue and extracting it with petroleum spirit. The results are in fair agreement with those obtained

by direct extraction with petroleum spirit, but in some cases there is a slight increase, which may be due to the elimination of tannin. It seems that the fat occurring in the barks is not emulsified with water and so there is no likelihood of its being absorbed from the water extract by the hide. An additional proof is afforded by the mangrove extract. It gave to petroleum spirit only 0.03%, which shows that in the process of tannin extraction, the fat is not extracted by water from the barks.

No.	Name.	Moisture.	Fat.
		%	%
1	Sal bark	10.60	0.19
2	<i>Terminalia tomentosa</i> bark	6.70	0.20
3	Mangrove bark	11.70	0.39
4	Oak bark	9.30	0.30
5	Myrobalans	9.40	0.19
6	Babul bark	10.20	0.32
7	<i>Cassia auriculata</i>	10.80	0.82

The absorption of the fat by the hide during tanning is quite evident in the case of gambier. The fat in the gambier becomes suspended in water when the material is dissolved, and is absorbed by the hide along with tannin. This fact is supported by the experiments of Garelli and Apostolo (see this J., 1913, 877), showing that insoluble fatty acids simply suspended in water are fixed by skin and tan just as efficiently as when dissolved in alcohol or emulsified in water with ammonium soaps.

The fact that gambier yields soft tannage may be due to its fat content. Experiments were made to see if fat is similarly absorbed by the hide from various other materials. Small pieces of hide (8 grms.) were freed as far as possible from superficial fat by repeated extraction with petroleum spirit and then kept for about forty days in contact with fine powder of different tanning materials in quantities calculated to contain 2 grms. of tannin. The results are tabulated below:—

Material.	Quantity of the tanning material taken, grms.	Petroleum spirit solubles in the tanning materials taken, %	Total fat in the leather obtained, %	Net amount of fat absorbed, %	Percentage of fat absorbed out of total petroleum spirit extract.
Mangrove extract	3	0.0009	0.017	Nil	Nil
Sal bark	12	0.0024	0.017	Nil	Nil
<i>Terminalia tomentosa</i>	18	0.0324	0.018	0.001	2.7
Oak bark	14	0.0368	0.020	0.003	8.3
Babul bark	16	0.0576	0.027	0.010	17.4
Babul pods	10	0.0420	0.020	0.003	7.1
<i>Cassia auriculata</i>	11	0.1188	0.022	0.005	4.2
Mangrove bark	5	0.013	0.023	0.006	46.0
Control: pure tannic acid	2	—	0.017	—	—

These small scale experiments cannot be said to be conclusive, as a certain amount of experimental error is unavoidable. It will be seen, however, that the leathers absorbed more fat from the materials giving soft tannage than from those tanning harsh. The percentage of absorbed fat indicates the quality of the fats so far as their absorption by hide is concerned. These results indicate that the hide might in the prolonged process of tanning absorb fat direct from the barks, but it is difficult to say to what extent this absorption really takes place in the tan-pit. In the old process of tanning by contact with barks for several months, it is possible that the fat might have a softening action on the resulting leather. Whether the fat-content of the bark

plays any part in the tan-pit or not, the co-occurrence of fat with such tanning materials as give soft tannage suggests that, possibly as the results of certain metabolic processes in the tree, the tannin accompanied by a certain quantity of fat has the property of giving soft tannage. On the other hand, myrobalans do not contain much fat and yet they tan soft.

Suggested addition of fat to tannin extracts.

The above results suggested the addition of fat to tannin extracts of all kinds in order to reduce the harshness of tannage. Experiments were therefore carried out to see whether the addition of fat to tan-liquors made from solid tan extracts does actually influence the result. The simultaneous absorption of traces of fat along with tannin by hide cannot but be useful in giving soft leather of better texture, if the presence of fat does not retard the tanning process.

Six pieces of hide well-limed, washed, and cut into equal sizes of 12 in. by 6 in., were put in stoppered bottles together with 1 litre each of the tan liquors (2% tannin) made from the solid tan extract of mangrove, sal bark, and myrobalans. In three bottles no fat was added, and in the other three 10% of fat (oil of the seeds of *Schleichera trijuga*) calculated on the tannin content, was added, and all the six pieces were tanned under similar conditions. All the pieces took the same time to be struck through. They were then taken out, thoroughly washed till free from excess of tannin, dried in the shade, equally stretched, and finished off. They were not fat-liquored.

The results obtained are tabulated below :—

No.	Name.	Description of the leather obtained
1	Mangrove with fat ...	Softer and with better texture than No. 2.
2	Do. without fat	Hard though not cracky
3	Sal with fat.....	Distinctly softer and with better texture than No. 4.
4	Do. without fat	Hard though not cracky
5	Myrobalans with fat ..	Soft, hardly distinguishable from No. 6. Texture and surface feel better.
6	Do. without fat	Soft leather.

It will be seen that an addition of fat to the tan-liquors made from the extract improves the leather without retarding the process of tanning, and that the simultaneous absorption of traces of fat, along with tannin, by the hide softens the resulting leather; this effect on the texture of the leather cannot be produced by subsequent fat-liquoring. It seems that the property of tannin extracts which give harsh tannage is somewhat mellowed down. Moreover, the addition of fat would have a protective action on tannin and thus avoid to a great extent the loss of tannin that takes place in tannin extracts on storage. It is therefore suggested that trials should be made in this direction by manufacturers of tannin extracts. Even in case of extracts of such materials as myrobalans, it is preferable to add fat which will have a protective action on tannin, irrespective of the question of the softening action.

The oils and fats ordinarily used for fat-liquoring could be used for the purpose, but it is preferable to have a mixture of oil and fat of the consistence of treacle. About 10% of fat calculated on the tannin content should be added to the vacuum pan, where it should get thoroughly emulsified with the tan-liquors. This fat will be available in a partly emulsified form when the solid extract is made into liquor in the tan-pit or the tanning drum.

DISCUSSION.

In reply to questions, the CHAIRMAN said that hitherto fat had always been applied to thick leathers, such as hides, by currying; in this process the dry skin was immersed in melted fat, or the fat was put on the surface of the moist leather and allowed to penetrate slowly. "Fat-liquoring" was applied to light leathers immediately after tanning: neatsfoot oil was used for the purpose. The addition of fat to the extract in the drum during the tanning process was practised already in certain cases.

Professor PROCTER wrote that the paper was interesting and the idea of using oil appeared practical, though not quite new, especially in drum tannage. He thought drumming with a fat emulsion (sulphated oils) and an extract might also give a very good "raw hide" leather.

Scottish Section.

Meeting held at Glasgow on Tuesday, 27th October, 1914.

MR. ROBERT HAMILTON IN THE CHAIR.

METHOD OF ESTIMATING THE VOLUME OF SOLID MATTER IN MUDS.

BY W. H. COLEMAN.

Some time ago the author was confronted with the following problem: Cyanogen was being recovered from coal gas by passing the gas through a mud obtained by adding ferrous sulphate to gas liquor. The cyanogen liquor obtained consisted of a muddy liquid in which some of the cyanogen was present in the solution as ammonium ferrocyanide and some in the solid form as a complex double ferrocyanide of iron and ammonia. This was contaminated by ferrous sulphide, tarry matter, and other bodies. It became necessary to know how much of the total cyanogen was in the soluble and how much in the insoluble form, and as it was found impossible to filter off and dry the mud without altering its composition, it was not at first quite easy to do this. Finally the following method was adopted and was found to give fairly concordant results. The muddy liquid was well shaken, measured out, and allowed to settle, and the ammonium ferrocyanide determined in the clear liquid: this was called A. To another equal portion of muddy liquid 50 c.c. of water was added, the mixture was well shaken and allowed to settle, and the ammonium ferrocyanide determined in the clear liquid (B). The total $(\text{NH}_4)_2\text{Fe}(\text{CN})_6$ contained in the original muddy liquid was determined (C).

The calculation was made as follows :—

Let x = the number of c.c. of liquid in the 50 c.c. mud taken for (B) before dilution, then as 50 c.c. of water was added, $(50+x)$ is the number of c.c. of liquid in the 100 c.c. after dilution, and this would contain the same total amount of ferrocyanide as was contained in the x c.c. before dilution, provided of course none of the insoluble ferrocyanide went into solution on dilution.

$$\therefore (x \times A) = (50+x) B$$

$$\text{whence } x = \frac{50 B}{A-B} \text{ c.c.}$$

Then $50-x$ c.c. = volume of solid matter in 50 c.c. of the original mud.

Of course if the quantities were weighed out instead of being measured the weight of solution and of dry solid matter would be obtained.

To calculate the distribution of the ferrocyanide was then simple.

The conditions necessary for the determination to be accurate are:—The solid matter must be quite insoluble and must not be rendered soluble or altered in amount by dilution. The liquid must contain some soluble substance that can be easily determined and which must not be altered by dilution; the phenomenon of adsorption must not occur.

Applications: The above method might be applied to muds such as vat waste, cyanogen liquor, sewage, etc., and in many cases where an approximate result only is required it is only necessary to determine the decrease in sp. gravity caused by the dilution; to insoluble muddy deposits in solutions for crystallisation; and in volumetric analysis to ascertain the volume of a precipitate when a portion of clear liquid is taken for analysis.

The process is also applicable to the determination of naphthalene or "creosote salts" in creosote. The creosote is heated till quite liquid and the nitrogen determined by Kjeldahl's method. The creosote is then cooled and allowed to crystallise and some of the clear oil filtered off. The nitrogen is determined in this clear oil and from these results the volume of the deposited naphthalene can be calculated.

Communication.

NOTES ON GLASS.

National Physical Laboratory, February, 1915.

A certain amount of experimental work on glass-ware of various kinds has been carried out recently at the National Physical Laboratory, and it may be of interest to make known some of the results.

Chemical investigations have for some years been dependent on German glass; the publication of the analyses and of test results may, it is hoped, lead some English firms to produce articles which may replace those of German manufacture.

The subjoined table gives the analyses of some thermometric and chemical glass-ware.

Resistance of chemical glassware to chemical attack.

The table below, taken from the work of Mylius and Foerster on this subject, gives the action of various chemical reagents on glass used for chemical purposes (for analyses, see below).

Beakers.

Type of glass.	Water.		H ₂ SO ₄	NaOH	Na ₂ CO ₃
	20°	80°			
"R"	0-0054	0-0144	0	41	23
Jena	0-0071	0-0035	0	53	19
Bohemian	0-118	0-219	5	37	49

Flasks.

Type of glass.	Water.		H ₂ SO ₄	NaOH	Na ₂ CO ₃
	20°	80°			
"R"	0-0128	0-0128	0	51	26
Jena	0-0063	0-0057	0	63	24
Bohemian	0-093	0-255	11	52	70

The figures are in milligrams per sq. dem.

The solutions, viz., 2N.NaOH and N.H₂SO₄, were allowed to act at 100° for 6 hours, and 2N.Na₂CO₃ for 3 hours.

The Jena glass used was probably of the composition given under description "Original." This glass is not now used; but has been replaced by the "New Jena Glass," a special feature of which was its increased resistance to attack, which was brought about by long exposure to sulphurous gases. Soon after the introduction of this New Jena Glass by Schott and Gen., viz. in 1910, some tests were made at the N.P.L. The tests on the glass before and after the treatment with sulphurous gases are tabulated below. Several kinds of vessels were tested; the results for all were substantially the same.

Tests on "New" Jena Glass.

- Mark: (1) No annealing.
(2) Ordinary annealing.
(3) Special annealing in sulphurous gases for 36 hours.

Beakers.	Mgrms. Na ₂ O per sq. dem. given up to water:	
	at 20° C. in 1 week.	at 80° C. in 3 hours.
1	0-0022	0-0045
2	0-0032	0-0047
3	0-0019	0-0040

Analyses of thermometer and chemical glassware.

	Thermometer glasses.		Schott und Gen., Jena.		Chemical glassware.		
	Jena 59'''	Jena 16'''	Original.	"New."	Resistance, "R."	Kavalier's Bohemian.	Thuringen.
SiO ₂	72.86	66.58	66.74	64.60	68.00	76.02	74.36
Al ₂ O ₃	6.24	3.84	2.77	6.24	2.32	0.64	0.90
CaO	0.35	7.18	0.28	tr.	4.80	7.38	9.40
ZnO	—	6.24	8.28	10.43	2.40	—	—
MnO	tr.	0.28	0.65	tr.	0.14	tr.	tr.
Fe ₂ O ₃	tr.	tr.	tr.	tr.	tr.	tr.	tr.
PbO	—	—	—	—	—	—	—
Na ₂ O	0.82	14.80	8.99	9.71	10.17	7.60	14.83
K ₂ O	0.10	tr.	0.08	tr.	1.82	7.70	0.14
B ₂ O ₃	16.43	0.91	7.18	8.70	5.53	—	—
MgO	0.20	0.17	4.50	0.32	5.04	0.30	0.16
As ₂ O ₃	—	—	—	—	0.24	—	—
	100.00	100.00	99.47	100.00	100.46	99.64	99.79

Analyses marked with an asterisk have been made at the N.P.L. The other analyses are taken from a paper by Walker (J. Amer. Chem. Soc., 1905, 27, 865).

(Bohemian and Thuringen glass is now rarely used in chemical work, but the analyses given are of the best material of that class.)

Loss in weight in mgrms. per sq. dem.

	3 hours with 2N NaOH at 100° C.	3 hours with 2N Na ₂ CO ₃ at 100° C.	6 hours with N H ₂ SO ₄ at 100° C.
Beakers			
1	51	9	nil.
2	51	8	nil.
3	55	7	nil.
Conical flasks.			
1	63	8	nil.
2	60	11	nil.
3	71	10	nil.
Flat-bottomed flasks.			
1	62	8	nil.
2	71	8	nil.
3	79	6	nil.

There was a small improvement as regards resistance to the attack of water, but no improvement to the attack of alkalis. Since its introduction this type of glassware has been used in the N.P.L. and has given every satisfaction.


In the estimation of zinc and manganese, especially in silicate analyses, it is necessary to employ solutions containing alkali chlorides and ammonium sulphide and to allow the solutions to stand at a rather high temperature (50°–60° C.) for some times as long as 12 hours. In these circumstances the glass is invariably attacked, and although no quantitative experiments have been made with the Jena glass, the resistance to the attack of these solutions is certainly not as good as with alkaline solutions in the absence of chlorides and sulphides. In view of the fact that glass flasks have to be used for this purpose, it seems desirable to devise a test, in addition to the tests usually carried out, to determine the ability to withstand the joint action of alkali chlorides and sulphides.

The New Jena Glass examined at the N.P.L. in 1910 possessed in a very high degree the ability to withstand sudden change of temperature. A glass flask filled with molten paraffin wax at 250° C. broke when placed suddenly in water at 15° C., but only after successfully standing such a test at slightly lower temperatures.

Another question which is engaging attention is glass for miners' lamps, incandescence lamp chimneys, steam gauge tubes, and other purposes in which a gradient of temperature is established between the inside and outside.

Analyses of some of these are given in the following table:—

Analyses of lamp glasses.

	Jena incandescence glass (Schott & Gen.), best quality.	Miner's lamp glass, German make, mark A  B.	Miner's French lamp glass (yellow).	Miner's French lamp glass (colour- less).	Austrian lamp glass, "Sun Brand."
SiO ₂	73.88	74.28	51.26	51.92	76.78
Al ₂ O ₃	2.24	3.24	6.90	1.28	0.72
CaO	tr.	tr.	tr.	tr.	6.52
ZnO	tr.	tr.	7.16	0.82	—
MnO	tr.	tr.	tr.	tr.	tr.
Fe ₂ O ₃	tr.	tr.	tr.	tr.	tr.
PbO	—	—	27.54	34.93	—
Na ₂ O	6.67	0.73	tr.	2.08	11.14
K ₂ O	tr.	tr.	2.67	4.54	4.74
H ₂ O ₂	16.48	15.02	3.97	—	—
MgO	tr.	tr.	tr.	0.20	0.24
As ₂ O ₃	0.73	0.73	—	0.99	—
Sb ₂ O ₃	—	—	0.50	—	—
	100.00	100.00	100.00	99.76	100.14

It appeared, however, from Hovestadt's book on glass, and other information, that the additional

strength of the German glass was conferred on it in great measure by its heat treatment, and tests were made to investigate the state of strain in the glass.

For this purpose the following glasses were examined:—

(1) A miner's lamp chimney of white glass of German manufacture.

(2) A miner's lamp chimney of yellow glass of French manufacture.

(3) A piece of "Durax" tubing as used for chemical purposes.

From each of these tubes two rings of about 1 cm. depth were prepared by making transverse cuts across the tubes; the plane surfaces of the rings were optically polished. One ring of each specimen had a piece cut out so that the ring was free to spring. Other pieces were prepared for the determination of the refractive properties of the glasses.

The three open and three complete rings were examined in plane polarised light for strain. In both rings of the French glass, and in the open ring from the German lamp chimney, the amount of strain was negligible. In the unbroken ring from the German chimney there was very decided strain. Strain was also present in both rings of the Durax glass, the unbroken ring of this material showing much more pronounced strain than any of the other rings. The appearance presented by the rings when examined in the dark field is a very strong and sharp black circular line in the middle of the glass with a decided black cross upon it and the rest of the ring either white or milky.

The character of the strain present in the unbroken ring from the German chimney was determined by distorting the ring into an elliptical form by compression between two points at opposite ends of a diameter of the ring inclined at 45° to the plane of polarisation. By this means the milkiness could be made to disappear entirely from the regions about the diametral plane perpendicular to the line of compression, but the strain in the neighbourhood of the points of compression was increased. This shows that the strain is relieved by an increase in the curvature, and augmented by a reduction in the curvature; in other words, the inner layers of the ring are in a state of tension, and the outer layers in a state of compression. The fact that in the open ring the strain throughout is practically entirely relieved, suggests that these chimneys are made in one operation, and not by the combination of layers of material at different temperatures. It is evident that with the distribution of strain in the cold state indicated above, the chimney will tend to be relieved of strain when there is a radial temperature gradient throughout its substance with the outer surface cooler than the inner surface.

With the Durax tubing there is in neither ring freedom from strain. In the open ring the strain becomes worse on altering the curvature in either direction. Perhaps this indicates that the tube is built up of layers of the same or different materials, but brought together with one layer decidedly cooler than another. The presence of a thin white band in the substance of the glass may also indicate that the tube has been built up in the way suggested. An examination of all the rings in ordinary light showed the presence of striae likely to prevent the formation of really sharp spectrum lines in the determination of their refractive properties. This expectation was fully borne out by the appearance of the lines in the refractometer. No indication was obtained that any tube consisted of more than one type of glass, but the want of sharpness in the lines was sufficient to obscure the difference between glasses of very

nearly identical optical properties. The results obtained in these measurements are as follows:—

	n_D	$n_C - n_F$	ν
German chimney	1.4795	.00729	65.8
French chimney	1.5748	.01313	43.8
Durax combustion tubing .	1.5156	—	—

The *optical glasses* which resemble the above in refractive properties are, for the German chimney one of the new "Fluor Crowns," for the French chimney a light flint, and for the Durax tubing a hard crown.

Experiments were made to determine possible variations in the strained condition of lamp chimneys due to internal heating and resulting temperature gradient across the glass.

Coils of wire were wound round a cylindrical metal core, the whole enclosed in asbestos paper and fitted closely (without mechanical strain) into the ring of the chimney examined. A thermocouple was introduced between the lagging and the glass to enable the temperature of the latter to be determined on the passage of a current through the heating coil.

French chimney. This was initially without strain. On heating, strain was found to develop progressively as the temperature rose, and there is no evidence that at any temperature the strain declines to a minimum again.

German chimney. When cool and at uniform temperature this showed very decided strain in the shape of a central ring and cross. On heating up the ring the strain was relieved, but the glass is never *entirely* freed from the strain as evidenced by a complete absence of the stauroscopic figure. The tendency is rather for the central dark ring to move outwards and to be replaced eventually by another ring moving out from the inner surface of the glass ring. There is nevertheless a decided minimum effect, *i.e.* minimum strain, obtained when the temperature of the inner surface of the glass ring is about $150^\circ \text{C.} (\pm 20^\circ)$. The temperature gradient across the glass is such that in the

steady state the temperature of the outer surface of the lamp, corresponding to the above internal temperature, is roughly 70° , within the same limits of accuracy. Excessive heating above these limits results merely in producing a more pronounced strain. A further chemical analysis confirmed the view that the German miners' lamp chimney is of a single material.

The incandescence lamp chimneys are very thin and optical examination is not possible, but it appears fairly certain that in their case also the extra strength is attained by some process whereby the outside is chilled before the interior cools down. It seems possible also that the extra heat-resisting qualities of certain beakers, flasks, etc., of German glass may be due to the converse process, the interior being chilled previously to the exterior. All these glasses appear to be of the borosilicate type, such as is used for the well-known thermometer glass 59", but with somewhat more boric anhydride; the chemical glass contains zinc oxide, which is absent from the thermometer glass.

Obituary.

JOHN NORTHING.

The Society has lost one of its original members by the death, on Feb. 17th, of Mr. John Northing, of Wicklow. He was one of the now rapidly diminishing number of chemists of the Liverpool and Widnes district who joined together and formed the nucleus of this Society. For some years he was engaged with the Runcorn Soap and Alkali Co. and with Messrs. Wigg Bros. and Steel of Runcorn; later he crossed to Ireland to manage the works of Messrs. Boyd and Co., of Dublin, and for the past 21 years he was General Manager of the Dublin and Wicklow Manure Co.

Journal and Patent Literature.

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I.—GENERAL PLANT; MACHINERY.

PATENTS.

Gases and vapours; Metallic beds or layers for separating impurities from— [or for condensing tar]. H. A. A. J. Lelarge, Paris. Eng. Pat. 10,394, Apr. 27, 1914.

The gas is passed through a casing packed with metal strips wound in helical coils and coated with a viscous liquid, the coils in alternate layers being at right angles. The apparatus may be used for separating oils from exhaust gases or steam, or for condensing tar.—W. F. F.

Calcining kilns. J. A. Owen, Banbury. Eng. Pat. 14,959, June 23, 1914.

A CHAMBER formed in the foundations of the kiln is supplied with a forced draught of air through several radial channels. Above the chamber is a perforated cone which projects upwards into the

kiln. The discharge openings at the base of the kiln are provided with shoots and with doors or dampers, so that the forced draught may be supplemented by natural draught.—W. H. C.

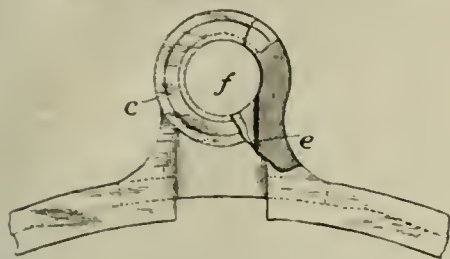
Gases; Method of separating— H. D. Gue, New York. U.S. Pat. 1,123,867, Jan. 5, 1915. Date of appl., Dec. 11, 1913.

A MIXTURE of gases of different densities is formed into a vortex, which is revolved at a high velocity. The mixture is supplied to the vortex at about the same velocity as that at which the latter is revolving, and the heavier and lighter gases are withdrawn respectively from the peripheral portion and the central portion of the vortex.—A.S.

Filler-press plate. R. Haag. Ger. Pat. 276,806, Sept. 26, 1913.

THE lug projecting from the periphery of the plate (see fig.) is provided with a groove, *c*, for the packing ring and with radial channels, *e*,

leading from the central opening, *f*, to the interior of the press. The lug is made as a separate



casting fitting exactly in a recess in the periphery of the plate, the whole being encased with vulcanite. —A. S.

Slimes, vinasse, and similar materials; Apparatus for dehydrating — E. Techen. Ger. Pat. 278,258, Sept. 16, 1913.

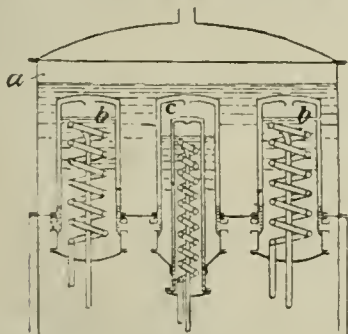
A DRUM with perforated periphery over which filtering cloth is stretched, and the interior of which is connected with a suction device, is rotated whilst dipping into the material. The perforations open into grooves formed in the outer surface of the drum, and the perforated wall has raised portions at the ends. The filtering cloth is stretched over these raised portions and clamped by the imperforate end walls of the drum, thus serving as packing material for the joints. On applying suction, the filtering cloth is drawn in, forming a trough of U-shaped section. —A. S.

Separating undissolved substances from liquids and simultaneously drying them. F. Berghauer. Ger. Pat. 278,883, Sept. 26, 1913.

A LIQUID containing undissolved solids in suspension, e.g., slime, is passed through a hollow rotating drum, the walls of which are made, in part or entirely, of filtering material. The drum is mounted in a casing divided into two compartments by longitudinal partitions extending from its inner surface to the periphery of the drum. Air or, preferably, hot waste gas is drawn into one compartment, then through the permeable wall of the drum, first inwards and then outwards, and out through the other compartment. The current of gas serves to draw the liquid through the filtering material, to dry the deposited solids, and to clean the filtering material. —A. S.

Evaporating apparatus; Multiple-stage — with concentric evaporating and distilling chambers. O. Schmeisser. Ger. Pat. 276,952, Jan. 12, 1913.

SEVERAL evaporators, *b*, *c*, are arranged within a vessel, *a*, which acts as the last "effect" of the



apparatus, their lower ends projecting below the base of the larger vessel, in order to obtain a larger

heating surface and facilitate cleaning. By this arrangement the number of effects can be increased without a corresponding increase in the surfaces from which loss of heat by radiation occurs. To increase the capacity of the apparatus, the number of smaller evaporators within the large vessel may be increased, or an evaporator consisting of one evaporating and one distilling chamber, as at *b*, may be replaced by one containing several concentric evaporating and distilling chambers, as at *c*. —A. S.

Distilling column. A. Gasser. Ger. Pat. 278,257, Sept. 18, 1913.

THE apparatus consists of vertical, tubular chambers arranged side by side, with intermediate heating elements, and it is divided into sections connected together by flanged joints and mounted on rails, so that any section can be readily removed to be cleaned, repaired, or replaced. —A. S.

Evaporating apparatus. E. Kuhnke, Leverkusen, Germany, Assignor to Synthetic Patents Co., Inc., New York. U.S. Pat. 1,126,491, Jan. 26, 1915. Date of appl., Aug. 14, 1913.

SEE Eng. Pat. 15,624 of 1913; this J., 1914, 126.

Apparatus for raising liquids, especially sulphuric acid. Ger. Pat. 279,074. See VII.

Expressing oil, juice, or fluid from seeds, nuts, fruit, fish, etc., and producing shaped blocks from plastic materials and the like. Eng. Pat. 501. See XII.

Apparatus for separating emulsions, especially for separating fat from glue solution. Ger. Pats. 277,281 and 278,891. See XV.

II A.—FUEL; GAS; MINERAL OILS AND WAXES.

Coal; Analysis of —, with phenol as solvent. S. W. Parr and H. F. Hadley. Illinois Univ. Exp. Stat., Bull. 76. J. Gas Lighting, 1915, 129, 260.

By treatment with phenol at 110° C. for 20 hrs. in an atmosphere of carbon dioxide, 35–40% of the coal substance was extracted from high-volatile coals (Vermilion County), and 20–30% from low-volatile coals (Williamson Co., U.S.A.). In each case the residue was non-coking, the extract containing the coking constituents and the greater proportion of volatile matter. Both residue and extract absorbed oxygen and water readily from the air at ordinary temperature, the residue showing the greater avidity; the oxygen absorbed is regarded as chemically combined. Coal, extract, and residue were practically the same in elementary composition; the gases obtained by destructive distillation of the three materials were also of similar composition. Oxidation was found to decrease the proportion of volatile matter obtainable from coal, residue, and extract, and also the amount of material removable from coal by solution in phenol. No chemical change was observed either in the phenol itself or in the components of the coal. —W. E. F. P.

Bomb calorimetry; Corrections in —. G. N. Huntly. Analyst, 1915, 40, 41–48. (See also this J., 1910, 917–921.)

CORRECTIONS are considered under the following headings:—*Thermometer tube (calibration)*. If a good thermometer be used without a calibration

table, the errors may amount to one unit of division (i.e. 0.01° with a thermometer reading to 0.01°). *Fuse.* The use of thick wires and high voltages should be avoided. The heats of fusion and combustion of the fine platinum wire (0.002 in. diam.) and cotton thread ordinarily used amount to about 5 and 20 calories, respectively. *Cooling.* The Regnault-Pfaundler correction should be applied for accurate work. This expression (which is the only formula taking into account errors due to evaporation from the calorimeter vessel and the heat evolved by the friction of the stirrer) represents the approximate integration of the time-temperature curve and may be much simplified, without loss of accuracy, by adjusting the experimental conditions so that curves of similar shape are always obtained; the shape of the curve depends on (1) the heat conductivity of the walls of the bomb, which is constant for a given instrument, (2) the rate of stirring, which is the predominant factor and may be made constant (preferably 120 oscillations per min.), and (3) the velocity of combustion, which for coals in the same state of aggregation (i.e. briquetted or not), or for oils and pure organic substances, may be regarded as practically constant. *Temperature coefficient.* Correction should be made for changes in the water equivalent of the apparatus (unless used in a constant-temperature chamber) and also, when a thermometer of the Beckmann type with variable zero is used, for variations in the value of the degree with temperature. These corrections are conveniently combined by determining the water equivalent, at regular temperature-intervals, by combustion of a pure substance, preferably benzoic acid. *Sulphur and nitric acid.* In the usual method of determining this correction (titration of total acidity, followed by precipitation with barium chloride), the acid solution obtained in an enamel-lined bomb provided with a lead washer is liable to contain minute, transparent particles of enamel and appreciable quantities of lead nitrate and sulphate. Errors due to the presence of these substances may be avoided by boiling the acid solution with a measured excess of standard sodium carbonate, filtering, titrating back with standard acid, and then precipitating with barium chloride. The usual practice of subtracting 22.5 calories for each 1% S found, is based on the assumptions that the sulphur is completely oxidised to sulphur trioxide in the bomb, and that in practice the sulphur in the fuel is converted entirely into sulphur dioxide; the first assumption is substantially accurate but the second is not. *Heat loss by evaporation.* This error is eliminated by the Regnault-Pfaundler correction, but not in methods of adiabatic calorimetry unless the calorimeter vessel is enclosed in an airtight manner. *Incomplete combustion.* The large fused globules of ash produced by the combustion of some (briquetted) coals in the bomb almost invariably contain enclosed particles of unburnt carbon; the latter should be determined by combustion of the powdered ash with lead chromate and potassium bichromate, and allowed for. Results should not appear to indicate a greater degree of accuracy than that warranted by the experimental conditions; with uncalibrated thermometers reading to 0.005° , for example, errors of 200 B.Th.U. per lb. are quite possible; under the best conditions, having regard to the possibilities of constant and other errors, closer agreement than 30 B.Th.U. between duplicate determinations on ordinary fuels must be regarded as accidental.—W. E. F. P.

Gas; Fractional combustion of — over copper oxide. E. Terres and E. Mauguin. J. Gas Lighting, 1915, 129, 257—258.

HYDROGEN is oxidised almost completely at 250° — 300° C., and dry carbon monoxide to the extent of

90—94% at 305° C. by copper oxide; mixtures of hydrogen and carbon monoxide in approximately equal quantities are completely oxidised at 300° C. Owing to deposition of carbon on the copper oxide, the combustion of heavy hydrocarbons (acetylene, ethylene, and benzene) is incomplete at 300° C., even in the presence of hydrogen. Methane begins to oxidise at 310° C. (slightly lower in presence of hydrogen) and is completely oxidised at a red heat, when in high proportion in the mixture, but only partly when in quite small proportion; hydrogen has no influence on the combustion of methane at a red heat. Mixtures containing hydrogen, carbon monoxide, and methane in the approximate proportions of 1:1:2, respectively, can be separated quantitatively by fractional combustion by copper oxide at 300° C., but this method is not applicable to mixtures of carbon monoxide and methane alone.—W. E. F. P.

Acetylene; Action of — upon metals. H. Reckleben and J. Scheiber. Chem.-Zeit., 1915, 39, 42.

OF a series of metals and alloys including zinc powder, tin powder, lead filings, iron powder, copper powder, nickel powder, brass, tombac, German silver, phosphor-bronze, aluminium-bronze, bronze, type-metal, and solder, none was affected by the continuous passage of pure dry acetylene during 20 months; with pure moist acetylene nickel increased in weight by 0.9% and copper by 1.6%. During the same period the unpurified moist gas (generated from commercial carbide) had no appreciable action on tin, tombac, German silver, aluminium-bronze, type-metal, or solder; zinc, lead and brass gave increases in weight of 0.4% to 0.9%, iron 6.4%, bronze 6%, and phosphor-bronze 14.4%. In six months copper powder had completely blackened and increased in weight by 92%; copper foil showed an increase of 80% after 12 months; acids acted upon the material producing traces of hydrogen sulphide but no acetylene, and the black residue resembled the carbonaceous product obtained by the action of acetylene on copper salts. A very similar deposit has been observed in copper tubes employed in acetylene installations. In no case were explosive substances produced. It is suggested that metal tubes, etc., subjected to continuous contact with acetylene should be coated with nickel or tin.—J.R.

Inflammable vapours and air; Speed of ignition of mixtures of —. M. Hofsä. Karlsruher Chem. Ges., July 10, 1914. Chem.-Zeit., 1915, 39, 64.

MIXTURES of air with the vapours of pentane, hexane, benzene, gasoline, and benzine, respectively, were tested, the speed of ignition being ascertained by determining the surface area of the inner cone of the flame (see Ger. Pat. 272,705; this J., 1914, 685). It was found that the variation of the speed of ignition with changes in the relative proportions of inflammable vapour and air could be represented by a curve, which had a characteristic form for each different mixture and passed through a maximum. The maximum speed of ignition was higher, the lower the boiling point of the liquid from which the vapour was derived.—A. S.

Petroleum industry; Continuous and discontinuous refining in the —. K. Mahr. Z. angew. Chem., 1915, 28, 20—22.

IN the continuous refining process adopted in many works for the lighter petroleum fractions, the petroleum is passed through a series of six to eight lead and four to five iron cylinders which are half filled with concentrated sulphuric acid and 5% sodium hydroxide, respectively. The oil is obtained in a state of fine division by the use of sieve-plates or a coarse lump packing. Crude benzine, containing little unsaturated, sulphuretted,

or oxygenated impurities, may be effectively refined in this way; but the heavier and less pure fractions should be treated according to the discontinuous process, in which, by means of mechanical stirring, a much more thorough mixing is achieved.—J. R.

Gilsonite from the Philippines. Ch. of Comm. J., March, 1915.

A DEPOSIT of uintaite or gilsonite has been discovered a few miles inland from the west coast of the island of Leyte, near the northern end of the island. The deposit is said to lie between the towns of Villaba and Leyte. The occurrence is described as a vein or bed outcropping with a thickness of several feet across the floor of a gully, and apparently dipping into the hills on either side at an angle of 40°. Near the outcrop there is a petroleum seep from which a heavy oil escapes in small quantity. The following analysis of a representative sample of the deposit is supplied by the Bureau of Science of the Philippine Islands: Character, solid and brittle; colour, dull, brownish black; fracture, perfect conchoidal; hardness, 2; sp. gr., 1.026; penetration at 25° C., 6°; loss of weight at 163° C. for five hours, 3.28%; total bitumen (soluble in CS₂), 93.79%; organic insoluble, 1%; mineral matter, 5.21%; fixed carbon, 7.68%. It is considered equal to the gilsonite that sells for £2 to £4 per ton in the American market.

Use of carbide sludge in building. Schumann. See IX.

PATENTS.

Briquettes; Manufacture of—and apparatus therefor. J. Armstrong, London. Eng. Pat. 1188, Jan. 16, 1914.

THE material, mixed with a binding medium such as tar, is charged from a hopper of V-section into two endless chains of moulds, travelling in opposite directions. When the moulds are filled, the two chains converge and are pressed and clamped together. They then pass downwards through a heated vertical tunnel, and on emerging from this the clamps are released, the chains diverge, and the moulds are emptied. The briquetting operation is thus performed automatically and continuously, out of contact with air, and under pressure of the expanding material.
—W. F. F.

Carbonaceous fuel. W. H. Aldrich, Pasadena, Cal. U.S. Pat. 1,124,382, Jan. 12, 1915. Date of appl., Feb. 26, 1912.

THE compressed carbonized product of a mixture of gas retort carbon and asphaltic oil.—W. F. F.

Agglomeration of materials in powder or small fragments, especially coal; Process of—. E. M. Heckel. First Addition, dated Feb. 14, 1914, to Fr. Pat. 439,605, Jan. 26, 1912 (see this J., 1912, 710).

A PASTE of starch and water acidified with sulphuric acid is used as an agglomerant instead of glucose.—W. H. C.

Briquettes of anthracite, coke, lignite, etc.; Manufacture of smokeless—. A. Exbrayat. Fr. Pat. 470,949, June 28, 1913.

SEAWEED is boiled with caustic soda solution and a little coal tar is added to prevent fermentation and an oxygen-yielding compound to prevent production of smoke on burning. The pasty mass thus obtained is used as an agglomerant in the manufacture of fuel and ore briquettes.
—W. H. C.

Coke-ovens; Horizontal—with vertical flues. Soc. Franco-Belge de Fours à Coke. Fr. Pat. 470,873, Feb. 7, 1914.

THE air is preheated by the waste gases in a regenerator composed of a system of flues through which the air and gas flow in parallel but opposite directions without any reversal of current. The heating gas enters the top of the vertical heating flues from a common main and is distributed at different levels where it meets the heated air. The latter passes upwards through vertical air flues and enters the heating flues through ports inclined downwards. The air receives a preliminary heating in a tubular heater through which the partially cooled waste gas from the regenerators passes. Blast furnace or producer gas preheated in a similar manner to the air may be used instead of coke oven gas for heating the ovens.—W. H. C.

Retorts; Vertical—for carbonising coal or the like. A. McD. Duckham, Ashtead, Surrey. Eng. Pat. 17,667, July 25, 1914.

PORTS for the escape of gases are arranged at different levels, and open into a flue which may be divided, by dampers, into compartments, each having an off-take and communicating with one or more ports. Heating or cooling flues similarly divided into compartments may be arranged on either side of the collecting flue.—W. F. F.

Vertical retorts for carbonising coal or the like; Apparatus for discharging—. A. McD. Duckham, Ashtead, Surrey. Eng. Pat. 17,668, July 25, 1914.

TO discharge continuously a retort in which the charge is subjected to mechanical pressure, the retort is provided in the known manner, at the bottom, with an extension having a curved wall. Immediately beneath this is an endless chain belt travelling on two rollers, which discharges the coke into a gas-tight hopper.—W. F. F.

Lignite and coal together; Process for the carbonisation of—. W. Röder and A. Peust. Ger. Pat. 278,145, Dec. 21, 1913.

FINELY-DIVIDED lignite is added to from ten to twenty times its weight of coal and the mixture carbonised.—A. S.

Gas-producers; Air grates for—. A. W. Dixon, W. H. Pearson, and J. Brown and Co., Sheffield. Eng. Pat. 28,742 of 1913; date of appl., June 12, 1914.

THE upper part of the grate is rotated upon the lower fixed part and is provided at its periphery with lugs or projections which break up the ash and clinker.—W. H. C.

Producer or the like; Apparatus for aiding the operation of clinkering a—. A. McD. Duckham, Ashtead, Surrey. Eng. Pat. 1345, Jan. 17, 1914.

A TEMPORARY grate formed of bars connected by a crosshead slides on rails mounted on a wheeled carriage and is thrust into the clinker by a hydraulic ram, which may be the ram of a mechanical poker mounted on the same carriage and used for breaking the clinker. The grate may be reciprocated during its forward movement by the alternate compression and release of helical springs, and the grate bars may be water-cooled.—W. F. F.

Gas-producer. H. F. Wallmann, Assignor to A., W. R., and H. H. Wallmann, Chicago, Ill. U.S. Pat. 1,125,919, Jan. 19, 1915. Date of appl., July 20, 1908.

IN a down-draught gas-producer, raw fuel is fed into a distillation conduit, mounted above the

producer chamber and heated by the hot gases from the latter: steam is passed into the conduit and the distillation products, together with steam and air, are passed into the producer chamber, into which the fuel residue also falls by gravity. The gas from the producer passes through a passage surrounding the distillation conduit on its way to the outlet.—W. F. F.

Gas: Process of manufacturing —. B. van Steenberg, Goshen, N.Y. U.S. Pat. 1,124,364. Jan. 12, 1915. Date of appl. May 6, 1911.

A GAS with a high content of illuminants of the olefine series, is obtained by passing hydrocarbon oil or vapour over a refractory material, and a catalytic agent heated electrically from within, to 800°—850° F. (about 430°—460° C.). It may be mixed with gas obtained by passing steam and oil vapour over a refractory body and a catalytic agent heated to a temperature sufficiently high to decompose the steam.—W. F. F.

Carburetted water-gas: Manufacture of —. O. B. Evans, Assignor to The United Gas Improvement Co., Philadelphia, Pa. U.S. Pat. 1,125,676. Jan. 19, 1915. Date of appl. Feb. 20, 1912.

THE "blows" of producer gas and "runs" of blue (uncarburetted) water-gas are passed successively in opposite directions through the carburetting chamber. The water-gas is carburetted alternately at different points in the chamber, and the producer gas is burnt alternately at points opposite those at which the previous carburation was effected, the combustion products and carburetted water-gas being withdrawn alternately at opposite ends of the chamber.—W. F. F.

Coke-oven gas: Utilisation of — and the recovery of by-products [ammonium nitrate] therefrom. T. Twynam, Redcar. Eng. Pat. 1820. Jan. 23, 1914.

THE excess of gas which is not required for the coke-oven plant is converted first into mechanical and then into electrical energy. The electrical energy so obtained is utilised to produce nitric acid from the air and the nitric acid is used to absorb the ammonia contained in the crude coke-oven gases to produce ammonium nitrate.—W. H. C.

Oils or spirits for use in internal combustion engines: Production of —. B. O. Jenkins, Bristol. Eng. Pat. 3899. Feb. 14, 1914.

A DISTILLATE from coal tar or coke oven tar, e.g. benzol or naphtha (25.33, or 50%), is mixed with a volatile alcohol (e.g. 74.66, or 49% of ordinary alcohol) and about 1% of camphor, and the mixture distilled to obtain a fuel of high flash-point.

—C. A. M.

Hydrocarbons or the like: Manufacture of light —. P. Sabatier and A. Mailhe, Toulouse. Assignors to Soc. des Raffineries Catalytiques des Petroles et Hydrocarbures, Paris. U.S. Pat. 1,124,333. Jan. 12, 1915. Date of appl. Mar. 31, 1914.

LIGHT hydrocarbon oils, boiling below 300° C., are obtained by passing the vapours of heavy hydrocarbons over a metallic catalyst (nickel), maintained by means of an electric current at a temperature of 300° C. to red heat. The catalyst may be in a fine state of division and in contact with an electrically conductive metallic substance.—C. A. M.

Oils from natural oil-bearing earths or the like: Extraction of —. E. Kaufmann. Ger. Pat. 278,279. Sept. 14, 1913.

THE extraction vessel is fitted with a sieve and the earth is kept in circulation by means of a screw or the like, which forces it upwards through the sieve

into the superincumbent solvent. An agitator rotates in the layer of solvent above the sieve, and one or more other agitators may be provided to mix the earth and solvent below the sieve. By the method described it is possible to treat satisfactorily calcareous or argillaceous earths which cake when brought in contact with a solvent for the oil.—A. S.

Lubricant [cylinder oil]; Production of a highly viscous —. Zeller und Gmelin. Ger. Pat. 278,956. Sept. 20, 1913.

PETROLEUM pitch is extracted with a volatile solvent, such as benzene, chloroform, or benzine or other light hydrocarbon oil, the extract is purified in the usual way with sulphuric acid and alkali, washed with water, and the solvent distilled off. A liquid cylinder oil is obtained having a viscosity of 20° (Engler) at 100° C. and a flash point of 310°—315° C.—A. S.

Peat or other substances: Removal of moisture from —. T. Rigby, Dumfries, Scotland, Assignor to Wetcarbonizing, Ltd., London. U.S. Pat. 1,124,954. Jan. 12, 1915. Date of appl. May 15, 1912.

SEE Eng. Pat. 16,958 of 1911; this J., 1912, 1114.

Oven for generating gas and producing coke. H. Koppers, Essen, Germany. Assignor to H. Koppers Co., Chicago, Ill. U.S. Pat. 1,125,345. Jan. 19, 1915. Date of appl. July 28, 1913.

SEE Fr. Pat. 460,517 of 1913; this J., 1914, 68.

Motor spirit from heavy hydrocarbons: Production of —. W. A. Hall, New York. Eng. Pat. 24,491. Oct. 28, 1913.

SEE Fr. Pat. 467,381 of 1914; this J., 1914, 853.

Process of refining [hydrocarbon] oils. U.S. Pat. 1,125,422. See III.

Manufacture of ammonium sulphate from distillation gases. Ger. Pat. 277,379. See VII.

Saturator for the production of ammonium sulphate from distillation gases. Ger. Pat. 279,134. See VII.

Gas-analysis apparatus. U.S. Pat. 1,124,432. See XXIII.

II.B.—DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

PATENTS.

Animal charcoal of high decolorising power; Process for the preparation and revivification of —. A. Zelnicek. Fr. Pat. 471,295. April 24, 1914. Under Int. Conv. May 2, 1913.

CARBONACEOUS materials are heated with a concentrated solution of zinc chloride until the latter commences to volatilise. The black carbonised residue is then washed free from zinc compounds. Spent animal charcoal may be mixed with cellulose or the like before being revived by the treatment described.—W. H. C.

Wires of hard metals [for electric lamp filaments]; Process for drawing —. N. V. Philips Metaal-Gloeilampfabrik. Ger. Pat. 278,278. April 6, 1913.

THE wire is drawn at a very low temperature attained by intense cooling of the wire, the lubricant, or the die.—A. S.

Arc lamp electrodes; Manufacture of—. J. Hagen. Ger. Pat. 278,119, Oct. 1, 1913.

BROKEN coconut shells are carbonised and the charcoal made into electrodes in the usual way with the aid of a binding agent. A viscous liquid produced during the carbonisation may be used as binding agent.—A. S.

Ultra-violet rays; Production of—. J. von Kowalski-Wierusz, Freiburg, Switzerland. Eng. Pat. 9046, April 9, 1914.

SEE Fr. Pat. 468,215 of 1914; this J., 1914, 971.

Production of an oil for heating or lighting from neutral tar. Ger. Pat. 277,502. See 111.

Manufacture of ammonium sulphate from distillation gases. Ger. Pat. 277,379. See VII.

Saturator for the production of ammonium sulphate from distillation gases. Ger. Pat. 279,134. See VII.

III.—TAR AND TAR PRODUCTS.

Toluene in commercial solvent naphtha; Determination of the percentage of—. H. G. Colman. J. Gas Lighting, 1915, 129, 314—315.

ONE hundred c.c. of the sample is distilled at the rate of one drop per second from a round-bottomed flask provided with a Young 12-bulb pear, or other efficient fractionating column, and the distillate up to 138° C. is collected. If this does not amount to 35 c.c., a second 100 c.c. is fractionated and the distillates are combined. If the combined distillates do not amount to 35 c.c. the sample is considered to be practically free from toluene. Otherwise 35 c.c. of the distillate is mixed with 50 c.c. of pure toluene and 15 c.c. of pure benzene, the toluene in this mixture is determined as described previously (see this J., 1915, 168), and the toluene content of the solvent naphtha is calculated.—W. H. C.

Water, phenol, and benzene; The equilibrium in the system—. S. Horiba. Mem. Coll. Sci., Imp. Univ., Kyoto, 1914, 1, 49—55.

THE equilibrium state of the system at 25° C. is shown in a triangular diagram plotted from the experimental results given in the following tables:

Mixtures with two layers.

Upper layer.			Lower layer.		
Phenol.	Benzene.	Water.	Phenol.	Benzene.	Water.
%	%	%	%	%	%
0	99.05	0.05	0	0.198	99.802
4.78	94.08	0.24	1.43	0.21	98.36
17.36	81.83	0.81	2.80	0.21	96.99
21.15	77.22	1.63	3.01	0.21	96.77
23.01	69.81	2.18	3.35	0.21	96.44
44.39	50.56	5.05	4.07	0.19	95.74
55.80	36.13	8.07	4.58	0.19	95.23
74.5	3.0	22.5	5.65	0.17	94.18
70.71	0	29.29	8.195	0	91.805

Saturated solutions with phenol as solid residue.

Phenol.	Benzene.	Water.
%	%	%
81.06	18.94	0
89.78	7.02	2.30
92.31	4.07	3.62
95.14	0	4.85

—A. S.

Toluene; Bromination of—. A. F. Holleman. Rec. Trav. Chim. Pays-Bas, 1914, 33, 183—191. Bull. Soc. Chim., 1914, 15, 783.

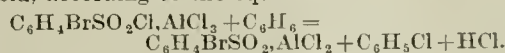
THERMOCHEMICAL study of the products of bromination of toluene in the nucleus, shows that only the *ortho*- and *para*-derivatives are formed. Pure *o*-bromotoluene melts at -27°, *p*-bromotoluene at +26.7°, and the eutectic mixture of the *o*- and *p*-derivatives at -37.3° C.—R. G. P.

Coal tar products investigation in the United States. Oil, Paint, and Drug Rep., Feb. 8, 1915.

MR. T. H. NORTON, formerly U.S. Consul at Chemnitz, has been appointed a commercial agent of the Department of Commerce to undertake a special investigation of the chemical industry in the United States, particularly in respect to coal-tar products. It is hoped that his report will be helpful in the development of synthetic dyestuff manufacture in the United States.

Friedel and Crafts reaction; Researches on—. [Condensation of *p*-bromobenzenesulphonic acid with benzene and its derivatives.] S. C. J. Olivier. Rec. Trav. Chim. Pays-Bas, 1914, 33, 91—182. Bull. Soc. Chim., 1914, 15, 783—784.

A DYNAMIC study of the condensation of *p*-bromobenzenesulphonic acid chloride with benzene and its derivatives in presence of aluminium chloride. In carbon bisulphide solution no sulphone is formed as in benzene solution, but *p*-bromobenzenesulphinic acid, according to the equation:



As this reaction takes place in absence of carbon bisulphide in solutions to which traces of sulphur chloride (S_2Cl_2) are added, and more rapidly in carbon bisulphide solutions which have been kept than in fresh solutions, it is probable that the reaction is due to sulphur chloride, which retards the formation of sulphone. When aluminium bromide is used instead of the chloride a pale yellow, hygroscopic, crystalline compound, $\text{C}_6\text{H}_4\text{BrSO}_2 \cdot \text{AlBr}_3$ (decomposing at 125°—132° C.), is formed, with liberation of free bromine. Study of the formation of sulphone in solutions with benzene or its derivatives shows that the sulphonic acid chloride reacts only as an equimolecular compound, $\text{C}_6\text{H}_4\text{BrSO}_2\text{Cl} \cdot \text{AlCl}_3$; 1 mol. of aluminium chloride can only convert 1 mol. of sulphonic acid chloride, the constant of the reaction (when excess of aluminium chloride is not present) being proportional to the concentration of aluminium chloride; when excess of aluminium chloride is present the constant increases greatly. Velocity of reaction diminishes in the order— $\text{C}_6\text{H}_5\text{CH}_3$, C_6H_6 , $\text{C}_6\text{H}_5\text{Cl}$, $\text{C}_6\text{H}_5\text{Br}$, $\text{C}_6\text{H}_5\text{NO}_2$. These facts are interpreted by assuming that the acid chloride is activated in the compound, $\text{C}_6\text{H}_4\text{BrSO}_2\text{Cl} \cdot \text{AlCl}_3$, while the benzene is activated in proportion to the amount of aluminium chloride combined with the sulphonic acid chloride or sulphone. Free aluminium chloride is a most energetic catalyst.—R. G. P.

β -Naphthol; Reaction of—. J. Katayama and B. Ikeda. Yakugakuzasshi, Oct., 1914. J. Pharm. Chim., 1915, 11, 73—74.

A VIOLET coloration is obtained when 1 c.c. of a β -naphthol solution is acidified with a few drops of concentrated sulphuric acid and mixed with 0.05 c.c. of a 0.01% sodium nitrite solution. The reaction is given by a solution containing 0.0002 gm. of β -naphthol per c.c., and is probably due to the formation of a quinonoid derivative of β -naphthol.—W. P. S.

Determination of very weak acids and bases by means of electric conductivity measurements. Horiba. See VII.

PATENTS.

[Hydrocarbon] oils; *Process of refining* —. S. W. Whitmore, Cleveland, Ohio. U.S. Pat. 1,125,122, Jan. 19, 1915. Date of appl., March 28, 1914.

HYDROCARBON oils are mixed with naphthalene (500 to 800 lb. per 5000 galls.), and the mixture distilled.—C. A. M.

Tar; Production of an oil for heating or lighting from neutral —. A. Markl. Ger. Pat. 277,502, July 9, 1913.

Tar of any kind is mixed with a very dilute, aqueous alkali solution, allowed to settle, and the tar separated and distilled; the oily fraction passing over after the water is a mobile liquid having a high calorific value, whilst the residue is an asphaltic pitch.—A. S.

Toluene; Manufacture of [nitro] derivatives of —. J. Maire, Argenteuil, Assignor to A. E. Vergé, Vincennes, France. U.S. Pat. 1,124,496, Jan. 12, 1915. Date of appl., July 21, 1913.

SEE Eng. Pat. 17,128 of 1913; this J., 1914, 890.

Nitro-bodies; Process for the continuous reduction of aromatic —. J. E. Marwedel, Uerdingen, Germany. U.S. Pat. 1,124,776, Jan. 12, 1915. Date of appl., Sept. 11, 1913.

SEE Fr. Pat. 426,006 of 1913; this J., 1914, 193.

Nitrosulphonylchlorides of ortho[hydr]oxycarboxylic acids and of their derivatives. R. Kothe, Vohwinkel, and O. Dressel, Mülheim, Germany. Assignors to Synthetic Patents Co., Inc., New York. U.S. Pat. 1,125,124, Jan. 19, 1915. Date of appl., May 12, 1914.

SEE Eng. Pat. 12,061 of 1914; this J., 1914, 855.

Arylated naphthylaminesulphonic acids and process of making same. W. Hahnenkamm, Assignor to Farb. vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. U.S. Pat. 1,125,311, Jan. 19, 1915. Date of appl., Mar. 7, 1912.

SEE Fr. Pat. 440,879 of 1912; this J., 1912, 809.

Metallic beds or layers for separating impurities from gases and vapours [or for condensing tar]. Eng. Pat. 10,394. See I.

Production of oils or spirits for use in internal combustion engines. Eng. Pat. 3899. See IIa.

Manufacture of light hydrocarbons or the like. U.S. Pat. 1,124,333. See IIa.

IV.—COLOURING MATTERS AND DYES.

British manufacture of aniline dyes.

A DISCUSSION took place in the House of Commons on February 22nd on the subject of the Government scheme for the manufacture of aniline dyestuffs.

Mr. A. H. PAGET said that there was probably not more than three months' supply of dyes in this country. The majority of traders thought that the only possible solution of the problem which the Government had to solve was to put a protective duty on dyestuffs after the war. He hoped the Government would also assist the manufacture of synthetic drugs. The present Government scheme was a distinct advance on the original one, but the £100,000 suggested for research was utterly inadequate, in view of the enormous sums spent in

Germany for a similar purpose. He asked what guarantee there was that the dyes required would be provided during the war. They understood that two at least of the factories in India had been compelled to close for want of the necessary chemical products. He asked whether the Indian Government had been consulted as to their participation in the scheme if the money were not found in this country. It was a question whether the duty on alcohol should not be removed for the purposes of the chemical trade, as it had been in Germany.

Mr. W. A. S. HEWINS said that the scheme would not enable them to get the dyes required. Some 3000 different dyes were used, and the £100,000 would not go far in laboratory experiments for the purpose of adapting the various dyes to the needs of manufacturers. If research were to be endowed, it should be on an adequate scale. He asked how the dye users were to be compelled to purchase from the National Company. In his opinion the Government proposals would introduce protection of the most objectionable type, analogous to the American tariff. If the Government afforded such protection to the dyestuff industry, it would be difficult for them to refuse it to other industries. He believed that, though it would not be possible to make by any means all the dyes that were being used, a very large number could be made shortly by using to the fullest extent the resources and potentialities of the country, and that in this way the difficulties of the situation could be overcome to a great extent. As regards general principles, the action of the Government should not be in the direction of State-ownership or State-running of the industry; it should be regulative and advisory. There were important dye factories in this country, as well as important chemical works which could produce dyes. If both dye and chemical potentialities were organised, he believed that the question could be solved. If the industry were to be made a success, it must be given security. If the Government were willing to give subsidies and bounties, they should not hesitate to consider the question of reasonable security. He did not regard such a scheme as this as leading to a scheme of Tariff Reform, but they would not get sufficient capital unless adequate security were promised.

Mr. T. C. TAYLOR considered that the best way to relieve British colour users was to facilitate the sending of raw material to and bringing it back from Switzerland. The colour manufacturers had been deprived of free alcohol, and the patent laws had not helped as they ought to have done. The principles of coercion and exclusion were blots on the scheme. He was willing to subscribe considerably if the five years' agreement were struck out.

Sir P. MAGNUS said the scheme seemed too ambitious for the period of the war only, and scarcely adequate for the period after the war. If the Government did not intend to help the industry after the war was over so that we might successfully compete with foreign producers, then it would be almost better to leave the scheme alone. But if the Government desired that we should be no longer dependent for dyestuffs on foreign manufacturers after the war, he hoped they would do what they could to secure for the industry an organisation not altogether dissimilar from that which at the present moment existed in Germany. The sum of £10,000 a year for ten years for scientific research was under those circumstances absolutely inadequate for the purpose. At the present time there were over one thousand highly-trained chemists engaged in this industry in Germany. This country could not compete unless for some period after the war was over some safeguards were given to the capital embarked in the industry.

Mr. W. PEARCE said that, provided it was accompanied by proper scientific, commercial, and business management, the Government scheme would be of real service and make a beginning in bringing back a large part of the enormous chemical industry to this country.

Mr. RUNCIMAN (President of the Board of Trade) said that the annual expenditure on dyestuffs in this country was between 2½ and 2¾ millions, of which £1,750,000 worth came from Germany, a small amount from Switzerland, and the remainder was made mainly in this country. We were rapidly approaching the danger point as regards the replenishing of our dye supplies. Switzerland could only send her finished products here provided we sent to them the raw material for those products. If the Government bought up the raw products here and sent them to Switzerland, to be returned later as dyestuffs, there was no system of distribution that would not lay the Government open to the charge of making unfair selections and of conferring benefits on individual firms. In these circumstances the Government had come to the conclusion that the only practicable method was that English dye users should purchase the raw products and send them to Switzerland, and that a company representative of those users should be responsible for the distribution of the finished products on the fairest and most equitable terms, and should make arrangements for their sale on the co-operative principle. Some held the view that it would be better that such a company should be brought to an end, and that the organisation should disappear immediately the war was over. The question was examined by a committee of experts, and they came to the unanimous conclusion that this would be throwing away a valuable organisation and would have the effect of again placing the textile and other industries dependent on dyes in a situation in which there would be nothing to enable them to survive the strain of cutting off the supply of dyes. The committee accordingly recommended that the company should continue after the war was over, and that in future, arrangements should be made which could be expanded along lines laid down on the advice of men of technical ability and commercial acumen, for such assistance of the company as would give it some chance of a successful career. They had entered into an arrangement with the Swiss manufacturers for raw products to go out from England, and they had organised the production of some of these raw materials on a wider basis, and they had seen to it that the manufacture of explosives should not altogether exclude the possibility of their having some of the surplus product to send to Switzerland in return for the finished dye. Then they had obtained an option on the works of Messrs. Read Holliday and Sons, of Huddersfield, which enabled them to take it over at a price which on the average profit of the last six years represented a return of about 6%. There was some chance that the concern, helped and reorganised as it would be, in the future would be able to hold its own, as it had done in the past, in face of German competition. Provisional agreements had been entered into with one or two concerns in England for the purchase of intermediate products. None of the arrangements could go through if they did not link them up together. Indeed, if that were not done they would not deal adequately with the emergency. The small consumer must be safeguarded. He had observed criticisms from Lancashire, Yorkshire, and Scotland, and the most severe had come from the three greatest dyeworks in the United Kingdom. These great concerns could to a large extent take care of themselves, and if the scheme failed they would not regret it nearly as much as the small consumers. The success of the proposed concern must depend largely on the way in which

the German patents were administered. The Emergency Act of last session provided that the operators of German patents in this country should have a full chance of conducting those patents under licence; and it was the intention of the Government not to cripple the company when the war was over, but to give them every opportunity of making the most of those patents. The Government left open for discussion with Germany the payment of royalty in respect of the patents. But the operating of these patents, which would be undertaken by the new company, would proceed after the war was over without interruption and without hindrance. The regulations of the Board of Customs and Excise would enable the company to obtain permission to use alcohol for industrial purposes free from duty by arranging that the denaturing of such alcohol should be carried out under conditions which would not hamper the industry. The same regulation would apply to other concerns that manufactured under the same conditions. The most important criticism related to the agreement which subscribers to the company were asked to sign. The best help that could be given the company was an assured custom for a short period of years, and without that assured custom it naturally followed that the company could not take the bold step without which no prosperity could attach to the reorganisation of the dye industry. As to the objection that the company was not large enough in its scope, it was impossible to range over the whole of the chemical industry, with a small capital. They had made a start, and left the door open for expansion in the future. While there were no chemists on the committee, they had taken the best commercial advice which could be obtained, and they had had at their elbow two at least of the greatest chemists in Europe, one of whom before the war received a retaining fee from one of the largest German combines. The best of our chemists were as good as any that could be found in Europe. The difficulty from which we suffered was that there were not enough second-grade chemists. It was the business of the Government, as in all technical education, to increase the amount of training and instruction for the production of large numbers of such chemists. He did not look upon the grant of £100,000 for the expansion of chemical training, especially in the production of dyes, as being a bonus or subsidy to this concern. It was a grant given for technical education. There was no reason why in the immediate future we should not be able to produce the requisite number of chemists for the dye industry and higher branches of the chemical industry, provided we paid them enough and offered them the prospect of a career. This concern, if it wished to be successful, would have to buy knowledge and skill at a fair price. He asked the committee to accept this scheme as the only one that held the field, and one that was assured of success.

Mr. CHAMBERLAIN said that with the exception of the President of the Board of Trade everybody had regarded the scheme of the Government as not being suitable for the emergency. Mr. Runciman had argued that as it was necessary during the war to form a company it would be a pity to allow it to come to an end immediately after the war. Also that Switzerland could not supply us with what we required unless we supplied her with raw materials, and in order to do this a company must be formed. He himself did not understand why a company was necessary for that purpose. The Government had only to issue to existing individuals licences for the export under conditions which would be laid down, and which the Government could supervise by their agents in Switzerland, and the thing could be done by existing individuals. The Government were quite right to try not only to tide over the immediate months of crisis, but to

relieve the country from a situation which experience had shown to be one of peril. The Government was to form a company to send raw or partially manufactured materials to Switzerland in order to get in return dyestuffs from Switzerland and had issued licences to the company for that purpose. The Government committee had gone far to secure a monopoly in the raw product to be exported to Switzerland for the company. Who was to have the advantage of the goods to come from Switzerland? The company was to distribute them to give (1) a preference to its subscribers, and (2) a preference to those subscribers who bought their dyes from the company for a term of years. For the moment, then, it was clear that there was a very severe coercion. For the immediate emergency during the war, when the necessity was greatest, every pressure that could be applied was put on users of dyes to subscribe to the company. The fact that they were subscribing was no test of their belief in the concern. It was only a test of their urgent need for these dyes. Preference having been given to certain people during the war, these people were to come under an obligation to buy preferentially from the company after the war. They were to buy at a "reasonable price." What security did they give to the company and to the people who were asked to invest money in it? Nobody could exaggerate the magnitude of the German organisation in this trade. The net profit of one German organisation alone was something like £1,000,000 a year. These companies could afford out of their enormous reserves, apart from profits, to trade for a very long time, if they thought it necessary to forego profits, in order to prevent serious competition arising with their industry. The British company had the moment the war was over to face the full force of the competition of this organisation armed with full knowledge and with all the power of experience and skill. The only security which investors believed they had for a return on the money was that under the term "reasonable price" was covered a preference for the products of the British company against the products of the German company. And now the President of the Board of Trade told them that there was no preference, and that if the Germans offered goods cheaper anyone was entitled to buy them. Probably the British company might not be able to supply the British customer with his full demand for any article. What was to prevent the German companies from penalising a man who had to go to them for a part of his supply because the British company could not give him all that he required? He thought that the lines on which the Government was working gave no security for the investor of capital, no security for the user of dyes, and no security for the subscriber, who was both an investor of capital and user of dyes. Protection was not merely given by a tariff, it could be given by a subsidy or by a bounty. Protection could be secured by a monopoly, by a bargain to do trade with one man rather than another, if it could be enforced. This scheme was as protective as anything he had ever proposed or contemplated. He believed that they had to have protection in one form or another in regard to this particular business under these particular circumstances. He did not think the kind of protection which was proposed would be effective. He wanted the money in this case to be used in founding an industry and not thrown away. The Government scheme did not offer the kind of solution on which business men, left to themselves and judging it as a business proposition, would risk their money. He saw no signs of confidence on the part of the men concerned in the future of the business, and he begged the Government to give the question further consideration and see whether they could not find security for a youthful industry,

as desirable after the war as it was urgently needed now, without taking these measures of monopoly, of exclusion, and of preference against particular traders in order to secure support and subscriptions for a scheme launched under Government auspices.

Sir ALFRED MOND said that he did not take such a gloomy view as Mr. Chamberlain, provided they had expert opinion of the right people in the scheme. He did not think the Germans were likely to sell goods at a loss for many years in order to crush out a concern which started to manufacture in this country. He did not see why there should be any secrecy with regard to the identity of the gentlemen who were advising the Government.

Mr. RUNCIMAN: Professor Green is one of them.

Sir A. MOND went on to emphasise the importance of having the best qualified men on the Board who could value the inventions and discoveries which the engineer staff brought to them. The argument that a tariff on German aniline dyes after the war would lead people to subscribe capital was radically unsound, because they did not know the amount of the tariff that would be imposed, nor the price at which the Germans would sell in competition. Moreover, a tariff might lead German manufacturers to establish works here. From the point of view of bringing aniline dyes here that might be a good thing, but it would be a powerful objection to the investment of money in the concern here. He hoped sufficient support would be forthcoming to make the Government scheme a great success.

Mr. J. M. ROBERTSON (Secretary to the Board of Trade) said no working alternative scheme had been presented to the committee. As to the grant for scientific research, if the Government found it necessary to make a frugal grant because of the circumstances and the time, it must not be thought lacking in sympathy with the cause. The grant would be made to the universities with the object of practically promoting this and other chemical industries.

Mr. J. SHARP HIGHAM suggested a new scheme for the establishment of a company under Act of Parliament to deal with drugs and chemicals. This company would discover what could be purchased cheaply, and what it could best make itself. The former it would export and distribute with 10% added for cost of this service and 5% for shareholders' profits. Chemists and experts should be placed by the company at the disposal of the trades concerned.

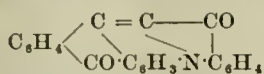
In his Presidential address to the Institute of Chemistry on March 1st, Prof. MELDOLA mentioned the Government scheme for the manufacture of dyestuffs, and emphasised the point that the problem was primarily a chemical and not a business one. About 500 different dyestuffs of definite composition had been provided as the products of chemical research. Of these a certain number only could be made in this country. The Government scheme provided for new and enlarged factories, but unless something more were done there would still be after the war an outstanding number of other products which had never yet been made here, and for the working out of these processes no combination of "business" talent was of the slightest value. It was by chemical research alone that our colour industry could be saved. The German colour industry was built up on the results of 40 years' research. To suppose that we could retrieve our position by starting a company the directorate of which was to consist solely of business people was ludicrous. The Government promise of a grant for 10 years of "not more than £100,000 for experimental and laboratory work" was a welcome concession, but who was to direct that research? The experts

were to be subordinated, and their assistance was to be invoked at the discretion of a Board the members of which could have no real knowledge of the conditions necessary for producing the materials they required. Would they be competent to point out dangers ahead? The "staple products" upon which they were asked to stake their capital might a few years hence be superseded by the products of subsequent discovery. The policy of attempting to run a highly specialized and rapidly developing branch of organic chemical industry by a company of business people, with expert assistance when required, was fatal if it was intended to establish the industry permanently here. The group of industries which had arisen from the products of the tar still was not going to remain stagnant after the war, and it was scientific guidance, and not mere assistance, that would keep them alive. It was the expert, and the expert only, who could foresee the course of development, who could keep in touch with the progress of research, and direct with intelligence the campaign against competitors. If such scientific direction were withheld all schemes were sooner or later bound to end in failure.

PATENTS.

Vat dyestuffs and process of making same. K. Schirmacher and A. Voss, Assignors to Farb. vorm. Meister, Lucius, und Brüning, Höchst on Maine, Germany. U.S. Pat. 1,233,390, Jan. 5, 1915. Date of appl., Feb. 25, 1914.

VAT dyestuffs of the isatanthrene series, dyeing cotton various tints of great fastness, are obtained by treating an aromatic glycine with a halogen-anthraquinone, converting the resulting anthraquinonyl-*o*-arylglycine ester by saponification and dehydration into an anthra-N-arylpyrrolecarboxylic acid, and treating the latter with a dehydrating agent. The simplest isatanthrene,



is a reddish-brown powder, sparingly soluble in water and in most organic solvents, readily soluble in pyridine with a reddish brown colour, and in concentrated sulphuric acid with a deep reddish-violet colour, and dyeing cotton red from a hydrosulphite vat.—A. S.

Vat dyes of the dihydro-1.2.2'.1'-anthraquinoneazaine (indanthrene) series; Production of— in a finely-divided condition. Farb. vorm. Meister, Lucius, und Brüning. Fr. Pat. 470,984, April 15, 1914. Under Int. Conv., April 15 and 22, and Aug. 25, 1913.

INDANTHRENE dyestuffs are obtained in a state of fine subdivision by treating them with a quantity of sulphuric acid of high concentration (fuming acid, monohydrate, or acid of 66° or 60° B., sp. gr. 1.84 or 1.71) insufficient to dissolve them at the ordinary temperature, and then treating the resulting product with water; or the dyestuff may be intimately mixed with sulphuric acid of 58° B. (sp. gr. 1.67) and the magma treated with water. If the mass be filtered after the treatment with acid, the impurities, especially flavanthrene, are removed in the solution, whilst the indanthrene is left as a residue either of sulphate or partly in the free state, according to the concentration of acid used. By using acid of 60° B. (sp. gr. 1.71), hot or cold, or by heating with acid of sp. gr. 1.67—1.6, the impurities may be removed in this way without any formation of indanthrene sulphate; or acid of high concentration may be used so that the indanthrene is converted completely into sulphate; the mass is then treated

with a limited quantity of water, filtered to remove the dissolved impurities, and the residual indanthrene sulphate decomposed with water. The products obtained give purer and more level shades than the original dyestuffs, and on account of their extreme fineness, in some cases approaching the colloidal condition, are suitable for use as pigments.—A. S.

Ingrain [azo] dyestuff for cotton; Manufacture of an—. Farb. vorm. Meister, Lucius, und Brüning. Ger. Pat. 277,528, Sept. 14, 1912.

3.5.3'.5'.TETRACHLORO-4.4'-DIAMINODIPHENYLUREA is tetrazotised and combined with 2 mols. of *m*-phenylenediaminesulphonic acid. The dyestuff when developed on cotton with diazotised *p*-nitraniline gives an orange shade very fast to washing and readily discharged. It gives a much brighter shade than the corresponding dyestuff from *pp'*-diaminodiphenylureadisulphonic acid and is superior to the dyestuff from *pp'*-diaminodiphenylurea in regard to fastness to bleeding.—A. S.

Disazo cotton dyestuffs fast to light; Manufacture of—. Farb. vorm. Meister, Lucius, und Brüning. Ger. Pat. 277,571, Oct. 26, 1912.

DIAZO-COMPOUNDS from aromatic aminosulphonic acids or their derivatives are combined with *o*-amino-*m*-xylenol alkyl ethers ($\text{CH}_3 : \text{CH}_3 : \text{OR} : \text{NH}_2 = 1 : 3 : 4 : 5$), and the mono-azo dyestuffs thus obtained are diazotised and combined with aminonaphtholsulphonic acids or their derivatives. The resulting dyes are faster to light than those described in Fr. Pat. 402,120 (this J., 1909, 1190).—A. S.

Azo dyestuffs containing arsenic; Manufacture of—. Farb. vorm. Meister, Lucius, und Brüning. Ger. Pat. 278,421, July 27, 1913.

3.5-DIAMINOPHENYLARSINIC acids, substituted except in the position 4, or their reduction products, are combined with diazo-compounds. The dyestuffs are valuable therapeutic agents for infectious diseases and have a relatively slight toxic action. By using diazo-compounds containing acid residues, *e.g.* diazotised sulphanilic acid, the process can be used for converting arsenic compounds insoluble in alkalis (*e.g.* hexa-aminoarsenobenzene) into compounds soluble in alkalis.—A. S.

Disazo dyestuffs; Manufacture of black, secondary— soluble in oils, fats, esters, and similar media. Badische Anilin und Soda Fabrik. Ger. Pat. 278,079, April 18, 1913.

AMINOAZO-COMPOUNDS prepared in the usual manner from one mol. of aniline, toluidine, or the like and a second similar molecule or a molecule of *a*-naphthylamine, are diazotised and combined with 1.8-naphthylenediamine or its *N*-alkyl derivatives. The resulting dyestuffs are soluble in fatty, essential, and mineral oils, and in waxes and amyl acetate, and hence can be used in the preparation of printing inks, boot polishes, and lacquers.—A. S.

Vat dyestuffs; Manufacture of—. Kalle und Co. A.-G. Ger. Pat. 277,197, Nov. 20, 1912. Addition to Ger. Pat. 241,997.

INSTEAD of the *a*-derivatives of isatin specified in the chief patent (this J., 1914, 247), the derivatives (including derivatives substituted in the nucleus, homologues and analogues) of 2.3-diketodihydro-(1)-thionaphthene, substituted in the 2-position, are used. The dyestuffs give a more violet shade than those described previously.—A. S.

Trisazo colouring matter; Blue —. A. Blank, C. Heidemriech, and J. Jansen, Leverkusen, Germany. Assignors to Synthetic Patents Co., Inc., New York. U.S. Pat. 1,125,050, Jan. 19, 1915. Date of appl., April 21, 1914.

SEE Fr. Pat. 471,284 of 1914; this J., 1915, 171.

Azo colouring matter. Azo dye. K. Desamari. Cologne, Germany. Assignor to Synthetic Patents Co., Inc., New York. U.S. Pats. 1,125,073 and 1,125,074, Jan. 19, 1915. Date of appl., April 1, 1914.

SEE Eng. Pat. 25,029 of 1913; this J., 1914, 71.

Azo dyestuff. K. Desamari. Cologne, Germany. Assignor to Synthetic Patents Co., Inc., New York. U.S. Pat. 1,126,413, Jan. 26, 1915. Date of appl., April 1, 1914.

SEE Eng. Pat. 22,313 of 1913; this J., 1914, 743.

Azo dyes. R. Kothe and O. Dressel, Elberfeld, Germany. Assignors to Synthetic Patents Co., Inc., New York. U.S. Pat. 1,126,489, Jan. 26, 1915. Date of appl., Jan. 5, 1914.

SEE Ger. Pat. 274,081 of 1913; this J., 1914, 784.

Val dyes; Yellow to brown —. M. H. Isler, Mannheim. Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen, Germany. U.S. Pat. 1,126,475, Jan. 26, 1915. Date of appl., July 2, 1914.

SEE Eng. Pat. 21,027 of 1913; this J., 1914, 544.

Azo dyes. H. Reindel, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen, Germany. U.S. Pat. 1,126,656, Jan. 26, 1915. Date of appl., June 30, 1913.

SEE Fr. Pat. 450,713 of 1913; this J., 1913, 593.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Textiles, etc. Tätigkeitsbericht des Kgl. Materialprüfungsamtes zu Berlin-Lichterfelde für das Jahr, 1913/14. Chem.-Zeit., 1915, 39, 62.

SAMPLES of bleached linen and cotton materials were examined as to weight, strength, and extensibility, both as purchased and after the dressing had been removed. No definite conclusions could be drawn as to the effects of the dressing, except that in general the elongation before rupture was greater after its removal. Artificial horsehair is now not only dyed but also weighted. Cotton tissues and warps which became brittle and tender were found in several cases to have been treated with sizing or finishing preparations containing magnesium chloride, from which hydrochloric acid would be liberated during such operations as ironing, hot calendering, etc. In some cases, the tendering was attributed to the materials having been dyed with sulphide dyestuffs, from which sulphuric acid may be formed under certain conditions. Thiourea used to preserve weighted silk according to Gianoli's process, was found frequently to contain a considerable quantity of thiocyanate. A yellow dyed silk tissue, which had been stored for about a year, and had become brittle and tender in places, was found to have been tolerably heavily weighted and treated by Gianoli's process, but the thiourea, owing to its solubility in water, had been removed from some parts and these had consequently deteriorated rapidly.—A. S.

[*Paper-making.*] *Retention of stuff.* F. Cyster. Paper Making, 1915, 34, 487—489.

THE most important factor in the retention of stuff on the wire of the paper machine is the condition of beating of the fibres. An example is given of two esparto papers of similar original composition but treated very differently in the beating, one being an "antique" paper beaten quickly and very lightly, the stuff containing 16.2% of mineral matter before running on the wire, and the other a "litho" paper, well beaten to give a close sheet, containing 15.6% of mineral matter before running. An examination of the back-waters showed that the following proportions of the original materials had passed through the wire:—"antique," fibre 6.41%, loading 42.45%; "litho," fibre 3.5%, loading 11.4%. In the case of wood pulp papers beaten quickly, the loss of fibre is greater than with esparto papers, amounting in one case to 10.3%, while a similar pulp well beaten showed a loss of only 3%. The loss of mineral matters is so largely affected by the condition of beating of the fibres that the author considers the question of plasticity in the testing of china clays is comparatively unimportant; the thickness of the sheet and the nature of the sizing are likewise quite subordinate factors. In paper mill economy the re-use of the back-waters is a matter of first importance, particularly in the manufacture of quickly beaten papers.—J. F. B.

PATENTS.

[*Silk cotton*] *Insulating material; Electric* — applicable as a heat-insulating material. F. Rowley, and Sanrainé Syndicate, Ltd., London. Eng. Pat. 1133, Jan. 15, 1914.

COMPRESSED silk cotton, e.g. kapok, is used as electric or heat insulating material and for waterproofing purposes. Sheets of the compressed material may be provided with a matrix when used for waterproofing purposes in buildings.—B. N.

Cellulose; Process of treating wood and plants to make —. B. Loomis, Hartford, Conn., Assignor to Loomis Utilisation Co., East Orange, N.J. U.S. Pat. 1,122,401, Dec. 29, 1914. Date of appl., Mar. 22, 1912.

THE material is treated in a closed vessel first with hot water and then with a dilute alkaline solution, which is circulated at gradually increasing temperatures through the material, a heater, and a separator, in which the matters removed from the material are separated by floating or deposition. The cleansed material is subsequently digested with alkali to reduce it to pulp.—J. F. B.

Paper-stock; Method and apparatus for producing —. W. E. Phelps, Baltimore, Md. U.S. Pat. 1,123,000, Dec. 29, 1914. Date of appl., June 26, 1913.

FIBROUS paper-making material is disintegrated by stirring it with water in a tank, and then passing it through a conduit making a circuit back to the tank. The conduit is divided into several sections, each separated from the next by a vacuum-pump, the suction produced by each consecutive pump being greater than that produced by the pump in the preceding section.—J. F. B.

Porous and fibrous material; Method of treating —. G. D. Burton, Assignor to The Burton Co., Boston, Mass. U.S. Pat. 1,123,166, Dec. 29, 1914. Date of appl., Sept. 24, 1912.

FIBROUS materials, such as corn (maize) stalks, straws, and grasses, are charged into a perforated drum revolving in a receptacle containing a soap solution, which may be mixed with borax, sodium

carbonate, or ammonia. The treatment is continued until the dirt, seeds, and other impurities attacked by these reagents have passed through the perforations of the drum. The cleansed material is then reduced to pulp by revolving the drum in a solution of caustic soda, sp. gr. 1.010—1.015, until the pulp fibres have all passed through the perforations, leaving the undigested weeds, etc., inside the drum.—J. F. B.

Plastic masses; Manufacture of—by the action of aldehydes on albuminous substances [yeast residues]. H. Blücher and E. Krause. Ger. Pat. 275,857, June 3, 1913.

THE residues obtained in the manufacture of yeast extracts are used as raw materials, mixed, if desired, with other albuminous substances and with filling materials.—A. S.

Glue and glycerin from waste paper coated with the same; Process for recovering—P. Hey. Ger. Pat. 279,141, Nov. 1, 1913.

THE paper is soaked in cold water and then placed on a series of superposed sieves in a closed chamber into which steam is delivered. The mixture of glue and glycerin is liquefied by the steam and flows through the sieves, being collected by intermediate inclined plates which deliver it into a common receptacle, provided with an outlet pipe, at the bottom of the chamber. The chamber is fitted with an overflow pipe for condensed water.—A. S.

Wool-scouring and analogous liquors; Recovery of grease and other ingredients from—W. G. Abbott, jun., Wilton, N.H., U.S.A. Eng. Pat. 18,736, Aug. 17, 1914.

SEE U.S. Pat. 1,110,277 of 1914; this J., 1914, 1006.

Fertiliser from sulphite-cellulose waste lyes. Ger. Pat. 278,492. See XVI.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

PATENTS.

Textile fabrics; Machines for washing—B. Nyborg, Norrköping, Sweden. Eng. Pat. 19,679, Apr. 30, 1914.

IN open-width washing machines the liquid from the squeezing rolls is received on a swivelled plate by which it can either be returned to the material before this enters the liquid in the vat, or delivered into a discharge trough. Rinsing liquid is also applied to the material before it reaches the liquid in the vat.—J. F. B.

Washing apparatus used in bleaching. N. McMurray and T. Knowles, Lambeg, Ireland. Eng. Pat. 16,160, July 7, 1911. Addition to Eng. Pat. 17,971, Aug. 7, 1913 (this J., 1914, 916).

THE rollers of the washing machine are provided with end flanges adapted to rotate with them, and secured in such a manner as to make the entire surface of the rollers free from obstructions or projections. Gudgeon bearings are carried in recesses in the ends of the rollers.—B. N.

Dyeing textile materials such as are capable of being packed; Machines for—K. Callebaut and J. de Blicquy, Brussels. Eng. Pat. 19,962, Aug. 25, 1914. Under Int. Conv., Jan. 23, 1914.

THE walls of a removable cage or receptacle for the material are inclined inwards, so as to form a

single or double truncated cone. An inlet chamber for the dye liquor is provided at the base or between the bases of the cones and the material is held in a horizontal layer above the inlet in the first case, or both above and below it in the second, so that the liquor flows outwards through the layers.—B. N.

[Sulphide] dyestuffs; Application of—E. Lodge and J. M. Evans, Huddersfield. Eng. Pat. 23,386, Nov. 18, 1914. Addition to Eng. Pat. 29,852, Dec. 29, 1913 (this J., 1915, 135).

THE process is applied to the dyeing of animal fibres, including furs and feathers, and also to artificial silk.—B. N.

Dyeing machine. W. W. Sibson and B. A. Parkes, Assignors to The Philadelphia Drying Machinery Co., Philadelphia, Pa. U.S. Pat. 1,125,747, Jan. 19, 1915. Date of appl., April 15, 1914.

A ROTATING cage is mounted within a tank, which is supported upon a frame, so that it can be oscillated or held in various adjusted positions, without disturbing the operation of the cage. A discharge pipe, connected to the lower end of the tank, is arranged so that it may be uncoupled, whereby the tank may be swung on its support. Means are provided for heating the dye liquor in the tank, and the latter is also provided with a counterbalanced cover.—B. N.

Multicolour effects in threads or fabrics. A. Heinzel, jun. Ger. Pat. 277,497, June 3, 1913.

ARTIFICIAL fibres, such as artificial silk, are impregnated with a solution of a cerium-oxygen compound having an oxidising action, the excess of the solution is removed by hydro-extracting or pressing, and the fibres, without further drying, are placed in a bath containing 10—20 c.c. of soda lye of 40° B. (sp. gr. 1.383) per litre. The treated fibres are spun or woven with untreated artificial fibres or with vegetable fibres, untreated or treated in a similar manner, then dyed, and treated with an agent capable of liberating oxygen from the cerium compound. A gelatin solution or the like may be applied as a finish to the artificial fibres after the treatment.—A. S.

Dyeing and like treatment of textile material; Apparatus for—J. T. and E. Brandwood, Bury. U.S. Pat. 1,125,893, Jan. 19, 1915. Date of appl., Feb. 12, 1913.

SEE Eng. Pat. 436 of 1913; this J., 1914, 133.

Printing-pastes and process of producing same. J. Carstens, Leverkusen, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 1,126,387, Jan. 26, 1915. Date of appl., Nov. 20, 1912.

SEE Eng. Pat. 22,201 of 1912; this J., 1913, 531.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Acids and bases; Determination of very weak—by means of electrolytic conductivity measurements. S. Horiba. Mem. Coll. Sci., Imp. Univ., Kyoto, 1914, 1, 35—47.

FROM data obtained by measuring, at 25° C., the conductivities of (1) a mixture of aniline (weak base) with an excess of hydrochloric acid, and (2) a mixture of phenol (weak acid) with an excess of sodium hydroxide, the following empirical formulæ were deduced and found satisfactory as a basis for the determination of weak bases and acids, respectively, under similar conditions:—

(1). $0.2985 C = x_a - x$, where C is the concentration of the weak base (aniline), x and x_a the specific conductivities of the mixture and acid, respectively, the concentration of the latter being between $N/50$ and

$N/25$. (2). $C_a = -\frac{x_m - x_b}{0.154 + 0.0433 \times C_b^{\frac{1}{2}}}$, where C_a

and C_b are the concentrations of the weak acid (phenol) and sodium hydroxide, respectively, x_m and x_b the specific conductivities of the mixture and the sodium hydroxide respectively, C_b being between $N/25$ and $N/50$, and C_a less than half C_b . The constants of the hydrolytic dissociation of aniline hydrochloride and sodium phenoxide were also calculated.—W. E. F. P.

Formic and acetic acids; Determination of — and the separation of these acids in very dilute solutions. E. Heuser. Chem.-Zeit., 1915, 39, 57—59.

THE determination of formic and acetic acids by acidifying with sulphuric acid and distilling with steam requires too much time for ordinary use, and if the sulphuric acid be replaced by phosphoric acid, the results are vitiated by the latter passing over into the distillate. Good results are obtained if the vapours are passed through a flask filled with glass beads and heated by a water-bath, on their way to the condenser (cf. Wenzel, Monats. Chem., 1897, 659). The sample is mixed with 50 c.c. of water and 50 c.c. of phosphoric acid of sp. gr. 1.2 and distilled at 44°C . (56 mm. pressure) until the volume is reduced to 50 c.c. A further 50 c.c. of water is then added and the mixture again distilled to a volume of 50 c.c. A current of air free from carbon dioxide is drawn through the apparatus during distillation. The use of a flask filled with glass beads is also necessary in determining acetic acid by distillation in a mixture of formic and acetic acids after destroying the former by oxidation with bichromate and sulphuric acid (see Macnair, Z. anal. Chem., 1888, 27, 398).—A. S.

Alkali bicarbonates; Dissociation pressures of the —. II. Potassium, rubidium, and caesium hydrogen carbonates. R. M. Caven and H. J. S. Sand. Chem. Soc. Trans., 1914, 105, 2752—2761. (See this J., 1911, 800.)

THE dissociation pressures of the bicarbonates of potassium, rubidium (above 158°C .), and caesium (above 165°C .) can be represented by the equation $\log p = a - b/T$ where $a = 10.832, 12.712$, and 16.930 , and $b = 3420, 4300$, and 6300 , for K, Rb, and Cs respectively, and the heats of dissociation, per 2 grm.-mols., calculated from these values were 31,460, 39,560, and 59,960 calories. Anomalous pressure values with rubidium and caesium bicarbonates, below the temperatures stated, were probably due to impurity. The results show an increase of stability with rise of atomic weight of the alkali metal, the temperatures of sensible dissociation of potassium, rubidium, and caesium bicarbonates being considerably higher than that of the sodium salt. By determining the molecular ratio $\text{H}_2\text{O} : \text{CO}_2$ in the gaseous phase, it was proved that the dissociation products of the alkali bicarbonates are normal carbonate, carbon dioxide, and water, no hydrated intermediate compounds being formed.—F. SODN.

Stassfurt deposits; Quantitative chemical composition of the —. M. Rozsa. Z. anorg. Chem., 1915, 90, 377—385.

DISCUSSING the origin of the Stassfurt deposits, the author is unable to reconcile either the disproportionate amount of anhydrite in comparison with rock-salt or the regularity and purity of the layers in the anhydritic rock-salt with Ochsensius' hypothesis of a continuous influx of sea-water and the removal of the final mother-liquors to the

outside ocean. On the contrary, in the early stages of evaporation of the Zechstein lake the process of deposition of gypsum and rock-salt has been interrupted or even reversed, owing apparently to the sporadic influx of other mother-liquors of varying composition. The comparative thinness of the rock-salt layer also denotes the removal of a considerable portion of the mother-liquors from the Zechstein lake rather than the continuous influx of sea-water. Such processes are explained on the basis of local saturation and deposition effected through segregation of partially evaporated sea-water in depressions, followed either by tectonic changes in the lake-bed resulting in the distribution of the mother-liquor over a large area, or, less frequently, by a fresh influx from the sea. The existence of numerous salt deposits in the area between the Russian and Dutch frontiers of Germany, the North Sea and the heights of central Germany is ascribed to this cause. The formation of annual anhydritic layers and the periodic variations in the proportion of calcium sulphate to sodium chloride, are attributed to changing climatic conditions: the effect of temperature and rainfall on depositions from such solutions is discussed at length. The arguments are supported by the results of a series of quantitative analyses.—J. R.

Potash industry; The waste liquors of the —. Berge. Z. angew. Chem., 1914, 27, 660—662.

IN a refinery treating daily 400 tons of crude carnallite salts, containing about 16% KCl, there is produced 200 cb. m. of waste liquors of sp. gr. 1.30, containing about 30% MgCl_2 . A promising process for the utilisation of these liquors is that suggested by K. Hepke (Ger. Pat. 278,106; following). Of the 200 cb. m. of waste liquors, 90 cb. m., containing 30 tons of MgCl_2 , would be decomposed, assuming a yield of 75%, to produce 16 tons of crude 80% magnesia and 58 tons of hydrochloric acid of 30% strength. The remaining 110 cb. m. of liquor, containing 43 tons of MgCl_2 , could be incorporated with the 16 tons of magnesia to produce about 140 tons of magnesium oxychloride.—J. F. B.

Potash supplies in the United States. Oil, Paint, and Drug Rep., Feb. 8, 1915.

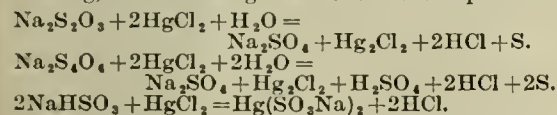
IT is stated officially that the reasons for the placing of an embargo by Germany on exports of potash to the United States, are that part at least of the potash is used in the production of explosives, which might ultimately be sold to countries at war with Germany. Further, potash is exported in jute bags, and the jute is now required by the German Government for other purposes. It is suggested that American importers should give the necessary guarantees that the potash would not be used to make explosives, and that heavy cotton bags should be sent to Germany to carry the potash. In the meantime, much attention is being given to the American sources of potash. As regards the Searles Lake deposits in California, it is stated that over £300,000 has been spent in development, but that a considerable addition to the plant will have to be made if potash is to be produced in commercial quantities. The Bureau of Soils considers that the expenditure of about £10,000 in manufacturing equipment for the Pacific Coast kelp fields will be sufficient to instal plant for producing potash on a small commercial scale. It is further stated that about 15,000 tons of potash might be obtained from the waste of the beet sugar industry in the United States, and a further 5000 tons from the scouring of raw wool. In a report to the U.S. Geological Survey, Mr. H. S. Gale expresses the opinion that the kelp beds afford the only really promising fields for acquiring potash in commercial quantities.

Magnesium chloride solutions; The solidification of concentrated —. H. Hof. Chem.-Zeit., 1915, 39, 15.

IN the process described previously (this J., 1914, 863) for solidifying the residual liquors of the German potash industry containing magnesium chloride, by the addition of calcined kieserite, the solidification is caused by the separation of magnesium chloride due to removal of water by the hydration of the magnesium sulphate, which however only proceeds to the tetrahydrate. In a similar manner mother liquors containing potassium salts may be solidified by addition of calcined "Hartsalz" rich in potassium chloride and in kieserite, or of "Hartsalz" rich in potassium chloride together with a sufficient quantity of calcined kieserite, whereby a product similar to kainit is obtained.—W. H. H. N.

Sulphites, thiosulphates, and polythionates; Method of determining —. A. Sander. Z. angew. Chem., 1915, 28, 9—12.

POLYTHIONATES, thiosulphates, and sulphurous acid may be determined in presence of each other by titrating the thiosulphate and sulphurous acid with *N*/10 iodine solution (*a* c.c.), the polythionate being unacted upon, and determining the sulphuric acid formed by the oxidation of the sulphurous acid by titration with *N*/10 caustic soda (*b* c.c.). Then *b*/2 c.c. is the measure of the iodine reacting with the sulphurous acid and (*a*—*b*)/2 that reacting with the thiosulphate. In a fresh portion of the original solution the sulphurous acid is converted into bisulphite by means of *N*/10 NaOH in the presence of methyl orange, and the neutralised solution is poured into an excess of a cold saturated solution of mercuric chloride: in 45 minutes, with frequent shaking, the following reactions are complete:—



The acidity is titrated with *N*/10 NaOH, as above, and that due to the known amount of thiosulphate and bisulphite computed. The remainder is due to polythionates, and is expressed in terms of grm.-mols. of NaOH; one-fourth of this result represents the grm.-mols. of polythionates present.—W. H. H. N.

Polysulphides of potassium. Polysulphides of the alkali metals. II. A. Rule and J. S. Thomas. Chem. Soc. Trans., 1914, 105, 2819—2829. (See this J., 1914, 198.)

AN examination of the solids formed by adding sulphur, in varying proportion, to an alcoholic solution of potassium hydrosulphide, and a determination of the amount of hydrogen sulphide evolved during the reaction, showed the chief product to be potassium pentasulphide, which separated in extremely hygroscopic orange-red crystals; no evidence of the formation of higher polysulphides was obtained. The pentasulphide darkened on heating, but melted without decomposition at about 220° C.; it readily oxidised on exposure to air, with the liberation of sulphur. Metallic potassium reduced an alcoholic solution of potassium pentasulphide to lower polysulphides, but no definite product was isolated.—F. SODN.

Calcium nitrate factories; Toxic symptoms among workers in —. F. Koelsch. Münch. Med. Woch., 1914, 1869. Pharm. J., 1915, 94, 241.

WORKERS in factories where calcium nitrate is produced electrically from the atmosphere, are subject to a peculiar form of industrial poisoning,

which is attributed to calcium cyanide in the dust inhaled. The symptoms do not develop until some alcoholic beverage is taken; then the head becomes hot and flushed while the limbs feel cold. Pulsation is felt in the chest and neck, while respiration becomes difficult. Even minute quantities of alcohol may produce these symptoms. The face and neck then become cyanosed while the trunk and arms acquire a bright red-coloured rash, unaccompanied by any great rise in temperature. The reflexes remain normal, and the senses are unimpaired. In severe cases giddiness and jactitation occur. The duration of the attack is variable, according to the amount of alcohol taken. When vomiting or diarrhoea occurs, instant improvement follows, and the rash immediately fades. No permanent ill-effects have been observed hitherto. No case of acquired immunity has been recorded. A few hours' stay in the dusty factory is sufficient to render a workman liable to attack. Total abstainers are not affected; after an absence of a day or two from the works alcohol may be taken with impunity. The attacks do not occur in workmen who have taken alcohol previous to going to work.

Calcium carbide manufacture. Times, Eng. Suppl., Jan. 29, 1915.

UNTIL the outbreak of the war the situation of the calcium carbide industry was satisfactory. While the demand for lighting purposes showed a steady increase, that for oxy-acetylene welding continued to increase with great rapidity, but on the other hand the requirements of carbide for making fertilisers, such as cyanamide, do not appear to have made much progress. By far the largest consumer for this last purpose was Germany, and it is reported that the chief German contractors, even before the war, failed to take the increased quantities which they had led the manufacturers to believe they could place. The outbreak of the war seriously interfered with manufacture. The factories in Norway were compelled to shut down, with one exception, chiefly owing to the difficulty of shipping raw material. A British-run factory, that of the Albion Products Co., continued to run its factory at full power, and even succeeded in somewhat increasing its production. In other parts of Europe mobilization caused either complete or partial shutting-down of the factories. The important factories in Austria, on the Dalmatian coast, have no means of transport except by sea. The result has been that a shortage is beginning to be felt in certain sizes of carbide, particularly those required for motor and cycle lamps, which these factories especially catered for. The war also caused a serious decrease in the manufacture of cyanamide, owing to the German market being made more or less inaccessible. The war has made a very considerable difference in the consumption of calcium carbide. The consumption for lighting purposes has decreased considerably, but the consumption for oxy-acetylene welding purposes and for emergency lighting has increased enormously. The British War Office decided to equip the motor-omnibuses and motor-cars sent to France with acetylene lighting, and is shipping large quantities of carbide to France. The only factory producing carbide in this country, that at Thornhill, Yorkshire, reports a very successful year. The war put an end to the Syndicate of Continental Carbide Factories, as it proved impossible to continue the co-operation between British, French, Austrian, and German manufacturers. British, French, and Swiss manufacturers each held a larger interest in the syndicate than the German manufacturers. At the present time a decided shortage of carbide is beginning to make itself felt in many countries, although in Great Britain prices are about at the same level as before

the war. It is, however, generally anticipated that they will be put up shortly, because not only is the cost of manufacturing increasing very rapidly, but the freights for carbide from the Continent to this country are already about 50% higher than before the war.

Stannous and potassium chlorides; The double salts of—. T. Fujimura. Mem. Coll. Sci., Imp. Univ., Kyoto, 1914, 1, 63—68.

ONLY two double salts, $\text{SnCl}_2 \cdot \text{KCl} \cdot \text{H}_2\text{O}$ and $\text{SnCl}_2 \cdot 2\text{KCl} \cdot 2\text{H}_2\text{O}$, were found to exist at 25° C., thus confirming the conclusion of Remsen and Richardson (Amer. Chem. J., 1892, 14, 89).

—W. E. F. P.

Lead oxide, acetic acid, water; The system—. S. Sakabe. Mem. Coll. Sci., Imp. Univ., Kyoto, 1914, 1, 57—61.

THE only basic salts found to exist in contact with solutions, at 25° C., were $\text{Pb}(\text{OH})(\text{C}_2\text{H}_3\text{O}_2)$ and $\text{Pb}(\text{C}_2\text{H}_3\text{O}_2)_2 \cdot 2\text{Pb}(\text{OH})_2$, thus confirming the conclusion of Löwe (J. prakt. Chem., 1866, 98, 385); no acid salt was formed under these conditions. (See also Jackson, this J., 1914, 1046.)

—W. E. F. P.

Peroxides of the alkaline-earth metals. E. H. Riesenfeld and W. Nottebohm. Z. anorg. Chem., 1915, 90, 371—376. (See also this J., 1915, 78.)

THE decomposition of anhydrous calcium peroxide at atmospheric pressure, although commencing at about 220° C., occurred very slowly up to about 273° C. At 273°, 14.6% of active oxygen remained after 21 hours; at 282°, 10.3% after 24 hours; at 298°, 4.2% after 22 hours; and at 308° C., 0.5% after 46 hours. At 255° C. the dissociation pressure was above 190 atmospheres, and it is concluded that the production of calcium peroxide by the action of oxygen on lime would require pressures which are unattainable in practice.—J. R.

Silicon tetrachloride, disilicon hexachloride, and the higher chlorides of silicon; Preparation of—by the action of chlorine on 50% ferrosilicon, together with a discussion on their mode of formation. Silicon compounds; Researches on—. VI. G. Martin. Chem. Soc. Trans., 1914, 105, 2836—2860.

SILICON tetrachloride and disilicon hexachloride were prepared by passing chlorine over commercial 50% ferrosilicon heated to 180°—200° C. in an iron tube; about 3 kilos. of the hexachloride and 200 grms. of trisilicon octachloride, besides smaller quantities of mixed higher chlorides, were obtained by fractionating, under anhydrous conditions, 54 kilos. of the crude tetrachloride first collected. The apparatus employed and mode of operating are fully described: an essential condition is the exclusion of atmospheric moisture. Silicon tetrachloride had no appreciable action on silicon at 200°—340° C. (compare Gattermann and Weinlig, Ber., 1894, 27, 1943), and disilicon hexachloride, although readily dissolving chlorine, was not affected by it at the ordinary temperature. The hexachloride, however, took fire in chlorine at about 300° C., forming silicon tetrachloride, and the tetrachloride is regarded therefore as the final product of the action of chlorine on ferrosilicon, resulting from the chlorination of more complex chlorides; this accounts also for the fact that no silicon tetrachloride was collected during the first half-hour of operating. All the products reacted with water to form white amorphous compounds which were readily combustible and dissolved in potassium hydroxide with the evolution of hydrogen.—F. SODN.

Disilicon hexachloride; Action of ethyl alcohol on—. *Researches on silicon compounds. VII.* G. Martin. Chem. Soc. Trans., 1914, 105, 2860—2872.

ALCOHOL reacts vigorously with disilicon hexachloride, producing intense cold and giving a mixture of ethoxy-derivatives. The compounds $\text{Si}_2\text{Cl}_5\text{OC}_2\text{H}_5$, $\text{Si}_2\text{Cl}_4(\text{OC}_2\text{H}_5)_2$, $\text{Si}_2\text{Cl}_3(\text{OC}_2\text{H}_5)_3$, $\text{Si}_2\text{Cl}_2(\text{OC}_2\text{H}_5)_4$, and $\text{Si}_2(\text{OC}_2\text{H}_5)_6$ were prepared as colourless oils, boiling at 84°, 104°, 122°, 138°, and 141° C. respectively, under 34 mm., by treating the hexachloride or a relatively lower ethoxy-derivative with alcohol; the tetra- and penta-ethoxy-derivatives reacted only on heating. The chloro-ethoxy-derivatives attacked the skin and were decomposed by moisture giving white amorphous explosive hydroxy-compounds, whilst the hexa-ethoxy-compound reacted with alkali with the evolution of hydrogen.—F. SODN.

Actinium and ionium; Recovery of— from the Olary ores. S. Radeloff. Chem. News, 1915, 111, 59—60. (See also this J., 1914, 229.)

ACTINIUM. Almost the whole of this constituent appears to be precipitated with the mixed crude sulphates (this J., 1914, 231, table III.) obtained in the course of extracting the radium. The mixture, containing about 3% of rare earths in addition to the constituents enumerated (*loc. cit.*), is fused in an iron crucible with excess of sodium hydroxide containing some sodium carbonate, the melt extracted repeatedly with hot water, the insoluble residue digested with excess of sodium carbonate under a steam pressure of 90 lb., the carbonate residue washed, treated with dilute hydrochloric acid, the solution evaporated to dryness, the residue treated with water, the silica filtered off, and the solution saturated with hydrochloric acid gas (to precipitate the radium and barium) and filtered. The filtrate, containing the actiniferous rare earths, is evaporated to dryness and the residue further treated to separate actinium. IONIUM appears to be chemically inseparable from thorium, so that by extracting and purifying the latter by any of the well-known methods, an active ionium product is obtained. The activity of this product depends on the ratio between the uranium and thorium present in the ore, this ratio being about 100:1 in the case of the Olary ore.—W. E. F. P.

Determination of potassium hydrogen tartrate and tartaric acid. Astruc. See XVIII.

PATENTS.

Sulphuric acid; Apparatus for use in the manufacture of—. R. Bithell and J. A. Beck, Belfast. Eng. Pat. 28,743, Dec. 12, 1913.

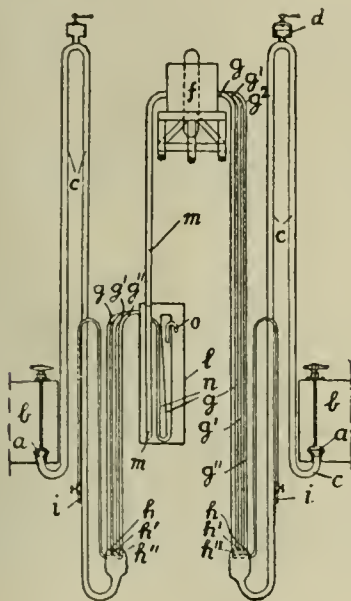
A COLUMN is built up of a number of superposed compartments, each having an opening in the base, fitted with an open pipe, the upper end of which is covered by a hood resting upon the floor of the compartment and perforated near its lower edge. Each hood is provided with a perforated annular flange or shelf, extending to the wall of the compartment, and overflow pipes, piercing the flange, connect the compartment with those immediately above and below. The apparatus is intended primarily to replace the usual Glover tower, hot burner gases passing upwards through successive layers of dilute acid supplied from above; the current of gas is deflected by the hoods and further broken up by the perforated shelves. An extended column or set of columns may be employed also instead of chambers and Gay Lussac tower.—F. SODN.

Acid from acid sulphates; Recovery of—. G. Hunnybun, Huntingdon. From F. J. Stanes and G. S. Rogé, Coimbatore, India. Eng. Pat. 29,254, Dec. 18, 1913.

AN intimate mixture of sulphur with twice its weight of sodium bisulphate is roasted in an open pan to the ignition point of sulphur. The heat of combustion of the latter drives off part of the sulphuric acid, and sulphur is added from time to time until most of the bisulphate is converted into sulphate.—O. R.

Raising liquids, especially sulphuric acid; Apparatus for—. C. Nagelschmidt. Ger. Pat. 279,074, Oct. 25, 1913.

THE siphon, *c*, and tubes, *g*, *g'*, *g''*, are filled with acid through the cock, *d*, the valve, *a*, is opened, and compressed air is forced in through the valve,



i, issuing through the nozzles, *h*, *h'*, *h''*, into the tubes, *g*, *g'*, *g''*, and producing a flow of acid from the vessel, *b*, into the collecting vessel, *f*. A vessel, *l* (see centre of figure) may be interposed to prevent spurting of acid and ensure more regular working. When the acid flows into this vessel, the air escapes through the tube, *o*, and siphon, *n*, until the acid level reaches *a*, whereupon pressure develops in the upper part of *l*, and forces the acid through the tube, *m*, into the collecting vessel, *f*.—A. S.

Hydrochloric acid; Process and apparatus for making—. A. Engelstad, Berlin, N.H. U.S. Pat. 1,121,910, Dec. 22, 1914. Date of appl. Feb. 4, 1914.

CHLORINE, oxygen (or air), and hydrogen are supplied continuously to a combustion chamber, in which combustion of the chlorine with a portion of the hydrogen is maintained by the simultaneous burning of another portion of the hydrogen with the oxygen. The hydrogen chloride and water vapour produced are led away and condensed to furnish aqueous hydrochloric acid, any uncondensed hydrogen chloride being absorbed by water from a separate source. An excess of hydrogen is used and serves to reduce the temperature in the combustion chamber.—F. SODN.

Magnesia and hydrochloric acid; Continuous process for the manufacture of—. K. Hepke. Ger. Pat. 278,106, Feb. 27, 1913.

AN infusible mixture of magnesium chloride or magnesium oxychloride with magnesia is passed through a rotary kiln lined with suitable material and heated by direct fire.—A. S.

Hydrochloric acid; Manufacture of—by the action of superheated steam on magnesium chloride. W. Schwarzenauer. Ger. Pat. 279,008, Feb. 20, 1914.

VERTICAL retorts are used, the steam being introduced at the top and hydrochloric acid gas discharged at the bottom.—A. S.

Iodine and other products from seaweed; Means, methods, and appliances for obtaining—. J. Hargreaves, Widnes, and G. K. Davis, Manchester. Eng. Pat. 234, Jan. 5, 1914.

SEAWEED is burned completely in vertical brick or iron chambers, each provided with a grid near the bottom, and connected in series by means of pipes; heated air is passed into the top of the first chamber, and the products of combustion are passed downwards through the remaining chambers, each chamber becoming in turn the last, intermediate, and first of the series. The combustible part of the gases from the last chamber is freed from tar and condensable matter, and utilised in any convenient manner. To prevent loss of iodine by volatilisation, a quantity of the ashes obtained in a previous burning is intimately mixed with fresh seaweed, preferably still moist.—O. R.

Kelp and similar aquatic plants; Utilisation of—. T. Boberg, N. Testrup, and Techno-Chemical Laboratories, Ltd., London. Eng. Pat. 1766, Jan. 22, 1914.

GIANT kelps, especially *Nereocystis lueckana*, *Macrocystis pyrifera*, and *Pelagophycus porra*, are minced and pulped, freed from occluded air by reduced pressure, and heated in closed vessels to 170° C. or upwards for 20 minutes, or forced through a continuous heater and heat exchanger, to destroy the water-holding slime constituents. The mass now yields a firm press-cake. The liquor contains about 70% of the original alkali salts, 90% of the iodine, 33% of the nitrogen which totals 1.2% on the dry basis, and 10% of original organic matter. Part of the liquor and washings from the press-cake is used to pulp fresh weed, and the excess is evaporated, and the dried cake incinerated, or burnt with fuel in a producer to recover nitrogen and some heat from its organic content, and the ash extracted for alkali. The press-cake is dried by waste heat, and either carbonised to yield fuel gas and a char valuable for filtering and clarifying, or burnt in a producer, when the nitrogen may be recovered as ammonia and the residual alkali extracted from the ashes.—W. H. H. N.

Salt and like mineral substances; Furnaces for melting—. International Salt Co., Ltd., London. A. W. Brown, Belfast, and J. H. Webster, Carrickfergus, Ireland. Eng. Pat. 2988, Feb. 5, 1914.

A MELTING furnace is combined with a refining furnace in the same structure, which surmounts a dual series of longitudinal gas and air regenerators, extending the full length of the two contiguous furnaces and common to both. Vertical, transverse, thin partition walls, spaced apart, extend from a point above the bottom to a point below the roof of the regenerator chambers. The molten salt

flows from the inclined hearth of the melting furnace into the purifying furnace, the hearth of which is divided into a number of shallow baths extending across its full width. The first is comparatively long, and serves for the deposition of solid impurities by gravitation; the next portion comprises comparatively short and shallow baths, in which the molten salt is agitated by means of compressed air or otherwise; the final bath is relatively large and deep, and the overflow for the purified salt is at about the same level as the top of the several baths, so that all the baths in the purifying furnace are kept full.—O. R.

Carbonic acid gas; Absorbent medium for—. J. Cadman, Edgbaston, Warwick. Eng. Pat. 12,454. May 20, 1914.

SMALL lumps of porous material, such as coke or charcoal, are immersed in molten caustic soda or the like, and the latter is agitated so that a film of alkali solidifies over the surface of the lumps. The absorbent being specially intended for use in respirators, calcium chloride is added to it to act as a cooler.—O. R.

Zinc sulphite and oxide; Process for the treatment of zinc solutions for the production of—. P. Ferrère, Paris. Eng. Pat. 13,333. May 30, 1914. Under Int. Conv., April 11, 1914.

A SOLUTION of a zinc salt, especially the sulphate, is saturated with sulphur dioxide in an agitating apparatus, preferably under pressure, and a quantity of alkaline-earth oxide or hydroxide less than half the equivalent of the sulphur dioxide in solution is added. Alkaline-earth sulphate is precipitated, and the solution, which contains zinc sulphite dissolved in excess of sulphurous acid, is treated to recover the zinc sulphite. The latter is calcined, yielding zinc oxide, the sulphur dioxide evolved being used in the first stage of the next cycle of operations.—O. R.

Dry, deflocculated body [graphite, etc.] and method of preparing same. C. P. Townsend, Washington, D.C., Assignor to Acheson Oiltag Co., Niagara Falls, N.Y. U.S. Pat. 1,116,957, Nov. 10, 1914. Date of appl., Jan. 18, 1910; renewed March 23, 1914.

GRAPHITE, or other suitable material, is deflocculated by the action of tannin or otherwise, as described in U.S. Pat. 964,478 of 1910 (this J., 1910, 1047), and the stiff paste formed is stirred into sufficient water to suspend the deflocculated material. The suspension is treated with a volatile liquid, such as acetone or ethyl or methyl alcohol, whereby the deflocculated material is precipitated in a "reversible" state, i.e., in a condition in which it may be collected and dried, but from which it passes immediately into a deflocculated suspension when treated with water. Suitable volatile liquids are those which are miscible with water in all proportions, and the precipitate is washed with the concentrated liquid until all water has been eliminated. Lampblack, carbon black, etc., after treatment as described, may be compressed into cakes or sticks to be used for the preparation of printing inks, Indian ink, etc., and the process may be applied to other amorphous pigments.—O. R.

[Radium and other] ions; Process for exchange of—adsorbed by colloids. B. Schwerin, Assignor to Elektro-Osmose A.-G. (Graf Schwerin Ges.), Frankfurt on Maine. U.S. Pat. 1,120,551, Dec. 8, 1914. Date of appl., April 24, 1914.

THE separation of closely related elements, such as the rare earths in general and radium and barium in particular, is effected by adsorbing them together in a suitable colloid, for example manganese dioxide, and de-adsorbing them by treating

it with a suitable electrolyte such as a 1% solution of aluminium chloride. Both processes are selective, and the desired adsorption is obtained by choice of the colloid, and the separation by the choice and concentration of the electrolyte. For the exchange of bases electro-negative colloids are used, and the de-adsorbing solutions found most effective are those of the strongest electro-positive bases. The best separations are obtained when adsorption is effected in the presence of the de-adsorbing solution. In one case the barium-radium adsorption in manganese dioxide was boiled for some minutes with 100 parts of water and 5.35 parts of ammonium chloride. The filtrate then contained 64.7% of the total radium and only 32.7% of the total barium.—W. H. H. N.

Thorium-X; Process for obtaining—. J. Lorenzen. Ger. Pat. 278,121, Sept. 12, 1913.

A COLLOIDAL solution of thorium oxide is dialysed, whereupon thorium-X passes through the membrane, yielding a pure solution. The thorium-X is regenerated continuously from the radiothorium present in ordinary thorium oxide, and further quantities can therefore be separated by renewing the distilled water in the dialyser. The colloidal thorium oxide may be prepared by treating a concentrated solution of thorium nitrate with ammonia, washing the precipitated thorium hydroxide, and digesting it with a small quantity of water after addition of a trace of thorium nitrate.—A. S.

Hydrogen and nitrogen; Process of manufacturing mixed—. G. P. Scholl, New York, Assignor to Westinghouse Lamp Co. U.S. Pat. 1,123,394, Jan. 5, 1915. Date of appl., Oct. 6, 1908.

A MIXTURE of nitrogen and hydrogen in which the ratio N:H is equal to R, is obtained by mixing ammonia gas and air in the proportion of (2R+4) to (3R-1) and passing the mixture over a catalytic agent to induce dissociation of the ammonia and combination of the oxygen with hydrogen. For example, a mixture of equal parts of nitrogen and hydrogen is obtained by charging a closed vessel with ammonia gas under pressure, introducing air until the total pressure is four times the absolute pressure of the ammonia, and then passing the mixture over a catalytic agent.—A. S.

Nitrogen; Process for fixing atmospheric—. S. Peacock, Chicago, Ill., Assignor to International Agricultural Corporation, New York. U.S. Pat. 1,123,584, Jan. 5, 1915. Date of appl., Apr. 19, 1913.

A GASEOUS mixture, obtained by burning sulphur in a limited quantity of air, is passed over heated carbon (800°C.) to form a compound of sulphur, carbon, and nitrogen from which ammonia is subsequently produced by treatment with hot water.—W. E. F. P.

Nitrogen; Process of fixation of atmospheric—by metal carbide. H. W. Lamb, Portsmouth, Va. U.S. Pat. 1,123,763, Jan. 5, 1915. Date of appl., Mar. 18, 1914.

MOLTEN iron carbide, prepared by the action of carbon upon iron oxide, is subjected to the action of nitrogen under pressure so as to form a cyanide.—W. E. F. P.

Nitrogen with oxygen and with hydrogen; Process for obtaining compounds of—. O. Bender. Ger. Pat. 279,007, Oct. 21, 1913.

THE compounds are formed by burning fuels by means of air under pressure, water in a finely divided form being added to the combustion gases or to the air for combustion in quantity equal to

that of the carbon burned. A hollow grate cooled by water, air, etc., is used to cool suddenly the reaction products and thus prevent them from decomposing. With a temperature of about 2000° C. in the interior of the furnace, about 1% NO and 0.25% NH₃ by vol. are stated to be formed.—A. S.

Air ; Apparatus for liquefying and separating —. J. F. Place, Glen Ridge, N.J., Assignor to American Air-Liquefying Co., New York. U.S. Pat. 1,123,588, Jan. 5, 1915. Date of appl., Feb. 18, 1909.

AIR compressed to, or above, its critical point is delivered in part through a throttled nozzle valve, to a rotary engine or air-expanding turbine, and in part to a constant-pressure liquefier, the cold expanded air and gases from the turbine and the liquefier, respectively, being utilised to cool the incoming compressed air.—W. E. F. P.

Oxygen ; Process for producing —. P. Danckwardt, near Dardanelle, Ark. U.S. Pat. 1,124,304, Jan. 12, 1915. Date of appl., March 4, 1914.

HEATED air is passed into a mass of alkali manganate or a mixture of alkali hydroxide or carbonate and manganese oxide, together with a diluent which has also a fluxing effect. The fused mass circulates to another part of the apparatus where oxygen is liberated by treating it with superheated steam.—W. H. H. N.

Alkali silico-aluminate ; Method of making —. A. H. Cowles, Assignor to Electric Smelting and Aluminium Co., Seward, N.J., U.S. Pat. 1,123,693, Jan. 5, 1915. Date of appl., Dec. 24, 1912.

FINELY-DIVIDED clay or/and felspar is treated with water and sodium chloride vapours while at a high temperature and in contact with furnace gases.—W. E. F. P.

Alkali-metal compounds [potassium chloride] ; Process of obtaining — [from felspar]. H. E. Brown, Kingston, N.Y. U.S. Pat. 1,123,841, Jan. 5, 1915. Date of appl., Apr. 30, 1914.

FELSPAR is mixed with sufficient calcium chloride and carbonate to convert all the potassium into chloride and produce a residue containing 40–55% of CaO, and is fused at about 1300° C. in an oxidising atmosphere and the volatilised alkali chloride condensed.—W. E. F. P.

Potassium compounds ; Process of extracting — from flue dust. S. Peacock, Philadelphia, Pa., Assignor to International Agricultural Corporation, New York. U.S. Pat. 1,124,798, Jan. 12, 1915. Date of appl., April 18, 1914.

FLUE dust is treated with a solution containing mono-calcium phosphate to convert potassium silicates into potassium phosphates, an acid being also added to react with any potassium salts held mechanically by the silicates.—W. H. H. N.

Potassium and aluminium ; Process for producing soluble salts of —. M. F. Coolbaugh and E. H. Quinney, Rapid City, S.D. U.S. Pat. 1,125,007, Jan. 12, 1915. Date of appl., June 2, 1913.

FINELY powdered potash rock is mixed with a regulated quantity of limestone to fix the silica, and heated to incipient fusion. The mass is quickly cooled and leached with dilute sulphuric acid, and the potassium and aluminium recovered by crystallisation. For each part of silica, 1.7 parts of limestone are used, and sulphuric acid to the

extent of 1.2 times the potash and 3 times the alumina content.—W. H. H. N.

Potassium salts ; Continuous process for dissolving —. H. Daus. Ger. Pat. 278,869, July 25, 1913.

THE salts are supplied to an inclined sieve so arranged that only the coarser particles are fed into the dissolving vessel near the outlet for the solution, the finer material being introduced at a point some distance away, so that it has time to dissolve before reaching the outlet and hence is not carried away mechanically in the form of slime.—A. S.

Arsenic acid and arsenical compounds ; Method of making —. G. P. Fuller, Assignor to National Electrolytic Co., Niagara Falls, N.Y. U.S. Pat. 1,125,086, Jan. 19, 1915. Date of appl., June 1, 1914.

ARSENIOUS oxide suspended in brine is electrolysed, the solution is filtered, and then neutralised to produce an arsenate.—W. H. H. N.

Ammonium sulphate ; Manufacture of — from distillation gases. E. Chur. Ger. Pat. 277,379, Nov. 19, 1912.

THE gases are freed from tar as usual and then, before passing to the saturator, are warmed and enriched in ammonia by treatment with warm, concentrated ammoniacal liquor. The latter is obtained by passing the ordinary ammoniacal liquor first through a boiler provided with a reflux condenser and then through a column still, the ammoniacal vapours from the still being returned to the boiler through a pipe terminating in a rose below the level of liquor in the boiler. The vapours from the boiler pass into the receptacle for the concentrated ammoniacal liquor, which is provided with means for ensuring intimate contact between the liquor and the distillation gases passing through.—A. S.

Saturator for the production of ammonium sulphate from distillation gases. Berlin-Anhaltische Maschinenbau A.-G. Ger. Pat. 279,134, Jan. 16, 1914.

THE gases are introduced through one or more long hoods, dipping in the liquid and extending across the width of the saturator. Between the hoods, and at right angles to them, are partitions which divide the upper part of the bath of liquid into zones and also separate the hopper-shaped wells in the bottom of the saturator from one another. By this subdivision of the space within the saturator the effects of variations in the pressure of the gases are minimised.—A. S.

Hydrogen ; Apparatus for the manufacture of —. F. Bergius, and Chem. Fabr. A.-G. vorm. Moritz Milch and Co. Ger. Pat. 277,501, Nov. 30, 1913. Addition to Ger. Pat. 254,593 (this J., 1913, 195 ; see also Fr. Pat. 447,080 of 1912 ; this J., 1913, 364).

AN apparatus for the production of hydrogen by the action of metals on liquid water under pressure, consists of a pressure vessel within which is a central heating tube and around the latter a series of reaction tubes, each of which can be brought in turn below a feed opening in the cover of the pressure vessel.—A. S.

Hydrosulphites ; Process for the electrolytic preparation of —. Badische Anilin und Soda Fabrik. Ger. Pat. 278,588, July 7, 1912.

THE process described in Ger. Pat. 276,059 (this J., 1914, 920) is made continuous by circulating the bisulphite solution from a reservoir, through the electrolysing vessels and back to the reservoir,

the bisulphite being renewed by the introduction of sulphurous acid. When the solution becomes sufficiently concentrated, hydrosulphite crystallises out and is separated and the mother-liquor returned to the circuit. A series of cells connected electrically in parallel is used. The bisulphite solution is preferably prepared by adding sulphurous acid to a sulphite solution immediately before introducing the solution into the electrolyzing cells, and the solution leaving the cells is neutralised. To prevent loss of sulphite and hydrosulphite by migration of ions, a vigorous circulation of liquid is produced through the diaphragm, or through a series of diaphragms, in the direction of the cathodes.—A. S.

Hydrogen peroxide; Vessels [of quartz glass or the like] for the preparation and storage of—. Zirkonglas-Ges. m. b. H. Ger. Pat. 278,589, Oct. 1, 1912.

VESSELS of quartz glass or other highly acid glasses, or quartz glass in which a small proportion of the silica is replaced by another acid oxide, such as oxide of titanium or zirconium, are used.—A. S.

Selenium dioxide; Preparation of—. W. D. Treadwell and E. Fränkl. Ger. Pat. 279,005, Dec. 24, 1913.

SELENIUM dioxide is produced by burning an intimate mixture of selenium vapour and air.—A. S.

Salts of complex fluorine acids; Manufacture of—. Gebr. Siemens und Co. Ger. Pat. 279,011, May 1, 1913.

A MIXTURE of an oxide or salt (carbonate, chloride) of a metal and an oxygen-compound of an element capable of forming a complex acid with hydrofluoric acid (e.g., boric acid, titanous acid, silica) is treated with the calculated quantity of hydrofluoric acid.—A. S.

Silicic acid; Preparation of pure—of great absorptive and adsorptive power. R. Marcus. Ger. Pat. 279,075, Feb. 20, 1914.

SOLUTIONS of water-glass are treated with aldehydes, such as formaldehyde, or phenols, and the resulting jelly is washed and dried.—A. S.

Oxygen; Process for removing—from gaseous mixtures. Siemens und Halske A.-G. Ger. Pat. 279,132, June 28, 1913.

THE gases are led over a metal heated to incandescence, the metal being one, such as zirconium or titanium, the oxide of which is not reduced by hydrogen or carbon monoxide at the temperature of working. In practice gases to be freed from oxygen frequently contain hydrogen or oil vapours: by the process described, oxygen can be removed from such gases without formation of steam.—A. S.

Dicyanodiamide or a mass consisting essentially of dicyanodiamide; Manufacture of—from crude calcium cyanamide. G. Grube and J. Krüger. Ger. Pat. 279,133, June 5, 1913.

A PORTION of the lime in an aqueous extract of crude calcium cyanamide is precipitated or combined with an acid, or free cyanamide is added to the solution, so that the quantity of residual free lime (capable of titration with hydrochloric acid) is equivalent to about one-fourth of the total cyanamide content, and this ratio is kept approximately constant by further additions during the spontaneous transformation of the cyanamide into dicyanodiamide at a temperature preferably above 40° C. In the case of solutions of cyanamide free from lime, the requisite alkalinity may be produced by addition of hydroxides or alkaline salts of potassium, sodium, lithium, barium, or strontium. (See also this J., 1914, 75, 749.)—A. S.

Cyanamides; Process for producing—. Dettifoss Power Co., Ltd., and J. H. Lidholm, London. Eng. Pat. 28,629, Dec. 11, 1913. Under Int. Conv. Feb. 24, 1913.

SEE Fr. Pat. 465,473 of 1913; this J., 1914, 644. Reference is directed, in pursuance of Sect. 7, Subsect. 4, of the Patents and Designs Act, 1907, to Eng. Pats. 2514 of 1874, 15,306 of 1899, 9522 of 1905, and 19,870 of 1906.

Calcium cyanamide; Process of producing—. J. H. Lidholm, London. U.S. Pat. 1,125,350, Jan. 19, 1915. Date of appl., Feb. 14, 1914.

SEE Fr. Pat. 469,045 of 1914; this J., 1914, 962.

Sea-weed products; Manufacture of—. Norsk Tangsyndikat, Christiania, Norway. Eng. Pat. 5145, Feb. 27, 1914. Under Int. Conv., March 1, 1913.

SEE Fr. Pat. 469,190 of 1914; this J., 1915, 28.

Thionyl chloride; Process for producing—. H. von Keler, Leverkusen, Germany, Assignor to Synthetic Patents Co., Inc., New York. U.S. Pat. 1,125,114, Jan. 19, 1915. Date of appl., Sept. 4, 1913.

SEE Ger. Pat. 275,378 of 1913; this J., 1914, 831.

Hydrogen gas; Process of purifying—. C. Bosch and W. Wild, Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen, Germany. U.S. Pat. 1,126,371, Jan. 26, 1915. Date of appl., Jan. 30, 1912.

SEE Fr. Pat. 439,262 of 1912; this J., 1912, 722.

Utilisation of coke-oven gas and the recovery of by-products therefrom. Eng. Pat. 1820. See IIA.

Manufacturing utensils from oxides of the rare earths, thorium oxide, zirconium oxide and the like. U.S. Pats. 1,121,889 and 1,121,890. See VIII.

Reinforced concrete cell for the electrolysis of salt, etc. U.S. Pat. 1,125,201. See XI.

Anode for the electrolysis of sulphate solutions. Ger. Pat. 278,038. See XI.

VIII.—GLASS; CERAMICS.

Notes on glass. National Physical Laboratory. See p. 210.

PATENTS.

Potters' slip, powdered substances, and the like; Sifting apparatus for treating—. T. Lawrence, Stoke-on-Trent. Eng. Pat. 26,224, Nov. 15, 1913.

TWO skeleton sifting boxes, fitted with detachable lawn frames, are mounted on a common, central axis, one inside the other, the lawn of the inner frame being of coarser mesh than that of the outer one. The inner box is supported within the outer one, so that it can be easily removed. Sifting is effected by rotating the boxes, centrifugal force throwing the slip or powdered substances against the lawns.—O. R.

Refractory products; Manufacture of highly—, during which spinel is formed in the mass. K. A. Mankau, St. Petersburg. Eng. Pat. 29,082, Dec. 17, 1913.

HIGHLY refractory products are produced by burning 6% of an oxide or oxides of the type RO and/or R₂O₃ with limestone, or with a mixture of limestone and 4–12% of magnesite or chrome iron ore, so that polybasic and polyacid spinels

are always formed in the mass, as described in Eng. Pat. 23,725 of 1912 (this J., 1913, 489).—O. R.

Rare earths, thorium oxide, zirconium oxide, and the like; Methods of manufacturing idencils and the like from the oxides of the —. A. Arnold, Charlottenburg, Assignor to O. Knöfler und Co., Plotzensee, Germany. U.S. Pats. (A) 1,121,889 and (B) 1,121,890, Dec. 22, 1914. Dates of appl., Dec. 20, 1913 and May 12, 1914.

(A) A MIXTURE of a rare earth oxide, e.g., zirconium oxide, and a completely volatile medium, such as water, is compressed in a mould and the product burnt; or a mixture of thorium and zirconium oxides with water is shaped by pressure and, before burning, glazed with thorium and zirconium oxides and a proportion of an additional oxide dependent on the fusing point desired. (B) Oxides of thorium and zirconium are subjected to a high pressure, and then made into a paste with a suitable fluid. The mass is cast in moulds and the shaped articles, which may be glazed as above, are burnt.—F. SODN.

Saggars for porcelain ware; Preparation of bodies for, and utilisation of sherds of —. F. Singer. Ger. Pat. 278,594, Jan. 11, 1913.

SLAKED lime is incorporated with the other usual components of bodies for saggars for burning porcelain, and the sherds of the used saggars are utilised as an artificial stone for the preparation of mortars.—A. S.

Enamelling; Muffle-furnace for —. O. Zahn, Berlin. U.S. Pat. 1,124,380, Jan. 12, 1915. Date of appl., Sept. 16, 1913.

SEE Fr. Pat. 460,104 of 1913; this J., 1914, 25.

Ceramic and other porous objects; Process for impregnating [waterproofing] —. M. Grünzweig, Ludwigshafen, Germany. U.S. Pat. 1,124,891, Jan. 12, 1915. Date of appl., May 28, 1908.

SEE Fr. Pat. 390,456 of 1908; this J., 1908, 1063.

Vessels [of quartz glass or the like] for the preparation and storage of hydrogen peroxide. Ger. Pat. 278,589. See VII.

IX.—BUILDING MATERIALS.

Wood; Density of wood substance and porosity of —. F. Dunlap. J. Agric. Research, 1914, 3, 423—428.

DETERMINATIONS made with longleaf pine (*P. palustris*, Mill.), Douglas fir (*Pseudotsuga taxifolia*, Lam.), Pacific yew (*Taxus brevifolia*, Nutt.), mockernut hickory (*Hicoria alba*, L.), beech (*Fagus atropurpurea*, Marsh.), red oak (*Q. rubra*, L.), and sugar maple (*Acer saccharum*, Marsh.), showed that for practical purposes the density of the wood substance in different species of trees may be considered as uniform, with a value of 1.54. Most commercial woods have an apparent density between 0.3 and 0.6, so that from four- to two-fifths of the total volume consists of empty cell space.—W. E. F. P.

Building materials (cements and mortars). Tätigkeitsbericht des Kgl. Materialprüfungsamtes zu Berlin-Lichterfelde für das Jahr 1913/14. Chem.-Zeit., 1915, 39, 61—62.

TEST-specimens of cement mortars of different composition proved not to be completely waterproof, but when coated with a 1 cm. layer of a mixture of 1 part of cement and 3 parts of sand

by vol., and the surface rendered smooth by dusting on cement, they resisted water completely up to a pressure of 4 atmospheres. This result shows that in testing mixtures for rendering mortar or concrete waterproof or water-repellent, the surface of the test-specimen should not be coated with a smooth layer of cement before applying the mixture to be tested. A defective finishing mortar proved to be composed of slaked lime, blast-furnace slag, argillaceous limestone, and tolerably coarse-grained quartz sand. Owing to the high content (about 26%) of clay, which absorbed water with increase of volume, the mortar was not capable of resisting rain, snow, etc., and its adherence was also affected injuriously by the coarse grain of the sand.—A. S.

Carbide sludge; Use of — in building. K. Schumann. Chem.-Zeit., 1915, 39, 43.

WASTE carbide sludge from the manufacture of acetylene when mixed with 40% of sand gave an excellent mortar which hardened in 24 hours. The sludge had the following percentage composition: 14.40% CaCO_3 , 0.20 CaS , 24.31 CaO , 0.03 SO_3 , 0.16 S, 0.01 Cl, 0.88 $\text{Fe}_2\text{O}_3 + \text{Al}_2\text{O}_3$, 1.29 SiO_2 , 46.40 H_2O , 0.08 C, 0.06 P_2O_5 .—J. R.

PATENTS.

Plaster; Manufacture of —. J. M. Brothers, Prestwich, Lancs. Eng. Pat. 10,130, April 24, 1914.

RAW gypsum and anhydrous quicklime are ground, mixed, and heated to 212° — 300°F . (100° — 149°C .), whereby the water of crystallisation of the gypsum is driven off and absorbed by the lime, producing a dry plaster. If the quicklime is in excess, steam is admitted to complete the hydration of the lime.—O. R.

Road-making and the like; Materials for —. E. J. Lovegrove and N. G. Crompton, London. Eng. Pat. 12,073, May 15, 1914.

A GROUTING or binder is composed of 30—70% of bituminous material intimately mixed with 70—30% of clinker, ash, or residue from refuse- or dust-destructors, in the form of an impalpable powder, as obtained, for example, from a suction dust-collecting device connected with the grinding machine.—O. R.

Cement; Process of making hydraulic —. W. R. Warren, New York. U.S. Pat. 1,123,964, Jan. 5, 1915. Date of appl., March 6, 1914.

MATERIAL containing chiefly lime (or lime and magnesia), silica, and alumina, is fused under non-reducing conditions, and the molten material is subdivided into small particles in presence of a spray of a solution of a salt, e.g., magnesium sulphate, capable of forming Sorel cement or its equivalent. The solid particles are removed quickly from the spray, and ground with a small quantity of a substance capable of accelerating the set of the cement. The product is a hydraulic cement containing about 50% CaO or $\text{CaO} + \text{MgO}$.—A. S.

Lumber; Drying [and preserving] — and product thereof. G. W. and G. B. McMullen, Picton, Ontario. U.S. Pat. 1,125,862, Jan. 19, 1915. Date of appl., April 6, 1914.

TIMBER, such as railway sleepers, is heated gradually in a closed kiln to not higher than 160°F . (71°C .). At first the atmosphere of the kiln is practically saturated, and the heating is continued with gradually decreasing humidity until the sleepers are dried, the atmosphere of the kiln being continually circulated. A germicidal and

water-protective material is then applied. The strength is not impaired, and the moisture content is reduced to a degree sufficient to prevent injurious action of fungi and bacteria.—B. N.

Dry rot of wood; Process for preventing —. W. Lichty. Ger. Pat. 278,441, Dec. 20, 1913.

WOOD is treated successively with a solution of a lead or mercury salt and a solution of a silico-fluoride, or directly with a mixture of such solutions.—A. S.

Acid- and fireproof bodies; Method of producing —. 1. Schlossberg, Hamburg, Germany. U.S. Pat. 1,126,659, Jan. 26, 1915. Date of appl., July 15, 1913.

SEE Ger. Pat. 258,683 of 1911; this J., 1913, 605.

[Silk cotton] *insulating material*. Eng. Pat. 1133. See V.

Preparation of bodies for, and utilisation of sherds of saggars for porcelain ware. Ger. Pat. 278,594. See VIII.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Steel-making furnaces; Electric —. T. D. Robertson. Engineering, 1915, 99, 176—178.

THE Kjellin (this J., 1907, 475, 1055; 1908, 816; 1909, 1047) and Röchling-Rodenhauser induction furnaces (this J., 1912, 137) are dealt with. The arc furnaces are divided into two main classes, namely arc-radiation and arc-conduction furnaces. Of the former the Stassano (this J., 1911, 1067; 1913, 95; 1914, 554) and the Rennerfelt (this J., 1912, 1188; 1914, 599, 837, 1210), and of the latter the Héroult (this J., 1902, 1237; 1907, 878, 1055, 1285; 1909, 147, 377), the Girod (this J., 1905, 739; 1909, 1204; 1910, 95, 96, 361, 827; 1911, 32, 35), and that devised by Grönwall, Lindblad, and Stalhane (this J., 1906, 1054; 1907, 622, 878; 1908, 410; 1909, 1047) are described. A description is also given of the working of a typical charge with a four-ton furnace of the last-named type, the melting current being about 5500 amps. at about 75 volts on each phase. The charge is first purified to remove the impurities with the exception of the bulk of the sulphur. The carburising constituents (powdered anthracite, etc.) are then added and a further purifying slag (lime, sand, and fluorspar), and the current is lowered to about 2000 amps. at about 50 volts pressure. Powdered anthracite is added to reduce any oxide of iron, and at the same time the sulphur passes into the slag. A small quantity of aluminium is added to remove traces of gases, and the metal is poured into the ladle. As far as can be ascertained, there is not much difference in the actual power needed to do the same work with the different types of the better known furnaces. In melting cold scrap, using two slags and refining to a first class quality, the approximate energy consumption decreases from 850 kw.-hours per ton in the case of a 2-ton furnace to 700 kw.-hours per ton in the case of a 5-ton furnace.—B. N.

Arsenic; Determination of — in iron, steel, and ores. A. Kleine. Chem.-Zeit., 1915, 39, 43. (See also this J., 1903, 1064.)

THE iron or steel (10 grms.) is treated gradually with nitric acid of sp. gr. 1.2 (120 c.c.), the solution is evaporated to dryness, and the residue then kept upon a hot plate till the evolution of

brown fumes ceases. After cooling, the residue is dissolved in hydrochloric acid of sp. gr. 1.19 (100 c.c.) by warming gently, so that no arsenious chloride volatilises. The solution is washed into a 300 c.c. conical flask and heated on a water-bath to eliminate any remaining smell of chlorine. Potassium bromide (1 grm.) and hydrazine sulphate (3 grms.) are added to the cold solution, the flask is connected by means of a long, jointed glass tube to the upper end of a spiral condenser, and the distillation proceeded with until most of the liquid has passed over and the residue starts bumping. The distillate should contain the whole of the arsenious chloride, but no iron or free chlorine; it is diluted with an equal volume of water and saturated with hydrogen sulphide. After the precipitate has settled, the excess of hydrogen sulphide is expelled by passing carbon dioxide; the sulphide is collected upon a filter and washed with cold water till the filtrate gives no cloudiness with silver solution. The precipitate is washed through the filter with ammonia (sp. gr. 0.96) followed by cold water, into 50 c.c. of ammoniacal cadmium solution (20 grms. of cadmium sulphate in 400 c.c. of water with 600 c.c. of ammonia of sp. gr. 0.96). The precipitated cadmium sulphide, after settling, is collected, washed with water, and stirred, together with the filter-paper, into conductivity water (100 c.c.). Starch solution (2.5 c.c.) and dilute hydrochloric acid (75 c.c. of a mixture of 850 c.c. of conductivity water with 300 c.c. of concentrated acid) are added, and the mixture is titrated at once with standard iodine solution (7.928 grms. of iodine and 25 grms. of potassium iodide per litre; 1 c.c. = 1 mgrm. S = 0.00156 grm. As). The starch solution is made by boiling 5 grms. of starch with 500 c.c. of water, adding a pinch of salicylic acid during the boiling, and finally replacing the evaporated water. Seven sets of very concordant results are quoted, e.g. 0.054, 0.055, and 0.056% As. (See also Clark; this J., 1887, 352.)—J. R.

Pyrophoric alloys (of iron and cerium); Rapid determination of iron in commercial —. I. Bellucci. Annali Chim. Appl., 1915, 2, 366—369.

FROM 0.2 to 0.3 gm. of the sample is dissolved in a small quantity of cold, concentrated hydrochloric acid, the solution is diluted with a small quantity of water and then, without filtering, is warmed and treated with hydrogen sulphide. The precipitate, consisting mainly of sulphides of metals present as impurities (copper, lead, antimony), is filtered off, and the filtrate, after expelling the excess of hydrogen sulphide, is treated with 5—10 c.c. of a 3% solution of hydrogen peroxide, evaporated to dryness, the residue dissolved in very dilute hydrochloric acid, and the iron determined iodometrically.—A. S.

[Aluminium.] *Southern Aluminium plant of North Carolina*. C. Hafer. Min. and Eng. World, Jan. 16, 1915, 131—135.

THE plant, which is in course of erection, is designed for the production of 12,000 tons of aluminium annually by the electrolysis, in 400 furnaces, of alumina dissolved in fused cryolite. The power for the hydro-electric plant of 45,000 kilowatts mean capacity is to be obtained from the Yadkin river. The alumina is to be obtained from imported bauxite by treatment with concentrated sodium hydroxide solution and reprecipitation. The hearths of the furnaces are made of carbon blocks and form the cathodes. The anodes, also of carbon, are suspended over the interiors of the furnaces and are not in contact with the sides and bottoms. Each furnace requires 20,000 amps. at 7 volts. Heavy aluminium rods will conduct the current direct from the generators.—T. St.

Palladium: The diffusion of hydrogen through —. A. Holl. Roy. Soc. Proc., 1915, A 91, 148—155. (See also this J., 1914, 571.)

THE pressure-time curve for the diffusion of hydrogen at 700 to 100 mm. pressure through palladium at 100° to 300° C. consists of two portions corresponding to the existence of two allotropic forms of the metal. The rate of diffusion is directly proportional to the pressure of the gas. Below 100 mm. the diffusion is slower and no such simple relationship exists.—J. R.

Welding by the thermit process. Patents avoided.

It is announced in the Illustrated Official Journal (Patents) of Feb. 24th, 1915, that Goldschmidt's Patents Nos. 10,859 of 1901 and 24,439 of 1902 have been "avoided" by the Board of Trade. These patents deal with the welding of metals by the "thermit" process. The trade mark "Thermit" (No. 210,269) has also been avoided, whereby the word becomes public property.

Action of acetylene upon metals. Reckleben and Scheiber. See IIA.

PATENTS.

[*Iron ores: Process of smelting* —. F. J. Machalske, Plattsburg, U.S.A. Eng. Pat. 15,457, June 27, 1914. Under Int. Conv., June 27, 1913.

IRON ore is smelted in a graphite-lined electric furnace, with lime and artificially prepared graphite. The latter has the advantage over other forms of carbon of not introducing impurities into, and of combining only to a very small degree with the molten iron.—T. St.

Iron ores and other substances containing iron: Process for reducing —. F. C. W. Timm. Ger. Pat. 277,282, May 9, 1912.

THE charge is heated in a shaft furnace by means of oxidising gases and then reduced by reducing gases, the gases passing in both cases downwards through the shaft. With certain kinds of raw materials, the preheating may be restricted to a portion only of the charge, the sensible heat of the reducing gases subsequently introduced serving to heat the remainder.—A. S.

Pig iron: Production of a special ore for the manufacture of —. L. Franck-Johannson. Ger. Pat. 278,780, May 11, 1912.

CALCAREOUS minette or oolitic iron ores are roasted, and after removal of a portion of the lime, by washing with water for example, are mixed with silicious minette ores or other silicious iron ores and briquetted. The ores are mixed in such proportions as to yield a singulosilicate slag. Manganeose ore and fuel may also be incorporated with the mixture, and the mixed ores may be heated with carbon or other reducing agent and thus converted into a mass containing a high proportion of reduced iron, in order to prevent passage of iron into the slag.—A. S.

Steel manufacture: Use of collecting vessels for the slags produced in —. F. Dahl. Ger. Pat. 279,542, Jan. 10, 1914.

THE slag is conveyed to collecting vessels by the transporting devices used for the iron or steel, and is thence led directly into small moulds in which it solidifies rapidly. The collecting vessels are protected against loss of heat, or may be heated, in order to prevent too rapid cooling with consequent diminution of the solubility of the slag in citric acid.—A. S.

Metals [steel coated with copper]: Process of making clad —. W. M. Page, Philadelphia, Pa. U.S. Pat. 1,125,158, Jan. 19, 1915. Date of appl., April 20, 1910.

STEEL articles are provided with a coherent coating of magnetic iron oxide and are then dipped into molten copper until bubbling ceases.—T. St.

Tubular articles [steel tubes coated with copper]: Process of making clad —. W. M. Page, Philadelphia, Pa. U.S. Pat. 1,125,159, Jan. 19, 1915. Date of appl., April 20, 1910.

THE outer surfaces of steel tubes are oxidised by heating in an atmosphere of steam, and are then brought into contact with molten copper, the inner surfaces at the same time being heated to such a degree that the copper actually in contact with the steel is at a higher temperature than the remainder.—T. St.

Metal [steel]: Clad — and process of producing the same. W. M. Page, Ridley Park, and W. Tassin, Chester, Pa. U.S. Pat. 1,125,160, Jan. 19, 1915. Date of appl., Feb. 8, 1911.

A STEEL billet is immersed in molten copper, at a temperature above the melting point of the steel, until sufficient iron has dissolved to remove oxygen and oxides, and a weld film of copper has formed on the steel. Iron is removed from the copper by preferential oxidation and the purified copper is then united to the steel billet.—T. St.

Metals and metallic articles: Heat treatment of — and appliances therefor. T. V. Hughes, Birmingham. Eng. Pat. 908, Jan. 13, 1914.

IN the heat treatment of metallic articles by means of heated inert gases, "dry pickling" is prevented by previously saturating the gases with the vapour of the metal under treatment, and, if desired, with that of another metal. The saturation is accomplished by passing the heated gases through conduits containing particles of the metal, or the article may be surrounded by netting, etc., of the metal, or the heat-treatment chamber or muffle may be painted inside with the dust of the vapour-producing metal.—T. St.

[*Lead-zinc sulphide ores: Concentration of* —. A. H. Higgins, and Minerals Separation Ltd., London. Eng. Pat. 1368, Jan. 17, 1914.

THE finely crushed ore is sized, or classified, and the products treated separately for the recovery of their constituents by selective flotation in water containing a small proportion of sodium carbonate and one or more frothing agents (e.g. eucalyptus, Texas, or wood tar oil), for example by the process described in Eng. Pat. 16,141 of 1913 (this J., 1914, 869) or in the apparatus described in Eng. Pat. 21,650 of 1913 (this J., 1914, 1160).

—W. E. F. P.

Ores: Process of concentrating —. J. M. Callow, Salt Lake City, Utah, Assignor to Metals Recovery Co., Augusta, Me. U.S. Pat. 1,125,897, Jan. 19, 1915. Date of appl., April 10, 1914.

IN a froth-flotation process, the mineral-bearing froth produced in an open vessel is broken up by the application of suction close to the surface, and the floating product simultaneously discharged.—W. E. F. P.

Furnaces: Electric [smelting] —. J. L. Dixon, Sheffield. Eng. Pats. 4742, Feb. 24, 8513, April 4, 16,263, July 8, and 17,909, July 29, 1914.

THE furnace is provided with from three to six upper electrodes and one lower electrode, and fed with two- or three-phase currents taken from

two or more transformers. Various methods of connecting the electrodes are described, so that by causing the upper electrodes to supply currents of unequal magnitudes, any desired proportion of current may be caused to flow through the lower electrodes, and hence through the bath and the lining of the furnace, without unbalancing the supply system.—B. N.

Melting pots, crucibles, and the like; Apparatus for regulating and for recording temperatures in —. I. Hall, Birmingham. Eng. Pat. 5889, March 9, 1914.

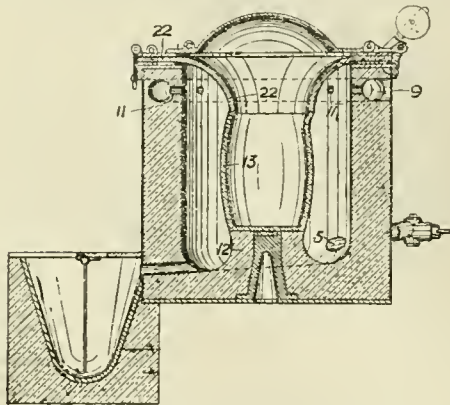
A DETACHABLE vertical pocket, holding a thermostatic apparatus, is secured to the outer wall of a crucible which hangs, by means of a flange round the edge, within an outer gas-fired furnace casing. An aperture in the flange of the crucible allows of the insertion into the pocket of the expansion members of the apparatus for regulating and/or recording the temperature. The interior of the crucible is thus not affected and the action of the mixing apparatus is unimpeded.—T. St.

Metal furnaces; Apparatus for regulating or indicating temperatures in —. I. Hall, Birmingham. Eng. Pat. 6016, March 10, 1914.

IN apparatus for regulating temperatures wherein the inner member of a differential expansion device abuts against and actuates a pivoted lever, the end of the expansion rod is recessed to receive a small steel ball which abuts either directly against the lever or against a recess formed on the under side of a yoke piece pivoted to it. A constant leverage is thus produced whatever the angle of the lever may be.—T. St.

Furnace or retort; Metal-melting —. M. Goldberger, Fort Wayne, Ind. U.S. Pat. 1,125,090, Jan. 19, 1915. Date of appl., Aug. 11, 1911.

THE crucible, 13 (fig.) rests upon a pedestal, 12, in the heating chamber, and has a removable trumpet-shaped extension, 22, the latter being attached to a flat ring hinged to the top of the



heating chamber and provided with a hinged, dome-shaped cover. The heating gases enter by the orifice, 5, pass through openings, 11, into the horizontal, annular channel, 9, in the furnace wall, and thence to the atmosphere.—W. E. F. P.

[*Metallurgical*] *converter*. H. Haas, San Francisco, Cal. U.S. Pat. 1,123,868, Jan. 5, 1915. Date of appl., Jan. 13, 1913.

TUYÈRES are provided only in the top surface of a central raised portion of the circular bottom of the converter.—A. S.

Metallurgical furnace. U. Wedge, Ardmore, Pa. U.S. Pat. 1,123,965, Jan. 15, 1915. Date of appl., May 3, 1911.

THE furnace is composed of a series of vertical columns arranged in the form of an annulus, opposite columns being connected by transverse girders. Beams above and below the girders cross the latter at an angle, and certain of them are discontinued between the central pair of girders to provide an opening for a central vertical shaft carrying rabblers. The beams have horizontal and vertical flanges, and slabs resting on the horizontal flanges fill the spaces between the vertical flanges. The beams above the girders support the hearth of one chamber, and those below the girders support the roof of the chamber below.—A. S.

Metallurgical furnace. U. Wedge, Ardmore, Pa. U.S. Pat. 1,123,966, Jan. 5, 1915. Date of appl., Feb. 14, 1913.

THE furnace consists of a number of sections separated by alleyways, each section being composed of a row of furnace units. The rabble-arms for the superposed hearths in each unit of a section are carried by a structure which is mounted in the alleyway alongside the section, so that it can be reciprocated therein.—A. S.

Zinc; Method of coating metals with — and *apparatus therefor*. The British Thomson-Houston Co., Ltd., London. From General Electric Co., Schenectady, U.S.A. Eng. Pat. 9367, April 15, 1914.

A SMOOTH zinc coating of uniform thickness, and of sp. gr. 6.5—6.75, is produced by "sherardising" at 350°—375° C., using zinc powder containing 80—92% of metallic zinc, the remainder being zinc oxide. Impurities, especially lead, must be excluded as far as possible. The temperature is kept within the narrow limits specified by using a special furnace, preferably heated electrically. A suitable form is described consisting of a rotatable box provided with insulated resistance grids on its walls, and packed on the outside with heat-insulating material. The time required varies with the thickness of the coating from 6 to 12 hours. The coated articles may be bent, swaged, or otherwise deformed at the ordinary temperature without injury to the coating.—T. St.

Metals from [cyanide] solutions; Precipitant for recovering —. G. H. Clevenger, Palo Alto, Cal. Assignor to Merrill Metallurgical Co. U.S. Pat. 1,123,685, Jan. 5, 1915. Date of appl., June 11, 1912.

POWDER made from a brittle alloy of zinc and not more than 3% of an alkali or alkaline-earth metal, e.g. sodium, is used to precipitate metals from cyanide solutions.—A. S.

[*Gold and silver*.] *Amalgamating process*. R. Luckenbach, Darby, Assignor to R. Thayer, Philadelphia, Pa. U.S. Pat. 1,124,482, Jan. 12, 1915. Date of appl., Oct. 18, 1911.

ORE pulp is introduced, in a number of distinct streams, below the surface of a mass of a liquid amalgamating reagent; the unamalgamated portion of the ore floats and is removed by means of an independent current of a fluid vehicle.

—W. E. F. P.

[*Copper sulphide*] *ores; Process of sulphatizing* —. A. D. Carmichael, Assignor to H. S. Montgomery, Norfolk, Va. U.S. Pat. 1,124,696, Jan. 12, 1915. Date of appl., Nov. 3, 1914.

THE ore is first heated to the decomposition point of iron sulphate, under non-oxidising conditions,

in a mechanical furnace of the superposed chamber type, and then discharged into an oxidising atmosphere, whereby iron and copper sulphides are converted into oxide and sulphate, respectively, and a maximum amount of sulphur dioxide is produced.—W. E. F. P.

Copper and process of producing the same. W. M. Page, Philadelphia, and W. Tassin, Chester, Pa., Assignors to The Duplex Metals Co., New York. U.S. Pat. 1,125,164, Jan. 19, 1915. Date of appl., April 28, 1910; renewed June 18, 1914.

THE copper, in a highly heated condition, is treated with iron in excess of the amount sufficient to react with the oxygen and oxides present. The excess of iron is then burnt out in the presence of carbon, which is made to float on the copper. The purified copper is cast in an inert atmosphere.—T. St.

Lead and antimony; Separation of — by converting the lead into chloride. R. Hesse, G. von Rauschenplat, and T. Schmitz. Ger. Pat. 277,241, July 30, 1913.

THE finely-divided material is intimately mixed with finely-divided chlorides of heavy or alkaline-earth metals, which decompose on heating, and the mixture is heated to redness. Lead chloride is removed from the product by lixiviation, antimony remaining in the residue. By adding an inert alkali or alkaline-earth halide to the charge, or by using a double salt, such as carnallite, as chlorinating agent, and heating to a higher temperature, a mobile melt is produced which separates into two layers, the lower one containing the antimony, and the upper one the lead chloride. The separation may also be effected by heating the finely-divided material to dark redness in a current of gases containing chlorine or hydrochloric acid, and then removing the lead chloride from the product by lixiviation. The process may be applied to oxide ores and metallurgical products, alloys, and speisses, especially those having a high content of antimony and a low content of lead.—A. S.

Zinc oxide; Treatment of finely-divided — [preparatory to smelting]. K. Witte. Ger. Pat. 278,061, Aug. 30, 1912.

THE oxide is moistened with water or other liquid and then heated and simultaneously subjected to a kneading action, so that, on drying, it forms small, dense particles of size ranging from that of millet seed to that of peas. A larger quantity of metal can be recovered from unit volume of the prepared oxide than from ordinary zinc oxide or from zinc ores.—A. S.

Zinc from materials containing it; Process for obtaining —. F. C. W. Timm. Ger. Pat. 278,154, Nov. 16, 1912.

ZINC ore or other material containing zinc is mixed with fuel and the zinc is distilled by the heat developed by combustion of the fuel by a current of air or the like. In the first stage of the process a layer of the charge is ignited on a support permeable to gas, and a relatively low temperature is maintained, whilst the charge is supplied either intermittently or continuously until a layer of the desired height is obtained. The temperature is then raised to distil the zinc. In both stages the air or other gas flows downwards through the charge. The process is applicable to all materials from which zinc can be recovered without completely fusing.—A. S.

Tungsten or other high-melting metals of the chromium group, or their alloys; Production of shaped articles, especially hollow bodies of —. Chem. Fabr. Reinmetall G. m. b. H. Ger. Pat. 278,156, Feb. 13, 1913.

THE powdered metal is mixed to a paste with water, alcohol, or other volatile liquid, and a mould of plaster or porous clay is coated with the paste, dried, and the mass sintered by heating it electrically. The mould is preferably enclosed in a frame of bars or bands of the sintered metal, and the paste is cast around similar bands or bars, the ends of the latter being subsequently used as contacts for leading in the electrical heating current.—A. S.

(A) *Nickel-cobalt and (B) nickel alloys of high chemical resistance and which can be worked mechanically.* W. and R. Borchers. Ger. Pats. (A) 278,902, July 5, 1913 (Addition to Ger. Pat. 265,076), and (B) 278,903, July 5, 1913 (Addition to Ger. Pat. 265,328).

THE molybdenum in the alloys described in the former patents (this J., 1913, 1160) may be partly or wholly replaced by one or more of the metals, gold, platinum, iridium, osmium, palladium, rhodium, ruthenium, or tungsten.—A. S.

Manganese steel; Method of making —. W. G. Nichols, Chicago Heights, Ill., U.S.A. Eng. Pat. 12,762, May 23, 1914.

SEE U.S. Pat. 1,100,905 of 1914; this J., 1914, 792.

Iron and steel; Modification of the method for recovering — from waste enamelled articles. A. de Back, Essen, Germany, Assignor to Goldschmidt Detinning Co., New York. U.S. Pat. 1,126,621, Jan. 26, 1915. Date of appl., May 9, 1913.

SEE Eng. Pat. 77 of 1913; this J. 1913, 607.

Tin; Process for electrolytically refining —. G. Michaud and E. Delasson, Montreuil, France. U.S. Pat. 1,124,315, Jan. 12, 1915. Date of appl., Sept. 17, 1912.

SEE Fr. Pat. 435,936 of 1911; this J., 1912, 395.

Ores; Method for chloridizing roasting of —. A. Ramén and K. J. Beskow, Helsingborg, Sweden. U.S. Pat. 1,124,519, Jan. 12, 1915. Date of appl., May 23, 1911.

SEE Eng. Pat. 23,108 of 1909; this J., 1910, 1459.

Ore-roasting furnace. E. Bracq, Lens, France. U.S. Pat. 1,125,949, Jan. 26, 1915. Date of appl., May 6, 1911.

SEE Addition, dated Feb. 4, 1911, to Fr. Pat. 426,789 of 1910; this J., 1911, 1067.

Casting metals of high melting-point. A. L. J. Queneau, Philadelphia, Pa., Assignor to S. P. Wetherill, Edgewater Park, N.J. U.S. Pat. 1,126,079, Jan. 26, 1915. Date of appl., June 19, 1909; renewed Nov. 25, 1914.

SEE Eng. Pat. 13,304 of 1910; this J., 1911, 901.

Manufacture of briquettes of anthracite, coke, lignite, [ores,] etc. Fr. Pat. 470,949. See II A.

Process for drawing wires of hard metals [for electric lamp filaments]. Ger. Pat. 278,278. See II B.

XI.—ELECTRO-CHEMISTRY.

PATENTS.

Carbon articles; Method of compressing baked — and closing laminations and seams therein. J. W. Brown, Lakewood, Assignor to National Carbon Co., Cleveland, Ohio. U.S. Pat. 1,121,792, Dec. 22, 1914. Date of appl., June 6, 1912.

THE article is subjected to pressure, whilst in a plastic state induced by heating, preferably by the passage of an electric current.—F. SONN.

Galvanic cells; Depolariser for —. P. Burger, Berlin. U.S. Pat. 1,123,843, Jan. 5, 1915. Date of appl., July 2, 1913.

A MIXTURE of manganese dioxide and finely-divided, chemically pure carbon (acetylene soot).—W. E. F. P.

Reinforced-concrete cell for the electrolysis of salt, etc. N. Statham, Yonkers, N.Y., Assignor to Industrial Chemical Co., New York. U.S. Pat. 1,125,201, Jan. 19, 1915. Date of appl., Nov. 1, 1913.

A CELL casing of reinforced concrete, of rectangular section and with open sides, is formed in one piece and is provided with openings for the introduction of anodes, and with a brine inlet, cathode drip pipes, and connected cathode exhaust mains embedded in the casing. The portion of the cell normally in contact with the electrolyte, is lined with acid-proof tiles. Cathode elements are clamped against the open sides of the casing, each element comprising a cathode diaphragm, and a co-operating concrete body formed with a cathode chamber. The cathode elements are provided with drip openings co-operating with the drip pipes, and with gas inlets communicating with the upper ends of their cathode chambers, gas and steam mains supplying treating gases to the gas inlets.—B. N.

Anode for the electrolysis of sulphate solutions. H. K. Borchgrevink and R. Molstad. Ger. Pat. 278,038, Oct. 14, 1913.

A PRODUCT of the approximate composition, $\text{Fe}_2\text{O}_3 \cdot 7\text{PbO}$, obtained by fusing together ferric and lead oxides, is used for the construction of anodes.—A. S.

Gases; Producing reactions in — at high temperatures and apparatus [electric furnace] for practising the same. L. L. Summers, Chicago, Ill. U.S. Pat. 1,125,208, Jan. 19, 1915. Date of appl., June 14, 1913.

THE furnace is provided with a pair of electrodes, one of which is water-cooled, arranged at opposite ends of a refractory chamber. The more inert gas is introduced at one end and heated by the arc. A second gas is introduced in the region of the water-cooled electrode and mixed with the heated gas, the final products of the reaction being then withdrawn from the furnace.—B. N.

Electrodes for electric furnaces. F. J. Machalske, Plattsburg, N.Y., U.S.A. Eng. Pat. 15,456, June 27, 1914. Under Int. Conv., June 27, 1913.

SEE U.S. Pat. 1,099,558 of 1914; this J., 1914, 796.

[Silk cotton] *insulating material.* Eng. Pat. 1133. See V.

Method of making arsenic acid and arsenical compounds. U.S. Pat. 1,125,086. See VII.

Electrolytic preparation of hydrosulphiles. Ger. Pat. 278,588. See VII.

Manufacture of malted food. Eng. Pat. 17,113. See XIXA.

XII.—FATS; OILS; WAXES.

Oil content of seeds as affected by the nutrition of the plant. W. W. Garner, H. A. Allard, and C. L. Foubert. J. Agric. Research, 1914, 3, 227—249.

EXCEPT for a period immediately following flowering and that directly preceding maturity, there is a fairly uniform increase in the oil content of soya beans throughout the development of the bean; there is no evidence of any period of intense formation of oil. A similar increase in oil content takes place in cotton seeds. Owing to the physiological relationship of oil to carbohydrate, it appears that maximum production of oil in the plant requires conditions of nutrition favourable to the accumulation of carbohydrate during the vegetative period and to the transformation of carbohydrate into oil during the reproductive period. Partial defoliation (to the extent of 50%) of soya plants reduces the yield of beans, but the size of the beans and their oil content are only slightly affected; the removal of a portion of the blossoms or young pods causes a notable increase in the size of the beans allowed to develop, but does not materially affect the percentage of oil. Different varieties of soya beans grown under the same conditions show marked differences in oil content and size of bean; different varieties of cotton show differences in the size of seed, but little difference in the oil content. In tests carried out with a wide range of soil types and climatic conditions, it was found that the relative effects of different soil types on the oil content of seeds are not specific and constant, but depend largely on seasonal conditions. Under practical conditions, climate is a more potent factor than soil type in controlling the size of the seed and its oil content. Within ordinary limits the relative fertility of the soil appears to be a minor factor in influencing the size of the seed and its oil content. The addition of a complete fertiliser to an unproductive soil causes a larger cotton seed to be produced and increases the percentage of oil; application of nitrogen compounds in increasing quantities does not affect the size of the seed but lowers the percentage of oil, whilst applications of phosphorus or potassium compounds do not affect either character. The size of soya beans is not affected by the addition of phosphorus compounds to the soil, but the oil content is increased; the addition of potassium compounds has no decided effect on either soya beans or earthenuts.—W. P. S.

Olive oil; Studies on the extraction of —. J. Ventre. Ann. de l'Ecole Nation. d'Agric. de Montpellier, 1914, 13, 249—269. Bull. Agric. Intell., 1914, 5, 1506—1510.

THE increased yield of oil due to late harvesting of olives is only apparent, being due to the loss of water by evaporation. The best time for plucking is when the skin is red or black, and without wrinkles; if delayed too long, the yield of oil is diminished. The proportion of oil to dry matter is not sensibly affected by storage, provided ventilation is adequate and the olives are placed in layers not exceeding 16 inches in depth. The quality of the fruit is not diminished by storage for a certain time, and the yield of oil may be increased. Heated olives give a better yield of oil; the optimum temperature (35°—40° C.) should be obtained by natural fermentation. A comparison of the relative efficiency of hydraulic and mechanical presses, showed that the former have a slight advantage, and should therefore be

employed in large factories. The addition of water gives a better extraction, but hot water is no better than cold.—E. H. T.

Hydrogen; Catalytic addition of—to unsaturated substances. Formation of metallic nickel in hardening oils with the aid of nickel oxide and other nickel compounds. W. Normann and W. Pungs. Chem.-Zeit., 1915, 39, 29—31 and 41—42.

VARIOUS unsaturated oils (100 grms.) were readily hardened (in 2 to 3 hours) by hydrogen (2 litres per minute) in presence of the oxide, hydroxide, carbonate, or formate of nickel (1 grm.) between 200° and 255° C. The formation of metallic nickel during the process was established by an electrical conductivity method, a magnetic method, and two analytical methods, depending, respectively, upon the measurement of the amount of hydrogen evolved with sulphuric acid and the production of nickel carbonyl. Although the carbonyl reaction was not quantitative, it gave reliable qualitative results at 90°, 50°, and 30° C., but in each case rigorous exclusion of air was necessary. Nickel oxide was not reduced under these conditions by carbon monoxide nor by benzaldehyde or formaldehyde at 225° C. On an average the catalyst was shown to contain 4% to 7% of metallic nickel. Rapid hardening was also effected by means of a nickel kieselguhr mixture, prepared by reduction at 500° C., and containing 4.1% Ni. (See also Bedford and Erdmann; this J., 1913, 611.)—J. R.

Nickel; Detection of—in hardened oils. F. Prall. Z. angew. Chem., 1915, 28, 40.

EXTRACTION of the oil with hydrochloric acid and detection of the nickel in the acid extract by the dimethylglyoxime reaction is unreliable, as some freshly extracted oils free from nickel give a red coloration. It is recommended that the ash from 100—200 grms. of the fat be extracted with dilute hydrochloric acid, the acid extract heated to eliminate most of the acid, ammonia added, and after standing a few hours the precipitated iron and aluminium filtered off, and the filtrate tested for nickel with alcoholic dimethylglyoxime solution.—R. G. P.

Detection and determination of free or combined glycerol. François and Boismenu. See XX.

PATENTS.

Oil, juice, or fluid from seeds, nuts, fruit, fish, and materials and substances generally which contain oil, juice, or fluid; Machine or apparatus for expressing—also adapted for producing shaped blocks or pieces from plastic materials, substances and the like. G. R. Schueler, Kingston-upon-Hull. Eng. Pat. 501, Jan. 8, 1914.

THE material is crushed between two revolving moulding wheels, on the peripheries of which are teeth which engage with each other to form wedge-like pockets at the base of each two teeth. On each side of the wheels are perforated plates forming side walls to the pockets between the teeth, and the crushed material is expelled through the perforations.—C. A. M.

Oils and the like; Method of extracting— F. O. Barstow and T. Griswold, jun., Midland, Mich. U.S. Pat. 1,125,920, Jan. 19, 1915. Date of appl., Oct. 9, 1912.

A SOLVENT moving in a closed circuit encounters intermittently, at successive points, the material to be treated whilst this is travelling in the opposite direction, in a closed chamber. The dissolved constituents are separated from the solvent at one point of the circuit.—W. F. F.

Cotton-seed; Method of treating— A. W. French, Piqua, Ohio. U.S. Pat. 1,121,913, Dec. 22, 1914. Date of appl., July 6, 1914.

PREPARATORY to expressing the oil, the seed is hulled, and the meats and hulls are crushed separately. The meats are then partially cooked with excess moisture, and, when they have passed through the initial "sweat" and a portion of the moisture has been removed, the hulls are introduced, without interrupting the cooking operation, and meats and hulls are cooked together.—F. SODX.

Animal oils; Process for the manufacture of polymerised products from— W. Kaempfe, Grossenhain, Germany. U.S. Pat. 1,122,400, Dec. 29, 1914. Date of appl., Sept. 30, 1913.

ANIMAL oils are heated with water under pressure, with or without an inorganic catalyst such as manganese sulphate, in order to hydrolyse the more readily hydrolysable glycerides. The hydrolysed products are separated and the residue is polymerised by the aid of heat, e.g., with superheated steam.—J. F. B.

Polymerised oils; Process for obtaining pale-coloured— Court und Baur G. m. b. H. Ger. Pat. 279,140, Oct. 28, 1913.

THE vessel in which the oil is heated is filled completely and the outlet pipe is sealed in a receiver by a layer of the cold oil to prevent access of air.—A. S.

Hydrogenating fats, oils, and waxes; Process of— T. B. Walker, Austin, Tex. U.S. Pat. 1,123,962, Jan. 5, 1915. Date of appl., May 22, 1913.

THE fused fatty acid or compound of the same is sprayed by hydrogen under pressure against heated, finely-divided catalytic material in the presence of an electric discharge.—A. S.

Oils; Process of hardening [hydrogenating]— K. Birkeland and O. Devik, Christiania. U.S. Pat. 1,125,259, Jan. 19, 1915. Date of appl., April 10, 1913.

THE oil, with or without previous removal of volatile substances, is mixed with a catalytic agent and forced from a jet into an atmosphere of hydrogen and thence downwards into a body of the oil, whereby the hydrogen, carried by suction to the bottom of the vessel, is absorbed on rising through the oil. After reduction of the pressure the oil is transferred to another vessel under lower pressure, and then back again to the high-pressure vessel, this circulation being continued until sufficient hydrogenation has been attained.—C. A. M.

Fatty acids and their glycerides; Process for saturating unsaturated—by combining them with hydrogen. E. Utescher, Hamburg, Germany. U.S. Pat. 1,124,560, Jan. 12, 1915. Date of appl., Feb. 10, 1913.

SEE Eng. Pat. 20,061 of 1912; this J., 1913, 797.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Resinous exudation from Aleppo pine and the oil of turpentine obtained therefrom. D. E. Tsakalotos. J. Pharm. Chim., 1915, 11, 70—72.

A SPECIMEN of the resinous exudation of Aleppo pines (*Pinus halepensis*) growing in Attica, Greece, yielded oil of turpentine, 21.4, dry solids (resin), 70.8, solid impurities, 4.5, and water, etc., 3.3%. The oil of turpentine consisted almost entirely of d-pinene (see also this J., 1909, 1050).—W. P. S.

Copals; Action of chlorinated solvents on hard —. C. Coffignier. Bull. Soc. Chim., 1914, 15, 780—783.

THE following table shows the percentage of resin insoluble in the hot solvent (see this J., 1903, 808).

	Kind of copal.		
	Zanzibar.	Madagascar.	Demerara.
Ethylene dichloride ..	78.7	70.0	70.5
Ethylene trichloride ..	83.2	70.8	79.2
Ethylene perchloride..	79.2	88.2	64.2
Tetrachloroethane ..	66.5	37.8	48.7
Pentachloroethane ..	78.4	63.0	53.1

In estimating the insoluble matter it is necessary to drive off the solvent over a naked flame; heating in the oven is insufficient. The use of tetrachloroethane enables Madagascar copal to be differentiated from Zanzibar or Demerara copal.—R. G. P.

PATENTS.

Condensation products from unsaturated hydrocarbons; Preparation of —. Chem. Fabr. auf Actien, vorm. E. Schering. Ger. Pat. 278,486, May 24, 1913.

ETHYLENE hydrocarbons are condensed with hydrocarbons containing at least two double linkages in the molecule, in presence of anhydrous inorganic chlorides as catalysts; or a portion of the reaction product may be used as catalyst in a succeeding operation. The products may be either solid or liquid and are suitable for use as substitutes for natural resins.—A. S.

Colour lakes; Alumina —. P. Tust, Vohwinkel, Germany, Assignor to Synthetic Patents Co., Inc. New York. U.S. Pat. 1,126,591, Jan. 26, 1915. Date of appl., July 7, 1914.

SEE Eng. Pat. 15,557 of 1913; this J., 1914, 876.

Colour-lakes. P. Thomaschewski and P. Tust, Vohwinkel, Germany, Assignors to Synthetic Patents Co., Inc., New York. U.S. Pat. 1,126,664, Jan. 26, 1915. Date of appl., July 7, 1914.

SEE Fr. Pat. 464,948 of 1913; this J., 1914, 876.

Production of vat dyes of the indanthrene series in a finely-divided condition. Fr. Pat. 470,984. See IV.

Manufacture of black, secondary disazo dyestuffs soluble in oils, fats, esters, and similar media. Ger. Pat. 278,079. See IV.

Dry deflocculated body [graphite, lampblack, etc.], and method of preparing same. U.S. Pat. 1,116,957. See VII.

Manufacture of polymerised products from animal oils. U.S. Pat. 1,122,400. See XII.

Process for obtaining pale-coloured polymerised oils. Ger. Pat. 279,140. See XII.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

PATENTS.

Indiarubber or similar materials; Machines for washing, macerating, or crepeing —. W. G. Gass, Bolton, Lancs. Eng. Pat. 1199, Jan. 16, 1914.

The front, movable roller of a double-roller mill is mounted in arms pivoted to the frame of the

machine, and is adjusted with respect to the back, fixed roller by means of bolts, passing through the arm and the frame. The nuts on the bolts may be actuated either separately or by means of a suitable coupling gear; for instance the nuts may be in the form of worm wheels, gearing with a worm on a short shaft provided with a hand wheel.—E. W. L.

Caoulchoue; Process for the manufacture of products from natural or synthetic — or synthetic caoulchoue-like substances, and the products obtained thereby. F. E. Matthews and E. H. Strange, London. Eng. Pat. 2070, Jan. 26, 1914.

CAOUTCHOUC, rubber, etc., is treated with liquid sulphur dioxide. For example, liquid sulphur dioxide is added to a cooled solution in benzene of synthetic rubber produced by the action of sodium on butadiene, and the mixture is warmed at about 40° C. in a closed vessel. After some time the vessel is opened and the excess of sulphur dioxide removed, when the solution will be found to have increased in viscosity, or have set to a jelly, or a proportion may have been precipitated. The product obtained on evaporation to dryness is an elastic substance resembling caoutchouc, and may be compounded with the usual substances, and vulcanised according to the amount of "vulcanisation" already effected by the sulphur dioxide.—E. W. L.

Rubber-covered metal article and method of making the same. L. Daft, Rutherford, N.J., Assignor to Electro-Chemical Rubber and Manufacturing Co. U.S. Pat. 1,124,302, Jan. 12, 1915. Date of appl., Dec. 24, 1912.

SEE Eng. Pat. 2306 of 1912; this J., 1912, 595.

Rubber; Process of reclaiming —. H. W. Kugler, Assignor to The Firestone Tire and Rubber Co., Akron, Ohio. U.S. Pat. 1,124,920, Jan. 12, 1915. Date of appl., Dec. 20, 1912.

SEE Fr. Pat. 466,243 of 1913; this J., 1914, 605.

[Rubber] latex; Apparatus for treating —. H. A. Wickham, London. U.S. Pat. 1,126,327, Jan. 26, 1915. Date of appl., April 27, 1914.

SEE Eng. Pat. 2627 of 1914; this J., 1915, 40.

Preparation of erythrene. Ger. Pat. 278,647. See XX.

XV.—LEATHER; BONE; HORN; GLUE.

Tanning materials; Potassium cyanide as a qualitative reagent for —. H. G. Bennett. Collegium (London), 1915, 56—60.

POTASSIUM cyanide gives a yellow flocculent precipitate with both lentisco (*Pistacia lentiscus*) and sumac, and cannot be used, as Andreasch suggested (see this J., 1898, 933), to distinguish between these materials. The reaction is due to hydroxyl ions and is given by sodium and potassium hydroxides. Potassium cyanide with pyrogallol, pyrogallol-tannins, gallic acid, and gallotannic acid, gives a transient bright red coloration which returns on shaking. This reaction, due to oxidation, is given by caustic alkali in the case of gallic acid only. Sodium and potassium carbonates, sodium phosphate and arsenate give a green colour with gallic acid, the oxidation being probably carried to a further stage. Catechol derivatives with the alkali hydroxides and carbonates usually give a transient green colour which changes to red. Catechol itself gives no reaction

with potassium cyanide, though catechol-tannins develop the red colour. Potassium cyanide may be used in another way to distinguish catechol- and pyrogallol-tannins. A 10% solution of cyanide is added to a clear tannin solution and the mixture poured into an excess of hard water. Pyrogallol-tannins and some mixed tannins give a distinct precipitate, whilst in the case of catechol-tannins the solution remains clear. Some mixed tannins (*e.g.*, mimosa) which answer many of the tests for pyrogallol-tannins, do not give the precipitate.—F. C. T.

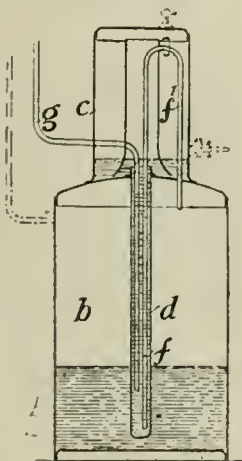
Leather; Determination of nitrogen in—. E. Nihoul. *Collegium* (London), 1915, 6—12, 39—42.

If anhydrous copper sulphate be used as catalyst in the Kjeldahl method, the results are too low unless potassium permanganate is also added. The Willfarth modification (*Chem.-Zeit.*, 9, 502), involving the use of mercury, also gives too low results, and requires at least 2—3 hours digestion. In the author's modification 0.7 gm. of leather is soaked with 10 c.c. of concentrated sulphuric acid, and a further 5 c.c. used to wash down any particles on the side of the flask, which is very slowly heated, and the contents boiled for 30 mins. After cooling to 40°—50° C., a few crystals of permanganate are added, and the temperature is again slowly raised; the solution soon becomes colourless, and further heating is unnecessary. A large excess of caustic soda for the distillation is avoided, and zinc dust (tested by a blank determination) is used to ensure gentle ebullition. For carrying over the vapours a long tube of 1 cm. bore, bent twice at 140° is used. Instead of using a spray trap, the part of the tube within the flask has several perforations and a constricted end.—F. C. T.

PATENTS.

Emulsions; Apparatus for separating—, especially for separating fat from glue solution obtained by steaming carcasses. E. Meyn. Ger. Pats. (A) 277,281 and (B) 278,891, Jan. 29 and May 16, 1913.

(A). The glue solution is introduced through the tube, *g*, into the cylinder, *d*, and the heavier aqueous liquid flows through the tube, *f*, *f'*, into the vessel, *b*, which is heated by means of steam, whilst the fat, which gradually separates, rises and overflows into *c*. On starting, a portion of the aqueous liquor also flows into *c*, and this serves to prevent the fat from coming in contact with the hot cover of the vessel, *b*. The limb, *f*, of the tube, *f*, *f'*, may be in the form of a spiral. (B). The glue solution is introduced from below into a vessel narrow at the top, where it is closed by a cock, and widening towards the bottom where it is connected steam-tight with the bottom of an outer enclosing vessel. The aqueous liquor flows into the outer vessel through a vertical tube opening near the bottom of the inner vessel, and the fat gradually rises and is drawn off through the cock. The inner vessel is surrounded by a steam coil.—A. S.



Leather, and treatment of same. D. B. MacDonald, Leicester. Eng. Pat. 714, Feb. 10, 1914.

SHOULDER, belly or split leather is given the special properties usually associated with "bend" leather by treating it with a solution of celluloid, pyroxylin, or cellulose acetate or other cellulose ester dissolved in an organic liquid, or with viscose dissolved in water, and is thus made suitable for "bottom" leather as used for soles, midsoles, and insoles of boots and shoes. Colouring matters, wax, castor oil, or resins may also be added to these solutions. Two solutions claimed for the purpose consist of: (1) celluloid, pyroxylin, cellulose acetate, or the like, 4; acetone, acetone oil, or other ketone, 16; benzol, benzine, or wood alcohol, 31; amyl acetate, amyl alcohol, ethyl acetate, terpenes, or camphor oil, 8; glacial acetic acid, 1 part by weight; (2) celluloid, 6; alcohol (90% or over), 33; methyl alcohol, 21; light ketone (acetone, light acetone oil, etc.), 40; camphor oil, 4 parts by weight. (Reference is directed, in pursuance of Sect. 7, Sub-sect. 4, of the Patents and Designs Act, 1907, to Eng. Pats. 983 of 1881, 1753 and 11,734 of 1903, 16,598 of 1906, 28,743 of 1907, and 15,306 of 1909; this J., 1907, 265; 1908, 459.)—T. C.

XVI.—SOILS; FERTILISERS.

Soil carbonates; Decomposition of—. W. H. MacIntire. *J. Agric. Research*, 1914, 3, 79—80.

SOILS, although alkaline from excessive treatment with calcium carbonate, are capable of decomposing magnesium carbonate under sterile, moist conditions. The affinity of magnesia for silica is so great that precipitated magnesium carbonate is decomposed by pure silica. In experiments where loamy soils were treated with a quantity of magnesium carbonate equivalent to 15 tons of good grade limestone per 2,000,000 lb. of soil, the carbonate had disappeared entirely at the end of 8 weeks. The affinity of lime for silica is far greater than has been supposed, and the reaction in soils is an important factor in the conservation of lime; it continues long after alkalinity has been attained, but does not approach the magnesia-silica reaction in rapidity. Toxicity due to excessive treatment with magnesium carbonate after its conversion into silicates was demonstrated by the effect on plant growth. (See also this J., 1915, 93.)—W. P. S.

Tetracarbonimide, a nitrogenous constituent of soils. E. C. Shorey and E. H. Walters. *J. Agric. Research*, 1914, 3, 175—178.

TETRACARBONIMIDE, $\text{CO}(\text{NH} \cdot \text{CO} \cdot \text{NH})_2 \cdot \text{CO}$, was found to be present, sometimes in appreciable quantity, in samples of sandy soil from Florida; these soils have been mentioned previously as containing vanillin and other benzene derivatives (this J., 1914, 432). The compound was also detected in soils from other districts. 18 kilos. of a soil from the grounds of the U.S. Department of Agriculture yielded 30 mgrms. of tetracarbonimide, and it is estimated that about 7 lb. was present per acre-foot of soil. It is suggested that the tetracarbonimide may be formed in the soil by oxidation of purine bases.—W. P. S.

Soil solution; Influence of the osmotic pressure of—on spring wheat. N. Toulakoff. *La Pédologie*, 1913, 15, 71—103. *Bull. Agric. Intell.*, 1914, 5, 1426—1429.

THE investigation consisted in tracing the effects of solutions of some common salts of sodium,

ammonium, and magnesium at osmotic pressures up to 15 atmos. upon spring wheat grown in zinc pots, containing about 11 lb. of black soil mixed with manure. The control pots were maintained at a constant osmotic pressure by keeping the moisture content at 60% of the maximum. A very pronounced stimulating effect upon the wheat was observed when the (increased) osmotic pressure was 3 atmospheres, but with higher pressures the effects were progressively inhibitive, although the nitrogen-content of the grain was increased. Solutions containing nitrogen, either as acid or base, gave better results as regards yield of grain and straw than non-nitrogenous solutions. Of the latter, sulphates had a greater effect than chlorides.—E. H. T.

Fluorine; Influence of — on vegetation. A. Gautier. Comptes rend., 1915, 160, 194—195. (See also following abstract.)

FLUORINE occurs in living organisms in two forms, always associated with phosphorus. In epidermal tissues, nails, the hair, and other tissues by which it is eventually eliminated, the proportion of the two elements is about the same as in apatite, whilst in the living cells of the glands, muscles, and nerves the proportion of fluorine to phosphorus sinks to 1 to 400. The function of fluorine in these latter tissues was demonstrated by vegetable cultures grown in artificial media of known fluorine content. In most cases fluorine favoured the growth, flowering, and seed production, certain *Sinapis*, for example, producing nine times as many seeds in the fluorinated media. In exceptional cases, such as corn, rye, and oats, its influence remained doubtful, but very rarely was it found to be harmful.—G. F. M.

Maize; Rare mineral elements necessary for the development of —. P. Mazé. Comptes rend., 1915, 160, 211—214.

WHEREAS maize will flourish in a medium consisting of a solution in spring water of compounds of N, P, K, Ca, Mg, Si, Fe, Mn, Zn, S, and Ce, if distilled water be substituted for the spring water, the plant will grow fairly well for some weeks, after which further development will suddenly cease, showing that in the latter medium some essential constituents are lacking. Cultures made in the distilled water medium to which some or all of the compounds $Al_2(SO_4)_3$, $Na_2B_4O_7$, NaF, KI, and Na_2HAsO_4 were added, showed that the maize developed in the normal way only when Al, B, F, and I were present in addition to the eleven elements mentioned above. The diminution in weight of the plant when fluorine was absent was particularly noticeable. Arsenic exerted a toxic action and distinctly inhibited the growth.—G. F. M.

Seeds; Heat evolved in the germination of —. M. Darsie, C. Elliott, and G. J. Peirce. Botan. Gaz., 1914, 58, 101—136. Bull. Agric. Intell., 1914, 5, 1432.

THE inherent vitality of seeds may be tested by measuring the heat evolved during their germination period. Silvered Dewar flasks were used as calorimeters, and the experiments made upon barley, clover, maize, hemp, oats, and wheat, showed that the heat set free varied directly with the germinating power and with the vigour shown after germination. The older the seeds, the less was the heat evolved. The "normal" temperature, i.e., the average daily increase of temperature due to germination of 10 grms. of seed, was 1.82° C. for hemp, 0.75° C. for clover, 0.73° C. for wheat, 0.55° C. for oats and 0.49° C. for maize. An abnormally high temperature

indicates infection (fungoid): an abnormally low one, lessened vigour due to old age.—E. H. T.

Oil content of seeds as affected by nutrition of the plant. Garner and others. See XII.

Combating sugar beet nematodes. Müller and Molz. See XVII.

PATENTS.

Superphosphates and the like; Method of drying —. T. L. Willson and M. M. Haff, Ottawa, Assignors to Southern Investment Co. of Canada, Ltd., Montreal, Canada. U.S. Pat. 1,122,183, Dec. 22, 1914. Date of appl., Aug. 17, 1912.

SUFFICIENT ammonia is passed over the products of interaction of phosphate rock and sulphuric acid, to form a dry fertiliser, containing ammonium monocalcium phosphate, $Ca(NH_4)H_2(PO_4)_2$, and ammonium sulphate.—O. R.

Fertiliser; Conversion of waste products into a — by heating with sulphuric acid. A. von Krottnauer. Ger. Pat. 278,398, April 20, 1913.

THE waste products are saturated with water containing sufficient sulphuric acid to effect decomposition, then heated by hot air until the mass is liquefied, and finally dried, the whole process being continuous.—A. S.

Fertiliser from sulphite-cellulose waste lyes; Manufacture of a —. L. Kern. Ger. Pat. 278,492, Jan. 3, 1914.

THE waste lyes are mixed with kieselguhr containing mineral and organic substances, such as is found, for example, in Algeria, Bohemia, and Virginia. By the combination, in this way, of two practically worthless products, a fertiliser is obtained which is suitable for peaty soils poor in silica and for plants rich in silica, e.g., maize, cereals, grass, etc.—A. S.

Process for destroying plant and house pests. Ger. Pat. 278,448. See XIXB.

XVII.—SUGARS; STARCHES; GUMS.

Sugar production in the United Provinces, India. W. Hulme. Agric. J. India, 1915, 10, 54—62.

OF the 896,869 tons of sugar imported into India during 1913—14, about three quarters came from Java. At the present time most of the cane is grown in the United Provinces by native farmers on small and scattered areas, and is crushed in an inefficient manner in bullock-driven mills, but endeavours are being made to organise cultivation, and to extract the sugar in modern factories. During the inter-campaign the sugar factories might be used for the extraction of oil from seeds and for the manufacture of a cattle food from seed cake and residual molasses.—J. P. O.

Sugar beet nematodes; Combating —. H. C. Müller and E. Molz. Z. Ver. deuts. Zuckerind., 1914, 64, 959. Chem.-Zeit., 1915, 39, Rep. 18.

LARGE amounts of Chili saltpetre, and its continued application in smaller quantities, favour the attack of nematodes on sugar beets. Sulphur, common salt, and different sugars, have no beneficial action, while the effect of sulphuric acid and sodium hydroxide is questionable. Calcium oxide, on the contrary, destroys the parasite, and is valuable for treating the slimes from the water used in washing infected roots.

Carbon bisulphide is of little practical use, being too volatile; but 2% formaldehyde solution and undiluted allyl alcohol give satisfactory results. Manuring with peat or beet leaves appears to benefit the growth of the nematodes, either because the water-retaining power of the soil is thereby improved, or because constituents favourable to the growth of the organism are supplied. Ploughing the surface of the soil (only about 10 cm. deep) is advantageous, since it promotes the growth of small plants, attracting the nematodes, which can then be removed. Lure plants, following Kühn's method of using them, are efficient, though the procedure is too costly for practical work; destruction of the lure plants by means of 30% ferrous sulphate solution would be preferable. Inundating the infected soil has no useful result, even after a year. In loams rich in humus most of the parasites are found in the upper 30 cm., and the power of migration varies according to conditions, being on the average 56 cm. horizontally in three months, and 50 cm. vertically in a shorter time.—J. P. O.

Sugar ; Solubility and crystallising power of — in factory juices and syrups, and the formation of true molasses. H. Claassen. Z. Ver. deut. Zuckerind., 1914, 64, 807. Chem.-Zeit., 1914, 38, Rep., 530.

THERE is no direct relation between the solubility of sugar and the saturation value on the one hand and crystallising power and molasses formation on the other, since from many molasses having a saturation value less than unity, sugar does not separate, whereas in others having a high saturation value crystallisation proceeds readily. Moreover, the effect of non-sugars upon the solubility of sugar does not correspond with their action upon the crystallising power, so that the molasses-forming power of non-sugars can only be determined by experiments in which sugar is crystallised from supersaturated solutions under the most suitable conditions, and not by solubility determinations. Work carried out by Köhler, Schukow, Schnell, Geese, and Prinsen Geerligs shows that with impure solutions the saturation value depends upon the amount and nature of the non-sugar, as well as upon the temperature, which has an important influence, especially with products of low purity. Consequently, generalisations from isolated determinations are untrustworthy, rendering such solubility tables as those of Roppe, Fradiss, and Höglund valueless, excepting perhaps when working with syrups of high purity. Recent researches made by the author have shown that both the solubility and saturation values of the thick-juice, and especially of the centrifugal syrups and molasses, of a beet factory show considerable variations during several weeks. On raising the temperature the saturation value always increases, particularly when the purity is low; and with molasses of 66°—54.5° purity the saturation value at 45° C. varies between the extreme limits of 0.80 and 1.39, considerable differences being also encountered even with products of higher purity. With molasses containing a large amount of lime (which has not been added subsequently) the saturation value is low as a rule, but not always, and not proportionally. Invert sugar, dextro-rotatory substances, ash, and the ratio of mineral to organic matter likewise influence the saturation value, though not in any regular manner. The crystallising power, and consequently the purity of the true molasses obtained, depend very largely upon the temperature, as well as upon the nature of the non-sugar, but not upon the saturation value; the purity may vary between 54.3° and 61°. In this connection also all the non-sugar substances have an undetermined influence, making the customary analyses devoid of any reliable information. It is recommended that in controlling

boiling in the factory, the author's tables and apparatus should be used, while in crystallising operations the temperature and quantity of water added must be carefully controlled according to the water content and purity of the molasses, the quality and uniformity of the crystals obtained being also observed.—J. P. O.

Molasses ; Stanek's new method for the determination of sucrose by double polarisation in beet —. Z. Zuckerind. Böhm., 1914, 39, 8. Chem.-Zeit., 1914, 38, Rep., 530.

UNDER the auspices of the Verein der Zuckerindustrie in Böhmen, Herles, Koydl, Novotny, and Urban have examined Stanek's new method of double polarisation (this J., 1914, 705), in which the direct reading is taken in the presence of exactly the same amount of potassium chloride and citric acid as the inversion reading, clarification being effected with bromine water in place of lead acetate. It was concluded unanimously that the process is both accurate and readily carried out, and that it gives values 0.5 to 1.5% higher than the ordinary double polarisation procedure, and very close to those obtained by direct polarisation. Herles, however, recommends the use of basic lead nitrate in place of bromine, and both he and Urban point out the necessity of establishing new dilution constants for the modified method of working, those of Herzfeld being no longer applicable.—J. P. O.

Alkylated sugars ; A new method of preparing —. W. N. Haworth. Chem. Soc. Trans., 1915, 107, 8—16.

METHYLATED derivatives of sugars and other carbohydrates can be prepared by the action thereon of dimethyl sulphate and sodium hydroxide. The sugar is dissolved in the minimum quantity of water in a wide-necked flask with a cork fitted with two dropping-funnels, a condenser, and a mechanical stirring apparatus, and the flask is placed in a water-bath at 70° C. About three times the quantity of methylating agents theoretically required are employed, the alkali (a 30% solution of sodium hydroxide) being in slight excess. These are added to the solution in the flask from the funnels in the course of an hour, the mixture being stirred continuously; the temperature is subsequently raised to 100° C. for about half an hour. The mixture must be kept slightly alkaline during the whole operation. The product is cooled, extracted twice with chloroform, the extract dried, and the chloroform distilled. The aqueous residue may be re-methylated with smaller quantities of the reagents after suitable concentration. From sucrose, heptamethylsucrose is the highest derivative obtainable in this manner, but the octamethyl compound may be prepared by two subsequent treatments by the ordinary method. Dextrose and lactose yield methylated methylglucosides and methyl-lactosides respectively.—J. F. B.

iso-Dibenzoylglucosylglycose. Tutin. See XX.

PATENTS.

Sugar ; Preparation of — in the form of fine crystals. J. F. P. Kestner, Lille, France. Eng. Pat. 17,010, July 17, 1914. Under Int. Conv., July 22, 1913.

SUGAR in the form of flour, known as Brazilian sugar or "aréado," is produced by causing melted sugar containing only about 5% of water to flow in a thin layer upon a horizontal surface, to which a rapid horizontal vibratory motion is imparted, and allowing the sugar to cool thereon. For continuous operation an endless travelling band having

longitudinal vibratory movements may be employed.—J. F. B.

Pastes, adhesives, or the like. H. Milligan, Liverpool. Eng. Pat. 6445, Mar. 13, 1914.

MANIOC root (100 parts) is mixed with a metallic chloride, such as magnesium chloride (up to 50) and/or sodium chloride (up to 22.5 parts), with or without a relatively small quantity of maize flour, farina, or the like.—O. R.

Cane sugar or cane sugar solutions; Process for defecating —. J. Wetter, London. From M. Weinrich, Yonkers, N.Y., U.S.A. Eng. Pat. 1576, Jan. 20, 1914.

SEE U.S. Pat. 1,084,772 of 1914; this J., 1914, 212.

Preparation and revivification of animal charcoal. Fr. Pat. 471,295. See 11B.

XVIII.—FERMENTATION INDUSTRIES.

Radioactive emanations; Influence of — on yeasts and on alcoholic fermentation. G. Jacquemin and G. Giurel. La Vie Agric. et Rurale, 1914, 3, 232. Bull. Agric. Intell., 1914, 5, 1505.

RADIOACTIVE emanations have an immediate and continuous stimulative action upon elliptical yeasts. A radio-activity of $\frac{1}{2}$ —1 unit per litre accelerates the fermentation of sugar by yeast, producing a more complete conversion into alcohol. This fact is of value for the fermentation industries, particularly for the wine industry.—E. H. T.

Wines; Production of — by ferments other than wine yeasts. V. Martinand. Rev. de Viticult., 1914, 42, 29—34. Bull. Agric. Intell., 1914, 5, 1503—1505.

THE author has isolated the organised ferments present on the grapes from which a celebrated wine is made, and has found several which are not yeasts, and which, although yielding but little alcohol, impart a characteristic agreeable fruity flavour to the wine. Sixty grapes from a vineyard in Burgundy were found to contain only one elliptical yeast, four apicular yeasts, two torule, one fungal yeast, six ferments causing working in must, and the moulds, *Botrytis cinerea* and *Penicillium glaucum*. The functions of the organisms, other than the elliptical yeasts are to activate the alcoholic yeasts, and to secrete enzymes which accelerate the decomposition of proteins. They probably also utilise the dextrose to some extent and serve to free the must and wine from any free sulphurous acid. They are cultivated separately and added to the must at the same time as the elliptical ferments. Fermentation is very rapid and the floating grape-skins should be cooled by spraying with must from the bottom of the vat. Sulphurous compounds are not necessary as a rule; if used, they should be applied during the initial racking off, and in the later racking if the temperature rises above 35° C. Such selected ferments might be used with pure yeasts. They would impart a new, without affecting the old, characteristic flavour, and there would be no danger of after-fermentation.—E. H. T.

Tartaric acid and potassium; Rapid determination of total — in wines. A. Kling and A. Lassieur. Ann. Falsif., 1914, 7, 410—416.

TARTARIC acid may be determined by the following modification of the racemate method (this J., 1910, 451; 1911, 706): 25 c.c. of the wine is treated with

10 c.c. of a 2% ammonium *l*-tartrate solution and 20 c.c. of a solution of calcium acetate (16 grms. of calcium carbonate and 120 c.c. of glacial acetic acid per litre); after standing for 30 minutes, the precipitate is collected on a filter, washed, dissolved in dilute sulphuric acid, and the solution titrated with potassium permanganate solution. The result is calculated into grms. of potassium hydrogen tartrate per litre of wine; 0.2 gm. per litre is deducted from the amount found as a correction for *l*-tartrate occluded by the precipitate. Potassium is determined by the perchlorate method; under the conditions given this method determines the potassium present as salts of organic acids and also as sulphate. The ash of the wine is treated with 10 drops of water and 10 drops of perchloric acid (56° B., sp. gr. 1.615), evaporated at 110° C. until most, but not all, of the perchloric acid has been driven off; the moist residue, when cold, is treated with 6 c.c. of 97% alcohol containing 0.2% of perchloric acid, the precipitate is collected on a filter, washed with 95% alcohol, washed into a crucible with alcohol, the latter is evaporated, and the residue is heated to dull redness for 12 minutes with 3 grms. of sodium carbonate, whereby the potassium perchlorate is converted into chloride. The mixture is dissolved in water, 10 c.c. of *N*/10 silver nitrate is added followed by 5 c.c. of nitric acid (36° B., sp. gr. 1.324) and 0.5 c.c. of ferric alum solution, and the excess of silver is titrated with *N*/20 thiocyanate solution. During the titration the sediment of silver chloride should be disturbed as little as possible, since silver chloride reacts to some extent with ferric thiocyanate.—W. P. S.

Potassium hydrogen tartrate and tartaric acid; Determination of —. H. Astruc. Ann. Falsif., 1914, 7, 416—417.

KLING'S racemate method (this J., 1910, 451; 1911, 706) has been found to be the most trustworthy method known at present for the determination of tartaric acid and its salts, *e.g.*, in alcoholic drinks, fruit juices, etc.—W. P. S.

Nipa palm swamps in the Philippines as sources of alcohol. U.S. Cons. Rept. Chem. Trade J., Feb. 20, 1915.

THERE are over 100,000 acres of nipa palm swamp available in the Philippines, of which about 90% has never been touched. It is estimated that the nipa sap obtainable in the islands would yield 50,000,000 gals. of alcohol fuel every season. Some of these areas are privately owned, but a large proportion of them is still at the disposal of the Government, and can be leased for 10% of the raw material produced each season. Practically all the alcohol now produced in the Philippines comes from one nipa swamp of about 45,000 acres, of which one-third is being worked. The total production of alcohol in the islands is approximately 2,500,000 gals. per season, nine-tenths of which is made from nipa sap. Only 2% of the alcohol now produced is denatured for commercial use. No modern improvements have been introduced in the industry, nor has any attempt been made so far to improve the cultivation or to increase the production of sap. The estimated cost of installing a distilling plant capable of producing 500 gals. a day is a little over £2000, while the daily output cost would be £15, or about 7d. per gallon.

PATENTS.

Brewing process with malt from which the husks have been removed. G. F. Hermann. Ger. Pat. 278,482, Jan. 16, 1913.

THE coarse grist used for mashing, itself serves as a filtering material on a support of muslin, gauze, or the like.—A. S.

Fermentation process. A. Molhant, Mons, Belgium. U.S. Pat. 1,124,500, Jan. 12, 1915. Date of appl., May 11, 1913.

SEE Fr. Pat. 455,483 of 1912; this J., 1913, 956.

Apparatus for dehydrating slime, vinasse, and similar materials. Ger. Pat. 287,258. See I.

Productions of oils or spirits for use in internal combustion-engines. Eng. Pat. 3899. See IIa.

Manufacture of plastic substances by the action of aldehydes on albuminous substances [yeast residues]. Ger. Pat. 275,857. See V.

Method and apparatus for making alcohol. Eng. Pat. 28,928. See XX.

XIXA.—FOODS.

Meats; The colouring matter of raw and cooked salted —. R. Hoagland, J. Agric. Research, 1914, 3, 211—224.

THE colour of uncooked salted meats cured with potassium nitrate is, in most cases, due chiefly to the presence of the addition compound of nitric oxide and hæmoglobin, the nitric oxide resulting from the reduction of the potassium nitrate. The colour of cooked salted meats is due to the presence of the addition compound of nitric oxide and hæmochromogen resulting from the reduction of the hæmoglobin compound during cooking. With certain kinds of salted meats, the colour of the raw meat may be due in part or wholly to the hæmochromogen compound.—W. P. S.

Detection of nickel in hardened oils. Prall. See XII.

Rare mineral elements necessary for the development of maize. Mazé. See XVI.

PATENTS.

Malted food; Manufacture of —. B. Combe, Hatherley, Gloucestershire. Eng. Pat. 17,113, July 20, 1914.

MILK, or a mixture of milk and cream, is mixed with 2.33% of its weight of honey, and an electric current of 3.5 amperes at 200 volts is passed through the mixture for 15 minutes. A mixture of malt and flour is then incorporated with the milk while the current is still passing, the total quantity of malt and flour added being such as to form the whole into a thick paste, which is afterwards dried at a low temperature.—W. P. S.

Bread and the like; Predetermining the time necessary for the fermentation or rising of dough for —. A. Watkins, Hereford. Eng. Pat. 19,487, Sept. 5, 1914.

THE apparatus consists of a box, about four-fifths of the interior of which is occupied by an inverted jar-shaped receiver. The box has a hinged lid carrying a bell and a spring connected with the bell hammer. To determine the time required to bake a batch of dough, some of the dough is filled into the receiver within the box, the lid closed, and the box placed in the oven with the bulk of the batch. As the dough rises, the receiver is lifted and pushes up the lid, which releases the spring and rings the bell. From the time taken and the use of a factor to be obtained from tables, the time necessary to finish the batch is calculated. —J. H. J.

Lard and the like; Rendering of —. E. E. Burkle, Bridgeport, Ohio. U.S. Pat. 1,124,852, Jan. 12, 1915. Date of appl., March 26, 1913.

THE lard is heated together with water and sal soda (sodium carbonate), in a water-jacketed open pan; it is then allowed to cool, the water removed, and the mass reheated to remove traces of water. The proportion of soda used is 3 lb. to 100 lb. of raw fat.—J. H. J.

Skim-milk; Method for the utilising of —, and milk composition. J. M. W. Kitchen, East Orange, N.J. U.S. Pat. 1,125,692, Jan. 19, 1915. Date of appl., Jan. 9, 1913.

SKIM-MILK is evaporated and powdered, and mixed with a ground cereal rich in vegetable fat, such as maize, in such proportion as to give a product having the same content of fat as whole milk and a correct nutritive ratio between protein and fat. —J. H. J.

Butter; Sterilising and securing uniformity of edible quality in —. J. M. W. Kitchen, East Orange, N.J. U.S. Pat. 1,125,693, Jan. 19, 1915. Date of appl., Sept. 13, 1913.

BUTTER is sterilised by heat and aerated with germ-free air until all objectionable odour has been removed. It is then allowed to cool, with continuous stirring, and when solidified is stored in a refrigerator until required for use. —J. H. J.

XIXB.—WATER PURIFICATION; SANITATION.

Water analysis; Contributions to —. L. W. Winkler. Z. angew. Chem., 1915, 28, 22—23.

IN testing for hypochlorite in potable waters sterilised by means of bleaching powder, two drops of methyl orange (1 : 5000) followed by 2 to 3 c.c. of 10% hydrochloric acid are added to 250 c.c. of the water: hypochlorite effects decolorisation in a few seconds. Ozone acts similarly. The test is sensitive to 0.1 mgrm. of active chlorine per litre; methyl red is 20 times as sensitive as methyl orange. In presence of manganese the water must be cleared with alum (0.1 grm. per litre) before applying the test. Active chlorine is estimated by adding 0.2 grm. of very pure potassium iodide, 1 c.c. of starch solution, and 2 to 3 c.c. of 25% phosphoric acid to 100 c.c. of the water and titrating the liberated iodine with N/200 sodium thiosulphate: nitrite is destroyed by bleaching powder, and ferric iron does not liberate iodine in presence of phosphoric acid. Traces of manganese as small as 0.1 mgrm. per litre may be detected by adding 1 drop of methyl orange to each of two portions (250 c.c.) of the water; 1 to 2 c.c. of 10% sodium hydroxide is added to the first portion, and after a few minutes both portions are acidified with 5 c.c. of 10% hydrochloric acid: in presence of manganese the first portion is decolorised within 2 minutes. The reaction cannot be applied in presence of hydrogen sulphide; nitrite renders it less sensitive; but it is unaffected by iron. Phosphoric acid is precipitated as ferric phosphate by warming the water (1000 c.c.—in some cases 5000 c.c.) on the water-bath for an hour with 1 c.c. of 10% ferric chloride solution and 2 c.c. of 10% alum solution. The flocculent precipitate is collected on a moistened wad, and the flask and filter are washed three or four times with warm 30% nitric acid in quantities of 10 c.c., whereby the precipitate is completely dissolved. After the addition of a drop of hydrochloric acid the filtrate is evaporated to dryness on the water bath, the residue dissolved in distilled water containing a few drops of nitric acid, the resulting

solution filtered, evaporated to 5 c.c., and treated with 5 c.c. of molybdic acid reagent (prepared by adding 500 c.c. of 20% nitric acid to a filtered solution of 25 grms. of commercial ammonium molybdate in 100 c.c. of distilled water and 100 c.c. of 10% ammonia and allowing to stand for several days). Even 0.05 mgrm. of phosphoric acid produces a precipitate after some time. After standing overnight the precipitate is collected upon a wad, washed with 10 to 20 c.c. of the above reagent, and dissolved in the least possible amount of ammonia. The solution is made up with the distilled water washings to 50 (or 100) c.c. and treated with 5 (or 10) c.c. of the molybdic acid reagent. To 55 (or 110) c.c. of distilled water contained in a similar beaker are added 1 drop of ammonia followed by a standard potassium chromate solution (see this J., 1915, 149) until the tint is matched. This operation must be accomplished rapidly. Twice the number of c.c.'s of potassium chromate solution required gives the number of mgrms. of P_2O_5 per litre of the original water. The gravimetric method yields high results for quantities of less than 5 mgrms. P_2O_5 per litre, owing to the presence of molybdic acid in the magnesium pyrophosphate. Of six samples of potable water examined, one gave 0.02 mgrm., four gave 0.05 mgrm., and one gave 0.44 mgrm. of P_2O_5 per litre.—J. R.

Salts; Reactions between certain — in boiling water. P. Petit. *Monit. Scient.*, 1914, 4, 537—541.

SOLUTIONS of pure calcium and magnesium bicarbonates, containing from 36 to 360 mgrms. CaO or MgO per litre, were boiled for 1 hour in a flask fitted with a reflux condenser and immersed in a bath of calcium chloride solution boiling at 110° C. The solutions were then filtered rapidly and titrated. Under these conditions the percentage of lime precipitated as carbonate diminished with increasing dilution of the solution, but the quantity remaining in solution was constant at about 17 mgrms. CaO per litre. With solutions of magnesium bicarbonate, the percentage of magnesia precipitated and the quantity remaining in solution both diminished with increasing dilution of the solution. In a mixture of calcium and magnesium bicarbonates a more complete precipitation of the lime was obtained, especially with higher concentrations of calcium bicarbonate; the proportion of magnesium carbonate precipitated was unaffected. The presence of sodium chloride reduced the amount of lime precipitated, but increased the amount of magnesia precipitated. Magnesium sulphate added to the calcium bicarbonate solution retained much of the lime in solution, especially when the amount present was small. Calcium sulphate caused a large increase in the precipitation of magnesium carbonate.—J. H. J.

Dust; The moist bacterial — of inhabited places. A. Trillat. *Comptes rend.*, 1915, 160, 153—156. (See also this J., 1914, 1070.)

LARGE glass cylinders holding 60—80 litres were filled with the expired breath of animals or men, together with particles of moisture containing bacteria. In still air at 18° C. the bacterial particles settled at a rate proportional to their dimensions, those of $1\ \mu$ diameter at the rate of 1 cm. in 3 min. Settling was accelerated by sudden cooling of the air, and the organisms were deposited on the cold surface. A fall of barometric pressure, especially if accompanied by a fall of temperature, accelerated the settling of the bacterial particles. When a fan was rotated within the cylinder, subsidiary currents were produced at right angles to the main vertical current,

and under the influence of these currents most of the bacterial particles were maintained in equilibrium. At certain points clusters of the bacterial particles were seen, while in the vertical currents the particles rose and fell. These experiments show that there are disadvantages attaching to revolving fans in ill-ventilated rooms.—J. H. J.

Iodine; Germicidal value of —. T. Maben and J. S. White. *Chem. and Drug.*, 1915, 144.

To test the value of iodine as a sterilising agent in medical practice, the Rideal-Walker test was applied to iodine tincture diluted with an equal volume of 90% alcohol and to an aqueous solution diluted with water to the same strength. The solutions were compared with carbolic acid solutions of 1 in 100 and 1 in 120, using *B. typhosus* as test organism. No growth was obtained in subcultures from the iodine solutions, whereas the carbolic acid solutions permitted growth. Still weaker solutions of iodine ($\frac{1}{2}$ and $\frac{1}{4}$ %) prevented growth, but $\frac{1}{8}$ % solution allowed it. It is concluded that iodine in alcoholic or aqueous solution is about four times as powerful a germicide as phenol on naked organisms.—J. H. J.

Arsenic antidote. J. W. England. *Amer. J. Pharm.*, Feb., 1915. *Pharm. J.*, 1915, 94, 281.

THE following method is recommended for preparing an antidote for arsenic by means of Magma Magnesia N.F.:—40 c.c. of ferric sulphate solution (U.S.P.) is diluted with water to 300 c.c., and in another vessel 300 c.c. of magnesia magma is mixed with an equal volume of water. When the antidote is required, the iron solution is added gradually, with shaking, to the magnesia magma. This method gives a more voluminous magma than when the magnesia is added to the iron solution.

Toxic symptoms among workers in calcium nitrate factories. See VII.

PATENTS.

Sewage and other foul liquids; Aeration of —. W. Jones, and Jones and Attwood, Ltd., Stourbridge. *Eng. Pat.* 22,952, Oct. 11, 1913.

A SERIES of diffusers spaced apart and each formed of a porous earthenware plate, on the underside of which compressed air is admitted, is arranged transversely across the bottom of each section of the tank holding the sewage to be aerated. The sewage is transferred from one section of the tank to the next by a circulator consisting of an uptake pipe at the bottom of which compressed air is admitted; the mixture of air and sewage rises and is delivered into the covered top of a down-take pipe, into which air is also admitted below the water level. The lower end of the down-take pipe is enlarged to form a foot chamber, where the excess of air escapes and is passed on to supply the diffusers, while the sewage passes into the bottom of the next section of the tank.—J. H. J.

Trade effluents; Process for removing fat and soap from —. G. Spanner. *Ger. Pat.* 278,370, Dec. 14, 1912.

THE effluent is agitated or otherwise treated to produce froth, and at the same time a suitable chemical, such as aluminium silicate (clay), is added, the effect of which is to maintain the froth as a floating layer. This layer carries mechanically the suspended and fatty matters present in the effluent, and can be removed in settling tanks or the like.—A. S.

Purification of water; Supply of reagents in the —. F. P. Candy, Sutton, Surrey. Eng. Pat. 782, Jan. 12, 1914.

A CLOSED chamber containing the aluminium sulphate or other reagent is connected by a pipe at the bottom to the bottom of a closed solution chamber. A portion of the water flowing through the pressure main, which is shaped at one part like a Venturi tube, enters the solution chamber by a pipe a little way above the bottom and passes out by a pipe at the top, back into the throat of the Venturi pipe. When communication is established between the reagent chamber and the solution chamber, the heavy aluminium sulphate solution passes downwards and forms a layer on the bottom of the solution chamber just below the level of the water inlet pipe; the incoming water picks up a little of the heavy solution and carries it forward continuously into the main.—J. H. J.

Water; Process for obtaining drinking — free from pathogenic germs and of any desired degree of hardness. J. C. Berntrop. Ger. Pat. 278,367, July 11, 1913.

SUFFICIENT calcium hydroxide is added to soften the water and leave a slight excess, e.g., about 0.25 grm. of free CaO per litre, and after allowing to stand, say for 5 hours, to ensure destruction of germs by the excess of lime, a quantity of alkali bicarbonate is added sufficient to produce the desired degree of hardness, the water is filtered, and the alkalinity is exactly neutralised with sulphuric acid.—A. S.

Air; Process of and apparatus for drying and sterilising —. R. P. van Calcar, Leiden, J. Ellerman and H. J. Martijn, The Hague. Eng. Pats. (A) 24,159 of 1913; (B) 4018 and (C) 4020 of 1914; date of appl., Oct. 24, 1913. Under Int. Conv., Nov. 29 and Dec. 24, 1912, and July 19, 1913, respectively.

(A) THE air enters around the lower sides of a rectangular box with a conical top connected to a hopper, in the mouth of which is a fan for producing a strong suction through the apparatus. In the body of the box is a tier of trays arranged in zig-zag fashion and carrying the drying agent, calcium chloride, which when liquefied drops downwards to the sloping floor of the box. Above or between the trays are pipes capable of being heated. Cold moist air passing through the apparatus is dried, warmed to normal temperature and nearly sterilised. When treating warm moist air, the pipes are replaced by shallow troughs containing a freezing mixture. (B) The bottoms of the trays are furnished with projecting pegs down which the liquefied calcium chloride trickles. By having air inlets of different sizes on three sides only of the box, the air is made to eddy as it passes through and is brought into better contact with the streams of calcium chloride. (C) A tray situated in the lower portion of the box is furnished with upright pins encased in porous material. This tray catches the liquefied calcium chloride falling from the upper trays and effects a preliminary drying of the air passing through.—J. H. J.

Metals; Process for extracting — from living [human] bodies. T. M. Clague, Newcastle-upon-Tyne. U.S. Pat. 1,123,683, Jan. 5, 1915. Date of appl., Sept. 20, 1913.

A PART of the body near that from which the metal is to be extracted and a part of the body remote from the former part are each surrounded with a conducting liquid, through which they are connected respectively with the negative and positive poles of a source of electric current, and a current is passed through the body. (See also this J., 1913, 881.)—A. S.

Disinfection by means of heated, compressed air saturated with steam or with a mixture of steam and a disinfectant in the form of gas or vapour. Deutsche Desinfektionszentrale G. m. b. H. Ger. Pat. 278,432, Nov. 10, 1912.

THE compressed air is withdrawn from the lower part of the disinfecting chamber by a fan and passed successively through a heater, a vessel in which it is saturated with steam, and a vessel containing a disinfectant, and then back to the upper part of the disinfecting chamber. Provision is made for supplying fresh air to the circuit, and the disinfecting chamber is fitted with a heating jacket.—A. S.

Plant and house pests; Process for destroying —. F. X. Bickel. Ger. Pat. 278,448, Feb. 2, 1912.

INFECTED plants are inoculated with metallic mercury, which is introduced through holes made in the lower branches near the main stem; or the plant or other infected material is exposed to mercury vapour in an enclosed space.—A. S.

Mercury compounds; Manufacture of solutions of — with disinfecting properties and inert towards metals. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 278,734, Nov. 23, 1913.

SOLUTIONS of mercury salts are mixed with soluble silicates and ammonia. A solution of mercuric chloride (1:1000), for example, may be mixed with 10 parts of water-glass of 35° B. (sp. gr. 1.32) and 4 parts of 20% ammonia. The solutions may be used as disinfectants, for wood preservation, anti-fouling paints, etc.—A. S.

Sterilisation of liquids. V. Henri, A. Helbronner, and M. von Recklinghausen, Paris, Assignors to The R.U.V. Co., Inc. U.S. Pat. 1,124,737, Jan. 12, 1915. Date of appl., Dec. 24, 1912.

SEE Fr. Pat. 403,945 of 1909; this J., 1910, 107.

Absorbent medium for carbonic acid gas. Eng. Pat. 12,454. See VII.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Cinchona alkaloids; Volumetric determination of —. E. Dufilho. Bull. Soc. Pharm. Bordeaux, 1914, 53. Ann. Falsif., 1914, 7, 453—454.

THE cinchona preparation (bark, extract, etc.) is heated with sulphuric acid in a closed flask on a water-bath, the solution of the alkaloid sulphates thus obtained is rendered alkaline with sodium hydroxide, and the alkaloids are extracted with a mixture of ether and chloroform. The ether-chloroform solution is washed with saturated sodium sulphate solution, an excess of *N*/10 sulphuric acid is added, the mixture evaporated to remove the ether and chloroform, and the excess of sulphuric acid is titrated in the residual solution, using litmus as indicator. The alkaloids are then liberated by the addition of an excess of sodium hydroxide, extracted with a mixture of ether and chloroform, and the latter solution is evaporated to dryness after the addition of a quantity of sulphuric acid required to combine with alkaloids; a small quantity of ether is added to the residue, and the crystalline mass is extracted with a saturated quinine sulphate solution. The alkaloid sulphates other than quinine sulphate are dissolved and are titrated with *N*/10 sodium hydroxide solution in the presence of phenolphthalein; the quantity of quinine present in the sample is obtained by difference.—W. P. S.

Opium; Assay of —. A. R. L. Dohme. J. Amer. Pharm. Assoc., 1915, 85. Pharm. J., 1915, 94, 209.

FOUR grms. of powdered opium is exhausted with water, the solution concentrated to 50 c.c., and after making strongly alkaline with caustic potash or soda solution, the alkaloids other than morphine are removed by extracting with ether. The alkaline liquid is then acidified with sulphuric acid, made slightly alkaline with ammonia, and the morphine extracted by shaking with a mixture of equal volumes of chloroform and isobutyl alcohol. The chloroform is first distilled off from the extract and then the isobutyl alcohol under reduced pressure; the residue is dissolved in excess of standard acid and the excess of acid titrated with alkali, using methyl red as indicator.—T. C.

Tobacco plant: Composition of — at various stages of growth. E. Pannain. Bull. Agric. Intell., 1914, 5, 1450—1452.

THE plant investigated was the variety Xanthi Yaka, grown at Francaville al Mare in the Abruzzi. Analyses were made of the nursery seedlings, the plants before flowering, of the leaves from each picking, and of the stems and roots. Keller's nicotine-method was accelerated by liberating the alkaloid with 20% potash, extracting with a mixture of equal parts of sulphuric acid and petroleum ether, and titrating with *N*/10 sulphuric acid in presence of Congo-red. The seedlings contained more nitrogen and organic acids, and gave more ash than the half-grown or fully-grown plants. In the pre-flowering period, the top leaves gave higher figures for ash, nitrogen, and alcohol and ether extracts, than the lower ones; but they contained less nicotine and organic acids. In the ripe leaves (which are picked as they mature from the bottom upwards), the first and second pickings contained 1.42 and 1.52% of nicotine and third and fourth pickings 0.75 and 0.74%, respectively on the dry basis; the amount of ash decreased from the first to the fourth picking. The leaf blades were richer in every constituent, except organic acids, than the ribs; and this holds good for the whole leaves in comparison with the stems and roots. The roots of the seedlings contained 0.80% of nicotine and the stems 0.48%, and those of the plants before flowering, 0.65 and 0.29%, respectively.—E. H. T.

Sempervirene, a new alkaloid of gelsemium. A. E. Stevenson and L. E. Sayre. J. Amer. Pharm. Assoc., 1915, 60. Pharm. J., 1915, 159.

THE concentrated alcoholic extract from 5 lb. of gelsemium was repeatedly extracted with chloroform, the chloroform extract concentrated and repeatedly extracted with very dilute hydrochloric acid. The acid liquid was freed from gelsemic acid by treatment with benzene, then extracted with chloroform and the concentrated chloroform extract washed with water. The aqueous extract was evaporated to dryness, distributed over sand and extracted with acetone and then with alcohol. The alcoholic extract on evaporation yielded the hydrochloride of a new alkaloid, *sempervirene*. *Sempervirene* forms pale yellow crystals. Its sulphate, hydrochloride, and nitrate are very sparingly soluble in water; the nitrate is slightly soluble and the hydrochloride readily soluble in alcohol. Only minute quantities of *sempervirene* are present in gelsemium.—T. C.

Struxine, a new alkaloid in *Nux vomica*. H. H. Schaefer. J. Amer. Pharm. Assoc., 1914, 1677. Pharm. J., 1915, 94, 241.

A NEW alkaloid, *struxine*, has been found in *Nux vomica*, associated with strychnine and brucine. In neutralising the acid solution of the crude alkaloid sulphates of *Nux vomica*, the new alkaloid

separates as a base when the liquor is just neutral or is still slightly acid, while strychnine and brucine remain in solution. When purified by reprecipitation and crystallisation from alcohol, struxine was obtained as colourless crystals, which begin to char when heated at about 250° C. Its mol. wt. is 371 and probable formula, $C_{21}H_{30}N_2O_4$. It forms normal and acid salts. Only a few lots of *Nux vomica* contained this substance, and then the quantities yielded differed greatly among the different lots. All the beans which contained this alkaloid were from shipments made from Cochinchina; these lots, which consisted mostly of small beans, insect-eaten and partly decomposed by prolonged exposure in wet fields, contained the largest percentage of the alkaloid (average 0.1%). It is supposed that the new alkaloid is a product of decomposition, by fermentation or oxidation of either strychnine or brucine.

Bark of Lophopetalum toxicum; The active principle of the —. Galvialo. Pharmazeutisches J., 1914, 515. J. Pharm. Chim., 1915, 11, 78—80.

THE author has isolated from the bark of *Lophopetalum toxicum*, which is used as an arrow poison by the natives of the Philippines, 0.2% of a crystalline substance, $C_{26}H_{54}O_6$, having the properties of a glucoside; this substance was soluble in hot alcohol, ether, benzene, and chloroform, but insoluble in water. When crystallised from benzene or alcohol the m. pt. was 222°—230° C., whilst the crystals obtained from an ether solution had m. pt. 190°—195° C.—W. P. S.

iso-Dibenzoylglucosylose. F. Tutin. Chem. Soc. Trans., 1915, 107, 7—8.

DIBENZOYLGLUCOSYLOSE (Power and Salway, this J., 1914, 435, 566) melts, after repeated crystallisation from ethyl acetate, at 152°—153° C. In the course of purifying this substance, the author obtained a smaller proportion of *iso*-dibenzoylglucosylose, melting at 173°—174° C.; $[\alpha]_D = -6.3^\circ$ in 1% solution in methyl alcohol. It crystallises in colourless needles from water or ethyl acetate and is more sparingly soluble than the former compound, which it resembles in general properties. Its penta acetyl derivative melts at 173°—174° C. The occurrence of rutin in *Daviesia latifolia* is also confirmed.—J. F. B.

Propyleneglycol-monoglucoside; Biochemical synthesis, by means of emulsin, of —. E. Bourquelot, M. Bridel, and A. Aubry. Comptes rend., 1915, 160, 214—216.

A SOLUTION of dextrose in α -propyleneglycol, $CH_3CH(OH)CH_2OH$, and water after exposure for six months to the action of emulsin, partly at the ordinary temperature, and partly at 33° C., was found to contain a considerable quantity of glucoside, which after separation from the unchanged dextrose and glycol, remained as an almost solid, white, non-crystalline mass. In aqueous solution it had a specific rotation $[\alpha]_D = -30.32^\circ$. On hydrolysis with sulphuric acid or emulsin it yielded the racemic glycol, identical with that used as starting material; hence no preferential conversion of one or other of the optical enantiomorphs into glucoside had occurred.—G. F. M.

Papain. H. F. MacMillan. Chem. and Drug., 1915, 133—136.

THE papaw tree (*Carica papaya*) is largely grown in Ceylon, the Hawaiian Islands, and the West Indies for its edible fruits and for the preparation of papain. Papain is prepared by scarifying the nearly mature green fruits, whilst still on the tree, with a bone or ivory knife, and collecting

the milky, viscid exudate in porcelain, glass, or earthenware vessels. The juice rapidly coagulates and must be dried promptly to prevent decomposition: a trace of formalin may be added to the juice as a preservative. The coagulum is sometimes dried in the sun but preferably by artificial means. In Montserrat dryers, 3 ft. by 3 ft. by 6 ft. in length, are used, having sides and ends of brick and open at the top. About 1 foot below the top is an iron sheet on which is a layer of sand 1–2 ins. deep. The coagulum is spread upon brown linen held in frames which fit the top of the dryer, or upon sheets of glass. Drying is effected at a low temperature, sometimes below 100° F. (38° C.). The dried material, when ground, yields a white or cream-coloured powder, which is packed in tightly-closed bottles. The exports of papain from Ceylon for the three years, 1911, 1912, and 1913, were:—

Countries to which exported.	1911.		1912.		1913.	
	Quan.	Value.	Quan.	Value.	Quan.	Value.
U.K. ..	4,054	20,320	9,088	34,332	12,705	44,183
Belgium	—	—	76	229	376	1,881
Germany	2,907	11,401	1,708	7,159	2,555	12,705
U.S. ..	550	2,500	2,048	8,948	2,912	13,078
Total	6,011	34,221	12,920	50,668	18,548	71,847

NOTE.—R.1=1s. 4d.

Considerable difference of opinion exists as to whether Ceylon or West Indian papain is the better, this being largely due to the general practice of adulterating papain, particularly Ceylon papain, with starch, rice, etc. Genuine papain has a slightly salt and somewhat acid flavour, and a peculiar, characteristic smell. It should be crisp and not sticky. (See also this J., 1915, 100.)—T. C.

Oil of Artemisia absinthium. V. Paolini and R. Lo Monaco. Atti del. Reale Accad. Lincei, 1914, 23, 123–129. Bull. Agric. Intell., 1914, 5, 1448–1449. (See also this J., 1914, 1072.)

FRESH cultivated plants grown near Rome and Perugia gave on distillation about 10% of mixed α - and β -thujone, about 48% of thujol (free and as acetic, isovaleric, and palmitic esters), a mixture of at least two compounds in which δ -thujol predominated, phellandrene, cadinene, and a blue oil of unknown composition.—E. H. T.

Vanillin; Note on—C. F. Boehringer u. Soehne. Chem.-Zeit., 1915, 39, 31–33.

SPECIMENS of vanillin prepared from oil of cloves and guaiacol, respectively, melted alike at 78–95°C., and it should not be difficult to manufacture the pure substance on a large scale from guaiacol, thus rendering the German industry independent of imported cloves.—J. R.

Vanillin in quinine wines; Detection of—A. C. Chauvin. Ann. Falsif., 1914, 7, 420–422.

A TEST proposed by Lecomte consists in mixing an ethereal extract of the wine with dilute hydrochloric acid and adding an alcoholic solution of phloroglucinol; a red zone appears at the junction of the two liquids within about 10 minutes if vanillin is present. The author, however, points out that the reaction is also given by furfural and its derivatives, that these are frequently present in the wines used in the preparation of quinine wines, and that the reaction is not, therefore, characteristic of vanillin.—W. P. S.

Acetylsalicylic acid. H. L. Smith. Pharm. J., 1915, 94, 200–201.

Five samples of acetylsalicylic acid were compared with a sample of aspirin (Bayer) by various tests, including the rates of hydrolysis in water, 0.2% hydrochloric acid, and 1% sodium carbonate solution. Two samples of m. pt. 136° C. and 135°–136° C., respectively, and also a sample prepared by the author, m. pt. 135°–135.5° C., were practically identical with aspirin, m. pt. 135°–136° C., whilst one sample of m. pt. 133°–135° C. contained free salicylic acid and another of m. pt. 125°–127° C. was very impure and probably contained acetylsalicylsalicylic acid. Acetylsalicylic acid should not give a violet coloration with ferric chloride solution.—T. C.

Sodium salicylate solution; Discoloration of—by alkalis. H. G. Greenish and A. E. Beesley. Pharm. J., 1915, 94, 201–202.

AN aqueous solution of sodium salicylate gradually develops a brownish coloration deepening to black, on addition of sodium bicarbonate, whilst with sodium carbonate, caustic soda, and ammonium carbonate only a yellow colour is developed. The coloration appears to be due to the action of atmospheric oxygen on the salicylate in presence of sodium sesquicarbonate, $\text{Na}_2\text{CO}_3 \cdot \text{NaHCO}_3$, present either as an impurity in commercial sodium bicarbonate or produced in the solution by loss of carbon dioxide. The addition of small amounts of reducing agents, particularly sodium sulphite or bisulphite, greatly inhibits the development of the coloration.—T. C.

Esters; Preparation of some—F. Bodroux. Comptes rend., 1915, 160, 204–207.

THE facility with which ethyl formate was formed by distilling ethyl alcohol with aqueous formic acid suggested that formic acid, like the mineral acids, might promote catalytically the esterification of acetic acid, but it was found to be inferior in this respect even to oxalic or picric acids. The esters of hydrobromic acid were formed in yield varying from 19 to 65% according to the alcohol employed, by distilling the latter with aqueous hydrobromic acid, b. pt. 126° C., but these yields were much improved by using a mixture of hydrobromic and sulphuric acids obtained by passing sulphur dioxide into 180 grms. of bromine, suspended in 250 grms. of water, until decolorisation was effected. Thus with propyl alcohol an 80.3% yield of propyl bromide, and with isobutyl alcohol a 70% yield of primary and tertiary isobutyl bromides was obtained.—G. F. M.

Glycerophosphoric esters; A method for the investigation of—, and the constitution of crystallised sodium glycerophosphate. L. Grimbart and O. Bailly. Comptes rend., 1915, 160, 207–210.

IN the preparation of sodium glycerophosphate by Poulenc's method (this J., 1907, 716) there was obtained in addition to the crystallised salt, an uncrystallisable liquor which contained nearly 50% of sodium glycerophosphate. The sodium salts were converted into calcium salts, which were freed from glycerin by washing with alcohol. By oxidation in the cold with bromine water the glycerophosphate obtained from the liquor was converted into a ketone the presence of which was demonstrated by Denigès' resorcinol and salicylic acid reactions (this J., 1909, 219), and by the formation of an osazone. The crystallised glycerophosphate gave no such reactions on oxidation, and it is therefore concluded that it has the constitution, $(\text{NaO})_2\text{PO} \cdot \text{O} \cdot \text{CH}(\text{CH}_2\text{OH})_2$, the secondary alcohol group of the glycerol being combined with the phosphoric acid, whilst the

non-crystallising salt has the constitution, $(\text{NaO})_2\text{PO.O.C}_6\text{H}_5\text{.CH(OH).CH}_2\text{OH}$, and thus contains the easily oxidisable $-\text{CH(OH)}$ group intact.—G. F. M.

Glycerophosphates; Analysis of—: M. François and E. Boismenu. *Ann. Falsif.*, 1914, 7, 423—432.

THE sample should be dried at 150°C .; calcium glycerophosphate sometimes contains from 5 to 17% H_2O . In the analysis of calcium and sodium glycerophosphates, it is usually sufficient to determine the residue on ignition, the phosphoric acid (by precipitation with molybdic acid reagent and conversion into ammonium magnesium phosphate, after the sample has been fused with potassium nitrate), and the calcium or sodium, respectively, the calcium being separated as oxalate and the sodium determined as sulphate. The actual quantity of monoglycerophosphate present may be determined by Astruc's method (this J., 1910, 900). The same methods may be applied to the analysis of granules of calcium glycerophosphate, but when the material contains sugar or other added substance, the weight of the residue on ignition loses its significance, and the presence of sugar interferes with the usefulness of Astruc's method.—W. P. S.

Glycerol; Detection and determination of free or combined—. *Application to glycerophosphates*. M. François and E. Boismenu. *J. Pharm. Chim.*, 1915, 11, 49—68.

GLYCEROL, either free or combined, may be identified by heating the substance under examination on a water-bath to expel any formaldehyde, alcohol, or other volatile substances, then mixing with potassium bisulphate and again heating. If glycerol is present, acrolein is formed; the acrolein vapours yield a red coloration with Schiff's reagent (magenta-sulphurous acid), the colour changing to blue on heating. The bichromate method for the determination of glycerol (Hegner, this J., 1889, 4) yields trustworthy results only if a large excess of bichromate is used, the reacting mixture sufficiently concentrated, and the oxidation allowed to proceed for at least 2 hours. The method may be applied directly to glycerophosphates. To determine phosphoric acid in glycerophosphates, the substance is heated under a reflux condenser with sulphuric acid and potassium bichromate for 2 hours, the hot mixture is diluted with water, the excess of bichromate is reduced with sodium sulphite, and, after the addition of sodium acetate, the phosphoric acid is precipitated first as ammonium phosphomolybdate and then as ammonium magnesium phosphate in the usual way.—W. P. S.

Glycerol; Determination of— in pharmaceutical preparations. C. H. Briggs. *J. Amer. Pharm. Assoc.*, Jan., 1915. *Pharm. J.*, 1915, 157.

GLYCEROL can be determined in pharmaceutical preparations with a fair degree of accuracy by distilling sufficient of the sample to yield about 2 grms. of glycerol with 75 c.c. of santal oil (which greatly reduces the distillation temperature of glycerol) and 0.5 gm. of calcined magnesia *in vacuo*. When most of the oil has distilled over, 100 c.c. of petroleum benzine is added to the distillate and the benzine-oil mixture is repeatedly extracted with small amounts of water to remove the glycerol. After shaking the aqueous extract with a small amount of benzine to remove traces of oil, most of the water is evaporated at a temperature not exceeding 50°C . and the residue dried in a vacuum desiccator over sulphuric acid.—T. C.

Iodine in pharmaceutical preparations; Determination of—. C. Lormand. *Ann. Falsif.*, 1914, 7, 432—441.

THE author criticises methods given in the French Codex for the determination of iodine in various preparations. To determine iodine in tincture of iodine 5 grms. of the sample is treated with 6 drops of sodium bisulphite solution, diluted with water, and the excess of bisulphite converted into sulphite by the addition of 2 drops of sodium hydroxide solution. The solution is treated with 5 drops of nitric acid, boiled, and the iodine precipitated as silver iodide after the addition of a further quantity of nitric acid. In iodine-iodide ointment a portion of the free iodine may be absorbed by the fatty constituent. The following method may be used to determine iodine in "iodo-tannin-phosphated wine":—Fifty grms. of the sample is treated with milk of lime prepared from 10 grms. of lime, the mixture is diluted to 250 c.c., filtered, and the iodide is titrated in an aliquot portion of the filtrate by means of thiocyanate.—W. P. S.

Wintergreen oil; Colour tests to distinguish natural and artificial—. G. N. Watson and L. E. Sayre. *J. Amer. Pharm. Assoc.*, Dec., 1914. *Pharm. J.*, 1915, 94, 281.

AN excess of sulphuric acid gives, with natural oil of wintergreen, a dark red colour, but no colour with the synthetic oil. With oil of birch a yellow or light shade of red is produced. When to a few drops of the oil are added 2 c.c. of concentrated sulphuric acid and 2 drops of a saturated alcoholic solution of heliotropin, the natural oil gives a crimson colour, changing to deep violet on dilution with alcohol; oil of birch reacts similarly, but the colour is not so pronounced; the synthetic oil yields a bright yellow colour, due only to the action of the acid on the heliotropin. A test which differentiates the oil of wintergreen and oil of birch is as follows:—To 1 c.c. of the oil in a test-tube add 2 c.c. of concentrated sulphuric acid, then 1 c.c. of saturated aqueous solution of chloral hydrate. With the natural oil, a deep green develops, a dark green oil layer above a lighter green aqueous zone. The addition of 2 or 3 c.c. of water aids in bringing out these shades. Oil of birch gives a deep violet oil layer. The synthetic oil produces no colour, except after long standing, when a faint violet colour may develop. A simple physical test depends upon the fact that, when oil of wintergreen is agitated in a bottle it will produce a foam, which will be retained for some time. If, on the other hand, methyl salicylate is treated similarly, it will produce no froth.

Action of ethyl alcohol on disilicon hexachloride. Martin. See VII.

PATENTS.

Alcohol; Method of and apparatus for making—. W. K. Freeman, Oscawana, N.Y., U.S.A. Eng. Pat. 28,928, Dec. 15, 1913.

HYDROGEN is passed through a chamber containing a number of carbon arcs and the resulting ethylene, after cooling, is conducted to the lower part of an absorption tower where it meets a descending stream of warm sulphuric acid. The acid liquid drawn off from the lower part of the tower contains alcohol together with ether, acetone, and sulphurous compounds; it is distilled to recover the alcohol. The absorption tower contains superposed trays filled with acid-resisting materials so that a large surface of acid is exposed to the gas, and means are provided for heating the acid and for regulating its delivery into the top of the tower.—W. P. S.

Pharmaceutical preparations [ointments, liniments, etc.]. F. E. Matthews and E. H. Strange, London. Eng. Pat. 663, Jan. 9, 1914.

PREPARATIONS for external application are obtained by mixing the salicylic ester of isopropyl or butyl alcohol, or of a polyhydric alcohol, particularly normal butyl salicylate, with oil, fat, or wax; solid substances, such as zinc oxide, magnesia, or chalk, may also be added.—W. P. S.

Carbon compounds; Process of effecting dissociative reactions upon —. W. O. Snelling, Pittsburgh, Pa. U.S. Pat. 1,124,347, Jan. 12, 1915. Date of appl., Sept. 5, 1913.

CARBON compounds capable of dissociation by heat in a reversible manner, with the liberation of hydrogen, are heated in a closed chamber or tube with walls more permeable by hydrogen than by other substances present, and the hydrogen formed is thus withdrawn during the reaction.—C. A. M.

Formaldehyde; Preparation of compounds of metals with —. H. Franzen. Ger. Pat. 277,437, April 19, 1912.

PURE compounds of metals (e.g. Pb, Ca, Sr) with formaldehyde are obtained by treating an aqueous solution of formaldehyde, either cold or at a moderate temperature, with the oxide or hydroxide of the metal; or by double decomposition of solutions of a salt of the metal and an alkali compound of formaldehyde.—A. S.

2-Piperonylquinoline-4-carboxylic acid and its homologues; Preparation of derivatives [amides] of —. Chem. Fabr. auf Actien, vorm. E. Schering. Ger. Pat. 277,438, May 25, 1913. Addition to Ger. Pat. 252,643 (this J., 1912, 1201).

THE amides of 2-piperonylquinoline-4-carboxylic acid and its homologues are prepared by the usual methods. Like the amides of 2-phenylquinoline-4-carboxylic acid and its homologues described in the chief patent (*loc. cit.*) they are tasteless, but unlike the latter they do not cause an increased separation of uric acid.—A. S.

2-Phenylquinoline-4-carboxylic acid; Preparation of derivatives of —. Chem. Fabr. auf Actien, vorm. E. Schering. Ger. Pat. 279,195, April 24, 1913.

AMINO-DERIVATIVES of 2-phenylquinoline-4-carboxylic acid are obtained by treating 2,2', 2,3', or 2,4'-nitrophenylquinoline-4-carboxylic acid with reducing agents; by the interaction of aniline, pyruvic acid, and an aminobenzaldehyde in alcoholic solution; or by adding pyruvic acid to a boiling alcoholic solution of the condensation product of aniline and an aminobenzaldehyde, and heating. For therapeutic purposes, the new products are superior to 2-phenylquinoline-4-carboxylic acid, in that they are either much less active than the latter in causing separation of uric acid or quite inactive in this respect.—A. S.

Acetylated isourea ethers; Preparation of —. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 277,466, April 30, 1913.

ACETYLATED isourea ethers are prepared by the action of bromoisovaleryl halides on isourea ethers, or on salts of the latter in presence of alkaline substances. The new products, which are odourless and readily soluble in the gastric juice, are valuable sedatives.—A. S.

β -Diketone-tetracarboxylic acid esters; Preparation of bicyclic —. H. Meerwein. Ger. Pat. 277,467, May 3, 1913.

MIXTURES of methylenemono- and bis-malonic acid esters, or substances capable of yielding such mixtures, are treated with alkaline condensing agents.

For example, the mixture of methylenemalonic acid methyl ester, methylene-bis-malonic acid methyl ester, and *n*-pentane- $\alpha_2\beta_2\delta_2$ -hexacarboxylic acid methyl ester, obtained by condensing formaldehyde with malonic acid methyl ester, may be treated with sodium methoxide, yielding the 1,3,5,7-tetracarboxylic acid methyl ester of bicyclo-[1,3,3]-nonanediene-2,6, from which two isomeric dicarboxylic acid esters and the bicyclo-nonanediene itself may be prepared. The compounds are of value for the preparation of therapeutic agents.—A. S.

Dihydromorphine; Preparation of —. F. Hoffmann-La Roche und Co. Ger. Pat. 278,107, May 27, 1913.

THE crude product obtained by the action of hydrogen, in presence of a catalyst, on acid or neutral, aqueous or aqueous alcoholic extracts of opium, is treated with an acid if necessary, then evaporated, and treated with absolute alcohol; the impurities are dissolved and a salt of dihydromorphine remains as an insoluble residue.—A. S.

Dihydromorphine; Preparation of alkyl ethers and acetyl derivatives of —. Knoll und Co. Ger. Pat. 278,111, April 29, 1913.

DIHYDROMORPHINE is treated with alkylating or acylating agents by the usual methods. Dihydrocodeine is obtained by methylating and diacetyl-dihydromorphine by acetylating.—A. S.

Cinchona alkaloids; Preparation of homologues of the —. Ver. Chininfabriken Zimmer und Co., G. m. b. H. Ger. Pat. 279,012, Sept. 13, 1913.

KETONES derived from cinchona alkaloids (compare this J., 1909, 381, 541) are converted in the usual way, by means of organo-magnesium compounds, into the corresponding tertiary alcohols. The products contain one alkyl group more than the original alkaloids.—A. S.

Erythrene; Preparation of —. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 278,647, Aug. 5, 1913.

ERYTHRENE is isolated by known chemical or physical methods from the gases produced by the incomplete combustion of organic substances.—A. S.

3-Amino-4-hydroxybenzene-arsine; Manufacture of derivatives of —. Farb. vorm. Meister, Lucius, und Brünning. Ger. Pat. 278,648, Feb. 20, 1913.

By the action of formaldehyde-sulphoxylates on 3-amino-4-hydroxybenzene-arsine, compounds are formed which are not oxidised on exposure to air, and which yield soluble salts giving neutral solutions. These compounds are of value for therapeutic purposes and for the preparation of other medicinal substances.—A. S.

Arsenic acid compounds of the higher polyhydric alcohols and their salts; Manufacture of —. F. Hoffmann-La Roche und Co. Ger. Pat. 279,254, July 12, 1913.

THE higher polyhydric alcohols or their esters are heated with arsenic anhydride *in vacuo* to a high temperature, and the products converted into salts in the usual way.—A. S.

Protocatechuic acid and protocatechuic aldehyde; Manufacture of —. L. Schmidt. Ger. Pat. 278,778, Sept. 16, 1913.

PROTocatechuic acid is obtained by the action of chlorine on piperonal in the absence of sulphuric acid. By the action of chlorine on piperonal

chloride dichloropiperonal chloride is formed, and this yields protocatechuic aldehyde when decomposed with water.—A. S.

5(4)-Methyl-4(5)-arylaminoethyliminazoles; Preparation of—. O. Gerngross. Ger. Pat. 278,884, July 23, 1914. Addition to Ger. Pat. 276,541.

5(4)-METHYL-4(5)-ARYLAMINOMETHYLIMINAZOLES of the type described in the chief patent (this J., 1914, 1004) are prepared by the action of 5(4)-methyl-4(5)-chloromethyliminazole or its salts on primary aromatic amines. They possess valuable pharmacological properties, causing an increase in the pressure of the blood and also acting as antiseptics against lower organisms, whilst they are less poisonous than β -iminazolyethylamine.—A. S.

Hexamethylenetetramine di-iodide; Preparation of—. M. Rix. Ger. Pat. 278,885, Oct. 15, 1913. Addition to Ger. Pat. 275,974 (this J., 1914, 943).

HEXAMETHYLENETETRAMINE di-iodide is obtained by allowing the components, in the form of powder, to interact in presence of a small quantity of an inert solvent. In presence of traces of alcohol, for example, insufficient to make the mixture sensibly moist, the reaction is complete within a few seconds.—A. S.

Pyrrole; Preparation of α -alkyl derivatives of—. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 279,197, Jan. 25, 1913.

THE radicals of polyhydric alcohols, their derivatives, or equivalents, are introduced into the α -position of the pyrrole ring by the methods used for the introduction of radicals of monohydric alcohols. The new products may be used in the synthesis of alkaloids of the pyrrole and pyrrolidine series.—A. S.

Mercurised amino-compounds; Manufacture of—. J. D. Riedel A.-G. Ger. Pat. 279,199, Oct. 7, 1913.

THE alkali salts of aminomethanedisulphonic acid are treated with mercuric oxide in presence of water. The resulting compounds do not precipitate albumin from solution, and their aqueous solutions, which will keep unaltered for a long time, if treated with a small quantity of alkali carbonate and protected from the air, may be used medicinally for injections.—A. S.

Hydrolecithin; Preparation of—. J. D. Riedel A.-G. Ger. Pat. 279,200, Jan. 27, 1914. Addition to Ger. Pat. 256,998 (this J., 1913, 507).

LECTHIN is reduced to hydrolecithin in aqueous solution by treatment at the ordinary temperature with hydrogen or a mixture containing hydrogen, in presence of a catalyst, such as a finely-divided or colloidal platinum metal, and salts of bile acids, e.g., cholates, taurocholates, glycocholates, choleates, or desoxycholates, or mixtures of the same.—A. S.

Cascara sagrada; Preparation of an extract of—free from bitter substances and soluble in water. M. Penschuck. Ger. Pat. 279,214, March 3, 1914.

THE powdered drug is mixed with zinc oxide and a sufficient quantity of water thoroughly to moisten the mixture, and exposed to the air, in thin layers, at the ordinary temperature for 7–10 hours, with frequent vigorous stirring; the moist mass is then subjected to high pressure, and the expressed extract evaporated *in vacuo*.—A. S.

Esters of higher hydroxy-fatty acids; Preparation of—. E. Freudenberg and L. Kloeman. Ger. Pat. 279,255, July 3, 1913.

ESTERS of higher unsaturated fatty acids are treated with hydrogen peroxide in presence of a

catalyst. The products have a higher specific gravity than the original esters and are valuable therapeutic agents.—A. S.

Fat and oil compounds; Dry—. M. Hamburg, Bishop Stortford. U.S. Pat. 1,124,611, Jan. 12, 1915. Date of appl., Dec. 13, 1913.

SEE Eng. Pat. 29,481 of 1912; this J., 1913, 672.

Pharmaceutical product [alkyl ethers of α -bromoiso-valerylisourae]. M. Engelmann and B. Merkel, Elberfeld, Germany, Assignors to Synthetic Patents Co., Inc., New York. U.S. Pat. 1,126,432, Jan. 26, 1915. Date of appl., April 8, 1914.

SEE Ger. Pat. 277,466 of 1913; preceding.

Beta-acetyl-alkyl-dialkylamines. G. Merling, Elberfeld, and O. Chrzescinski and H. Köhler, Leverkusen, Assignors to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 1,126,549, Jan. 26, 1915. Date of appl., June 5, 1913.

SEE Eng. Pat. 14,231 of 1913; this J., 1913, 1128.

Manufacture of azo dyestuffs containing arsenic. Ger. Pat. 278,421. See IV.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Photographic papers; Sensitometry of—. L. A. Jones, P. G. Nutting, and C. E. K. Mees. Phot. J., 1914, 54, 342–359.

AN attempt has been made to apply to photographic papers and prints similar principles of examination to those first applied by Hurter and Driffield (this J., 1890, 455) to photographic plates and negatives. Density values by reflected light (D_r) were determined directly by means of a modified form of the Bechstein illuminometer. The same light source is used to illuminate a piece of opal glass and the density to be measured; by a suitably arranged adjustable sector and set of lenses the luminosity of the opal can be varied and the amount of variation read off on a scale; the density is illuminated at 45° and viewed at 90° so as to avoid all specular reflection. The images of the two illuminated objects are brought together in a photometer cube. In every series of measurements the instrument is first set to read 100% when a piece of the same paper, developed and fixed, but not exposed, is placed in the position of the density. The instrument enables the reflecting power of the density to be determined; calling this R (expressed decimally) the authors deduce

$$D_r (\text{reflection density}) = \log. \frac{1}{R}$$

an expression of the same form as that for transmission density in the case of a negative. The reflecting density is dependent on three factors—the surface reflection of the density, the surface reflection of the paper on which the emulsion is coated, and the amount of the silver deposit. The following formula is given as representing these relationships:—

$$D = \log \frac{1}{(1-C)T^2R_p + C}, \text{ where } C \text{ is the surface}$$

reflection, T the transmission of the deposit, and R_p the reflecting power of the paper. The paper

to be examined was exposed behind a sector wheel having steps in the ratio of $\sqrt{2}$ instead of the usual wheel with a ratio of 2. Characteristic curves of a number of papers were obtained by plotting D_r against exposure. Some of these curves resemble closely the characteristic curves of plates, showing a first part of increasing slope, a middle straight part, and a last part of decreasing slope, called "under," "correct," and "over" exposure, respectively.

"Maximum black" is defined as the reflecting power of the deepest deposit that can be obtained. This was found to vary from 1% to 10% of the incident light (D_r from 2 to 1), from 8% to 10% being a greyish black and from 1% to 3% a very intense black. Generally a "glossy" paper gave a higher maximum black than a carbon surface, the latter than a "matt" surface; and a soft paper gave a lower value than a hard paper. The following limiting values for good papers are suggested:—Matt soft, 1.1, hard 1.35; glossy soft, 1.5, hard 1.8. Gamma, as with photographic plates, is the slope of the straight line portion of the curve ($\tan \alpha$), with the difference that the normal practice with papers is to develop to a maximum γ , so that γ with papers corresponds to γ_∞ with plates. "Total scale" is the density difference between the points on the under exposure and over exposure curves at which gamma is 0.2, at which points a 25% difference of exposure is required to produce an appreciable difference of density—about 0.02. The densities on either side of the two points selected may be of value in the print, and it may be more logical to regard total scale as the density difference from just perceptible darkening to just appreciably less than maximum black, but the use of the limits mentioned are regarded as more generally useful. "Contrast" is dependent on γ and "total scale." The variations in "total scale" given are from 0.9 to 1.7; variations in γ were found to range from 1.1 up to 2.65. "Rendering power" is defined as the ratio between latitude and total scale, in which the "latitude" of the paper is the length, in log. exposure, of the straight line portion of the curve; the ratio is multiplied by 10 to keep the values of rendering power between 0 and 10. The "rendering power" thus is a measure of the power of the paper to reproduce the negative proportionally, throughout the whole of its—the negative's—scale if the latitude and the total scale were the same, i.e., if the characteristic curve were only a straight line, the rendering power would be 10; in a table given, the variations in "latitude" are from 0.35 to 0.75 and in rendering power from 2.5 to 5. "Standard exposure" is defined as the minimum exposure in candle-metre-seconds, necessary to print through a density of 2.0, or 100 times the "threshold value" of the paper; for the purpose of this definition the term "candle" is defined as one visual candle-power of the light emitted by a tungsten incandescent lamp burning at an efficiency of 1.25 watts per mean horizontal candle-power. Knowing the "standard exposure" of the paper, E_s , and the maximum density of the negative being printed from, D_m , then the correct exposure becomes

$$E = \frac{E_s}{\text{anti-log.}(2 - D_m)}$$

The "latitude" of a paper rarely exceeds 0.75 = 5.6 in actual exposures) while the range of a negative may easily be 1 to 34 in exposures. It is therefore necessary to examine a negative as to the most important parts and arrange to print these on the straight line part of the paper. Three types of negative are specified and their treatment discussed. The general method is the same in each case—the range of densities in the "important" part of the negative is measured and a paper

selected having approximately the same "total scale," the exposure being then adjusted as already mentioned. The effect of development was very similar to the effect in the case of plates, where a bromided developer is used. There is a period at the beginning of development where γ rises and the inertia value decreases, and a further period, after γ has risen to a maximum, where the only apparent effect is the "regression of the inertia." It is not always easy to stop development before γ has reached its maximum, so that only parallel movement to the left is seen when the curves are plotted. The authors find carbon paper and especially platinum paper to have short straight line portions and low values of maximum black, though with considerable total scale, and low gammas. On the other hand, gelatino-chloride print-out papers showed a long total scale with high maximum blacks, but with a short latitude and therefore low rendering power. The paper concludes with two tables, one of which shows for a range of standard exposures (E_s in C.M.S.) from 50 up to 204,800, the necessary exposures for negatives with a range of maximum densities from 2.1 up to 3; the other table gives the constants for a number of bromide, gaslight, and print-out papers. (See also Renwick, Phot. J., 1913, 53, 127.)—B. V. S.

XXII.—EXPLOSIVES; MATCHES.

PATENT.

Explosive. C. A. Woodbury, Chester, Pa., Assignor to E. I. du Pont de Nemours Powder Co., Wilmington, Del. U.S. Pat. 1,124,679, Jan. 12, 1915. Date of appl., May 18, 1912; renewed June 9, 1914.

An explosive detonating at relatively low velocity is obtained by incorporating ammonium nitrate in relatively large (globular) particles with nitroglycerin and an absorbent.—U. A. M.

XXIII.—ANALYTICAL PROCESSES.

Silver; Volumetric determination of—C. Debrun. Ann. Falsif., 1914, 7, 407–409.

In the Gay-Lussac method silver is determined by titration with a sodium chloride solution, of which 100 c.c. at 15° C. is equivalent to 1 gm. of silver. When the titration is made at a temperature other than 15° C., the volume of the sodium chloride solution used must be corrected, and the author gives the necessary corrections in tabular and graphic form. Thus, at 0° C., 100 c.c. of the solution will have an apparent volume of 99.953 c.c.; at 5° C., 99.938 c.c.; at 10° C., 99.956 c.c.; at 20° C., 100.092 c.c.; at 25° C., 100.205 c.c.; at 30° C., 100.328 c.c.; and at 35° C., 100.484 c.c.—W. P. S.

Corrections in bomb calorimetry. Huntly. See IIa

Fractional combustion of gases over copper oxide. Terres and Mauguin. See IIa.

Determination of the percentage of toluene in commercial solvent naphtha. Colman. See III.

Determination of very weak acids and bases by means of electric conductivity measurements. Horiba. See VII.

Determination of formic and acetic acids and the separation of these acids in very dilute solutions. Heuser. See VII.

Method of determining sulphites, thiosulphates, and polythionates. Sander. See VII.

Determination of arsenic in iron, steel, and ores. Kleine. See X.

Rapid determination of iron in commercial pyrophoric alloys [of iron and cerium]. Bellucci. See X.

Detection of nickel in hardened oils. Prall. See XII.

Potassium cyanide as a qualitative reagent for tanning materials. Bennett. See XV.

Determination of nitrogen in leather. Nihoul. See XV.

Stanek's new method for the determination of sucrose by double polarisation in beet molasses. See XVII.

Rapid determination of total tartaric acid and potassium in wines. Kling and Lassieur. See XVIII.

Determination of potassium hydrogen tartrate and tartaric acid. Astruc. See XVIII.

Contributions to water analysis. Winkler. See XIXb.

Volumetric determination of cinchona alkaloids. Dufilho. See XX.

Assay of opium. Dohme. See XX.

Detection of vanillin in quinine wines. Chauvin. See XX.

Detection and determination of free or combined glycerol. Application to glycerophosphates. François and Boismenu. See XX.

Analysis of glycerophosphates. François and Boismenu. See XX.

Determination of glycerol in pharmaceutical preparations. Briggs. See XX.

Determination of iodine in pharmaceutical preparations. Lormand. See XX.

PATENTS.

Gas-analysis apparatus. C. W. Heath, Cincinnati, Ohio. U.S. Pat. 1,124,432, Jan. 12, 1915. Date of appl., March 5, 1914.

THE caustic absorbing solution is contained in a vessel of inert material, and is covered by a layer of oil which may be forced by the pressure of the residual gas into the measuring tube. Corrosion of the measuring apparatus by the caustic solution and also the action of air on the latter, are thus prevented.—W. F. F.

Pyrometer; Radiation——. R. S. Whipple, Cambridge, Assignor to The Taylor Instrument Companies, Rochester, N.Y. U.S. Pat. 1,125,233, Jan. 19, 1915. Date of appl., Aug. 18, 1910.

SEE Eng. Pat. 21,369 of 1909; this J., 1910, 1239.

XXIV.—MISCELLANEOUS ABSTRACTS.

Catalytic action. J. Böeseken. Rec. Trav. Chim. Pays-Bas, 1914, 33, 195—203. Bull. Soc. Chim., 1914, 15, 783.

THE action of a catalyst may be explained by the formation of an intermediate product, or by its decomposing action on the molecule with consequent concentration of the active portions. Results obtained by the author and his pupils are more in accord with the latter theory. For instance Olivier (see page 217), found that a catalyst exerts its maximum power in the free state. It is held that the catalyst forms with the substance activated a compound capable of dissociation, and that the activity of the catalyst is greater the wider the limits of temperature and pressure within which such dissociation can take place.
—R. G. P.

Trade Report.

German chemical export trade; The——and the war. H. Grossmann. Chem.-Zeit., 1914, 38, 1169—1173.

THE internal demand for chemical products is well maintained, and the trade with many neutral countries is uninterrupted; but the industry is suffering appreciably from cessation of trade with enemy powers and lack of certain raw materials, among which the following are prominent: sulphur pyrites, chromium and tungsten ores, bauxite, phosphate minerals, saltpetre, copper and other metals, vegetable fats and oils, lard, petroleum, wool, flax, hemp, jute, rubber, and iodine. Great Britain has been the chief customer for sugar (annual production 917,000 metric tons) and aniline and coal-tar colours (annual production 64,300 metric tons). In 1913 the total German imports of chemical materials comprised in Group 4 of the customs' tariff were valued at M. 430,385,000 (£21,000,000), including acids, salts, etc., to the value of M. 278,187,000 (£13,500,000); the exports reached a value of M. 956,414,000 (£47,000,000), including M. 377,087,000 (£18,000,000) for acids, salts, etc., M. 298,044,000 (£14,300,000) for dyestuffs, and M. 101,256,000 (£5,000,000) for fine chemicals and pharmaceutical products. Taking into account the chemical products not included in the above tariff group, the total value of German chemical exports in 1913 is estimated at two milliards of marks (£97,500,000). In the following list for the four chief countries concerned in this trade, the two unbracketed numbers represent Germany's imports and exports, respectively, in millions of marks, for 1913; the bracketed number gives in each case the amount corresponding to agricultural and forest products: U.S.A., 1711.1 (1138.0), 713.2 (131.8); Great Britain, 875.9 (154.3), 1438.2 (365.7); Austria-Hungary, 827.5 (457.2), 1104.8 (185.2); Russia, 1424.6 (1304.7), 880.2 (155.6). It is stated that the shortage of German chemicals is having a serious effect in N. America, especially in the glass, leather and textile industries, and that lack of potassium chloride has brought the electrolytic manufacture of potash to a standstill. On the other hand, the nitrolim industry is flourishing in N. America, as it is also in Germany. The author suggests that there is a tendency in Germany to underrate the importance and capacity of the British chemical industry, and reference is made to the exhibits of British firms at the Brussels and Turin Exhibitions and to the work of Mond. The enterprise

shown in the British fat and oil industry is contrasted with the neglect of organic chemical processes requiring a complicated technique. Efforts are to be made through the German metal exchanges to free the metal trade from the London influence, which is said to rest upon a traditional rather than an economic basis; similar steps are to be taken respecting other raw materials. Much attention is devoted to the question of the production of dyes in Great Britain: it is pointed out that after 50 years' neglect the organisation of such an industry presents great difficulties. It is assumed that after the war Austria, Russia, Belgium, and France will continue to draw their supplies of chemicals from Germany and that much of the loss now being sustained will then be recovered: in this connection the considerable drain made by the war upon German trained technical chemists is mentioned.—J. R.

Chemical industry and war. H. Grossmann. Z. angew. Chem., 1915, 28, 17—20.

THE author examines the effect of the war on the chemical industries of various countries and the prospects of the German chemical industry after peace is restored. Shortage of coal and derived products is said to exist among the hostile nations with the exception of Great Britain. In Germany much attention is being devoted to the provision of rubber, cotton, petroleum, animal and vegetable oils, metals, and various ores (see preceding abstract). After the war Germany, it is urged, should seek additional markets rather than limit her foreign commercial intercourse. The American plan of a periodic compilation of industrial statistics is advocated, so that, among other advantages, the productive capacity of an industry might be taken into account in fixing maximum prices. Reference is made to the increasing demand and the diminishing supply of chemicals in Great Britain, as evidenced by advertisements. The necessity of appealing to the State for help in developing chemical industries is adversely commented upon. It is stated that the United States, in spite of a rapid development of chemical manufactures, is still almost wholly dependent upon Germany for dyes and other chemical products, any interruption of which would seriously affect a number of industries. The war will probably stimulate the American production of such materials, and efforts will be made to capture the S. American market. In Switzerland, the dividend of the "Gesellschaft für chemische Industrie" at Bâle has been reduced from 10% to 6%, and the erection of the proposed soda works at Olten is doubtful. Russia is suffering from a shortage of coal; and notwithstanding the great progress recently made by the Russian chemical industry with the help of German capital and intelligence, there is a great lack in the country of chemical and pharmaceutical preparations, which are being imported from Japan; commercial chloroform has even had to be purified in the University laboratory at Moscow. At the outbreak of the war Russian Poland contained 264 chemical factories with 9200 hands, employed in the production of such articles as soap, candles, cosmetics and perfumes to the annual value of 30,000,000 roubles (nearly £3,200,000). According to official figures, on September 1st out of 257 chemical factories with 60,721 employees, 58 factories with 42,741 employees were working part time, while 4 factories had increased their staff from 763 to 900. In the Moscow district 16% of the works were running normally, 80% had diminished their output, and 4% had shut down. Raw materials are generally scarce. The Russian agricultural, wood, sugar, and spirit industries offer great possibilities of development.

Little is known of the condition of affairs in France, although the occupation of the N.E. region must have had serious consequences for the chemical industry; the electrochemical industry in the Alpine district has also probably suffered. In Austria-Hungary the petroleum industry, the overseas trade, and the Balkan export trade have all undergone serious disturbance. A closer economic relationship between Austria and Germany is foreshadowed. It is predicted that, in spite of the loss of so many skilled chemists in the war, Germany will be able to meet all foreign competition on the conclusion of peace.—J. R.

France; "Prohibited" goods which may be exported from —. Board of Trade J., Feb. 18, 1915.

A DECREE of the French Minister of Finance, dated the 12th February, abrogates the prohibition of export and re-export in respect of the under-mentioned articles, hitherto included in the Prohibited List, so far as concerns consignments which are destined for the United Kingdom, the British Dominions, Colonies and Protectorates, Belgium, Japan, Montenegro, Russia, Servia, or the United States of America:—Acetone; anhydrous and hydrated alumina and salts of alumina; aluminium, ore and metal, pure or alloyed; pitch of resin (*brâis de résine*), pine and fir resin, colophony, oil of turpentine; cocoa, chocolate; camphor; calcium carbide; carbons for electricity; copper, ore or metal, pure or alloyed, boiler-makers' wares and tubes of copper; hydrogen peroxide; cinchona bark; tin, ore and metal, pure or alloyed; extracts of quinine; oleaginous fruits and seeds; glycerin; animal greases (fats) other than that from fish (tallow, lard, lanoline, margarine, oleomargarine, and similar substances); graphite; whale oil; vegetable oils, other than castor oil and pulghera oil; condensed milk, with or without the addition of sugar; yeasts; filings and waste of copper, tin, zinc, pure or alloyed; mercury (ore and metal); ores of chromium, manganese, molybdenum, titanium, tungsten, and vanadium; iron ore; nickel (ore and metal, pure or alloyed); aluminium wares other than jewellery; paraffin; phosphorus and phosphates of lime; lead, ore and metal, pure or alloyed, lead pipes; sea salt, salina salt, and rock salt, crude or refined; sulphur and pyrites; zinc ore.

* New Books.

[The Roman numerals in thick type refer to the similar classification of abstracts under "Journal and Patent Literature" and in the "List of Patent Applications."]

I. *McCollum, B., and O. S. Peters:* Surface insulation of pipes as a means of preventing electrolysis. Wash., D.C., Gov. Pr. Off. 1914. 44 p. il. pl. 8vo. (U.S. Bu. of Standards. Techn. pap. No. 15.) 1915.

Smith, A. W.: Materials of machines. 2nd ed. Cr. 8vo. Chapman and Hall. London. 1915. Net 5s. 6d.

IIA. *Jones, E.:* The anthracite coal combination in the United States; with some account of the anthracite industry. Cambridge, Mass., Harvard Univ. c. 1914. 13+261 p. (13 p. bibl.), tabs. charts, O. 1915. \$1.50 n.

Institution of Gas Engineers. Transactions. 8vo. Spon. London. 1915. Net 10s. 6d.

Webber, W. H. Y.: Gas supply in principle and practice. N.Y., Macmillan. 2+199 p. il. 12mo. \$1.25 n.

Stillman, T. B.: Examination of lubricating oils. Easton, Pa., Chemical Pub. c. 1914. 125 p. il. fold. tab. 8vo. 1915. \$1.25.

II B. *Manufacture of electric arc carbons.* 8vo. pp. 66. "Electrician." London. 1915. Net 2s. 6d.

V. *Stecher, G. E.*: Cork, its origin and industrial uses. 87 p. front. tabs. 12mo. Van Nostrand. 1915. \$1 n.

IX. *Weiss, H. F.*: The preservation of structural timber. N.Y., McGraw-Hill. 312 p. il. 8vo. 1915. \$3 n.

X. *Brarley, H.*: The case-hardening of steel. Illustrated. 8vo. pp. 186. Iliffe. London. 1915. Net 7s. 6d.

Giolotti, F.: The cementation of iron and steel; tr. from the Italian by J. W. Richards and C. A. Rouiller. N.Y., McGraw-Hill. 407 p. il. 8vo. 1915. \$4 n.

Houghton, E. F. and Co., Philadelphia: Steel and its treatment, by the metallurgical staff. 2nd ed. Phil. (The author) c. 1914. 104 p. il. pls. diagrs. 12mo. 1915. \$1.

Electric welding. 48 p. illus. 8vo. Indus. P. 1915. 25c.

Park, J.: Text-book of practical assaying. Cr. 8vo. pp. 354. C. Griffin. London. 1915. Net 7s. 6d.

Rosenhain, W.: An introduction to the study of physical metallurgy. N.Y., Van Nostrand. 1914. 22+368 p. il. pls. figs. tabs. O. \$3.50 n.

XI. *Timbie, W. H. and Higbie, H. H.*: Alternating-current electricity and its application to industry. N.Y., Wiley. c. 1914. 80+534 p. figs. 8vo. 1915. \$2 n.

Townsend, J. S.: Electricity in gases. 8vo. pp. 512. Clarendon Press. London. 1915. Net 14s.

XII. *Ellis, C.*: Hydrogenation of oils. Catalysts and catalysis and the generation of hydrogen. 8vo. Constable. London. 1915. Net 16s.

Vitetta, G.: Manuale di olivicoltura pratica. Casalmonferrato. 16°. p. XVI. 250. 1914. Lire 3.

XIII. *Ingle, H.*: A manual of oils, resins, and paints. Vol. I. Analysis and valuation. Cr. 8vo. pp. 138. C. Griffin. London. 1915. Net 3s. 6d.

XVI. *Royal Agricultural College, Cirencester*; *Annual Scientific Bulletin of the* —. Nos. 4 and 5. 1912-1913. Swd. 8vo. pp. 108. W. H. Smith and Son. London. 1915. 2s.

Brenchley, W. E.: Inorganic plant poisons and stimulants (Camb. Agri. Monographs). 8vo. pp. 110. Cambridge Univ. Press. London. 1915. Net 5s.

Burgess, P. S.: Soil bacteriology, laboratory manual. Easton, Pa., Chemical Pub. c. 1914. 8+123 p. il. forms. 12mo. 1915. \$1.

Forti, C.: I concimi e le concimazioni. 2a ediz. Torino. 4to. fig., p. 414. 1914. Lire 10.50.

Marescalchi, A.: Guida pratica per la concimazioni. Casalmonferrato. 16°. fig. p. IX. 137. 1914. Lire 2.

Mukarji, N. G.: Handbook of Indian Agriculture. 3rd ed., revised. 8vo. Thacker. London. 1915. Net 15s.

Smith, E. F.: Bacteria in relation to plant diseases. v. 3. Vascular diseases (continued). Wash., D.C., Carnegie Inst. 8+309 p. il. pls. Q. (Publications). pap. 1915. \$5.

XIX A. *Vutte, H. T. and Vanderbilt, S. B.*: Food industries: an elementary text-book on the production and manufacture of staple foods. Easton, Pa., Chemical Pub. c. 1914. 8+309 p. (7 p. bibl.) il. 8vo. 1915. \$1.75 n.

XIX B. *Jameson, R. N.*: Methods of sewage disposal for Texas cities (Austin, Tex.). Univ. of Tex. 1914. 64 p. (11 p. bibl.). 8vo. (Bull.) 1915.

Kershaw, G. B.: Sewage purification and disposal. 8vo. pp. 350. Camb. Univ. Press. London. 1915. Net 12s.

Metcalf, L., and Eddy, H. P.: American sewerage practice. v. 1. Design of sewers. N.Y., McGraw-Hill. 747 p. il. 8vo. 1915. \$5 n.

Koller, Th.: Utilisation of waste products. A treatise on rational utilisation, recovery and treatment of waste products of all kinds. Translated from the second revised German edition. Second English revised edition. 340 pp., with 22 illus. Demy 8vo. London. 1915. 7s. 6d. net.

XXIV. *Annuario di chimica scientifica ed industriale* colle applicazioni all' agricoltura ed industrie agronomiche, alla metallurgia, ecc. diretto dal prof. Guareschi coadiuvato da un' eletta di chimici (Supplemento annuale all' Enciclopedia di chimica) Anno XXX (1913-1914) Torino. 4to. fig., p. 480. 1914. Lire 15.

Chemical Manufacturers' Directory of England, Wales and Scotland. With some Firms in Ireland. 1915. 8vo. bds. Simpkin. London. Net 2s. 6d.

Crookes, Sir Wm.: Acquired radio-activity (Royal Soc.). 4to, swd. pp. 14. Dulau. London. 1915. Net 1s. 6d.

Luff, A. P., and Candy, H. C. H.: A manual of chemistry, theoretical and practical, inorganic and organic. New, enlarged ed. 12mo. pp. 680. Cassell. London. 1915. Net 8s. 6d.

Oscroft, P. W.: Advanced inorganic chemistry. Cr. 8vo. pp. 512. Bell. London. 1915. Net 5s.

Mills, G. J.: Chile; physical features, natural resources, means of communication, manufactures and industrial development; with introd. by W. H. Koebel. N.Y., Appleton. 1914. 22+193 p. il. pls. fold. maps. O. 1915. \$1.50 n.

Rogers, A. (ed.): Industrial chemistry, a manual for the student and manufacturer; 305 illustrations. 2nd ed., thoroughly rev. and enl. N.Y., Van Nostrand. c. 1912-1915. 20+1005 p. Q. \$5 n.

La Marca, F.: Il corbezzolo e la sua utilizzazione. Casalmonferrato. 16°. fig. p. 105. 1914. Lire 1.50.

* Compiled by H. Grevel and Co., 33, King Street, Covent Garden, London, W.C., from whom all the works in the preceding list can be obtained.

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Official Notice.

ANNUAL GENERAL MEETING, 1915.

In accordance with the provisions of By-law 61, notice is hereby given that the Annual General Meeting will be held in Manchester at 10.30 a.m., on Wednesday, July 14th, 1915. A programme of the proceedings will be issued later.

Under Regulation 5, all elections to the Committees and all elections of officers of Local Sections, with the exception of those to fill up unforeseen vacancies, must take place so that they can be reported to the Council in time to be considered at the meeting held under By-law 24 not less than two months prior to the Annual General Meeting (*i.e.*, at the meeting on April 23rd).

CHARLES G. CRESSWELL,
Secretary.

Canadian Section.

Meeting held at Montreal on Tuesday, 8th December, 1914.

MR. T. H. WARDLEWORTH IN THE CHAIR.

FOREST PRODUCTS LABORATORIES OF CANADA.

BY JOHN S. BATES, PH.D.

In the list of Canada's natural resources the forest stands second, with an annual production amounting to over \$170,000,000. In recent years it has been realised, however, that the timber resources of Canada are not unlimited and that it will require careful methods of conservation to meet the permanent demand for wood, even within the borders of our own country.

The Forest Products Laboratories of Canada were established in 1913 under the jurisdiction of the Forestry Branch of the Department of the Interior. The Canadian Forestry Association, the Canadian Pulp and Paper Association, and a number of far-seeing Canadian citizens are to be credited with bringing this matter to the attention of the Government. At the same time the Forest Products Laboratories would not have been possible but for the personal interest and judgment shown by the Hon. W. J. Roche, Minister of the Interior, and Mr. R. H. Campbell, Director of Forestry. It was decided to accept the generous offer of co-operation extended by McGill University, and the laboratories have, therefore, been located in Montreal, with headquarters on the University campus. The mutual advantage of such a location will be at once recognised.

The Forestry Branch, which has been in existence since 1899, is occupied primarily with the conservation of the forests themselves and is concerned with such problems as preventing fires, re-forestation, and regulating methods of lumbering in the national forest reserves, and, in general, educating public opinion in the proper care of living trees.

The Forest Products Laboratories, on the other hand, are interested in the conservation of forest

resources by proper utilisation of the raw material. The purposes of the laboratories have already been outlined in Forestry Branch Circular No. 8. As the name of the department suggests, the greater proportion of time will be spent in the experimental investigation of wood and the many products which can be manufactured therefrom. Investigations are being undertaken with a view to extending the knowledge of wood itself, pointing out improved methods for using the raw material furnished by the Canadian forests, and finding ways and means of utilising the vast amount of waste wood which is occasioned in the lumber and allied industries. The success which has followed the efforts of the United States in their Forest Products Laboratory at Madison, and of Germany and other European countries in their various scientific laboratories, has shown the possibilities of similar work in Canada.

Through the untiring efforts of the first superintendent, Mr. A. G. McIntyre, the first units of the laboratories were organised in the latter part of 1913. On the resignation of Mr. McIntyre the writer assumed the duties of superintendent in April last, and Mr. W. B. Campbell was appointed Assistant-Superintendent. Since that time the various divisions have been more fully equipped and a good start has been made in actual experimental work. The present staff numbers twenty-three, of whom seventeen are technically trained men. Through the courtesy of McGill University two buildings at 700, University Street, have been placed at the disposal of the Forest Products Laboratories for a period of four years and these are now being altered to meet present requirements. The office and laboratory building contains about twenty rooms now in use as general offices, drafting room, chemical laboratory, photomicrographic room, library, exhibition, etc. An adjoining building is being re-constructed to serve as experimental paper-mill. The use of the University testing laboratory has been granted for the work in timber testing. A small saw-mill has been fitted up on the outskirts of the city for handling the wood specimens to be tested. A wood-working shop and machine-shop are also available.

An outline of the work in the various Divisions will give an idea of the scope of the work at present being undertaken.

For the Division of Timber Tests a Hatt-Turner impact testing machine and a 30,000-pound Olsen universal testing machine have been purchased. These are installed in the McGill University testing laboratory. Additional equipment owned by the University, including a 200,000-pound Wicksteed machine, a 150,000-pound Emery machine, and a 60,000-pound Richlé machine, are also used by the laboratories for special work. The first project in this Division is a comprehensive series of tests to establish the "mechanical and physical properties of Canadian woods, as determined by tests on small clear specimens." Testing has been in progress for several months on representative specimens of Douglas fir from British Columbia and Alberta. Other species will be tested in due course, so that the absolute and comparative strengths of Canadian woods will be established for the benefit of the wood-using industries. A second investigation now in progress is the testing of commercial pit props and booms, used in large quantities by the mining industries of Canada and now in great demand for export to Great Britain. Some three hundred sticks have already been presented by the Dominion Coal Company,

Ltd. This represents one phase of the general investigation of mine timbers being carried on by the Forestry Branch in co-operation with McGill University. A third project in view is the testing of Douglas fir and other species in the structural sizes ordinarily used.

The present equipment in the Division of Timber Physics includes microscopes, microtome, photomicrographic apparatus, balances, electric ovens, and other apparatus necessary for the determination of moisture content, specific gravity, fibre characteristics, and other physical properties of wood. The present scope of this division is limited largely to a study of the physical nature of specimens handled in the Division of Timber Tests. It is hoped to extend the work to include wood seasoning and the many important branches of wood technology.

Special stress is being laid on facilities for study in the field of pulp and paper. To this end a separate building is being equipped to allow the carrying on of pulp and paper-making processes on a semi-commercial scale. The equipment, which will be installed in the near future, includes a very complete Fourdrinier paper-machine, which is the largest experimental paper-machine ever constructed, single and double beaters with interchangeable basalt lava and steel rolls, small Jordon engine, stuff chests, screens, paper-testing instruments, etc. These will be followed by sulphite and sulphate digesters, bleaching apparatus, and such other equipment as is necessary to conduct experiments in a thoroughly practical manner.

It is very encouraging to find that the pulp and paper industry is taking a keen interest in this development, and valuable gifts have been presented by various companies. One of the first investigations will be a study of the beating of paper pulp, which will include a comparison of steel and stone rolls.

A Division of Wood Preservation has recently been organised. Although it will be impossible to do extended laboratory work while we are limited to present quarters, arrangements are being made to carry on field tests which should prove of great value. Studies will be made of methods of treating railway sleepers, telephone poles, mine timbers, wood paving blocks, etc., and records will be kept of the life of treated and untreated timbers under varying conditions. A fungus pit is being installed in the laboratories to allow accelerated tests. The larger Canadian railroads have already expressed their keen interest in our present investigation of sleepers, and we are assured of their co-operation.

The Division of Chemistry is one which bids fair to solve many pressing problems. The laboratories have already been called upon to report on the recovery of potash from wood ashes. In addition to the chemical work which is closely interwoven with the mechanical and physical tests, it is important to develop research along strictly chemical lines. To overcome the present deficiency in facilities and staff an attempt is being made to encourage and assist chemical research on forest products in various Canadian universities. Queen's University has recently undertaken a chemical study of waste sulphite liquor.

A number of other divisions will be started when conditions permit. For the present a general study is being made of wood distillation, hydrolysis of wood, and allied subjects. In connection with proposed Canadian developments in wood distillation, the author was present at a series of commercial distillation tests on British Columbia Western Yellow Pine in North Carolina last August. Mere mention of such problems as utilisation of sawdust, bark, treetops, and stumps is sufficient to show the importance and difficulty of the work before us.

Books, bulletins, journals, pamphlets, and other literature on the subject of wood and its products are being collected as the nucleus of a comprehensive library for the benefit of the workers in the laboratories and of the public at large.

Arrangements are being made to collect a complete series of wood specimens from all parts of Canada to be exhibited in the laboratories. In addition to these, representative samples of manufactured wood articles, pulp and paper, wood flour, composition board, artificial silk, paper yarn, and the many other products which can be made from wood will be collected for exhibition and reference purposes. In this way a valuable exhibit of forest products will be available to stimulate the public in conserving and developing our great natural resources.

Two publications have already appeared as contributions from the Forest Products Laboratories, the first being Forestry Branch Circular No. 8, entitled "Forest Products Laboratories," and the second, Forestry Branch Circular No. 9, "Chemical Methods for Utilising Wood Wastes." A third bulletin on the subject of "Treated Wood Block Paving" will soon be ready for distribution. An announcement of the work in timber testing is also being prepared for publication.

In addition to experimental work, the laboratories are serving to the best of their ability as a public bureau of information on the subject of forest products.

To insure the success of the laboratories in helping to solve the problems of greatest and most immediate importance which are confronting the wood-using industries, special steps have been taken to keep in touch with the industries and with the work of other Government bureaus, universities, and scientific societies. To this end members of the staff visit various industrial plants, scientific institutions, and so forth from time to time, and attend the meetings of organisations interested in furthering the use and conservation of wood.

The laboratories are especially fortunate in having an Advisory Committee composed of gentlemen keenly interested in the welfare of our Canadian forests and possessing a wide, practical knowledge. The personnel of the board is as follows: Dr. Frank D. Adams (Dean of the Faculty of Applied Science, McGill University), Dr. R. F. Ruttan (Director, Department of Chemistry), H. M. Mackay (Professor of Civil Engineering), F. Howard Wilson (President, J. C. Wilson), Carl Riordon (Managing Director, Riordon Pulp and Paper Co., Ltd.), Judson A. DeCew (President, Process Engineers Ltd.), R. O. Swezey (General Manager, Montreal Engineering Co., Ltd.).

This outline is presented not so much to show what is now being accomplished as to indicate the possibilities which the future holds forth. The Forest Products Laboratories have begun in a small way. To meet the large needs of this growing country, the work of the laboratories must expand. The proving of their worth in public service will surely lead to a permanent home in a new and fully equipped building. It is to scientific and technical societies and to the universities and industries throughout the country that we must appeal for co-operation in making our work of real value.

One of the most forceful lessons of the present war is the startling realisation that Canada is woefully dependent on other countries, in spite of unparalleled natural resources. The Hon. W. T. White, Minister of Finance, said this week: "It is the duty of all Canadian citizens to co-operate in producing as much as possible of what can be used or sold. For Canada at this juncture the watchword of the hour should be production, production, and again production."

But can lasting results be obtained without the aid of scientific methods? And would it not be wise to change our motto "Made in Canada" to "Made Well in Canada"? It is the aim of the Forest Products Laboratories to lend practical assistance in attaining this end.

PRESERVATIVE TREATMENT OF WOOD.

BY W. B. CAMPBELL, B.S.C.

Possibly the first recorded attempt to increase the durability of wood was in the case of the famous wooden statue of Diana of the Ephesians, in which numerous holes were bored into which the priests were expected to pour oil from time to time to prevent rot. Since that time a large amount of work has been done with the same object in view. In the last ten or fifteen years hundreds of different processes and preservatives have been suggested, and though most of these have proved of no value in themselves, they have all helped to shed light on the subject.

The decay of wood is caused by certain forms of fungus which feed on the various portions of the wood substance. There are many varieties of these fungi and they act in many different ways; their requirements in the main are food, air, heat, and moisture. The food of the fungus consists of the cell contents and the cell walls. Different fungi attack different parts; some feed mostly on the cellulose, others on the lignin. Nearly all feed on the cell contents and some of them attack all portions of the wood. The cells of the sapwood contain protoplasm which is very easily attacked by the fungus, and accordingly the sapwood is the first to show its destructive effects. It is for this reason that engineering specifications frequently exclude sapwood in structural timber. If wood be immersed in water or in clay so that all or nearly all the air is excluded, it will last indefinitely. There are also certain heat limits outside which either the fungus is killed or its growth is so retarded that it has very little effect on the wood. The water supply is also a very important matter to the fungus; if the wood is kept very wet the air supply is cut off and the fungus does not increase. On the other hand, if the wood is kept very dry, as, for instance, wood exposed indoors to ordinary dry air, the moisture content drops to below 10% and the fungus ceases to grow. Of the four requisites of fungus only two are, to any extent, under control, namely, food and water. The water content can be reduced by air-drying or by kiln-drying, but as a method of preserving wood this is of no value, since the timber readily absorbs moisture from air. The other alternative is the food supply; by poisoning this the growth of fungi can be entirely prevented. The method is usually employed by injecting into the wood substances which are sufficiently toxic to kill the fungi or retard their growth, both by the toxicity and by excluding air and moisture.

Before applying the preservative to the wood, some preliminary treatment, such as seasoning, is found advantageous. In the majority of cases simple air seasoning is adopted: the wood is piled so as to be freely exposed to the air but protected as much as possible from rain, etc., until it has lost the greater part of its moisture and has come to a condition approaching "air-dry." Green timber contains 40 to 60% of water; "air-dry," about 10 or 12%. Air-drying seems, at first sight, a very simple operation, but there are some difficulties. A long time is necessary to dry large-sized timbers, there is considerable risk of fire, and the timber may be partially destroyed by fungoid growth before the treatment is started. The drying may be hastened by the use of a kiln, but this is not considered practicable where large

timbers are to be handled. Steaming under light pressure, followed by a vacuum, is also used, but in most cases is not considered satisfactory, and there is also danger that the steaming may impair the strength of the wood. In one creosoting process the green wood is submerged in a bath of creosote, heated above 100° C., whereby the water is driven off as steam and replaced by creosote. With this process there is also the possibility of over-heating with consequent loss of strength. Many combined treatments are considered more suitable for certain woods.

The preservatives used are of great variety, but fall naturally into two classes—those soluble in water and those of an oily nature immiscible with water. The chief representatives of these classes are respectively zinc chloride and creosote oil or dead oil of tar. Others of the first class are mercuric chloride, sodium fluoride, and copper sulphate. The only other representative of the second class is crude petroleum, which is used only to a very slight extent.

As the preservatives used are always in greater amount than is necessary to prevent fungoid growth, the aim of the various methods of application is to secure as great a depth of penetration as possible at the lowest possible cost. Dipping or brush treatments are the cheapest methods: pressure treatments are more effective but more costly. Salts in aqueous solution penetrate wood with comparative ease, so that they are frequently applied by the bath method. This was the original way of applying these salts, and it is still frequently used where zinc chloride is being applied and I believe always with mercuric chloride. Open baths and brush applications are also used with creosote where a heavy treatment is not necessary or where, as in the case of telephone poles, it is not necessary to treat the whole pole. But the better penetration obtained in pressure processes and the shorter time necessary for the treatment has led to their adoption in most plants.

Creosote is usually applied by one of the pressure processes. The original aim was to get as much oil as possible into the wood; to do this creosote was applied to the timber in an evacuated chamber, and then pressure was applied to drive the creosote into the wood. This process caused the creosote to saturate the cell walls and to fill the cell cavities. Later investigation showed that the oil in the cavities was not doing any work, and various processes were developed to saturate the walls without leaving any oil in the cavities. These are known as "empty cell" processes. One method of accomplishing this is as follows:—Instead of an initial vacuum, an initial air pressure of about 50 lb. is applied and then the creosote is forced in against this, using a total pressure of about 200 lb.: when the wood has absorbed rather more than the specified quantity of oil per cubic foot, the excess is drained off and the pressure allowed to fall to atmospheric. The compressed air inside the wood then expels some of the creosote from the cells but does not remove that which has been absorbed by the walls. In another process no initial pressure or vacuum is used but a final vacuum is applied to draw off the excess. This, it is claimed, gives a cleaner surface than the other methods.

The comparative efficiency of the different preservatives depends upon the use to which the wood is to be put and is entirely a matter of balancing the additional cost against the desired additional life. Soluble salts do not give as long a life as creosote in wet places, since they are liable to be dissolved, but this solution is not nearly so great as might seem at first sight, since the cell material is all colloidal and the salts are held very tenaciously. The advocates of mercuric chloride claim that the salt is held so closely by the wood

that there is no danger of poisoning. Whether this is the fact or not is uncertain. The U.S. Government authorities are inclined to discourage the use of mercury on account of this danger. A case is cited of a number of cows which died after licking the sleepers on a railroad using this process: on the other hand it is stated that these particular ties were treated with zinc chloride.

The creosote oil used is a coal-tar fraction having a specific gravity of about 1.09 at 20° C., distilling between 210° C. and 353° C. This is frequently diluted with heavier tar for purposes of economy, but even when so diluted, the toxicity is sufficiently high. The tar used should contain only a small quantity of free carbon, otherwise this may separate and remain in the outer layers of the wood, making a very dirty material. The lighter fractions of the oil are most toxic but in the course of time they evaporate, leaving only the heavier constituents. It seems, therefore, that the mixture as found in the oil is more efficient than either of the fractions separately, since the heavy constituents will not readily penetrate the wood alone, and greater toxicity is needed at the beginning in order to destroy growths already started.

One of the largest uses for treated wood is for railroad sleepers. In Canada in 1910 9,000,000 sleepers were used; in 1911, 14,000,000; in 1912, 21,000,000. A great many of these were for construction, but more than half were for renewals. There are approximately 100,000,000 railway sleepers laid in Canada at present, costing the railroads 12 to 15 c. a year each for maintenance. Experience elsewhere has shown savings of 1 to 5 c. a year per sleeper, due to preservative treatment. At a saving of 1 c. per sleeper this represents a total saving of \$1,000,000 per year. The woods used at present are Jack pine, cedar, Douglas fir, hemlock, tamarack, and western larch. All of these—except cedar—rot easily and last only from four to seven years: all are soft and the mechanical wear is very great. They are becoming scarce and frequently have to be hauled over considerable distances. There are within reasonable distance considerable uncut forests of beech, birch, maple, and other hardwoods, which are much more resistant to wear when sound, but decay very rapidly. By preservative treatment the decay is prevented and they can be made to outlast any of the soft woods.

Creosoted wood is also coming into extensive use for street paving in the more progressive cities. By making a pavement of creosoted wood blocks, laid on a concrete foundation, with a minimum of sand cushion between, it has been found possible to have a street which combines to an almost ideal extent all the desirable properties of ease of cleaning, low ultimate cost, freedom from dust and noise, and ease of haulage.

London Section.

Meeting held at Burlington House on Monday, March 1st, 1915.

PROF. W. R. HODGKINSON IN THE CHAIR.

There was a further series of exhibits of chemicals and apparatus which hitherto have mainly been produced abroad but now are being manufactured in this country (see also this J., 1915, 126). The following is a list of the exhibitors and products:—

The British Aluminium Co., Ltd. Aluminium powder, granulated aluminium, pure aluminium hydroxide.

Messrs. A. Boake Roberts & Co., Ltd. (Stratford). Cineol, o-nanthic ether, &c

Messrs. Burroughs, Wellcome and Co. (Dartford) Atropine, cocaine, eserine, homatropine, hyoscine, and pilocarpine salts; kharsivan and neo-kharsivan (salvarsan and neo-salvarsan), &c.

Messrs. W. J. Bush & Co. Ltd. (Hackney). Salicylic acid, soda salicylate, aceto-salicylic acid, vanillin, benzylidene acetone, diphenylmethane, &c.

Messrs. Fuerst Bros. (17, Philpot Lane, E.C.). English acid-proof stoneware, tower-filling and pipes.

Kestner Evaporator and Engineering Co. Ltd. Homogeneous coating of lead on mild steel, wrought iron, and gun metal.

Silvertoyn Lubricants, Ltd. Pure medicinal liquid paraffin.

Thermit Ltd. Pure carbon-free manganese and chromium metal; alumino-thermic welding compound.

Dr. J. T. Hewitt, F.R.S., on behalf of a firm of chemical manufacturers in the London district, whose name is not published. Phenylhydrazine hydrochloride, pure and commercial.

After a brief description of the various exhibits had been given.

Sir WILLIAM RAMSAY, referring to possible German competition after the war was over, said that the French Société d'Encouragement pour l'Industrie Nationale were seriously debating, and the French Government seriously thinking of excluding every German product from France, of preventing any German from manufacturing anything in France, and of buying up all German industries at present existing in France. The Russian Government thought of pursuing the same policy.

PRODUCTION OF NITRATES FROM THE AIR, WITH SPECIAL REFERENCE TO A NEW ELECTRIC FURNACE

With reference to the concluding paragraph in the discussion on the above paper by Mr. E. Kilburn Scott (this J., Feb. 15th, 1915, p. 126)* as to the Ostwald patents for the catalytic manufacture of nitric acid, Mr. H. B. Weeks writes as follows:—

"In the course of Mr. Barton's address to the Shareholders at the Annual Meeting of the Nitrate Products and Carbide Co. Ltd., he stated that 'the efficiency of the plant at Vilvorde fell so low as to cause the Directors grave anxiety,' but he also stated (which Mr. Kilburn Scott has omitted to state) 'that not only had the cause of the fall in efficiency been ascertained, but that in investigating that cause they had been enabled to so modify and improve the plant that the efficiency eventually obtained was actually 12½% in excess of that on which the original estimate of profits was based, and that this extra 12½% efficiency had been obtained without any addition to the working costs.'"

Scottish Section.

Meeting held at Glasgow, on Tuesday, November 24th, 1914.

MR. ROBERT HAMILTON IN THE CHAIR.

THE CORROSION OF NON-FERROUS ALLOYS.

BY CECIL H. DESCH, D.S.C., PH.D.

The method usually employed to determine the relative corrodibility of metals and alloys consists in exposing specimens of the materials to be

compared to the action of a corrosive agent for a sufficient time, and determining the loss of weight in each case. The corrosive agent may be that to which the material is intended to be exposed during actual use, such as atmospheric air, fresh or salt water, sewage, or industrial liquors, or it may be an artificial solution, selected with the object of accelerating the test. In the latter case an external electromotive force is sometimes applied.

It is difficult to obtain accurate information in this way. The test of exposure to actual working conditions is so slow as frequently to be impracticable, whilst most forms of accelerated test fail to indicate in any satisfactory way the power of resistance to corrosion in actual practice. For example, the relative order of resistance of different specimens of steel when exposed to atmospheric influences is by no means identical with that of the resistance to attack by dilute sulphuric acid, and a determination of the loss of weight under the latter conditions is valueless, and is generally recognised as being so, when it is desired to compare steels with a view to their use in external work. A similar statement may be made in regard to the non-ferrous metals and alloys.

Another form of test consists in determining the electromotive force which is developed when the specimen of metal under examination is connected with a standard metal, and immersed in a suitable electrolyte. It has been assumed that an arrangement of different metals in an electro-chemical series in this way will indicate the relative order of resistance to corrosion, all corrosion being regarded as electrolytic in character. This test has proved valueless in practice. The effects of polarisation are so complex that it is almost impossible to obtain comparable results with different specimens, the values of the electromotive force varying greatly with time, whilst even the values obtained when some kind of equilibrium appears to have been reached bear little or no relation to the properties observed in practice.

The principal defect of laboratory tests of corrosion, and especially of accelerated tests, is their neglect to take into account the mechanical factors which influence the process. A specimen of metal is immersed in a solution or exposed to the atmosphere. After a sufficient length of time, the specimen is withdrawn, washed, and then brushed or scraped until an apparently clean surface of metal is again exposed. The loss of weight is then regarded as representing the amount of corrosion. This determination is sometimes supplemented by an analysis of the "corrosion product," under which are included the salts dissolved by the liquid, the flocculent precipitate of basic salts which is formed when the electrolyte is neutral, and any adherent crust, either of oxide or of metal. Moreover, when the alloy is made up of two different kinds of crystals, exfoliation is sometimes observed, and the crystals which are thus dislodged also find their way into the "corrosion product." An analysis of such a heterogeneous mixture throws little light on the process of corrosion.

Observation of corrosion under industrial conditions makes it evident that the mechanical properties of the substances formed during the process exercise an important influence on its velocity. For example, iron corrodes much more rapidly in ordinary moist air than either zinc or aluminium, a fact which would not be inferred from the relative positions of the three metals in the electro-chemical series, or from their behaviour when immersed in dilute acids. The difference is due to the fact that iron forms a porous rust, which admits the passage of gases and

of condensed moisture, thus facilitating further corrosion, whilst both zinc and aluminium form a tough, adherent layer of basic salts, which serves as a protective varnish and, even when quite thin, hinders any further action of the corrosive substances. This factor, which is left out of consideration in ordinary accelerated tests, and even in prolonged tests in which only the loss of weight is determined, is of the highest importance.

The influence of tin on the corrosion of brass may be taken in illustration. It has long been known, from practical experience, that the resistance of brass to corrosion by sea-water is greatly increased by the presence of a small quantity of tin in the alloy, and the standard Admiralty alloy for condenser tubes consists of 70% Cu, 29% Zn, and 1% Sn. The effect of tin cannot be accounted for on electro-chemical grounds, as the effect on the solution-pressure of the zinc must be very small. Experiments by the method described below, however, prove that the influence of the tin is largely, perhaps entirely, mechanical. Corrosion begins in the usual way, at a rate differing little from that of a similar alloy containing no tin. In the presence of a neutral electrolyte, a part of the dissolved metals is precipitated in the form of a basic salt. Copper and zinc are converted into loose, flocculent precipitates, which are readily detached from the surface of the metal by even the lightest washings with water. The tin, on the other hand, although present in such small quantity, forms a tough, adherent layer which, even when very thin, has the properties of an impervious varnish, and can only be detached from the surface with difficulty. Lead, which also exerts a protective influence on brass, acts in a similar manner, but it is found that a larger proportion of lead is necessary in order to produce a favourable effect, a small addition being insufficient to render the layer of basic salt compact. Iron, on the other hand, is quite without protective influence on brass, and indeed accelerates the process of corrosion.

The elaborate experiments with full-sized condenser tubes, conducted by Dr. Bengough for the Corrosion Committee of the Institute of Metals, have shown the importance of solid deposits in affecting the nature and extent of the corrosion of brass by sea water.* The influence of solid particles of coke or other foreign matter in contact with the metal is still under discussion, but appears to be considerable.†

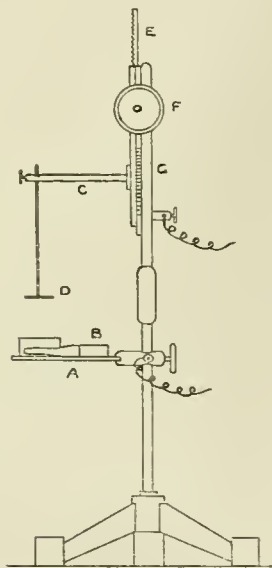
It has seemed worth while to devise a method of testing metals in regard to their power of resisting corrosion which should be rapid, applicable to small specimens, and suitable for the investigation of the influence of adherent films, alluded to above. In the case of alloys composed of two or more micrographic constituents, it was also thought desirable to observe the relative rate of corrosion of those constituents. For this purpose it was decided to use specimens of the size usually adopted for metallographic examination, having a polished surface suitable for direct observation by means of the microscope. Further, it was thought advisable to assist and regulate the corrosion by the application of an external electromotive force. Objections have been urged against such a procedure, on the ground that chemical and electrolytic corrosion are different in character, but the experiments with condenser tubes, alluded to below, have clearly shown that the mechanism of the two processes is identical, whilst the conditions of a rapid laboratory test cannot be fulfilled without the aid of an applied electromotive force.

* Journ. Inst. Metals, 1911, 5, 28; 1913, 10, 13 (see this J., 1911, 219; 1913, 913).

† A. Philip, *ibid.*, 1914, 12, 133, and discussion (this J. 1914, 923).

The method adopted in a series of experiments with Mr. S. Whyte* consisted in supporting a small platinum cathode 1 cm. above the horizontal polished surface of the specimen by means of a Classen stand for electrolytic analysis. A containing cell was built up of plasticine, and the electrolyte was then introduced by means of a pipette. The external electromotive force was supplied by two dry cells.

The method has now been improved in detail, and a special apparatus, of the form shown in the figure, is now used. The vertical brass rod of the stand is divided into two parts, insulated from one another by a short section of ebonite. The lower rod carries a brass plate, A, which may be clamped at any height. The small brass block, B, carries a pair of spring clips between which the specimen, 12.5 mm. square, is held with the polished



horizontal surface upwards. The cathode is a piece of fine platinum gauze, D, 10 mm. square, firmly attached to a vertical wire which passes through a hole in the arm, C, and is held by a screw. This arm is attached to a sliding plate, which may be raised and lowered by a rack, E, and pinion, F. A scale, G, allows the height to be adjusted. The specimen, which has been prepared as if for microscopical examination, is carefully freed from grease and placed in position. The cathode is lowered until in contact with the specimen and then raised 5 mm. A wall of plasticine is built up to contain the electrolyte, which is usually 1 or 2 c.c. of a 5% solution of sodium chloride. The two binding screws are connected with the source of current, which is most conveniently a storage battery provided with a distributing board and measuring instruments for electrolytic analysis. Corrosion is then allowed to proceed for 5, 10, 20, or 60 minutes, according to circumstances. The wires are disconnected, and the electrolyte is rinsed out of the plasticine cell into a beaker, using a wash-bottle with a fine jet. A loose, flocculent precipitate is usually obtained. Any solid deposit adhering to the corroded surface so loosely that it is detached by light rubbing with the finger tip, may usually be added to the bulk, but a firmly adherent deposit,

requiring the use of a wooden chisel-edge or a knife-blade to detach it, should be collected, if present, for separate analysis.

The surface of the corroded metal is examined under the microscope both before and after the removal of the adherent layer. The texture of the latter is thus observed, as well as the nature of the attack on the metal, and the comparative behaviour of different micrographic constituents, when such are present in an alloy. The analysis of the products of corrosion is performed as far as possible by colorimetric methods, on account of the very small quantity of each element to be estimated, amounting in many cases only to a fraction of a milligram. It has been found possible to estimate the proportions of copper, zinc, iron, tin, and lead with a satisfactory degree of accuracy, and there will probably be no difficulty in estimating other metals in a similar manner.

A useful test may often be made by employing a much larger quantity of solution, such as 100 c.c. For this purpose the apparatus is arranged as above, but the wall of plasticine is built up somewhat higher, and provided with a lip at one corner by which the liquid may overflow into a receiving vessel. The solution of electrolyte is allowed to drop into the corrosion cell from the jet of a burette, the tap of which has been previously adjusted so that the total quantity escapes in a fixed time, such as an hour. In this case, the flocculent precipitate of basic salts does not settle, but is continually carried over into the receiving vessel, and the surface of the metal remains clean, except when an adherent layer is formed. This method is therefore a convenient one for determining whether such a protective layer is formed or not during the corrosion of a given alloy.

Experiments on the corrosion of brasses of different composition have led to the following conclusions:—

1. Corrosion of brasses takes place by dezincification. Both copper and zinc are removed in solution, but the ratio of zinc to copper in the solution and the flocculent precipitate is much higher than in the alloy.

2. The β -alloys are much more readily attacked than the α -alloys, and the preferential removal of zinc is much more strongly marked in alloys of the former class.

3. In alloys containing both the α and the β constituent, the latter is almost completely corroded before the former is attacked. (The corrosion of this class of alloys is now being investigated by Mr. Whyte.)

4. A layer of metal is left below the corroded surface, containing much less zinc than the original alloy, and having an open, spongy texture. In the case of β -alloys, this layer may contain as much as 99.6% Cu. It is sharply defined in depth, that is to say, a gradual transition from unaltered to completely dezincified brass is not observed. This is true of α as well as of β -alloys.

5. The spongy layer readily oxidises under the influence of atmospheric or dissolved oxygen. The layer of cuprous oxide which is often observed on the corroded surface of brass tubes, is doubtless of secondary origin, the original process having been one of dezincification.

6. The removal of zinc proceeds at first along the boundaries of crystal grains, and, in the case of α -brasses, which commonly exhibit twinning, along the dividing planes between twin crystals. Well-defined etch-figures are frequently seen on the surface of both kinds of brasses after removal of the coppery layer.

* Journ. Inst. Metals, 1913, 10, 304; 1914, 11, 235; Journ. West of Scotland Iron and Steel Inst., 1914, 21, 176 (see this J., 1914, 358).

7. The presence of iron in solid solution accelerates corrosion, whilst that of tin checks it after the process has continued for a very short time. This check is not due to electro-chemical causes, but to the mechanical protection afforded by a tough, adherent layer of basic salts, containing tin. Lead in small quantities is without protective effect, but with 2% Pb (in the case of an α -brass) a protective layer of basic salts is formed, and corrosion is greatly retarded, in spite of the fact that distinct dezincification is observed at first around the globules of lead in the alloy.

8. The process of corrosion by sea and other natural waters is of essentially the same character as that of electrolytically stimulated corrosion under the conditions described above. This conclusion has been confirmed by the comparison of laboratory specimens with portions cut from tubes and plates which have become corroded during actual use. For example, a condenser tube which had undergone extensive corrosion by Manchester Ship Canal water was examined. The original brass had contained Cu 72.72%, Zn 27.04%, Fe 0.15%, and Pb 0.09%. Along the bottom of the tube a band of metal had been almost completely dezincified, whilst at a somewhat higher level the layer of spongy copper extended only partly through the thickness. Microscopical examination showed that the boundary between copper and unaltered brass was everywhere perfectly sharp, without any intermediate layer of partly dezincified alloy. Moreover, the removal of zinc was found to have proceeded by way of crystal boundaries and twinning planes before penetrating into the interior of the crystal grains.

The same effects could be reproduced in their smallest details by means of electrically stimulated corrosion in the laboratory. A sound, uncorroded section of the same condenser tube was converted into a cell by closing the lower end with plasticine. The tube, filled with sodium chloride solution, was connected so as to become the anode, a coiled platinum wire, placed centrally, serving as cathode. After the current had passed for 24 hours, the section of tube was dried, sawn through, and examined microscopically. The same features were observed, a completely dezincified layer, in which the brass was now represented by spongy copper, separated sharply from unaltered brass, the dividing line running along boundaries of crystal grains and twin lamellae. Similar results have been obtained with other corroded objects.

When making an examination of a corroded tube, it is necessary to fill the tube with fusible metal before cutting and grinding, in order to preserve the sharpness of the edges, and to prevent the dislodgement of fragments of brittle copper.

Recently, the application of this method has been extended by the author and Mr. H. Hyman to the bronzes or gun metals, the experimental details being exactly as described above. The ordinary gun metals, including the well-known Admiralty alloy, are composed of the α -solid solution, together with smaller masses of the $\alpha\delta$ -eutectoid. It is found that either the α - or the δ -constituent may be attacked the more rapidly, according to the difference of electrolytic potential employed. Thus, by varying the electromotive force applied in the corrosion test, the etching effect may be reversed. There is in this case no process quite similar to dezincification, and the formation of a layer of metallic copper is not observed. It is found, however, that the layer of basic salts may be either loose or coherent, according to the conditions of the test.

and that in the latter case corrosion may be arrested or checked after a certain amount of action has taken place.

Obituary.

EUSTACE CAREY.

Eustace Carey was born on March 12th, 1835, and was educated at University College School, London, and at the Royal School of Mines. In the year 1857, he went to Widnes as chemist in the works of Messrs. Gaskell, Deacon and Co., and in 1871 became a partner. On the formation of the United Alkali Company in 1890, in which Messrs. Gaskell, Deacon and Co. was merged, he became Secretary, retaining that position until January, 1914, when ill-health compelled him to retire. The credit of having rescued the Leblanc soda process from the danger of annihilation belongs chiefly to Eustace Carey, with the late Henry Deacon and the late Dr. Ferdinand Hürter, who introduced improved methods, especially as regards the production of chlorine and its utilisation in the manufacture of bleaching powder and liquor, and chlorates. He was one of the founders of this Society, and it was he who, at the meeting in Manchester on April 19th, 1880, proposed the appointment of a committee to consider the formation of a Society for the promotion of the application of chemical science to manufactures; he was a member of the first Publication Committee, with Ludwig Mond, John Spiller, Thomas Tyrer, G. E. Davis (Hon. General Sec.), and H. E. Roscoe (President), and continued to serve on that Committee until July, 1885. He was Hon. Northern Secretary until July, 1883, when both this office and that of Metropolitan Secretary were abolished. He was Chairman of the Liverpool Section from 1893 to 1894 and again from 1901 to 1906; he also served on the Council as an Ordinary Member from 1883 to 1885, 1886—1888, and 1900—1903, and as Vice-President from 1903—1906 and 1907—1910, being elected President in 1906. He was again elected to the Council in 1913, and remained a member until his death.

He was the author of several important and suggestive communications to this Society, including his Presidential Address on "Technical Training and Manufacturing Methods" (Birmingham), (this J., 1907, 791—797); "Some Remarks on the Working of the Employers' Liability Act, 1880" (this J., 1883, 152—153); "The Organisation and Management of a Chemical Works" (this J., 1893, 901—906); "The Invasion of the Inventor" (this J., 1894, 1024—1026); "Chemical Industries in the United States" (this J., 1905, 3); "Some Observations on the Alkali Works Regulation Bill" (this J., 1902, 214); "Exports of Heavy Chemicals" (this J., 1896, 322); "Factory and Workshops Act" (this J., 1902, 214); "Firing with Coal-dust" (this J., 1905, 369).

Mr. Carey died at his residence, Grassendale Park, Liverpool, on March 3rd.

Journal and Patent Literature.

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I.—GENERAL PLANT; MACHINERY.

Corrosion of boiler tubes. Tätigkeitsber. des Kgl. Materialprüfungsamtes zu Berlin-Lichterfelde für das Jahr 1913/14. Chem.-Zeit., 1915. 39, 71.

MANY cases of local corrosion of boiler tubes were found to be due to the liberation of oxygen bubbles from the feed water: these adhere to the walls of the tube causing oxidation, and the oxygen from fresh feed water is then liberated preferentially on the parts roughened by oxidation, thus accelerating the local corrosion.—T. C.

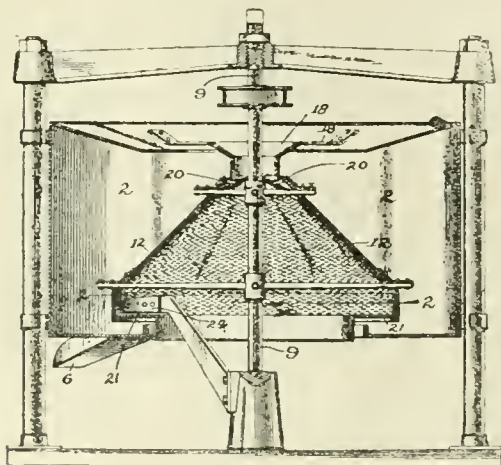
PATENTS.

Drying machines. J. McL. Cameron. London. Eng. Pat. 10,467. Nov. 3, 1913.

A VERTICAL cylindrical casing is divided into compartments by horizontal partitions having central apertures for the passage of a vertical shaft, and one or more radial apertures for the passage of the material downwards. Movable partitions, supported from and rotated by the shaft and also provided with one or more radial apertures, are arranged between the fixed partitions. Agitators are suspended from the lower side of each partition in such a way that they agitate the material during part of the rotation only. A distributing device is provided at the top of the casing and the heated air or gas is admitted at several levels.—W. H. C.

Dryer; Centrifugal—. F. B. Anderson. Assignor to C. O. and A. D. Anderson. Cleveland, Ohio. U.S. Pat. 1,122,460, Dec. 29, 1914. Date of appl., Sept. 25, 1911.

THE material to be dried is fed through the hopper, 18, and is deflected by means of the devices, 20, 20, against the inner surface of the upper part of the



perforated, conical drum, 12, which is rotated about the shaft, 9. The liquid passes through

the perforations into the casing, 2, and is discharged through the shoot, 6, and the solid matter gradually travels down the inner surface of the drum till it is stopped by the inwardly projecting flange, 21, from which it is removed by the scraper, 24.—W. H. C.

Drying apparatus; Centrifugal—. C. W. Howard, Fort Madison, Iowa. U.S. Pat. 1,123,536, Jan. 5, 1915. Date of appl., Jan. 17, 1914.

SEVERAL drying cylinders, each revolving on its own axis, are mounted upon a horizontal frame so that they can be rotated around its central axis. During part of the rotation around the axis of the frame the motion of the cylinders around their own axes is arrested to allow the solid matter to be discharged. Means are provided to fill the cylinders and to collect the separated liquid whilst they are being rotated.—W. H. C.

Dryer; Rotary—. W. E. Prindle, Manitowoc, Wis. U.S. Pat. 1,126,077, Jan. 26, 1915. Date of appl., Aug. 6, 1913.

A ROTARY drying cylinder is divided into a number of segmental compartments by radial partitions, which do not extend to the axis, thus leaving a central passage, into which the compartments open. At one end the cylinder is provided with a feeding device and connected with a furnace to supply hot gases, whilst at the other end it communicates with an expansion chamber, provided with baffles and with an outlet for the dried material and connected with a fan, which draws the hot gases through the dryer.—W. H. C.

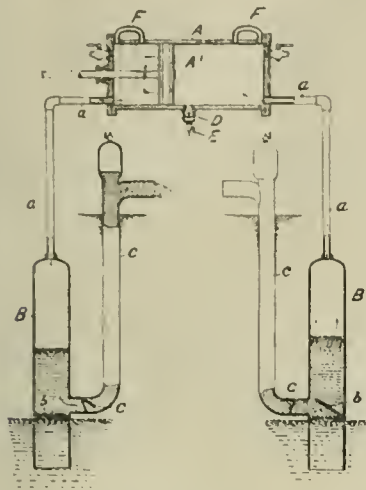
Drying machine; Automatically-acting horizontal—. T. Suzuki, Tokyo, Japan. U.S. Pat. 1,126,587, Jan. 26, 1915. Date of appl., Sept. 2, 1913.

A CYLINDRICAL drying chamber is connected with an air-supply chamber at one end and an exhaust chamber at the other. A rotary stirring member comprising a number of spaced bars, carrying scoops arranged spirally, is mounted in the drying chamber, and fingers projecting from the bars engage with a valve in the bottom of a feed hopper carried by the drying chamber, so as to cause intermittent flow of the material from the hopper into the drying chamber. The drying chamber is heated by a furnace beneath it, and air heated in a conduit passing through the furnace is led to the air supply chamber and drawn through the drying chamber by a fan in the exhaust chamber.—B. N.

Raising or forcing water and other liquids; Apparatus for—. F. O. de Hymel, M. C. Shiner, J. T. Rives, and A. L. Matlock, San Antonio, Tex., U.S.A. Eng. Pat. 23,476, Oct. 16, 1913.

THE pump consists of two chambers, B, which dip into the liquid and are provided with inlet flap-valves, b, and with non-return, delivery flap valves, c, in the rising mains, C. The chambers are connected above by pipes, a, with the opposite ends of

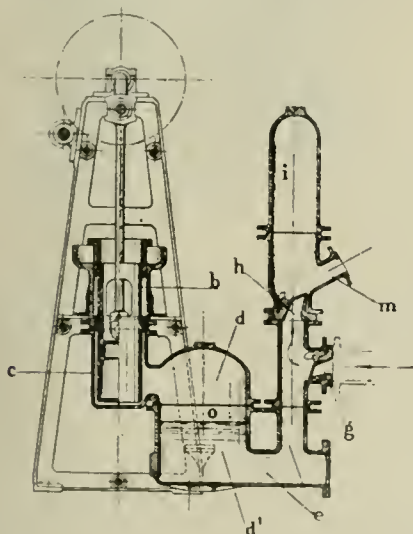
the air cylinder, A. As the piston, A', which is connected to a suitable driving mechanism, reciprocates, a vacuum is produced in one of the



chambers, B, whereby water is drawn in, whilst pressure is produced in the other chamber, forcing the water into the rising main. When the piston approaches the end of the stroke, the pressure on each side of it is equalised by the by-passes, F, F. A regulated quantity of air is allowed to enter the cylinder through the cock, E, and the valve, D, to replace loss.—W. H. C.

Pump for corrosive liquids. A. Ferraris, Turin, Italy. Eng. Pat. 4482, Feb. 20, 1914.

THE pump consists of a cylinder, c, a piston, b, an intermediate chamber, d, d', and a valve chamber, e. The cylinder and the upper part of



the intermediate chamber contain an inert liquid, e.g., vaseline oil, to serve as a medium for transmitting the action of the plunger to the corrosive liquid, which fills the valve chamber and the lower part of the intermediate chamber up to the level, o. The corrosive liquid enters through the valve, g, is forced into the air chamber, i, through the valve, h, and is discharged through the rising

main connected at m. Those parts of the pump that come in contact with the corrosive liquid are made of suitable resistant materials.—W. H. C.

Separation of solid substances from liquids; Method of and means for the centrifugal—J. Hughes, London, W. O. Travis, Hampton, Middlesex, and R. A. Sturgeon, Llangollen, N. Wales. Eng. Pat. 24,038, Oct. 23, 1913.

THE pressure produced in liquids when subjected to centrifugal force is utilised to consolidate and eject the separated solid matter. The drum of the centrifugal machine is provided with a piston, which can move axially with respect to the drum. On starting the machine the pressure of the liquid fed into the drum, causes the piston to move downwards and leave a space for the liquid. The solid matter collects on the inner side of the drum, and the liquid is discharged through openings in the cover. When sufficient solid matter has accumulated, the supply of liquid is cut off and liquid is admitted below the piston. This causes the piston to move towards the cover and compress and consolidate the solids. Finally the cover, which is normally kept closed by centrifugal weights, is lifted slightly by projections on the piston, and the solids are ejected between the upper edge of the drum and the cover. The liquid below the piston is then discharged and the process repeated. The joint between the piston and the drum is made by a split ring. The liquid admitted below the piston may be the same as that being treated, in which case the machine is double acting. In an alternative form the drum is movable axially and the piston fixed.—W. H. C.

Separators; Centrifugal—J. Bromet, F. Thorman, and H. C. Wood, Tadcaster. Eng. Pat. 1712, Jan. 22, 1914.

THE basket of the separator consists of an upper cylindrical and a lower conical portion, separated by a partition but communicating at the periphery. A helical scraper, mounted on an inner drum, and rotated on a sleeve carried on the main shaft at a different speed to the basket, serves to detach the solid matter and discharge it into the lower chamber, from which it is removed by an adjustable scraper entering through a central discharge opening.—W. H. C.

Separating heavy particles floating in a liquid or gas; Centrifugal devices for—J. H. Fedder, New York. Eng. Pat. 5621, March 5, 1914. Under Int. Conv., March 15, 1913.

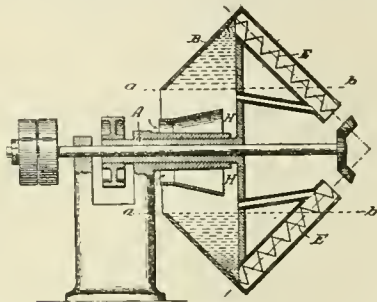
THE gas is passed longitudinally through a drum fixed within a casing. A central shaft extending through the drum and casing carries curved blades, the rotation of which imparts a centrifugal motion to the gas; the heavy suspended particles are thrown to the periphery of the drum, and pass through small openings into the outer casing.—W. H. C.

Purifying gaseous fluids by means of a centrifugal fan or centrifugal compressor; Apparatus for—Soc. d'Exploitation des Appareils Rateau, Paris. Eng. Pat. 13,930, June 9, 1914. Under Int. Conv., June 11, 1913.

THE gas is passed through a fan and, leaving with a high tangential velocity, passes through a whirling chamber into and through a turbine provided with fixed vanes and moving rotor blades, so arranged that the gas travels through the turbine in a radial direction. The rotors of the turbine are mounted on a shaft, which is independent of the fan shaft. (See also Eng. Pat. 22,131 of 1901; this J., 1902, 1322.)—W. H. C.

Separating solid substances from liquids; Centrifugal machine for—G. Jahn, Arnswalde, Germany. U.S. Pat. 1,124,907, Jan. 12, 1915. Date of appl., April 23, 1914.

THE material is fed through the aperture, *A*, into the rotating conical drum, *B*, closed at one end by a diaphragm, *H*. The separated material



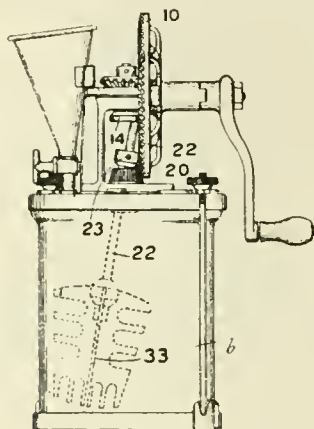
is discharged through openings at the periphery of the diaphragm into the outlet conduits, *E*. The latter are provided with conveyors and carry telescopic outlet pipes, connected, by means of rods, with a sleeve on the shaft so that they may be moved whilst the drum is rotating.—W.H.C.

Clarifier for liquids; Centrifugal—F. P. Mason, New York. U.S. Pat. 1,126,247, Jan. 26, 1915. Date of appl., April 25, 1914.

THE liquid is fed into the central tube of a rotary bowl and is forced to pass first towards the periphery, and then in the reverse direction through a number of concentric perforated cylinders, situated within and rotated with the bowl. The perforations in adjacent cylinders are staggered with respect to one another, but those of alternate cylinders are in the same radial plane. The clarified liquid is discharged from the innermost cylinder.—W. H. C.

Mixing machines. E. C. R. Marks, London. From Landers, Frary, and Clark, New Britain, Conn., U.S.A. Eng. Pat. 16,753, July 14, 1914.

THE agitator, 33, curved to suit the curved bottom of the vessel, *b*, is mounted on the shaft, 22, which is supported by the collar, 23, in the sleeve,



20, and rotated with it. The upper end of the shaft is fitted eccentrically into the disc, 14, so that as the latter is rotated the agitator is swung

round the vessel and at the same time rotated on its own axis. The collar, 20, and the disc, 14, are both rotated by the wheel, 10.—W. H. C.

Paint and the like dipping tanks; Fluid-tight joints for shafts and the like of agitators of—Wilkinson, Heywood and Clark, Ltd., F. G. Kidd, and W. McLaughlin, London. Eng. Pat. 27,111, Nov. 25, 1913.

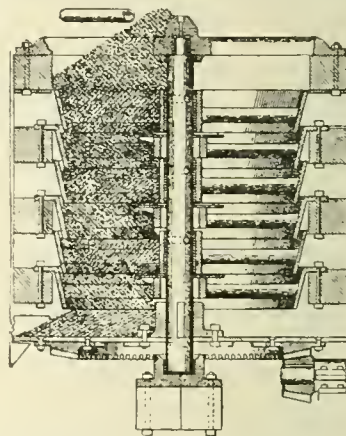
A FLANGED sleeve fitted on the agitator shaft is pressed by springs or the like against the surface of the side of the tank through which the shaft and sleeve pass, so that the flange makes a rubbing, fluid-tight joint therewith.—W. H. C.

Crushing, pulverising, or disintegrating machines. R. Emmott, Burnley. Eng. Pat. 2759, Feb. 3, 1914.

IN apparatus in which revolving beaters or hammers enter the spaces in curved grids forming the lower portion of the grinding chamber, curved grids, or plates, or bars are also provided in part of the upper portion of the chamber. These plates have rows of teeth or projections between which the beaters pass. The teeth in adjacent rows are staggered in relation to one another.—W. H. C.

Triturating device. F. K. Hoover and A. J. Mason, Chicago, Ill. U.S. Pat. 1,124,442, Jan. 12, 1915. Date of appl., June 9, 1911.

OVERLAPPING rings are supported by "spiders" one above the other, from a central shaft, and have beater arms projecting towards the shaft;



alternate rings are rotated. The material to be treated is fed into the top of the hollow space enclosed by the rings and passes downwards, to a supporting plate below, from which it is discharged by a scraper.—W. H. C.

Filter presses. C. J. Grace, Truro. Eng. Pat. 3212, Feb. 6, 1914.

SUBSIDIARY inner frames of light construction are fitted into the ordinary heavy frames and can be lifted out with the cake when the press is discharged. A current of electricity may be passed through resistance wires stretched across the subsidiary frames to dry the cake before discharge.—W. H. C.

Filtering pan. W. E. Trent, Reno, Nev. U.S. Pat. 1,125,769, Jan. 19, 1915. Date of appl., June 7, 1913.

SEVERAL pans, spaced apart and connected together, are arranged one above the other and

are all supported by hollow trunnions. Each pan contains a filter frame covered with filtering medium, and the interior of each filter frame is connected with a vacuum pump through one of the hollow trunnions. Each pan has a distributing trough and a supply pipe from a common main for supplying the material to be filtered, and also a pipe for the supply of water under pressure to wash out the solid deposit.—W. H. C.

Distilling a great quantity of a liquid in a small space: Apparatus for—. Naamlooze Venootschap Maatschappij Destillator, and H. Middelbeek, Rijswijk, Netherlands. Eng. Pat. 4685, Feb. 23, 1914.

THE liquid is sprayed from a ring-shaped perforated tube, fixed in the upper part of the distilling chamber, at such an angle that the spray strikes the wall of the vessel obliquely and is diverted into the body of liquid, leaving the central space through which the vapour rises free from spray.—W. H. C.

Evaporating apparatus. C. W. Zastrow, Wood's Hole, Mass. U.S. Pat. 1,124,096, Jan. 5, 1915. Date of appl., July 31, 1911.

AN evaporating chamber is provided with a series of perforated baffles supported on angle rings fixed to the interior of the casing. The baffles can move up and down between the limits of the angle rings, and the perforations in successive baffles form a staggered series of openings. The liquid is heated by steam passing downwards through a number of vertical coils.—W. H. C.

Evaporation; Process of—. F. B. Holmes, Woodbury, N.J., Assignor to E. I. du Pont de Nemours Powder Co., Wilmington, Del. U.S. Pat. 1,126,471, Jan. 26, 1915. Date of appl., Jan. 14, 1914.

LIQUIDS which tend to become acid during evaporation are evaporated in the presence of freshly-precipitated aluminium hydroxide.—W. P. S.

Vacuum-pan. C. P. Grimwood, New York. U.S. Pat. 1,126,757, Feb. 2, 1915. Date of appl., March 30, 1914.

THE pan is divided into compartments the sides of which are closed by hollow transverse partitions provided with superposed horizontal passages. The heating medium is supplied to the horizontal passages through valved pipes connecting them in horizontal sets.—W. H. C.

Evaporator. L. M. and McK. Jennings, Star, Va. U.S. Pat. 1,126,767, Feb. 2, 1915. Date of appl., March 12, 1914.

AN evaporating pan is provided with a scum discharge trough formed on one side between the upturned bottom of the pan and the side wall. Means are provided for producing in the liquid surface currents flowing towards the scum discharge trough.—W. H. C.

Furnaces; Process of forming and repairing the linings of—. A. Schwarz, Assignor to New York Cement Gun Co., New York. U.S. Pat. 1,125,741, Jan. 19, 1915. Date of appl., March 3, 1913.

FINELY divided refractory material is projected on to the furnace wall, which is maintained at fluxing temperature at the point where the material is being applied.—W. H. C.

Liquids; Apparatus for impregnating—*with gases* [carbon dioxide]. J. F. Wittemann, Lakewood, N.J., and R. W. Wittemann, Brooklyn, N.Y., Assignors to Amaranth Machinery and Supply Works, Inc., New York. U.S. Pat. 1,128,261, Feb. 9, 1915. Date of appl., July 13, 1911.

A carbonating vessel is provided with an inlet neck controlled by an automatically operated valve. A liquid-supply conduit leads to and surrounds the lower part of the neck, and a closed transparent chamber, connected at its lower end with the end of the liquid-supply conduit, surrounds the upper part of the neck and the valve; a vent is provided on this transparent chamber, and a gas-supply pipe extends through it into the neck.—J. F. B.

Desiccation and collection of substances in a finely-divided condition. I. S. Merrell and Merrell-Soule Co., Syracuse, N.Y., U.S.A. Eng. Pat. 4707, Feb. 24, 1914.

SEE Fr. Pat. 468,859 of 1914; this J., 1914, 1024.

IIA.—FUEL; GAS; MINERAL OILS AND WAXES.

Nitrogen in coal and coke; Nature of compounds of—. E. Terres. Chem.-Zeit., 1915, 39, 73.

GLYCOCOLL, asparagine, albumin, glue, pyridine, azobenzene, hydrazobenzene, acetonitrile, phenylisocyanate, and nitrobenzene were subjected to destructive distillation under conditions similar to those obtaining in coal distillation: only those substances containing an amino group or substituted amino group yielded ammonia, hence the substance in coal which yields ammonia on dry distillation is probably of an albuminous nature. Extracts of coal with organic solvents contained more nitrogen than the insoluble residue, but the presence of amino groups in the extracts could not be proved. Coke when treated with steam at high temperatures yielded over 89% of its nitrogen as ammonia when precautions were taken to prevent decomposition of the latter, agreeing with the assumption of Rau and Christie that the nitrogen of coke is present as a nitride of carbon.—T. C.

Nitrogen in coal; A comparison of various modifications of the Kjeldahl method with the Dumas method of determining—, with notes on errors in the Dumas method due to nitrogen evolved from the copper oxide. A. C. Fieldner and C. A. Taylor. J. Ind. Eng. Chem., 1915, 7, 106—112.

COMPARATIVE determinations were made with eight different samples (seven coals and one lignite) containing from 0.8 to 1.8% N. The highest and most concordant results were obtained by the combined Kjeldahl-Gunning method, using both mercury and potassium sulphate, as proposed by Dyer (this J., 1895, 601). The quantity of potassium sulphate should be from 7 to 15 grms. per 30 c.c. of sulphuric acid: with larger amounts losses of nitrogen may occur (compare this J., 1912, 361; 1913, 215). Mercury was more effective than copper sulphate as a catalyst, and potassium sulphate was superior to phosphorus pentoxide for raising the boiling point of the mixture. With the official (U.S.A.) Gunning method the results were 0.2—0.3% too low, even after digesting for 4 hours. In all modifications of the Kjeldahl method it was necessary to digest for about 2 hours after the mixture became

colourless to secure maximum results with coal. With the Dumas method the greatest difference in the average values was 0.1% and the mean difference was 0.05%. Errors due to nitrogen present in the copper oxide may be minimised by using "wire-form" oxide pulverised to pass a 40-mesh and be retained by a 100-mesh screen, heating it for several hours *in vacuo*, and cooling in an atmosphere of carbon dioxide.—A. S.

Firedamp testers. E. Beckmann and C. Steglich. *Chem.-Zeit.*, 1915, 39, 3—6.

A SIMPLE test for methane consists in drawing mine-air into a cylindrical container and sparking with a cerium-iron igniter; air containing from 7 to 10.3% of methane is thus ignited and the resulting rise of pressure is indicated by a gauge. A more accurate tester consists of a brass or nickel cylinder which communicates with a mercury manometer: the mine-air is drawn into the vessel by a pump and is then ignited by a platinum spiral heated to bright redness by an electric current. The carbon dioxide and water formed by the combustion of methane, etc., are absorbed by stick potassium hydroxide, which is left in the vessel for a large number of tests. When the temperature has again become normal the change in pressure is read off on the manometer. About 100 grms. of potassium hydroxide is placed in the vessel, which will then hold 140 c.c. of the air-sample. The heating current for the platinum spiral is cut off automatically after 2 minutes, and a safety device makes it impossible to pass the current while there is communication between the inside of the vessel and the outer air. As little as 0.5% of methane is plainly indicated. Various forms, portable and stationary, with and without automatic alarms, etc., are described. With 10% of methane a maximum diminution of pressure is given; 20% gives a slight positive pressure, and this attains a maximum with 40%. In doubtful cases a little pure air is admitted and the test repeated.—T. St.

Gas flames: Observations on —. Haber. *Deuts. Physik. Ges.*, July 24, 1914. *Chem.-Zeit.*, 1914, 38, 1113.

ANALYSES have shown that the composition of the gases at the tip of a flame differs from that of the gases at the edge. A separation takes place within the inner cone, the heavier constituents passing to the tip, and the lighter to the edges of the flame. This separation is not due to the current of the gases, but is a function of the flame. —C. A. M.

Benzol in gas; Determination of —. A. Krieger. *J. Gasbeleucht.*, Feb. 6, 1915, 61. *J. Gas Lighting*, 1915, 129, 450.

MOST of the methods available for determining benzol in gas are more suitable for coal gas than coke-oven gas, which contains considerably less benzol. The author has modified Müller's method of washing the gas with cooled paraffin oil, and by using an improved absorption apparatus has made the method available for coke-oven gas. The gas is passed for eight hours at the rate of about 40 litres per hour through a washing oil contained in two cylinders (50 c.c. in each), maintained at -18°C . The cylinders are 9 ins. high and 2 ins. diam., and the gas is introduced through a tube ending in a perforated hood. The outlet tube fits in a tube, similar to a test-tube, filled with glass beads and extending downwards inside the cylinder; this tube has a small hole in the bottom, and a ring of holes about $\frac{1}{2}$ in. above the bottom. The cylinder is weighed before and after the absorption, and it is claimed

that the benzol is absorbed practically quantitatively. The most suitable washing oil is one which does not yield more than 10% of distillate below 200°C , nor less than 90% below 300°C . The best tar oil for washing purposes is one which distills between 240° and 260°C . It is not necessary to use paraffin oil for the purpose, although its freedom from colour is an advantage.—E. R. A.

Benzol, alcohol, and mixtures of these liquids with petrol as fuels for internal combustion engines. W. Watson, C. W. Frost, W. C. Lloyd, F. W. Richards, W. J. Stern, H. Shaw, and J. Wilson. *Inst. Automobile Eng.*, Dec., 1914. [Separate copy.] 20 pages.

THE question of carburation, particularly when starting, and in cold weather, with fuels such as benzol, alcohol, and some of the heavier brands of petrol, is of great importance, and tests have been carried out comparable with those of petrol, the results of which have been published (*Proc. Inst. Automob. Eng.*, 7, 35).

Benzol. The benzol used was similar in character to two samples purchased at different garages, and became practically solid at -12°C .; the first indications of crystallisation occurred at -4°C . The crystals at once sink in the liquid, and risk of choking the jet of the carburettor, as well as that of impeding the flow of liquid, is incurred. Even if crystals do not separate, the viscosity of the liquid at low temperatures may be sufficiently increased to influence the supply of fuel. The viscosity of benzol increases at a greater rate than that of petrol, and in cold weather it is important to heat the jet of the carburettor, or any constriction in the fuel-supply service. A mixture of one part of petrol to three parts of benzol starts depositing at -14°C ., whilst a mixture of equal volumes of these liquids gives no deposit at -21°C . It would be advantageous always to mix 30% of petrol with benzol. The knocking produced at low engine speeds when petrol is used as fuel is not observed with benzol. This appears to be due to the fact that the critical temperature above which the charge fires in a way resembling detonation rather than inflammation, is much lower for petrol. Benzol added to petrol causes a marked increase in the critical temperature, and an engine which knocks badly with pure petrol runs quite smoothly with a mixture of equal parts of benzol and petrol. When using less than twelve parts of air to one of benzol by weight the deposit of carbon in the engine is excessive, and the efficiency is greatly impaired. If the mixture is so adjusted that practically no carbon monoxide is found in the exhaust gases, the carbon deposit is no worse than with petrol.

Alcohol. Experiments were made with ordinary methylated spirit in a jet carburettor, a larger jet being used than in the case of benzol and petrol; it was also found necessary to supply additional heat to the carburettor, which was done by passing a current through a wire wound round the pipe leading from the jet to the throttle. This was not altogether sufficient, and owing to the irregular vaporisation of the fuel, irregular exhaust gas measurements were obtained. The mean effective pressures obtained with alcohol were slightly higher than those obtained with either petrol or benzol, and increased more rapidly with the strength of the mixture than in the cases of the other fuels. When using the strongest mixture, six parts of air to one of alcohol, the mean effective pressure was still increasing with the strength of the mixture, and 6% CO was found in the exhaust gases. Obviously this means that maximum power can only be attained by appreciable loss due to incomplete combustion.

Maximum thermal efficiency, as also that at complete combustion, increases slightly from petrol

to benzol and benzol to alcohol, and the temperatures attained with the three fuels do not differ much, though those with alcohol are a little lower than the others, which may account for the slightly higher thermal efficiency obtained with alcohol. Unless the vapour tension of the fuel in the cylinder is above a certain limit it is impossible to obtain an explosive mixture. This difficulty may be easily overcome in the case of petrol, as owing to the presence of highly volatile constituents it is possible to flood the cylinder and so obtain an explosive mixture. With benzol and alcohol no such volatile bodies are present, and consequently starting difficulties are encountered in cold weather. Experiments with different liquid fuels were made in a closed vessel, and it was found that with a very volatile brand of petrol an explosive mixture could be obtained at 0° C. and a pressure of 40 lb. per sq. inch. Air saturated with benzol vapour below 1° C. at atmospheric pressure is incombustible, and at all temperatures below 20° C. air saturated with alcohol vapour is incombustible even at atmospheric pressure. These results, together with others obtained from mixtures of these liquids, are shown graphically. When used in the engine the heat generated by the compression produced by starting the engine by hand is sufficient to vaporise the fuel, except, perhaps, in the case of alcohol, or, when the fuel is already vaporised, to keep it in the form of vapour during the compression.—E. R. A.

Gas: Variation in the composition of coal — according to the conditions of manufacture. J. G. Newbigging. Presidential address to Manchester Dist. Inst. Gas Eng., Feb. 27, 1915. J. Gas Lighting, 1915, 129, 507—510.

COMPARATIVE tests of a total heat calorimeter and a Boys calorimeter, extending over some months, showed an average difference of 7 B.Th.U. in favour of the Boys calorimeter. On two occasions only were higher results obtained from the total heat calorimeter.

The value of systematic gas analysis in gas-works practice is shown in a table, giving the analyses of gas taken at the inlet to the retort house governor. With the gauge showing one-tenth inch pressure, methane varied from 31.8 to 39.4%; nitrogen, 4.7—9.4%; total non-combustibles, 8.3—12.9%; calorif. value (B.Th.U. per cb. ft.), 580—677. With the gauge level, CH₄, 23.5—27.5%; N, 16.7—25.0%; total non-combustibles, 21.4—30.3%; calorific value, 439—514. With gauge showing one-tenth inch vacuum, CH₄, 18.0—25.1%; N, 20.0—31.2%; total non-combustibles, 29.5—39.5%; calorif. value, 356—466. —E. R. A.

Natural gas found in Ontario; Chemical composition of —. G. R. Mickle, W. H. Ellis, J. W. Bain, and E. G. R. Ardagh. Reprint from 23rd Report of Bureau of Mines, Ontario, 1911. 39 pages.

As far as at present ascertained, the natural gas of Ontario is "dry," i.e., not intimately associated with oil. Samples obtained direct from wells in the principal counties, were analysed according to the recommendations of Burrell and Seibert (Bull. 42, U.S. Bureau of Mines; see this J., 1913, 1096; 1914, 808), the separation of methane from its higher homologues being effected by liquefaction, for which liquid air was employed. Analyses of 40 samples of gas from different sources gave the following results: methane, 68.3—93.7; ethane, 0 to 19; propane, 0—3.5; nitrogen, 2.8—17.0; carbon dioxide, 0—1.65; hydrogen sulphide, 0—0.8; oxygen, 0—0.3%; olefines, carbon monoxide, and hydrogen were absent in all cases. The comparative uniformity of composition shown by the gases from widely separated areas is

apparently incompatible with the idea of a local and separate origin for each field. The influence of declining pressure on composition is also discussed and the necessity for the systematic sampling of wells during the whole of their productive life is emphasised.—W. E. F. P.

Natural gas from which gasoline is condensed: Separation of the constituents in a —. G. A. Burrell and F. M. Seibert. J. Amer. Chem. Soc., 1915, 37, 392—396.

A NATURAL gas from which gasoline is condensed on a commercial scale gave the following results upon analysis by fractional distillation *in vacuo* at low temperatures (see this J., 1913, 1096; 1914, 808): methane 36.8, ethane 32.6, propane 21.1, butanes 5.8, pentanes and hexanes 5.7 vol. %.—J. R.

Gasoline vapour in air: Determination of —. G. A. Burrell and I. W. Robertson. J. Ind. Eng. Chem., 1915, 7, 112—113.

Two methods are described. In the first the mixture of gasoline vapour and air is introduced into a bulb tube containing phosphorus pentoxide to absorb any moisture, the tube is cooled by means of liquid air to condense the gasoline, the air is withdrawn by means of a vacuum pump, and the tube is then removed from the liquid air, whereupon the gasoline vaporises and may be estimated by observing its pressure. In the second method, the gasoline vapour is burned with air or oxygen, and the contraction in volume and amount of carbon dioxide produced are determined. Results calculated by dividing the volume of carbon dioxide by 5 or the contraction in volume by 4, i.e., on the assumption that the gasoline vapour consists entirely of pentane, agree with those obtained by the use of liquid air.—A. S.

Gasoline from synthetic oil. W. O. Snelling. Amer. Inst. Mining Eng., Feb., 1915. Eng. and Min. J., 1915, 99, 379.

By heating hydrocarbon material low in hydrogen (e.g. vaseline, rod wax, gas oil, fuel oil, etc.) in a closed vessel until a pressure of 800—900 lb. was attained, the material occupying between $\frac{1}{2}$ and $\frac{3}{4}$ of the space within the vessel, a more or less definite mixture of hydrocarbons, resembling crude petroleum in appearance and constitution, was obtained; the excess carbon was deposited as mud, and a residual pressure of about 150 lb., due to the formation of about 2% of "natural gas," remained in the vessel after cooling. By alternately distilling the synthetic "crude oil" produced and reconverting the residue under pressure, from 50 to 70% of the original hydrocarbon material was obtained as gasoline (about 70 B. sp. gr. 0.67), suitable for use as ordinary gasoline but having a milder and sweeter odour.—W. E. F. P.

Bitumen and other viscous substances: Determination and drying of —. E. Bornemann. Chem.-Zeit., 1914, 38, 1132.

A SMALL pulley is fitted at the lower end of a rod which passes upwards in an inclined direction through one side of an ordinary drying oven. The end of the rod inside the oven is fixed to the bottom of a crucible, which is thus supported in an inclined position. The bitumen is placed in the crucible, and when the pulley is set in motion the rotation of the crucible causes a constant exposure of fresh surfaces of the bitumen. Drying is effected first at 60° C. until most of the solvent is driven off, and then at 105° C. for about 3 hrs. The crucible is cooled in a vacuum desiccator; if a scum of bubbles forms on the surface, the sample is not free from solvent and air, and the crucible must be returned to the drying oven.—J. H. J.

Wood charcoal filter for the waste gases from [ammonium] sulphate plant. Reinhard. See VII.

Determination of sulphur in organic substances [coal, coke, etc.]. Krieger. See XXIII.

PATENTS.

Carbonaceous [fuel] wastes; Utilisation of—. J. M. W. Kitchen, East Orange, N.J. U.S. Pat. 1,127,777, Feb. 9, 1915. Date of appl., July 22, 1913.

A HARD fuel free from volatile constituents is mixed with a softer fuel containing volatile constituents and a thick bed of the mixture is introduced into a furnace. Part of the fuel is burnt under forced draught, and the products of combustion are forced through the remainder, thus producing a combustible gas. This gas, with or without the addition of enriching gas, is superheated, washed, and burnt with the correct proportion of air under pressure.—W. F. F.

Fuels of low sulphur content; Manufacture of—. A. Fingerland, A. Indra, and A. Lissner. Ger. Pat. 279,817, April 4, 1914. Addition to Ger. Pat. 270,573 (this J., 1914, 411).

NATURAL or artificial fuels of high sulphur content are heated with metals, oxides, hydroxides, or salts capable of acting as catalysts in the subsequent treatment, and are then treated cold with acids or acid liquids.—A. S.

Coke; Process of making—and recovering by-products. C. A. Weeks, Assignor to T. R. Patton and F. C. Mencke, Philadelphia, Pa. U.S. Pat. 1,127,949, Feb. 9, 1915. Date of appl., July 25, 1911.

COAL is fed into a closed oven and burnt from below upwards by a regulated supply of air. The gases are withdrawn by suction from the space above the coal, till the latter becomes heated throughout, when the upper part of the oven is opened to the air and the coking completed.—W. F. F.

Gas producers [for peat]. The International Nitrogen and Power Co., Ltd., and O. D. Lucas, London. Eng. Pat. 476, Jan. 7, 1914.

WET fuel such as peat is fed to an air-locked hopper above the producer, through an inclined tube provided with a rotating worm, and heated by hot gases from the producer passing through a concentric outer tube. Moisture is drawn off from the fuel by a pipe at a point near the hopper and delivered with a regulated supply of air to the producer hearth. Tar deposited in the outer tube is fed downwards by a rotary scraper and drawn off. In an alternative form, the feed tube is itself rotated.—W. F. F.

Coal gas and the like; Means and method of producing—. [Recovery of pitch.] W. B. Davidson, Birmingham. Eng. Pat. 9034, April 9, 1914.

THE gas is delivered by dip pipes into a hydraulic main provided with a rotating paddle or archimedean screw along the bottom, which prevents the deposition of solid pitch and agitates the mixture of tar and pitch to expose fresh surfaces to the hot gases. By the fractional distillation of the tar in this way, by the hot gases, for a given time, pitch of any desired quality can be produced in installations of vertical retorts, coke ovens, or similar plant, where the hydraulic mains are sufficiently hot. The level of liquid in the main is regulated by a hand-operated lift valve at one end.—W. F. F.

Gas; Art of generating—. W. B. Chapman, Brooklyn, N.Y., Assignor to Chapman Engineering Co., New York. U.S. Pat. 1,125,962, Jan. 26, 1915. Date of appl., Nov. 23, 1908.

THE raw fuel is contained in a closed chamber opening into the upper part of the producer chamber at one side. The producer chamber is in three sections, the upper and lower ones being rotated and the intermediate one stationary. Gases evolved from the raw fuel are withdrawn through a pipe and delivered into the stationary portion of the mass of incandescent fuel in the producer chamber.—A. S.

Water-gas from bituminous fuels; Process for increasing the yield of by-products in the manufacture of—by the intermittent process. Dellwik-Fleischer Wassergas-Ges. m. b. H. Ger. Pat. 278,512, Nov. 4, 1913. Addition to Ger. Pat. 275,221.

A MIXTURE of steam and air is introduced into the producer above the column of incandescent coke, so as to provide that excess of steam which is favourable to a high yield of by-products without materially cooling the gas-producing material. The loss of heat due to the introduction of wet, low-temperature steam is compensated by the heat produced by combustion of some of the water-gas by the air introduced with the steam. (See also Fr. Pats. 466,121 and 466,422 of 1913; this J., 1914, 585.)—A. S.

Town gas; Process for purifying and treating—. D. Koechlin, Paris. Eng. Pat. 5764, March 6, 1914.

THE lighter gases (mainly methane and hydrogen) obtained during the latter part of the distillation of coal, with or without addition of water-gas, are passed in succession through two chambers containing iron oxide at 120° C. and nickel at 300° C., and are mixed with the heavier hydrocarbons obtained in the earlier stages, which have been passed through a chamber heated to redness. The iron oxide and nickel may be heated by passing flue gases above 300° C. around the two chambers in the opposite direction to the treated gas. The nickel may be regenerated by adding 0.25 to 2% of air to the gas to be treated. (See also Fr. Pat. 466,197 of 1913; this J., 1914, 585.)—W. F. F.

Oils [petroleum]; Process of improving—. A. McD. McAfee, Bayonne, N.J. U.S. Pat. 1,127,465, Feb. 9, 1915. Date of appl., Feb. 12, 1911.

CRUDE asphaltic petroleum is heated to remove low-boiling oils and moisture, aluminium chloride is added, and the low-boiling oils thus formed are distilled off. The residue, amounting to at least 30% of the original oil, is cooled and the aluminium chloride removed.—W. F. F.

Vertical retorts; Regenerator-setting for—. S. Glover, St. Helens, and J. West, Southport. U.S. Pat. 1,127,228, Feb. 2, 1915. Date of appl., Aug. 6, 1914.

SEE Eng. Pat. 18,599 of 1913; this J., 1914, 910.

Petroleum and the like; Apparatus or boiler for the distillation of hydrocarbons such as—. T. Delort, Baicai, Roumania. Eng. Pat. 3210, Feb. 6, 1914. Under Int. Conv., Feb. 8, 1913.

SEE Fr. Pat. 469,054 of 1913; this J., 1914, 954.

Oil-retort. J. Weiser, Vienna. U.S. Pat. 1,127,951, Feb. 9, 1915. Date of appl., Oct. 6, 1911.

SEE Eng. Pat. 18,063 of 1911; this J., 1912, 864.

Complete extraction of the industrial chemical products contained in crude ammoniacal liquor. Addition to Fr. Pat. 468,535. See VII.

IIB.—DESTRUCTIVE DISTILLATION ; HEATING ; LIGHTING.

PATENTS.

Heat-producing compound. W. F. McNabb and R. S. Wile, Pittsburgh, Pa. U.S. Pat. 1,126,055, Jan. 26, 1915. Date of appl., Oct. 28, 1913.

A MIXTURE of sodium peroxide, aluminium, and an alkali carbonate.—W. F. F.

Heat-generating furnace. W. Thomas and A. E. Mainwaring, Nanaimo, B.C., Canada. U.S. Pat. 1,128,199, Feb. 9, 1915. Date of appl., July 9, 1914.

THE fuel is fed through a coking and gasifying retort into the combustion chamber. Gas is drawn off from the retort, mixed with air, and passed under pressure into hollow grate bars supporting the incandescent fuel, and carrying Bunsen injectors opening into the fuel.—W. F. F.

Exhausting vessels [incandescence lamp bulbs]; Method of —. C. J. Thatcher, Upper Nyack, N.Y. U.S. Pat. 1,124,555, Jan. 12, 1915. Date of appl., March 11, 1910.

AFTER a preliminary mechanical exhaustion, the residual gas is absorbed by a solid, non-volatile absorbent contained in the lamp bulb or in an auxiliary vessel connected with it, the absorption being hastened by heating the lamp filament to intensive incandescence and thereby ionising the particles of the residual gas.—W. H. C.

Arc-lamp electrode. A. T. Baldwin, Lakewood, Ohio, Assignor to National Carbon Co., Cleveland, Ohio. U.S. Pat. 1,127,578, Feb. 9, 1915. Date of appl., May 22, 1913.

THE electrode contains carbon and a product obtained by fusing together cerium oxide, 3 parts, zirconium oxide, 2 parts, and tungstic oxide, 1 part.—W. F. F.

Arc lamp electrode. Ver. Chem. Fabr. Landau, Kreidl, Heller und Co. Ger. Pat. 278,731, Jan. 29, 1913.

ALKALI or alkaline-earth compounds of zirconium oxide or titanium oxide or of acids of high melting point are used, preferably in the colloidal condition, in the manufacture of mineralised arc lamp electrodes, the proportion of alkali or alkaline-earth or of acid, in all cases, being below that corresponding to a normal salt. In the case of mixtures with low content of alkali or alkaline-earth, small quantities of a compound of hydrofluoric acid are also added. The compounds mentioned may be prepared by the partial decomposition of alkali or alkaline-earth zirconates or titanates with water or acids to remove part of the base, or by the partial removal of silicic acid from silicates or of acids of high melting point from their compounds.—A. S.

III.—TAR AND TAR PRODUCTS.

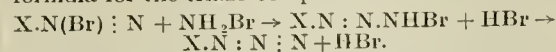
Bromination of aromatic amines. W. Fuchs. (Chem.-Zeit., 1915, 39, 73.

BROMINATION of monosubstituted anilines is best carried out using glacial acetic acid as solvent.

The bromine atoms always enter the ring in the *p*- and in the two *o*-positions to the amino group unless one of the latter is already occupied, so that the directing influence of the amino group is stronger than that of any other group.—T. C.

Azotisation by chloroamine. M. O. Forster. Chem. Soc. Trans., 1915, 107, 260—267.

AN aqueous solution of chloroamine, prepared by adding ammonia to sodium hypochlorite solution, reacts with the diazonium group, transforming it into the triazo-nucleus, phenyl-diazonium chloride for example yielding phenylazoimide. This suggests that the formation of phenylazoimide from benzenediazonium perbromide by the action of ammonia occurs through the intermediate agency of bromoamine, and that the perbromide is not a hydrazine derivative as maintained by Chattaway (this J., 1915, 174), but a true perhaloid. Further it supports the $-N:N:N$ formula for the triazo-complex.



Chloroamine will also react with the isonitroso-group, diazocamphor being produced, for example, from isonitrosocamphor in 70% yield, and with ammonia and certain ammonia derivatives such as piperidine, hydrazines are formed, probably according to the equation, $H_2N.OH + H_2NCl = H_2O + HCl + H_4N.N \rightarrow H_2N.NH_2$.—G. F. M.

PATENTS.

Tar distillation products; Process for obtaining low-boiling —. M. Melamid and L. Grötzinger. Ger. Pat. 278,192, Aug. 21, 1913. Addition to Ger. Pat. 264,811.

TAR, tar oil, or the like is treated with phosphoric acid in a state of fine subdivision, the mixture being heated and vigorously agitated. (See also Eng. Pats. 9856 of 1912 and 5484 of 1913, Fr. Pat. 443,650 and Additions thereto and Ger. Pat. 276,765; this J., 1912, 977; 1913, 415, 820, 861, 1000; 1915, 22.)—A. S.

Oxidation of organic compounds; Preparation of the products of —. K. Hofmann. Ger. Pat. 277,733, Jan. 31, 1913.

OXIDATION is effected by the action of nitrates or chlorates, or mixtures of these, in presence of magnesium salts, at a high temperature. In this way it is possible to prepare cheaply and simply anthraquinone from anthracene, oxalates from sawdust, Aniline Black from aniline, etc. (See also this J., 1914, 742.)—A. S.

Aminobenzothiazolcarboxylic acids or their acidyl derivatives; Preparation of —. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 277,395, May 9, 1913.

ACIDYL-DERIVATIVES of aminothiazoles of the benzene series, containing at least one methyl group in the benzene nucleus, are oxidised with permanganate in neutral or alkaline solution, and if desired, the acidyl group is removed from the products. The acidylaminobenzothiazolcarboxylic acids thus obtained are useful for the preparation of dyestuffs. They are pale yellow substances, which cannot be diazotised; their alkali salts are soluble in water.—A. S.

Isatin- α -aryldides, their homologues, or derivatives substituted in the nucleus. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 277,396, Sept. 4, 1913.

HYDROCYANOCARBODIARYLIMINES of the benzene series are treated with anhydrous aluminium

chloride in the presence of inert solvents or diluents. (See also Eng. Pat. 30,072 of 1913; this J., 1914, 246.)—A. S.

2-Hydroxynaphthalene-6-sulphonic acid: Preparation of derivatives of—, Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 278,091, Feb. 18, 1913. Addition to Ger. Pat. 276,331 (see Fr. Pat. 466,236; this J., 1914, 637).

THE sulpho-chloride of 2-hydroxynaphthalene-1-carboxylic acid is condensed with ammonia, amines, phenols, aminophenols, aminohydroxynaphthalenes, or their carboxylic or sulphonic acids or other derivatives or substitution products, and the carboxyl group is removed from the condensation products. This can be done very readily in the case of the condensation product from 2-hydroxynaphthalene-1-carboxy-6-sulphochloride, e.g., by warming in aqueous solution or suspension or by combining with diazo compounds.

—A. S.

Anthraquinone derivatives containing sulphur: Preparation of—, Farb. vorm. Meister, Lucius, und Brünig. Ger. Pat. 277,439, Oct. 27, 1912.

ANTHRAQUINONYLMERCAPTANS or anthraquinonyl disulphides are treated with halogens, with exclusion of water. The products, which may be used for the preparation of dyestuffs, combine with alcohols to form ester-like compounds, which on saponification yield sulphenic acids containing the S.OH group. With phenols they form hydroxyarylanthraquinonyl sulphides, and with aromatic hydrocarbons, in presence of aluminium chloride, they yield arylanthraquinonyl sulphides.

—A. S.

IV.—COLOURING MATTERS AND DYES.

Myrica rubra: The colouring principle of—, Its azo-, sulphide-, and nitro-dyestuffs. S. Satow. J. Ind. Eng. Chem., 1915, 7, 113—115.

THE bark of *M. rubra* has been used from ancient times in Japan for dyeing yellow and black. There are two varieties: that bearing the larger fruit yields more colouring matter of stronger tinctorial power than the other. The colouring matter, when isolated and purified by treatment with lead acetate and recrystallisation from acetone, agreed in composition, $C_{15}H_{10}O_8 \cdot H_2O$, and in most of its properties with the myricetin of Perkin (this J., 1895, 458; 1896, 662). The black produced by myricetin on iron mordant resists practically all tests; the orange brown colour on chrome mordant stands next to the black in regard to fastness. The single-bath method of dyeing gives the best results, especially with tin (orange yellow), alumina (yellow), and chrome mordants. By using myricetin as a component, several orange to brown azo dyes were prepared, and a new method of batik dyeing was devised. The cloth is dipped in an alcoholic solution of myricetin, dried without washing, coated on both sides with a mixture of resin and Japan wax, and the cold coating cracked by hand, after which the material is dipped in a diazo solution to develop the colour. After cracking the coating, the fabric may be immersed in dilute alcohol for a few seconds and then dipped in the diazo solution, whereupon several shades of colour are produced, according to the degree to which the coating has been dissolved by the alcohol. By fusing myricetin with sodium polysulphide solution, a sulphide dyestuff, dyeing cotton directly a deep sepia colour, was obtained, whilst by adding copper

sulphate to the mixture before heating, a product of greater tinctorial power and giving a bluish brown shade was produced. A dyestuff giving yellowish brown tints on animal fibres in an acid bath was obtained by fusing myricetin with sulphur, whilst by nitrating sulphonated myricetin a dyestuff giving bright yellow shades on animal fibres was produced.—A. S.

"Tree moss": Colouring matter of—, A. Edge. J. Soc. Dyers and Col., 1915, 31, 74—75.

THE shade produced with "tree moss" is brown, similar to that obtained from "dye-crotches" (generally of the genus *Parmelia*), but the colouring matter exhibits differences from the ordinary dye lichens. The "tree moss" used was *Usnea hirta*, from old fir trees in South Wales: it is not so rich in colouring matter as *Parmelia*; four times as much is necessary to give an equal depth, but the colour is extracted and fixed on the wool almost as quickly as an ordinary acid colour. The bright yellow shade obtained after 20 minutes becomes orange brown on continued boiling. The yellow colour possesses an excellent resistance to scouring and milling, and a very fair fastness to alkalis and to light. Pleasing shades of brown and fawn are obtained by treatment with metallic salts, but it does not appear suitable for dyeing on mordants. Lichens, such as the one under consideration, do not appear to give purple shades with ammonia. With the exception of turmeric, which is much inferior in fastness to alkalis, "tree moss" is the only natural direct-dyeing yellow known.—F. W. A.

Flavone group: Addition of auxochromes in the—, A. G. Perkin and E. R. Watson. Chem. Soc. Trans., 1915, 107, 198—209.

SINCE attempts to introduce an additional hydroxyl group into the quercetin molecule failed (this J., 1914, 305), similar experiments were carried out with luteolin and morin. Luteolin tetraethyl ether yielded only a tetranitro-derivative, but its monobromo-derivative gave on nitration bromo-6'-nitroluteolin tetraethyl ether. This was reduced to the amino-compound, diazotised, and boiled with water, yielding the hydroxy compound, but the conversion of the latter into hydroxyluteolin by means of hydriodic acid did not proceed smoothly and a perfectly pure product was not obtained. The impure hydroxyluteolin formed yellow needles, no deeper in shade than luteolin itself. Aminomorin was also prepared from nitromorin pentamethyl ether, but, like amino-quercetin, it could not be converted into the hydroxy-derivative, and the additional auxochrome did not produce any deepening in colour. The multiplication of auxochromes appears to widen the principal absorption band, but when this occurs, as in the above cases, at the violet end of the spectrum, it has very little effect on the visible colour.—G. F. M.

Pentahydroxyflavone: Preparation of a—, G. Bargellini and L. Monti. Gaz. Chim. Ital., 1915, 45, 1, 64—69.

THE synthesis of 1.3.3'.1'.5'-pentahydroxyflavone was effected by Kostanecki's method (this J., 1902, 36, 1130), 2.4.6-trimethoxyacetophenone being condensed with the methyl ester of trimethylgallic acid in presence of sodium to give 2.4.6.3'.1'.5'-hexamethoxybenzoylacetophenone, which was heated with hydriodic acid, whereby the methyl groups were removed, and the resulting hexahydroxybenzoylacetophenone, reacting in its enolic form, lost 1 mol. of water and was converted into the desired pentahydroxyflavone. Attempts to hydrogenate this in presence of palladium black

and under slight pressure, to obtain the corresponding flavanone, proved unsuccessful, although chalcones, which contain the group, $\text{CO}:\text{CH}:\text{C}$, in the form of an open chain, are readily converted into hydrochalcones in this way. 1,3,3',4',5'-Pentahydroxyflavone is a yellow substance insoluble or sparingly soluble in the ordinary solvents. The crystals separated by adding water to an alcoholic solution contain water of crystallisation which is lost at 110°C . The anhydrous compound begins to decompose above 270°C . It dissolves in caustic soda with an orange red and in concentrated sulphuric acid with a yellow colour.

—A. S.

Scutellarein; *Constitution and synthesis of* —. G. Bargellini. *Gaz. Chim. Ital.*, 1915, **45**, I., 69—79.

SCUTELLAREIN, $\text{C}_{15}\text{H}_{10}\text{O}_6$, is formed together with glucuronic acid by the hydrolysis, with 30–40% sulphuric acid, of scutellarin, $\text{C}_{21}\text{H}_{18}\text{O}_{12}$, a glucoside-like substance found in *Scutellaria altissima* and other species of *Scutellaria*, *Galeopsis*, and *Teucrium*. The author has found that natural scutellarein is identical with a tetrahydroxyflavone synthesised from 2,3,4,6-tetramethoxyacetophenone and methyl anisate by Kostanecki's method (this J., 1902, **36**, 1130; see also preceding abstract). This proves that scutellarein must be either 1,3,4,4'- or 1,2,3,4'-tetrahydroxyflavone, in agreement with the alternative formulae suggested by Goldschmiedt and Zerner (*Monatsh. Chem.*, 1910, **31**, 439).—A. S.

Chlorophyll; *Action of light on* —. H. Wager. *Proc. Linnæan Soc. Pharm. J.*, 1915, **94**, 317—318.

CHLOROPHYLL, either as a film on glass or on paper, or in solution in petroleum spirit, or in dried leaves, or layers of *Euglena* or algae, as well as in the living leaf, is bleached when exposed to strong sunlight, an aldehyde and a substance which liberates iodine from potassium iodide being formed. The aldehyde is apparently not formaldehyde and the oxidising agent is not hydrogen peroxide. When chlorophyll is exposed to sunlight behind coloured filters, the formation of aldehyde and oxidising substance is more pronounced in the red than in the blue or green for the same exposure. This photo-decomposition takes place only in presence of oxygen, and carbon dioxide need not necessarily be present. The yellow pigment of chlorophyll is much more rapidly bleached than the green pigment. These reactions are not due to the chlorophyll pigments only, other substances being present, associated especially with carotin and xanthophyll, upon which the activity of the chlorophyll partly depends.—T. C.

Anthocyan; *Later researches on* —. P. Q. Keegan. *Chem. News*, 1915, **111**, 87—88. (See also this J., 1914, **18**, 1199.)

The view that anthocyan is not produced from a special chromogen but formed complete *in situ* is held to be incorrect, as in numerous cases the tannins of the plant by suitable treatment assume a tint in solution similar to that of the petals in the natural condition. Plants producing phloroglucinol-tannins yield original reds, those producing caffeotannin original blues only, and those producing gallotannin display vivid violets or purplish blues. The colour of yellow flowers is due to carotin or its diffused oxidation product, xanthophyll, and very rarely to a flavone. White flowers frequently enclose a very dilute solution of anthocyan, but the lack of colour is due chiefly to the circumstance that the nitrogen needed by

the reproductive organs has been fully supplied from sources other than the inflorescence.

—G. F. M.

Amino-azo compounds; *Structure of* —. E. C. C. Baly and R. E. V. Hampson. *Chem. Soc. Trans.*, 1915, **107**, 248—255.

THE azoid and quinonoid formulae put forward by Hantzsch (*Ber.*, 1909, **32**, 2129) and Hewitt (*Chem. Soc. Trans.*, 1910, **97**, 511) to account for the various colours of aminoazobenzene hydrochloride, its ammonium salt, and its solutions in concentrated sulphuric acid, do not account for all the facts, notably that merely 1% of hydrochloric acid or sulphuric acid brings about a colour change with both aminoazobenzene and its trimethylammonium salt. The authors prefer an explanation based upon Baly's molecular force field theory, the compounds having their closed field of force opened up by the action of the solvent, with the result that other light waves are absorbed, or in other words, a latent vibration period characteristic of the substance itself, and not of any hypothetical structural isomeride, is rendered active by the particular solvent employed.—G. F. M.

British manufacture of dyestuffs.

IN a letter published in the "Morning Post" of March 1st, Prof. H. E. ARMSTRONG says that he considers the situation almost hopeless, owing to the lamentable ignorance of our public men of matters scientific. Mr. Runciman has flouted English chemists. Thus, in his speech in Parliament he said, "When I think of the way in which some of our chemists have been literally bought up by foreign concerns, I am surprised that anyone should say that we have not an adequate supply of chemical knowledge." We have a right to demand the public withdrawal of that expression. If the production of dyes is to be taken in hand seriously and the foundation laid of a permanent industry, men must be chosen to manage the enterprise who are as able as was the late Dr. H. Caro, who played so great a part in the development of the Badische Anilin Company, or as his successor Professor Bernthsen is, or as is Professor Duisberg, who has brought the Bayer Company to its present proud position and now dominates the whole industry. We have in our ranks one or more men of their type who would be immediately available. But apparently the advisers of the Government want subordinate intellects, not leaders. If we had been serious, if we had been organised, we should have mobilised our chemical forces months ago to make dyes; the dozen really competent organic chemists in the country would have been picked out and their students enrolled under them as workmen. Meanwhile the situation is so serious that licences are being granted, it is said, to trade with the enemy in dyes. Our decadence comes from the fact that we have had no public use for science in our country and that we are blind both as to our needs and as to our opportunities. Our lack of courage and initiative is deplorable, and our individuality a serious hindrance. Our state of inefficiency is symptomatic of the state of the country. Government is in the hands of amateurs for the most part; only the special services are in expert hands, but their work is largely interfered with by an uninformed official class. And when we recognise that our Civil Service needs improvement, the Commission appointed to consider the question has only one representative of science among its members; the Royal Society, however, makes no protest. The worst feature in the Government attitude is that it will prevent the foundation of works—other than that to be established now under State

control—which in due season might compare favourably with the monumental factories in Germany; their scheme may help to tide over the immediate difficulty, but it is foredoomed to fail eventually, and our plight will then be worse than ever.

SIR WILLIAM RAMSAY, in a letter printed in the "Times" of March 10th, says that "British Dyes, Ltd." is foredoomed to failure for at least two reasons. First, it is not under the management of chemists. Scientific chemists *must* form an important part of the directorate. [He then proceeds to mention a number of chemical and metallurgical industries which owe their success largely to the fact that they were in the hands of competent chemists.] Unless "British Dyes, Ltd." copies this precedent, there is little hope for it. Second.—No "protection" from foreign competition will save the situation. The only measure is the total exclusion of German dyes. Even yet we are blind to methods of German commerce. German manufacturers, backed by the whole power of the German State (if at the end of the war there is a German State), will undersell our producers of dyestuffs, secure the whole market, and thus establish a monopoly. That has been their policy in the past; it will be their policy in the future. Let us be warned in time. There is ample chemical talent in this country, both scientific and technical. Every chemist is anxious to serve his country. What is needed is to call together a council of chemists, ask for their collaboration in investigation and for their advice. Also it should be announced that it is intended to exclude absolutely the importation of all German dyes, and capital will flow in. Any other policy is shortsighted. The German chemical industry is worked as a huge trust, backed by the whole power of the German State. The French and the Russians are seriously considering this policy of exclusion; and if Britain still permits imports, this will be the dumping-ground of all Germany's chemical products, until, competition being strangled, we shall have to pay exorbitantly for all manufactured articles imported.

In a letter published in the "Times" of the same date, Sir HENRY ROSCOE says that it is novelties that pay in all industries, especially in those dependent on fashion. For a new shade, or tint, or style, any price can be obtained. It is not the manufacture of the well-known colours which will bring financial and final success to the new English colour company. The preparation of these articles is on well-known lines. It is the new thing which makes a business success. Such things can only be accomplished by the research chemist, and yet, so far at least, this man is to have no voice in the direction of affairs in the new colour company, but merely to be called in as an expert when, in the opinion of his business superiors, he can help them to solve some difficulty. The Germans acted upon this confidence in the researcher from the beginning, and gave him a voice in the management. This is a pure matter of business. British chemists have preached the same doctrine for 30 years without much success. Now the crisis has come. Are we still to continue upon the old lines? Are we too proud to take a leaf—a golden leaf—out of the enemy's book? If we fail to do so, success is improbable, if not impossible. In the colour industry it is then the research chemist, and he alone, who can keep the flag flying, for he alone can bring forward new forces and create new developments. Capital cannot do it, business capacity cannot do it, but the brains, the imagination, the skill, and the knowledge of the research chemist can. We have the money and we have the men, but these must

be put into their right places to do their work efficiently.

Replying to a question in the House of Commons on March 8th, Mr. RUNCIMAN said that the new company invited applications for shares from users of dyes and colours and from others willing to assist in providing a supply thereof. In the case of the latter class of subscribers the question of taking dyes from the company did not arise, and no special class of stock was contemplated. No hard-and-fast rule was contemplated with regard to the scale of subscription which would entitle a participant to a supply of dyes. Cases in which firms dependent on a supply of dyes were *bona fide* unable to subscribe more than a limited amount of capital would be sympathetically dealt with on their merits.

In the House of Commons on March 11th, Mr. H. BOOTH called attention to the prospectus of "British Dyes, Ltd.," advertised in the "Times" of March 6th. This scheme was the illegitimate offspring of a Free Trade Government. Disappointed shareholders and complaining employees would arraign them for it later. The prospectus was vague and misleading to a degree. There was to be no compulsory sinking fund. That was simply an invitation to slack finance. The Government's money was to be confined to debentures. No company promoter had ever had the audacity to propose that before. This was not a prospectus at all. It simply indicated what—in its own phraseology—"may emerge in time and if circumstances justify." The committee to advise on new issues, he was told, had refused their consent to this issue. Had the Treasury or the Government overridden the committee?

Mr. PENNEFATHER said that the prospectus should have contained information as to the capital of Read Holliday and Sons and as to the salary to be paid to Mr. Holliday and Mr. Turner. He submitted a calculation from which he concluded that the company would be in financial stress from the moment it went to allotment.

Sir F. CAWLEY said that so far as he could gather, the only supporters of the scheme belonged to the Board of Trade. The Government ought not to use public money to force people in. If the scheme were successful, the Company would be a combine with all the worst features of an American trust. As regards the grant for research, the Government had no right to give public money to one company for its own profit.

Sir P. MAGNUS complained that the grant for research should be left entirely to a board of directors none of whom possessed scientific attainments. He saw no chance of the scheme retaining the industry in our own hands, or re-capturing it from German manufacturers. As soon as the war was over, the German companies would dump down their dyes in this country, and it would be impossible for the British company to compete on equal terms with their German rivals in the price at which they could be sold.

Sir ARTHUR MARKHAM said the Germans would smash this company unless the Government went on spending money for the scheme, and in a few years the Germans would still continue to monopolise the trade. The £100,000 for research work was wholly inadequate. All the money the country was now finding would be lost upon nothing but a wild-cat scheme.

Mr. HEWINS said the prospectus was an outrageous document to come from any public department of the country. He believed the potentialities of the country were sufficient to get out of the difficulty in regard to dyes if the manufacturers and chemists had been taken into consultation by the Government.

Mr. J. M. ROBERTSON (Parliamentary Secretary to the Board of Trade) said that Sir Algernon Firth had expressed the opinion that the option could be sold to-morrow at a profit. It had been said that there was no security that the firm would remain British, but no better security had been suggested. It had also been objected that there were no scientific men on the board of directors. He agreed that there was some force in the argument, but there was also force in the argument on the other side. He knew of many chemical concerns which had been ruined by having highly-gifted scientific men on their boards. When such men were on the boards the position of the other directors was often a difficult one. He did not think it was the function of the Board of Trade to attempt to decide such an issue as that. They first of all consulted the Council of Dye Users as to the general course of the scheme, and it was the Dye Users who practically selected the directors. The view was in favour of not putting chemical experts on the board on an equality with the other directors, but the Board, he believed, were still at liberty to reconsider the decision and to co-opt scientific men to the board. The Committee to advise the Treasury on new issues made no recommendation in this case on the ground that, as the policy of the new company had already been decided upon by the Government, it did not come within their scope. If the Government had adopted the plan of making the dyes themselves he was sure they would have been attacked for doing so. The payment of bounties on dyes would have offered no security for the production of the particular dyes needed. It had been stated that no one wanted the scheme, but to that the reply was that it had been introduced in consequence of the urgent demands of many persons interested in the industry. The scheme provided full supply of colours on the largest basis and to the largest number of units. He could not accept the prediction that the moment the war was over Germany would be able to renew the supply of dyes and that the trade would be conducted just as it had been before the outbreak of war. There was in Germany a school which had long recognised that to supply goods at "dumping" prices was to make a present to the purchasers, and if that school were in power the policy of refusing any dyes to this country might be adopted. To prohibit the importation of dyes from any foreign source would be utterly impracticable, and to prohibit importation from Germany alone would result simply in German producers setting up their works in Switzerland and sending supplies thence. It was impossible to pledge a future Parliament to prohibit the importation of dyes in time of peace. The objections which had been urged to the Government's scheme were mutually destructive, and the scheme was the only practicable plan which was before the country.

It is announced that the number of applicants for shares in British Dyes, Ltd., was 880, and the amount applied for £571,000, of which £83,000 was applied for conditionally: the directors did not feel justified in proceeding to allotment on such a subscription, and accordingly a meeting of subscribers was held at Manchester on March 24th to consider the position. There it was stated that, in round figures, £100,000 had been offered, excluding conditional subscriptions and those for which the board did not propose to allot. After some discussion, it was unanimously resolved to proceed with the company, the directors to consider the advisability of dropping the agreement with users. At the conclusion of the meeting, several of those present announced their intention of increasing the amount of their subscriptions.

Dyestuff manufacture in Russia. Board of Trade J., March 11, 1915.

A SYNDICATE has been organised for the purpose of forming a Russian company to establish works for the manufacture of dyes and chemical products from native raw material, and a large amount of capital has already been promised or subscribed. Some of the largest industrial concerns, especially around Moscow, are interested in the proposed undertaking, and such firms as the N. N. Konshin Co., the Danilov Manufacturing Co., the Tubner Company, the Tversk Manufacturing Co., and the Emil Zundel Manufacturing Co., are included in the syndicate. The plans are on a comprehensive scale, and will provide, *inter alia*, for the erection of special laboratories, under the direction of properly qualified professors and assistants, for experimenting with raw material.

PATENTS.

Triarylmethane dyestuffs; Preparation of —.
Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 278,423, June 24, 1913.

THE ethanol derivatives of aromatic amines are condensed with aromatic aldehydes, and the resulting leuco compounds are oxidised or successively sulphonated and oxidised or oxidised and sulphonated. The products are yellower or greener and are faster to light both on the fibre and in the form of lakes than the corresponding dyestuffs from alkylated aromatic amines.—A. S.

Anthraquinone dyestuffs; Manufacture of —.
Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 278,424, Jan. 7, 1913. Addition to Ger. Pat. 238,980 (this J., 1911, 1373).

1,1'-DIANTHRAQUINONYL-2,2'-BISARYL ketones or their derivatives are treated with condensing agents having a reducing action.—A. S.

Vol dyestuffs of the anthraquinone series; Manufacture of —. Kalle und Co. A.-G. Ger. Pat. 278,425, Sept. 29, 1912.

THE azo dyestuffs from diazotised α -aminoanthraquinone and a diamine of the benzene series, are condensed with aldehydes, *e.g.*, benzaldehyde, to form monoaminotriazines, and the amino-group is then replaced by a hydrogen or other atom. The dyestuffs dye purer shades than the aminotriazines from which they are obtained.—A. S.

Monoazo dyestuffs; Preparation of mordant-dyeing —. Anilinfarben- u. Extrakt-Fabr. vorm. J. R. Geigy. Ger. Pat. 278,613, Nov. 11, 1913.

THE azo dyestuffs prepared from diazotised *o*-chloro-*m*-aminobenzoic acid and salicylic or cresotinic acids are heated to a high temperature with alkaline substances, whereby the chlorine atom in the ortho position to the carboxyl group is replaced by hydroxyl. The shades produced on wool dyed in an acid bath and treated with chromium compounds are deeper than those produced by the original dyestuffs, and are fast to light, potting, and fulling. Some of the dyestuffs may be used in calico printing in the form of their chromium lakes.—A. S.

Vat [anthracene] dyestuffs; Manufacture of —.
M. Kardos. Ger. Pat. 278,660, June 29, 1913. Addition to Ger. Pat. 275,220.

THE N-substituted derivatives of anthracene-1,9-dicarboxylic acid imine or its halogen substitution products are fused with alkali and the dyestuffs isolated as described in the chief patent (see this J., 1914, 827). The new products differ in shade

from those described previously. The dyestuff from anthracene-1,9-dicarboxylic acid methylimine, for example, produces considerably bluer tints than the dyestuffs described in the chief patent.

—A. S.

Selenofluoresceins; Manufacture of —. C. Jäger G. m. b. H., and R. W. Carl. Ger. Pat. 279,549, May 18, 1913.

FLUORESCIN or a halogen derivative thereof is treated with selenium in alkaline solution. Good yields of selenium derivatives analogous to the thiofluoresceins (see this J., 1900, 1006) are obtained. The products appear to be of little value as dyestuffs, but should prove useful for therapeutic purposes.—A. S.

Azo dyestuffs. M. Herzberg, Leverkusen, Germany, Assignor to Synthetic Patents Co., New York. U.S. Pat. 1,126,466, Jan. 26, 1915. Date of appl., Feb. 25, 1914.

SEE Eng. Pat. 10,380 of 1913; this J., 1914, 545.

Azo dyes. H. Jordan and W. Neelmeier, Leverkusen, Germany, Assignor to Synthetic Patents Co., New York. U.S. Pat. 1,127,261, Feb. 2, 1915. Date of appl., Aug. 28, 1913.

SEE Addition of Oct. 2, 1913, to Fr. Pat. 457,840 of 1913; this J., 1914, 414.

Preparation of the products of oxidation of organic compounds. Ger. Pat. 277,733. See 111.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Oxycellulose. W. D. Bancroft and R. H. Currie, jun. J. Phys. Chem., 1915, 19, 159—168.

OXYCELLULOSE is always the same product in a qualitative sense, whether prepared by the action of nitric acid, permanganate, chloric acid, bleaching powder, or bleaching powder and air. The authors have not succeeded in converting the whole of the cellulose into oxycellulose in a single operation, and it is doubtful whether pure oxycellulose has ever been prepared. Oxycellulose is partially soluble in dilute alkali hydroxides, with a yellow colour on heating; the residue is simply unoxidised cellulose in varying proportions. The dissolved substance is precipitated by alcohol or acid and after dialysis it is readily soluble in water. This soluble substance is regarded as the true oxycellulose and may be a homogeneous substance. The distinction made by Nastjukoff (this J., 1901, 573) between α -, β -, and γ -oxycelluloses does not exist. So-called α -oxycellulose is unattacked cellulose, more or less contaminated with products of decomposition; β - (alkali-soluble) and γ - (water-soluble) oxycelluloses are the same substance in different states of aggregation. The cupric-reducing property of oxycellulose is probably not characteristic and may be due to the presence of other decomposition products: this property readily disappears on prolonged heating without any essential change in the other characteristics of the oxycellulose.—J. F. B.

Viscose; Determination of the "ripeness" of —. V. Hottenroth. Chem.-Zeit., 1915, 39, 119—121.

THE xanthogenic ester of cellulose, in solution as viscose, undergoes dissociation or hydrolysis on storage, with ultimate reversion to cellulose. The progress of this reaction is termed "ripening" and is usually measured by differential titrations

with iodine after the addition of hydrochloric acid to one portion and of acetic acid to another. The difference represents the alkali combined as xanthate in the compound, XO.CS.SNa , and is proportional to the degree of esterification at any given stage. Since the determination of this factor in works' practice is not of the simplest order, and since the industrial importance of "ripeness" relates almost solely to the speed of coagulation of the viscose, the author has devised a rapid method of titration based on direct coagulation with 5% acetic acid or preferably with 10% ammonium chloride or sulphate solution: 20 grms. of the viscose is diluted with 30 c.c. of water and titrated with 10% ammonium chloride at a standard temperature until coagulation takes place. The method is entirely empirical and the best proportions of water and viscose may be selected according to the alkalinity of the viscose, percentage of cellulose, and saline by-products. The ammonium salt is preferable to acetic acid as the coagulating agent, being less affected by small accidental variations in the amount of caustic alkali present. Similarly, the interpretation of the titration results must also be founded on empirical observations to determine the optimum condition of "ripeness" for practical working.—J. F. B.

Celluloid; Influence of the addition of zinc oxide on the quality of —. H. Nishida. Caout. et Guttapercha, 1915, 12, 8576—8577, 8592—8593.

A COMPARISON was made of various physical properties and of the stability of a pure, transparent celluloid, consisting of a mixture of nitro-cellulose prepared from bleached rags, with 30% of camphor "A" (Japanese Govt.'s designation)—with those of mixtures, in proportions varying from 0.5 to 15%, of zinc oxide and the same celluloid. Before measurement, the samples were all dried until they contained the same quantity of volatile substances. It was found that the cubical contraction of the samples during drying diminished as the percentage of zinc oxide increased; that the equation connecting the density of the two components with that of the mixture, was that of a straight line; that the tensile strength and the modulus of elasticity fell—the latter very rapidly—with an increase in the content of zinc oxide; that the hardness of a mixture containing 15% ZnO was only half that of the pure celluloid; that the stability, as measured by the Abel heat test, was reduced by the addition of zinc oxide, although the temperature of decomposition was not affected materially; and that the specific electrical resistance fell from 122.5 in the case of the pure celluloid to 28.3 in the case of the mixture containing 15% ZnO .—E. W. L.

Sulphate- and sulphite-cellulose waste lyes; Investigations on the utilisation of —. E. L. Rimman. Ver. Zellstoff- u. Papierchem., Dec. 5, 1914. Chem.-Zeit., 1915, 39, 99.

OF the methods developed by the author, that for the recovery of soda from the waste lyes of the sulphate process, based on a modification of the ammonia-soda process, with production of acetates, formates, acetone, and oils as by-products (this J., 1912, 183), has not proved suitable on the large scale. The alternative method is more practicable. The dilute alkaline black-lyes are treated with recovered soda ash equivalent to the quantity of Na_2O present in them, and the mixture is causticised with lime. The filtrate is concentrated to 40° B. (sp. gr. 1.383) and treated with slaked lime in the proportion of 3—4 mols., also calculated on the original Na_2O . The mass is then submitted to destructive distillation in presence of a sufficient quantity of steam, which

if the process be conducted in tunnel kilns with continuous operation, is supplied by the moisture in the mass. The combustible gases produced are utilised for heating the kilns, while 100—125 kilos. of acetone spirit per ton of cellulose, as well as light and heavy oils, are collected; the residue consists of sodium carbonate, lime, and charcoal. The method devised for the treatment of waste sulphite lyes is based on the fact that when the lye is treated first at a low temperature and subsequently at 175°—180° C. with a sufficient quantity of lime, calcium sulphite is precipitated and the organic matters are transformed into the same condition as that in which they exist in soda-cellulose lyes, and are susceptible to analogous treatment. The crude lye is neutralised and concentrated, then boiled with lime, and the precipitate of calcium sulphite and humic substances removed. The calcium sulphite is used for the preparation of fresh bisulphite lye by lixiviation with aqueous sulphurous acid. The alkaline filtrate is concentrated to 40° B. (sp. gr. 1.383), mixed with 1.5 mol. of milk of lime and submitted to destructive distillation. From 5 cb. m. of sulphite lye (=1 ton of cellulose) there are obtained: 125 kilos. of calcium sulphite, 250 of humic substances, 16.5 of acetone spirit, 15 of light oils, and 10 of heavy oils. If sawdust be added when boiling the lye with lime, filtration is considerably facilitated and the yield of distillation products increased.—J. F. B.

Sulphite-cellulose waste lyes; Utilisation of—, especially for the manufacture of alcohol. H. B. Landmark. Chem.-Zeit., 1915, 39, 98—99.

ONE cb. m. of sulphite waste lye requires 11—13 kilos. of CaO for complete neutralisation; it is therefore more economical to expel most of the sulphur dioxide by aeration in a trickling-tower. In Norway the lye is evaporated partially before neutralisation and only 2—3 kilos. of CaO is then required. The yeast is first cultivated in a malt mash to which sulphite lye is subsequently added in increasing quantities. After 5—6 days the yeast can be used for pitching the main body of lye. The addition of a little milk or whey is very favourable to the fermentation, and a product known as "lignocasein" is then obtained, consisting of a yellow powder containing 65% of casein, which can be used as a size. The liquid containing the sugars is evaporated at 50° C. to a syrup and fermented at 26°—28° C. with waste brewery yeast; the yield is about 88 litres of spirit per ton of cellulose, at a cost of 8.5 oere (about 1.1d.) per litre of absolute alcohol. Fermentation lasts for 4—5 days. The spent wash is evaporated for the production of "cell-pitch" for use as a fuel or binding agent for briquettes; the calorific value of the cell-pitch from one ton of waste lyes is equivalent to that of 372 kilos. of carbon. The author prefers the fermentation process to Strehlenert's method (this J., 1913, 652) which is attended by certain engineering difficulties, but the lignin from the spent wash may be submitted to destructive distillation. The alcohol from sulphite lyes is suitable for all industrial purposes, including generation of motive power; Simonsen has recently proposed a petroleum distillate as a denaturing agent, which increases the calorific value of the spirit by 300 cal.—J. F. B.

Paper mill effluents; Purification of—. G. B. Kershaw. Paper Making, 1915, 34, 50—54.

THE average volume of water consumed in paper mills is estimated at 50,000 galls. per ton of paper made, but with fine white papers it may be as much as 200,000 galls. Whenever possible, the alkaline liquors from the digesters are evaporated for the recovery of the soda, but in cases where

a certain amount of dilute spent lye has to be disposed of, it should be stored and allowed to mix uniformly and gradually with the other waste waters from the mill. Suspended solids are deposited in large settling tanks, sometimes with the assistance of added chemicals, such as "aluminoferric." The solids in solution, apart from those in the digester lyes, are generally small in quantity and unobjectionable; if the effluent from the settling tanks contain not more than 5—7 parts of suspended matter per 100,000, the purification may be considered satisfactory. Sometimes the waste waters are strained through fine material in addition to the tank treatment. The disposal of the sludge is a great difficulty on account of the large quantities produced and the difficulty of drying. Occasionally the sludge is pressed, but generally it is allowed to dry in well-drained lagoons, since it is not of a noxious nature. The question of utilising portions of the waste solid matters depends on the design of the drainage system, so that the waste waters containing useful fibres can be treated separately from the general wastes. In many mills large quantities of lime and calcium carbonate sludge are produced, which have a certain agricultural value but are difficult to handle in the moist state.—J. F. B.

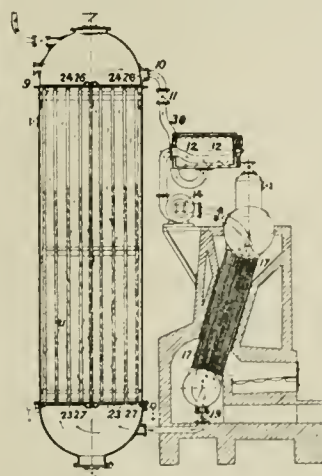
PATENTS.

Warps; Apparatus adapted for drying—. W. Yates, and Matthews and Yates, Ltd., Swinton, Lancs. Eng. Pat. 3747, Feb. 13, 1914.

THE warp is led through a casing in approximately parallel vertical courses, and hot air is directed transversely upon it from perforated horizontal pipes in the intermediate spaces. A fan withdraws air from the warp inlet or outlet side of the casing, and forces it through a heater back to the drying chamber. Vertical steam pipes may also be placed within the casing to heat the entering air, and exercise a drying effect by radiation upon the warp.—B. N.

Digester for the soda-, sulphate-, and sulphite-cellulose processes; Vertical—. H. A. Knopf. Ger. Pat. 275,035, July 5, 1913.

THE digester consists of a tall, upright vessel provided with upper and lower pairs of hinged



and then up through the tubes, 21. With the upright form of digester, it is possible to use vessels of up to 500 cb. m. capacity and to obtain by the soda process, pulp of a lighter colour than sulphite pulp.—A. S.

Wool scouring and like liquors; Concentration of — and the recovery of grease and alkaline substances therefrom. E. V. Chambers, T. C. Hammond, and G. G. Jarman, Huddersfield. Eng. Pat. 13,005, May 27, 1914.

THE liquor is heated to about 200° F. (93° C.), and then subjected to centrifugal action to separate grease and sand. The clear liquor obtained is used repeatedly for scouring until, through accumulation of alkali salts, it is concentrated to a density unsuitable for scouring purposes. It may then be further concentrated by means of washed flue gases, and the salts recovered by incineration.—B. N.

Basl fibre such as flax or hemp; Preparing — for spinning. B. S. Summers, Port Huron, Mich., Assignor to Summers Linen Co. U.S. Pat. 1,127,311, Feb. 2, 1915. Date of appl., June 12, 1911.

THE fibres are prepared and retted by treatment with an alkali and a solution of a nitrogenous animal product, such as decomposed casein.—B. N.

Wood-pulp boilers with indirect heating; Process for removing the deposit which forms on the heating surface of —. E. Morterud. Ger. Pat. 278,827, Aug. 13, 1913.

AFTER emptying the boiler, steam and cold water are passed successively through the heating tubes, whereby the deposit is first dried and rendered brittle, and then, when suddenly cooled, cracks and breaks away.—A. S.

Lignocelluloses, such as wood, mechanical wood pulp, straw, or the like; Treatment of —. C. Melhardt. Ger. Pat. 279,102, May 16, 1913.

THE material is subjected to a "natural bleach" or lixiviated with lime water to remove the non-resinous constituents of the incrusting substances and then the resinous constituents are removed by treatment with alkali. A considerably smaller quantity of alkali is required to remove the resin if the non-resinous constituents be removed first as described.—A. S.

Wood; Bleaching of —. A. Franck-Philipson, Jackson, Mich., U.S.A. Eng. Pat. 3467, Feb. 10, 1914. Under Int. Conv., Feb. 17, 1913.

SEE U.S. Pat. 1,068,580 of 1913; this J., 1913, 978.

Formic esters used as solvents of cellulose compounds; Recovery of —. J. Duclaux, Paris. U.S. Pat. 1,127,871, Feb. 9, 1915. Date of appl., Jan. 31, 1913.

SEE Fr. Pat. 439,721 of 1912; this J., 1912, 714.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Dyeing; Theory of —. V. W. D. Bancroft. J. Phys. Chem., 1915, 19, 145—158.

THE fastness to washing of the various dyestuffs on the fibre depends on the completeness with which the dye-bath is exhausted. If the bath has been exhausted completely, the dyed fabric will not bleed in any liquid having a weaker solvent action than the exhausted bath. If the bath is not to be exhausted completely, the goods must be removed when the shade is that which would be in equilibrium with an exhausted bath, or else the bath must be arranged so that it has a high stripping power and will only dye to the shade which is

in equilibrium with boiling water. The adsorption of dyestuff is not always greater at higher temperatures, and the main object in heating the bath is to coagulate or agglomerate the dyestuff in the fibre, thereby making it less soluble; the steaming of mordant-dyed goods has a similar effect upon the colour-lake. If a mordant is precipitated too rapidly it will be deposited largely on the outside of the fibre and the dyed goods will not be fast to rubbing and soaping. Certain colour-lakes may change their physical condition with time and become friable and less strongly adsorbed by the fibre than when freshly dyed. As regards fastness to light, only light which is absorbed can produce chemical action, and the fading depends on the readiness with which the substance reacts or on the presence of suitable depolarisers. As a rule, dyestuffs combined with mordants are faster than the same dyestuffs used alone. Many dyes are faster to light when combined with iron, chromium, or copper mordants than with aluminium or tin; this may be due to the absorption of certain rays by the coloured mordants, as, for instance, in the case of the protective action of copper mordant with blue substantive dyestuffs on cotton.

—J. F. B.

Coppered blues; Fastness of direct —. A. Edge. J. Soc. Dyers and Col., 1915, 31, 75—76.

IN addition to increasing the fastness to light, the "coppering" of direct blues gives a marked improvement in the resistance to neutral soaping. The fastness to light of "coppered" blues is generally decreased by washing with soap and soda, a notable exception being Benzoazurin G, which becomes redder but loses little, if any, of its fastness to light. This is due to the fact that this dyestuff forms a copper lake much less susceptible to alkali than that of any of the other blues suitable for after-treatment with copper salts. The injurious effect of an oleine finish on "coppered" blues is obviated if dextrin is present; a pattern finished with a solution containing 10 parts of dextrin and 5 parts of oleine per 100 was found to be considerably faster than the unfinished shade.

—F. W. A.

Dyeing and bleaching of some commercial fibres. S. G. Bailey. J. Soc. Dyers and Col., 1915, 31, 46—50.

BAHIA fibre is the most important brushmaking material, the cheaper African bass coming next. The former is used in its natural brown colour, and African bass is dyed to imitate it. Acid dyestuffs have no affinity for this fibre, easy levelling basic and direct dyestuffs being used. The fibre, tied in bundles, is packed in a tank to hold 6 cwt., 3 lb. of a basic dye being used and in addition 3 lb. of ferrous sulphate, which deepens the shade and makes it faster to rubbing. The bath is boiled for four to five hours. When direct dyestuffs are used, the ferrous sulphate is replaced by sodium carbonate. Direct dyestuffs are not taken up completely from the baths and standing baths are therefore used. Bassine fibre is resistant to dyestuffs. It is dyed only with basic dyestuffs, and usually to the shade of African bass, for which it is a cheaper substitute. It is also dyed black with logwood, but the dearer basic blacks give a better shade. No heat is used in drying. Mexican fibre is usually dyed black with direct or basic dyestuffs. It has no affinity for acid blacks, though other acid colours can be dyed. Direct colours are dyed with soda in a standing bath. The fibre is taken from the dye-tank without washing and dried over warm pipes. Bright shades are often dyed and these necessitate bleaching, which is carried out by boiling with 5% of oxalic acid and a trace of acetic acid.

Acid dyestuffs are used in a sulphuric acid bath. Coconut fibre or coir is dyed in all shades. For brushes it is dyed black with basic dyestuffs, for which, however, it has a poor affinity. For mat making various shades are obtained with acid dyestuffs, by dyeing for a very short period in a bath containing 8 oz. of sodium sulphate and 8 oz. of alum per 10 galls. of liquor; standing baths are used. For heavy shades basic and substantive dyestuffs are mostly used. Kitool fibre is always dyed black, using a basic dyestuff, as it has no affinity for acid or substantive colours. It is used chiefly in Germany and mainly for making brushes for turbines and big guns. For the latter purpose it is not dyed but is treated with mineral oil, which gives it a jet black colour after a few hours' immersion. Esparto grass, when used in brush-making, for which it has little value, is dyed brown with basic dyestuffs and mixed with African bass. Horsehair is bleached by means of peroxide and sulphur stoving, and dyed with acid dyestuffs.—J. B.

Indigo vat: Theory of dyeing with the —. M. H. Marbe. Rev. Gén. Mat. Col., 1914, 18, 263—272.

EXAMINATION of the physico-chemical properties of the indigo vat by means of dialysis, the ultra-microscope, and electrolysis, indicates that the calcium and sodium salts of indigo-white exist in the vat partly ionised and partly in the colloidal state. The ionisation is increased by diminishing the concentration and by raising the temperature. The proportion in the colloidal state increases with the concentration and diminishes with rise of temperature. All other conditions being equal, the calcium salt of indigo-white is ionised to a greater extent than the sodium salt. Dyeing trials showed that on cotton indigo is less fast than on wool, the dyeings on linen being faster than either. A portion of the indigo fixed on cotton is faster than the remainder, and it is concluded that this faster portion comes from the ionised indigo-white salt. The remainder, being deposited mechanically from the colloidal portion of the indigo-white salt, is less intimately associated with the fibre and therefore less fast. The mechanism of the dyeing process is elucidated with the aid of Perrin's theory of the precipitation of colloids. The dissociated portion of the indigo vat gives an inorganic ion of positive charge and of low molecular weight, and an organic ion of high molecular weight. The smaller inorganic ion approaches the surface of the fibre more quickly and gives it a positive charge. The fibre thus charged attracts the organic ion and the dyestuff is thereby fixed. The fact that the inorganic ion in the calcium salt of indigo-white is bivalent, and therefore more strongly charged, explains why a lime vat dyes better than a sodium vat. The retarding effect of an excess of sodium or calcium hydroxide in the vat is in agreement with this explanation, the hydroxyl ions thus introduced having a stronger negative charge than the positive charge of the sodium or calcium ions, so that the fibre is charged negatively and repels the negatively charged dyestuff ion. The author gives a lengthy historical review of previous work on the subject.—J. B.

PATENTS.

[Sulphide] dyestuffs; Application of —. E. Lodge and J. M. Evans, Huddersfield. Eng. Pat. 19,473, Sept. 5, 1914.

ANIMAL fibres (including furs and feathers), union goods, and artificial silk, are dyed with sulphide dyestuffs reduced by an alkali sulphide in the presence of an alkali sulphite and a neutral ammonium salt.—B. N.

Dyeing furs, hairs, feathers, and the like; Process for —. Act.-Ges. f. Anilinfabr. Ger. Pat. 277,496, Oct. 21, 1913.

THE material, mordanted or not, is dyed with a solution containing 3-aminocarbazole or a derivative thereof and an oxidising agent. Grey shades are produced.—A. S.

Oxidation-colours on vegetable or animal fibres; Production of fast —. Farb. vorm. Meister, Lucius, und Brüning. Ger. Pat. 277,310, March 29, 1913.

THE material is prepared with an oxidising agent, printed by the machines used in lithographic or typographic printing with a paste composed of "varnish" and bases of the benzene, naphthalene, or diphenylamine series which are readily oxidised to dyestuffs, and the colour then developed by steaming.—A. S.

[Azo] dyestuffs on the fibre; Process of producing — by means of the one-bath method. F. Kunert and E. Acker, Offenbach. Assignors to Chem. Fabr. Griesheim-Elektron, Frankfurt, Germany. U.S. Pat. 1,127,027, Feb. 2, 1915. Date of appl., Apr. 17, 1914.

SEE Fr. Pat. 471,123 of 1914; this J., 1915, 174.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Nitric acid; The boiling point of aqueous solutions of — at different pressures. Part I. H. J. M. Creighton and J. H. Githens. J. Franklin Inst., 1915, 179, 161—169.

THE boiling points of mixtures of chemically pure 99.79% nitric acid and water were determined at atmospheric, 360 mm., 250 mm., and 110 mm. pressure. Isobaric curves showing the change in the boiling point with variation in the composition are given; they are approximately parallel, and their shape is that characteristic of mixtures exhibiting a maximum boiling point. The boiling point of the pure acid was found to be 82.5° C. at 675 mm., and the highest boiling point was obtained with a mixture containing 69.24% HNO₃ (121.8° C. at 760 mm.). Determinations were also made of the boiling point and composition of the mixture of maximum boiling point at 760, 360, and 110 mm. pressure, 500 c.c. of mixtures with 60 to 80% of nitric acid being distilled until only 15 to 20 c.c. remained, and the acid content of the residue determined with standard barium hydroxide. The results confirmed the evidence given by the earlier experiments that the composition of the mixtures of maximum boiling point changes but slightly with the pressure. The mean results obtained, in good agreement with those recorded by Roscoe (J. Chem. Soc., 1861, 13, 146), were:—at 760 mm., 66.18% HNO₃, b.pt. 121.70° C.; at 360 mm., 67.15% HNO₃, b. pt. 99.9° C.; at 110 mm., 66.80% HNO₃, b.pt. 74.2° C.—T. St.

Sulphurous acid; Volumetric determination of free —. A. Sander. Chem.-Zeit., 1914, 38, 1057—1058.

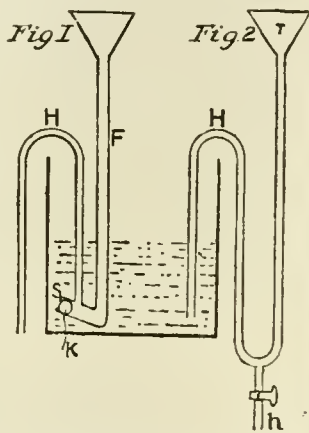
IN sulphurous acid solutions which contain other substances capable of absorbing iodine, the former may be titrated with sodium hydroxide solution using methyl orange as indicator; phenolphthalein cannot be used (see also this J., 1914, 615; 1915, 225). The sulphuric acid resulting from the oxidation of sulphurous acid by hydrogen peroxide may also be titrated in the same manner. When sodium bisulphite is treated with mercuric chloride before titration, 1 mol. of SO₂ requires 2 mols. of

NaOH, as the hydrochloric acid, liberated according to the equation: $\text{NaHSO}_3 + \text{HgCl}_2 = \text{NaSO}_3 + \text{HgCl} + \text{HCl}$, is also titrated. For the determination of sulphurous acid in the presence of sulphuric acid, the author prefers a method described previously by himself (this J., 1914, 442).—W. P. S.

Acid siphons. W. Szigeti. Chem.-Zeit., 1915, 39, 122.

Two patterns of acid-siphons constructed entirely of metal (lead or aluminium) are illustrated. Both are started by pouring some of the acid into the funnel at the top.

In Fig. 1 the vertical charging tube, F, is of larger bore than the siphon proper and is bent at an angle at the bottom terminating in a hole, S, constricted to the size of the siphon tube. II. When liquid is poured quickly into the funnel, a larger quantity passes down the tube, F, than can flow through the hole, S, and the excess rises in the tube. H, starting the siphon. A glass ball may be placed in the short branch to act as a check-valve in the hole, S, during starting, falling back again when the siphon starts. Fig. 2 shows a pattern constructed of aluminium for nitric acid, with a tap, h, for intermittent use without recharging.—J. F. B.



Lactic acid; Analysis of —. T. A. Faust. J. Amer. Leather Chem. Assoc., 1915, 10, 73—78.

TOTAL free acid is satisfactorily determined by titrating the diluted acid with $N/10$ or $N/5$ alkali, using phenolphthalein as indicator. Lactones and anhydrides are estimated by adding excess of alkali, heating on the water bath for 10 or 15 minutes, and titrating back with acid; the additional alkali used corresponds to lactones, etc. The methods at present used for the determination of volatile acid do not give concordant results. When the amount present is not more than 3%, it may be determined with sufficient accuracy by a single distillation, and titration of the distillate. With higher contents of volatile acid, Small's method should be used, 100 c.c. of the diluted acid being distilled to 10 c.c., the residue made up to 100 c.c. and again distilled as before, the two distillates combined, diluted to 200 c.c., distilled, and the final distillate titrated.—F. C. T.

Carbonic acid; Reduction of — [to formic acid]. G. Bredig and S. R. Carter. Chem.-Zeit., 1915, 39, 72—73.

CONSIDERABLE amounts of free formic acid are obtained by the action of hydrogen and palladium-black under pressure on carbon dioxide in presence of water, whilst formic acid is decomposed catalytically into carbon dioxide and hydrogen. The determination of the equilibrium between these reactions between 30° and 90° C. gave no indication of the formation of formaldehyde as an intermediate product, so that it is unlikely that the formation of formaldehyde is a stage in the assimilation of carbonic acid in nature.—T. C.

Boric acid; Determination of small quantities of —. G. Halphen. Ann. Falsif., 1915, 8, 1—2.

A MODIFICATION of Bertrand and Agulhon's method (this J., 1914, 105). The boric acid is separated as methyl borate, which is received in 0.2 c.c. of $N/1$ sodium hydroxide solution; the alkaline solution is evaporated to dryness in a small test-tube and the residue dissolved in 1 c.c. of water and 2 c.c. of hydrochloric acid (sp. gr. 1.162). Comparison solutions are prepared at the same time, containing definite, successively increasing quantities of boric acid. To each of the tubes is added 1 c.c. of a solution of turmeric in ethyl acetate, and the red colorations which develop are compared after the lapse of 50 minutes.—W. P. S.

Boric acid method [for determining ammonia]; Further applications of the —. [Determination of the purity of lithium carbonate and basic magnesium carbonate.] L. W. Winkler. Z. angew. Chem., 1915, 28, 48.

THE method previously described (see this J., 1915, 79) may also be applied to the direct determination of aliphatic amines such as methylamine and trimethylamine, and to ascertaining the degree of purity of pharmaceutical preparations of lithium carbonate and basic magnesium carbonate: 0.1220 gm. of lithium carbonate, dried at 160°—180° C., is added to a mixture of 1 gm. of boric acid and 10 c.c. of water, carbon dioxide is boiled off, and the cooled solution titrated with $N/10$ hydrochloric acid, using methyl orange (1:1000) as indicator. A burette reading of 33.03 c.c. corresponds to 100% Li_2CO_3 , while in mixtures of lithium and sodium carbonates every diminution of 0.1 c.c. corresponds to a content of 1.0% Na_2CO_3 . In the case of basic magnesium carbonate, 0.1 gm. is treated similarly with 2 grms. of boric acid and 20 c.c. of water. In determining the alkalinity of natural waters containing much carbonic acid, a very sharp end-point is obtained by boiling the water (100 c.c.) for a few minutes with pure boric acid (1 to 2 grms.) and titrating the cold liquid with $N/10$ hydrochloric acid, using methyl orange (2 drops only) as indicator. Cold solutions of atropine and codeine in aqueous boric acid likewise give sharp end-points, but other alkaloids, e.g. quinine, cannot be determined in this way.—J. R.

Ammonia; Heat of formation and specific heat of —. F. Haber. Deuts. Physik. Ges., Nov. 6, 1914. Chem.-Zeit., 1915, 39, 24.

THE heat of formation and specific heat of ammonia were determined with the following results:—

Heat of formation.			Specific heat.		
°C.	calculated.	found.	°C.	calculated.	found.
0	10,950	10,950	209	10.2	10.3
466	12,840	12,670	422	11.0	11.0
503	12,940	12,700	523	11.86	11.8
554	13,063	12,900			
659	13,255	13,150			

—J. R.

Wood charcoal filter for the waste gases from [ammonium] sulphate plant. Reinhard. J. Gasbeleucht., Feb. 6, 1915. J. Gas Lighting, 1915, 129, 456—457.

THE waste gases from the manufacture of ammonium sulphate from gas liquor, etc., can be rendered innocuous before their discharge into the air, by passing them through coolers, thence through iron oxide purifiers, and finally through iron pipes packed with wood charcoal. The last-named device is substituted for combustion which

has hitherto been demanded by the Government Factory Department of Saxony.—E. R. A.

Bromides; Detection of—in the presence of thiocyanates, cyanides, and ferrocyanides. L. J. Curtman and A. G. Wikoff. J. Amer. Chem. Soc., 1915, 37, 298—301.

THIOCYANATES, cyanides, and ferrocyanides interfere with the test for bromide even when excess of chlorine-water is employed. The neutral or slightly acid (with sulphuric acid) solution (containing, e.g., 500 mgrms. of any one of the above radicals) is heated just to boiling with saturated sulphur dioxide solution (15 c.c.), and treated while hot with 2-N copper sulphate solution, which is run in until the supernatant liquid becomes blue. A greenish liquid in the presence of thiocyanate indicates insufficient addition of sulphur dioxide. The hot filtered solution and washings are concentrated to 5—10 c.c. in a conical flask, washed into a test-tube, and shaken with 1 c.c. of 3-N sulphuric acid and 1 c.c. of 1% potassium permanganate; 0.5 c.c. of carbon bisulphide is then added and the mixture again shaken: a yellow colour in the carbon bisulphide layer indicates presence of bromide. Quantities of 2 mgrms. of bromine were thus detected in the presence of 500 mgrms. of the pure or mixed interfering radicals. The range of the above interference was estimated for each radical.—J. R.

Water, potassium iodide, and iodine; A study of the system—at zero degrees. G. Jones and M. L. Hartmann. J. Amer. Chem. Soc., 1915, 37, 241—258.

THE solubility of iodine in pure water at 0° C. was found to be 0.0006383 grm.-mol. per litre: this value includes 3.2×10^{-6} mols. in the form HI , I' , and I'' , leaving 0.0006380 mol. of I_2 dissolved per litre. At 25° C. there is apparently a very slight tendency (equivalent to about 0.04 volt) for oxygen to be liberated from the solution. The hydrolysis constant of iodine in water at 0° C. is given as 9×10^{-15} . The iodine was titrated according to the method of Washburn (J. Amer. Chem. Soc., 1908, 30, 31), with 0.15-N and 0.007-N solutions of sodium arsenite containing large amounts of monosodium and disodium phosphates, the weaker solution being used towards the end of the titration. When a very faint yellow tint was reached the solution was shaken violently with 5 c.c. of pure benzene, and the arsenite solution added drop by drop until the pink colour of the benzene layer disappeared on shaking. Data are given for the solubility at 0° C. of iodine in aqueous solutions of potassium iodide of strengths between $N/10$ and $N/1000$, also for the conductivity of the solutions before and after saturation with iodine. The figures obtained for solubility were (approximately) $N/10$, 1.2%; $N/20$, 0.6; $N/50$, 0.25; $N/100$, 0.14; $N/1000$, 0.03% by weight.—J. R.

Fluorspar; Cause of the phosphorescence of—R. Formals. Chem.-Zeit., 1914, 38, 1111.

THE phosphorescence of certain varieties of fluorspar is probably due to the oxidation of traces of finely divided arsenic sulphide. Ignited fluorspar does not show the phenomenon. The addition of a trace of arsenic sulphide to powdered felspar causes phosphorescence on heating.

—C. A. M.

Strontium sulphate; Solubility of—in solutions of calcium salts. M. Raffo and G. Rossi. Gaz. Chim. Ital., 1915, 45, I., 45—50.

A MIXTURE of strontium nitrate and calcium nitrate solutions was treated with a solution containing the quantity of calcium sulphate required theoretically to convert the strontium into sulphate; after standing for 24 hours, the mixture

was heated at 60° C. for 15 mins., allowed to cool slowly, and the precipitated strontium sulphate collected and weighed. The quantity of strontium in solution was then calculated and also the total quantity of calcium nitrate, including that from the decomposition of the strontium nitrate. According to this method, a 0.5% solution of calcium nitrate dissolved 0.048 grm. of strontium sulphate per 100 c.c.; a 1% solution dissolved 0.062 grm.; 2%, 0.108 grm.; 3%, 0.128 grm.; 4%, 0.149 grm.; 5%, 0.170 grm.; and 6%, 0.196 grm. of strontium sulphate per 100 c.c. Calcium salts appear to have no effect on the solubility of barium sulphate.—A. S.

Nickel and cobalt with cyanogen; Complex ions of—G. Rossi. Gaz. Chim. Ital., 1915, 45, I., 6—10.

THE results of determinations of the electrical conductivity of solutions of nickel and cobalt chlorides to which increasing quantities of potassium cyanide were added, indicate that the double salts formed in the respective cases are $\text{K}_2\text{Ni}(\text{CN})_4$ and $\text{K}_2\text{Co}(\text{CN})_6$.—A. S.

Silicate liquids; Crystallisation in—N. L. Bowen. Amer. J. Sci., 1915, 39, 175—191.

EXPERIMENTS were made to determine whether crystals sink in a fluid rock magma. A crucible containing an artificial mixture having the composition of a pyroxene, viz., diopside 56, and MgSiO_3 44%, was held in an electric furnace at 1430° C. for a definite period, and then suddenly cooled. Small olivine crystals separated and increased in number towards the bottom of the crucible as the duration of heating was increased, while the upper part of the chilled melt consisted of a clear glass. Definite sinking of pyroxene crystals was also observed in mixtures of greater viscosity, containing an excess of silica over the pyroxene composition. In mixtures containing a still larger proportion of silica, the rising of specifically light crystals was shown by the accumulation of tridymite crystals in the top layer of liquid. Convection currents apparently do not affect materially the sinking of the crystals; hence from the rate of sinking a rough estimate of the viscosity of the fluid mixture can be made; the viscosity increases with the silica content. The application of the experimental results to the problem of the variations in the composition of igneous rocks is discussed.—W. C. H.

Rare-earth compounds; Contribution to the photochemistry of—A. Benrath. Chem.-Zeit., 1915, 39, 25.

COMPOUNDS of numerous rare-earth elements, when associated with oxalic acid, hydroxy-acids, or alcohols, are reduced in presence of light. Thallic bromide is reduced progressively to TlBr_3 , TlBr , TlBr_2 , 3TlBr , TlBr , and Tl ; thallic chloride is converted successively to thallium sesquichloride, thallic chloride, and thallium; ceric salts oxidise even benzoic acid and fatty acids; derivatives of titanous acid are reduced to titanous and titanous salts. Similarly, oxalic acid in presence of light liberates free tellurium, selenium, and sulphur, respectively, from solutions of telluric, tellurous, selenic, selenous, and sulphurous acids. Molybdates and tungstates react more feebly than chromates. Iridium ammonium chloride is reduced to iridous chloride.—J. R.

Radium; New methods of extraction of—from uranium minerals. E. Ebler and W. Bender. Z. angew. Chem., 1915, 28, 25—40, 41—48.

A FULL review of the sources of radium and the methods applied in its extraction is given. Radium minerals always contain uranium and frequently vanadium and thorium. Joachimsthal pitchblende is practically free from thorium, and the

radium prepared from it consequently contains no mesothorium. The amount of pitchblende obtained from Joachimsthal varies from 10 to 20 metric tons per annum, corresponding to 1.7 to 3.5 grms. of radium. The cost of high-grade blende (50% U) is about M. 100 per kilo. (about £2 5s. per lb.). Pure carnotite (potassium uranyl vanadate) contains from 52% to 57% U, but the richest commercial ores contain only 6–7% U, and specimens are worked which contain as little as 0.5% U. The ratio Ra : U is practically constant, and, as in the case of pitchblende, amounts to about $3.33 \times 10^{-7} : 1$. In 1913 the United States produced 1941 metric tons of carnotite, corresponding to about 11 grms. of radium. The ore is difficult to work owing to the small radium content and the large proportion of silicates present. The ratio Ra : Ba is only one-tenth of the value which holds for pitchblende. A similar material, containing about 1.9% U, is worked at Olary, South Australia. Autunite, $\text{Ca}(\text{UO}_2)_2(\text{PO}_4)_2 \cdot 8\text{H}_2\text{O}$, is usually associated with uranocircite and chalkolith (torbernite), in which the Ca is replaced by Ba and Cu respectively. These minerals occur as incrustations upon certain granitic rocks, especially in Portugal and Russian Turkestan, and thus are often referred to in English literature as Portuguese and Russian carnotites; they contain practically no thorium or lead, and the Portuguese specimens are free from vanadium. The radium content amounts only to 21–70% of the amount required by the Ra : U equilibrium. The high specific gravity (3.0–3.6) facilitates mechanical concentration; so that samples containing only 2–3% U, corresponding to 10 mgrms. Ra per metric ton, may be successfully worked. The ash of culm, a bituminous coal occurring notably in Sweden, contains about 5.5 mgrms. Ra per metric ton and has been mentioned as a possible source of radium, as has also the mineral ampingabeit, which occurs in Madagascar. The extraction of radium from well sediments is dismissed as impracticable. Whenever possible the radium is concentrated by mechanical means, and in all cases is eventually obtained as insoluble sulphate. "Crude sulphate" is a technical term applied to a comparatively pure mixture of barium and radium sulphates with small amounts of silica, etc. Pitchblende was originally worked for uranium by fusion with caustic alkali and an oxidising agent and extraction with sulphuric acid. Curie and Debierne (see this J., 1903, 1363) concentrated the radium in the residue by extracting lead, alumina, silica, etc., through consecutive treatments with boiling sodium hydroxide solution, water, and hydrochloric acid. The residue was boiled with excess of strong sodium carbonate solution and the resulting carbonate converted to "crude sulphate" by solution in hydrochloric acid and precipitation with sulphuric acid. The whole operation occupied about 6 months, the treatment with sodium carbonate alone requiring from 4 to 6 weeks. About 20% of the radium was eventually obtained as pure radium salt and a further 56% in the form of radium-barium mixtures. Marckwald (Ber., 1908, 41, 1529) treated the pitchblende directly with a mixture of sulphuric and nitric acids; this method is also especially applicable to pure autunites, which dissolve readily in acids. Fusion with alkali bisulphate or successive fusion with sodium hydroxide and bisulphate is generally recommended by Sommer and Ulzer (Eng. Pat. 19,820 of 1909; this J., 1910, 1156). According to the process used by the Radium Company of America, carnotite is first concentrated by mechanical means and then treated with sodium hydroxide and water at 200°–300°C., whereby the vanadium is extracted, while the uranium and radium remain in the residue (U.S. Pat. 1,054,102; this J., 1913, 369). In Bleecker's method (U.S.

Pat. 1,015,469; this J., 1912, 237) the vanadium in carnotite is converted into soluble sodium metavanadate by fusion with a mixture of sodium chloride and sodium hydroxide. The insoluble residue is extracted with sulphuric acid, and the undissolved portion fused with sodium hydroxide: "crude sulphate" is then obtained by extracting the fused mass with hydrochloric acid and adding sulphuric acid to the extract. In addition to the cost entailed by using such large amounts of alkali, all these processes suffer from the disadvantages which accompany the formation of much soluble silicate. As a rule, carnotites yield from 2 to 7 kilos. of "crude sulphate" per metric ton; the radium content, however, is only about one-tenth that of the "crude sulphate" from pitchblende. Curie and Debierne purified the "crude sulphate" by repeated successive treatments with concentrated sodium carbonate solution, hydrochloric acid, and sulphuric acid. The carbonate was finally converted to chloride, lead being then removed as sulphide and calcium by evaporating to dryness and extracting the residue with concentrated hydrochloric acid. The residue of crude radium-barium chloride, after several recrystallisations, was finally fractionally crystallised. The tedious treatment of the "crude sulphate" with sodium carbonate solution was avoided by subsequent investigators by reducing the "crude sulphate" to sulphide. Reduction with carbon requires a very high temperature and is only efficient with well purified concentrates consisting essentially of barium sulphate. On the other hand, reduction with calcium carbide, calcium hydride, or a mixture of these substances (this J., 1913, 976; 1915, 78) is applicable to extremely poor "crude sulphates" containing much silica; and in the last two cases the reduction is autogenous. In all cases the powdered reduction product is stirred into hot dilute hydrochloric acid and the hydrogen sulphide expelled rapidly. The solution is diluted to approximately normal strength and the residue extracted repeatedly with acid of the same strength. The residue consists of lead sulphide and silica, while the solution contains the chlorides of barium, radium, calcium, and iron. The passage of gaseous hydrogen chloride into the solution precipitates barium and radium chlorides (see this J., 1913, 656). The separation of radium and barium salts always involves prolonged fractionation. The older methods included fractional crystallisation of the chlorides (Curie), bromides (Giesel), picrates, bromates, ferrocyanides (Kunheim and Co.), silicofluorides (Landin); fractional precipitation of the chlorides with gaseous hydrogen chloride; repeated formation and decomposition of radium amalgam (Marckwald and Coehn); fractional volatilisation of the bromides (Stock and Heynemann); partial thermal decomposition of the carbonates (Thiel); and partial conversion of the sulphates into carbonates (Brauner). In the newer methods a preliminary concentration of radium is effected through continual fractional adsorption and de-adsorption by means of colloidal hydrated manganese dioxide (see this J., 1913, 1155). The adsorbent is best prepared by adding 1.5-molar manganous chloride solution to 0.2-molar alkali permanganate solution in the proportion required by the equation:



By using suitable amounts of adsorbent most of the radium may be removed from the solution in a concentrated form: radium-barium chloride is then regenerated—and a further concentration simultaneously effected—by dissolving the adsorption product in hot hydrochloric acid and conducting gaseous hydrogen chloride into the solution. The resulting manganous chloride is used in preparing a fresh quantity of adsorbent.

There are further possibilities of an intermediate concentration by means of fractional de-adsorption: fairly successful results are described in which this process was effected by acids, by electrical means, and by the use of salt solutions. In the last case the adsorption product (10 grms.) was boiled for 5 minutes with an N/1 solution of the salt (1 litre): of a series of chlorides, that of aluminium gave the maximum concentration of radium in the residue. This concentration increased with increasing concentration of the aluminium chloride solution, but the best absolute yield of radium in the residual undecomposed adsorption product was obtained with a concentration of 15 grms. of crystallised aluminium chloride per litre. The adsorption process may be applied to barium-radium mixtures containing as little as $10^{-6}\%$ Ra, and the method is advanced as a general one for use in similar cases.—J. R.

Radio-elements; Adsorption and precipitation of —. F. Paneth. Chem.-Zeit., 1915, 39, 25. (See also this J., 1914, 22.)

SALTS adsorb best those radio-elements whose analogous compounds (i.e., those compounds containing the same electro-negative radical as the adsorbent salt) are sparingly soluble in the solvent concerned; this result supports the view that anion and cation retain their characteristic separable valencies even in the solid substance, and that the insolubility of precipitates also depends upon such retention. In view of the kinetic atomic exchange which necessarily occurs at the surface of the adsorbent, this assumption provides an adequate explanation of the adsorption rule. The fact that radio-elements may be precipitated at concentrations much below that corresponding to the solubility product is referable to the same cause.—J. R.

Thorium and radium emanations; The condensation of —. A. Fleck. Phil. Mag., 1915, 29, 337–362.

WHEN air mixed with thorium and radium emanations at atmospheric pressure is cooled, the thorium emanation appears to be condensed about 5°C . higher than the radium emanation, the apparent difference being due probably to the radium emanation in the gaseous phase over the condensed phase being swept away by the air current, whilst the thorium emanation is rapidly converted into solid active deposit and is thus retained more completely. In a highly exhausted tube, the emanation is more easily condensed as its concentration diminishes, and in certain circumstances the condensation curve of the radium emanation exhibits two maxima, one about -75°C . and the other about -161°C . It is suggested that this property may be dependent on the presence of water vapour. The existence of at least one maximum (probably the one at -161°C .) was further confirmed by means of a glass tube containing a large quantity of radium emanation, floating vertically in liquid air. A ring of bright luminosity was observed just above the surface of the liquid air, which was not due to a condition of the glass, nor to a concentration of the active deposit away from the emanation. Experiments with other forms of tubes have shown that internal changes are liable to take place inside the tube, which completely alter the condensation curve obtained. In a highly exhausted tube, at the temperature of liquid air, 0.0915% of radium emanation remained uncondensed. With thorium emanation, in a highly exhausted tube, the greater part was condensed between -165° and -170°C . When the two emanations were mixed in such a tube, the radium one appeared to be more easily condensed, but this was probably due to the rapid disintegration of the thorium emanation. In

one experiment, indirect evidence was obtained, which appeared to point to thorium and radium emanations being non-separable by condensation.—B. N.

Cathode rays; Salts coloured by — and the molecular force field theory. E. C. C. Baly. Chem. News, 1915, 111, 85–86.

THE author sees in the salts coloured by cathode rays, described by Goldstein (this J., 1915, 76), a further illustration of his molecular force field theory, and compares them with the metastable nitrophenol ethers in regard to their electromagnetic condition. If in a molecule the component atomic fields happen to balance, the molecular field will be entirely closed. The field may be opened, and the molecule rendered reactive by solution, and also by the presence of molecules possessing residual affinity independently of whether a solution is formed or not. In this latter case the system can absorb light selectively, thus shifting the equilibrium towards the reactive side, and compounds with their force fields opened out to a relatively high stage, hitherto only known among organic substances—nitrophenol ethers, nitroanthrone, etc.—would be expected also in the case of inorganic salts. As representatives of such metastable inorganic compounds, Goldstein's highly coloured salts appear to conform to the deductions of the force field theory in every way, except as regards abnormal reactivity, which yet remains to be proved.—G. F. M.

Colloids; Electric synthesis of —. J. Mukhopādhyāya. J. Amer. Chem. Soc., 1915, 37, 292–297.

SOLS of sulphur, selenium, and arsenic were readily formed by passing a current of 15 amps. through a thin platinum wire coated with the substance and surrounded by "conductivity" water. Better results were obtained by using a current of 2 amps. at 220 volts to produce an arc between two carbon electrodes immersed in water, the latter being cooled in a freezing mixture. The lower, flat-headed electrode was coated with the molten substance, through which, after solidification, a small hole was pierced: the arc passed between the part of the lower carbon thereby exposed and the pointed end of the upper carbon. Phosphorus, sulphur, and selenium yielded fairly stable sols in this way. With selenium a current of 0.6 amp. was used. Cadmium gave an unstable sol which soon coagulated, forming a mixed precipitate of metal and hydroxide. Copper behaved similarly, the precipitate consisting of a mixture of metal and oxide. A platinum cup was used in the case of mercury: the sol, which was grey, stable, and very pure, carried a negative charge. Sol formation under these conditions is attributed to volatilisation followed by condensation. Cadmium and copper sols are unstable owing to precipitation caused by the oppositely charged colloidal hydroxide (positive) and colloidal metal (negative). In the case of the stable colloidal solutions of gold, platinum, silver, and mercury, the sol consists entirely of metallic particles.—J. R.

Hydrogen peroxide solutions; Acidity of —. J. S. White. Pharm. J., 1915, 94, 316.

THE acidity of hydrogen peroxide solutions when determined by the B.P. (1914) method (direct titration with N/10 alkali, using methyl orange as indicator), is considerably less than when determined by the U.S.P. method (decomposition of the hydrogen peroxide by evaporation with excess of standard alkali and subsequent titration with standard acid, using phenolphthalein as indicator). The author considers this difference to be due to the presence of undecomposed

hydrogen peroxide in the B.P. process, which prevents the complete neutralisation of the acid present.—T. C.

Sulphuryl chloride; *The dissociation and formation of* —. M. Trautz. Chem. Ges. Heidelberg, Dec. 18, 1914. Chem.-Zeit., 1915, 39, 100.

BETWEEN 18° and 100° C. the reversible reactions, $\text{SO}_2 + \text{Cl}_2 \rightleftharpoons \text{SO}_2\text{Cl}_2$, without exposure to light, could not be maintained as pure gas-reactions; only on the addition of animal charcoal could fairly reproducible results be obtained. Both reactions then behaved as adsorption reactions, without any disturbing effect due to diffusion. The order of the reaction was roughly normal in both cases, but more exactly so in the case of the dissociation than in that of the formation. The formation was almost independent of temperature; the dissociation had a temperature coefficient of about 1.5. These and other observations could all be explained by the restricted sphere of the reaction (confined to the adsorption layer) as compared with a normal gas reaction. The formation of SO_2Cl_2 under the influence of the light of the quartz and "uviolet" lamp was studied at 18° and 99° C., at various concentrations. At the higher temperature it took place fairly normally as a reaction of the second order. The accumulation of by-products, both in this reaction and, after a time, in the reversible reaction in the dark, has a disturbing effect upon the constants. The dissociation under the action of light gave no constants at all on this account. The velocity of formation of SO_2Cl_2 in light was almost independent of temperature and in that respect normal. The velocities of the reaction in presence of charcoal and in presence of light were of a similar order of magnitude.—J. F. B.

Sulphur; *Methods of analysis of* —. M. G. Levi. Annali Chim. Appl., 1915, 1, 9—31.

THE author examined the methods available for the determination of sulphur in crude sulphur, especially as applied to low-grade Sicilian sulphur contaminated with bituminous matter. The method of Carius does not yield accurate results (compare Anelli, this J., 1911, 573), and combustion in a current of oxygen, though serving well for the purer kinds of sulphur, is tedious and less accurate when applied to samples containing notable quantities of bitumen. Satisfactory results are obtained by the method of Fresenius and Beck (Z. anal. Chem., 1903, 42, 21), in which 10 grms. is heated at a little above 200° C. to volatilise the sulphur, the residue weighed, and then incinerated to determine the bitumen. Accurate results can be obtained by oxidation with nitric acid and bromine by adopting the following method. About 0.2 grm. of the sulphur is weighed directly into a 100 c.c. conical flask, which is then fitted, by means of a ground glass joint, with a reflux tube. The flask is immersed in cold water and whilst held in an inclined position 10 c.c. of fuming nitric acid (sp. gr. 1.52) and 5 drops of bromine are introduced successively through the reflux tube. The flask is shaken occasionally until most of the sulphur and bromine is dissolved, whereupon a further 5 c.c. of nitric acid is added, and after heating for $\frac{1}{2}$ hour on the water-bath, the flask is again immersed in cold water, the solution diluted with 50 c.c. of water added in small portions through the reflux tube, and the sulphur determined as barium sulphate in the usual way. With low-grade sulphur, the determination should always be made with the sulphur separated from the original sample by extraction with carbon bisulphide.—A. S.

Oxygen; *A sharp reaction of free* —. K. Binder and R. Weinland. Z. komprim. u. flüss. Gase, 1913, 102—105. Chem.-Zeit., 1914, 38, Rep., 485.

ELEMENTARY oxygen imparts a red colour to an alkaline solution of catechol and ferrous sulphate; the reaction may be applied to the quantitative determination of oxygen in gaseous mixtures.—J. R.

Liquid air; *The use of* — in industry. Engineering, 1915, 99, 98—100, 155—157.

THE use of liquid air in industry has now reached very considerable proportions, and it is stated that there are machines of the Linde and Claude types installed which are capable of producing well over 30,000 gallons of liquid air per hour. The greater part of this liquid air is used for the production of oxygen and nitrogen; neon is obtained as a by-product and is used for filling tubes for electric lighting (see Claude, this J., 1911, 13, 736). Descriptions are given of the two chief types of apparatus, namely those of Linde and Claude. Liquid air is also used for separating pure hydrogen from "blue" water gas (see this J., 1911, 744). The only rival to the liquid air method of producing oxygen is the process of decomposing water by electricity, and this cannot compete in cost unless a market can be found for the hydrogen as well as the oxygen. Oxygen is now very largely used for welding and cutting metals by the oxyacetylene blowpipe, for enriching air for blast furnaces, and for increasing the yield of nitric acid in the Birkeland-Eyde electric and the Haeusser explosion processes. Liquid oxygen mixed with organic substances has been tried as an explosive. Nitrogen is largely used for the manufacture of cyanamide, for the Serpek process of preparing aluminium nitride, and for the Haber process of synthesising ammonia.—W. H. C.

PATENTS.

Sulphurous acid and oxides from [alkaline-carth] sulphates; *Manufacture of* —. A. Bambach. Fr. Pat. 470,652, April 8, 1914.

THE sulphate is heated to redness by contact with a burning mixture of gas and air, and the residue is then further heated, either by a flame containing an excess of air, or by the successive action of a reducing flame and oxygen (preferably as air). The process may be applied to sulphides, the heated material being decomposed with an oxidising flame or air.—F. SODN.

Acetic acid; *Manufacture of* —. Farbw. vorm. Meister, Lucius, und Brüning. Fr. Pat. 471,255, April 22, 1914. Under Int. Conv., April 26 and Dec. 15, 1913.

SEE Eng. Pat. 10,377 of 1914; this J., 1914, 961. The simultaneous action of different catalysts, with or without pressure, is also claimed.—F. SODN.

Sodium carbonate crystals; *Apparatus for the manufacture of* —. M. Spazier, Cincinnati, Ohio. U.S. Pat. 1,127,691, Feb. 9, 1915. Date of appl., April 29, 1914.

Two crystallising tanks, in which are mounted cross-bars with depending hangers to act as crystallising centres, are separated by a space permitting access to a drain board sloped so as to discharge drainage into both tanks. A surplus solution tank, above the drainage board, may also discharge into either tank.—F. SODN.

Sulphocyanides [thiocyanates]; *Treatment of* — [to produce ammonia]. P. E. Williams, Winstead. Eng. Pat. 2841, Feb. 3, 1914.

A THIOCYANATE is heated with an alkali or alkaline-earth and water, and the evolved ammonia rendered free from accompanying carbon oxysulphide

by passing it at once into contact with an alkaline-earth hydroxide. For example, a solution of calcium thiocyanate is evaporated nearly to dryness, mixed with slaked lime, the mixture covered with a layer of slaked lime, and the whole gradually heated to 500°–600° C. in a closed chamber, supplied with water or steam, with or without air.—F. SODN.

Ammoniacal liquor; Process for the complete extraction of industrial chemical products contained in crude——. L. C. Bonneau and V. E. Hasenfratz. First Addition, dated April 3, 1914, to Fr. Pat. 468,535, April 26, 1913 (this J., 1914, 962).

SULPHUR is extracted in a digester, fed with the boiling solvent and communicating by a siphon with a distilling apparatus in which the dissolved sulphur is recovered, the condensed solvent being returned continuously to the digester. When the material is exhausted, it is transferred with water to a vessel fitted with a stirrer, in which adhering solvent is recovered by heat, and distillation with lime commenced, and from this vessel the mixture is pumped into a column for the complete removal of ammonia. The solution is then led through settling vats, treated with potassium chloride, and the precipitated calcium-potassium ferro-cyanide boiled with sodium carbonate and filtered. The filtrate is treated with ferrous sulphate and the resulting precipitate oxidised to Prussian blue, which is washed and dried.—F. SODN.

Nitrogen compounds from carbides; Process of manufacturing——. T. Fujiyama, Tokyo, Japan. U.S. Pat. 1,126,000, Jan. 26, 1915. Date of appl., Feb. 25, 1914.

PULVERISED carbides are burnt in a closed chamber and nitrogen is introduced to combine with the burning substance, more material being added to keep the product covered with a layer of carbide. Decomposition is prevented by cooling the chamber.—F. SODN.

Rare earth metals; Manufacture of compounds of the——. Gebr. Siemens und Co. Fr. Pat. 470,633, March 21, 1914. Under Int. Conv., April 1, May 17, and July 16, 1913.

SEE Eng. Pat. 8015 of 1914; this J., 1914, 830. The reaction may be interrupted when an intermediate double fluoride of rare earth metal and calcium has been precipitated, and an organic acid, such as oxalic acid (preferably 5% of the weight of rare earths), may be added to the reaction mixture.—F. SODN.

Nitrogen compounds from pulverised carbides; Process of manufacturing——. T. Fujiyama, Tokyo, Japan. Eng. Pat. 9259, April 14, 1914. SEE U.S. Pat. 1,126,000 of 1915; preceding.

Electrolysing alkali-chloride solution; Process for——. W. Gaus. Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen on Rhine, Germany. U.S. Pat. 1,126,627, Jan. 26, 1915. Date of appl., Nov. 11, 1912.

SEE Fr. Pat. 446,610 of 1912; this J., 1913, 142.

Sulphur and sulphates from polythionate solutions; Production of——. W. Feld, Linz, Germany. K. E. Markel, London, Administrator. U.S. Pat. 1,127,219, Feb. 2, 1915. Date of appl., July 11, 1912.

SEE Eng. Pat. 10,147 of 1912; this J., 1913, 602.

Pumps for corrosive liquids. Eng. Pat. 4482. See I.

Heat-producing compound. U.S. Pat. 1,126,055. See IIb.

Preparation of the products of oxidation of organic compounds. Ger. Pat. 277,733. See III.

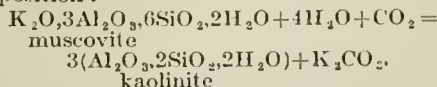
VIII.—GLASS; CERAMICS.

Glass for medicine bottles; Tests for determining suitability of——. L. Kroeber. Münchener Pharm. Ges., July 17, 1914. Chem.-Zeit., 1914, 38, 1196.

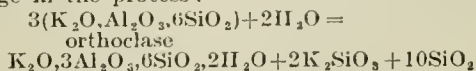
GLASS bottles for holding medicines should, after sterilising in steam at 100° C. for 30 minutes, answer the following tests, the reagents being put into the bottles and examined after 24 hours. (1.) Distilled water should give no iridescent film of silicate; (2.) a 1 to 2% morphine solution should be colourless or show at most a pale yellow colour; (3.) no separation of crystals should take place in a 0.5% solution of strychnine nitrate; (4.) a 1% mercuric chloride solution should show no separation of coloured oxide; (5.) from 2 to 3 drops of phenolphthalein solution in 100 c.c. water should develop at the most a pale rose colour, disappearing on the addition of 1 to 3 drops of N/10 acid. (6.) a 0.1% solution of narcotine hydrochloride should show at the most only traces of dust-like particles but no flocculent matter after one hour. Before using bottles for medicines, they should be treated for 1 hour with 1% hydrochloric acid and then thoroughly washed with water.—T. C.

China-clay; Microscopic characters of——. G. Hickling. J. Soc. Dyers and Col., 1915, 31, 70–71.

THE same mineral constituents appear to be present, in varying proportions according to the fineness of the sample, in all the grades of material into which the original rock is separated by "washing," except that the chief constituents of the clays, kaolinite and secondary muscovite, rarely occur in grains more than 0.03 mm. in diameter, and are therefore absent from the coarser sediments. The minerals present are quartz, tourmaline, primary muscovite (original constituent of the granite), secondary muscovite (produced in the decomposition of the felspar), and kaolinite. The first three occur in large fragments and are readily identified under the microscope, but kaolinite and secondary muscovite present difficulty, on account of their minuteness and irregularity of form. Both minerals occur in the form of curved prisms known as "rouleaux," which appear to be built up of a pile of fine plates, suggesting piles of coins. By determining the refractive indices (by immersion in mixtures of oil of clove and oil of cedar), it was found possible to differentiate between the rouleaux of muscovite and of kaolinite in certain cases, but some of the crystals gave intermediate values. Considerable evidence has been found that the percentages of muscovite obtained by chemical analysis are too high. It is probable that the muscovite is gradually transformed into kaolinite, and that the clay very largely consists of crystals intermediate in composition:—



The conversion of felspar into kaolinite is due to the gradual extraction of the alkali and loosely combined silica, muscovite being an intermediate stage in the process:—



China clay consists principally of the intermediate decomposition products from muscovite to kaolinite. The most obvious feature in the microscopic structure is the great variation in the size of the particles (0.03–0.0005 mm. diameter). The whole of the particles appear to be crystalline. The usual statement that china-clay consists mainly

of minute flakes is correct, but these flakes are plates split off from the rouleaux. It does not appear that the subdivision of the clay particles according to size has any material effect on the proportion of the various minerals present. Rouleaux are extremely rare in common clays, which contain a much greater variety of minerals than china-clay.—F. W. A.

Crystallisation in silicate liquids. Bowen. See VII.

PATENTS.

Glass-making furnace. L. A. Thornburg, Arnold. Pa., Assignor to American Window Glass Machine Co., Pittsburgh. Pa. U.S. Pat. 1,127,115, Feb. 2, 1915. Date of appl. Nov. 20, 1909; renewed June 14, 1913.

THE furnace is provided with a forehearth, which constitutes an extension of the drawing chamber, communication between the two being controlled by a vertical damper, which can be raised or lowered simultaneously with the topstone of the drawing chamber. Means are provided for cooling the topstone. The horizontal extension of the drawing chamber has on its base a central chilling boss, surrounded by a ring, and also a floating member which can be brought into position over the boss. The drawing chamber extension is shallower than the forehearth proper, but increases in depth towards its outer end.—W. C. H.

Glass-furnace. S. B. Henshaw, Assignor to The Charleston Window Glass Co., Charleston, W. Va. U.S. Pat. 1,127,245, Feb. 2, 1915. Date of appl. Oct. 6, 1913.

THE casing of the working chamber projects over the mass of molten glass and has an opening through which the glass can be drawn, and across which flame jets can be projected. A structure, which floats in the molten glass and can be rotated, is provided with openings which are successively brought into line with the drawing opening of the furnace. The structure is rotated by a wrench which engages with a socket, and a detachable sleeve of refractory material mounted upon and rotated with the structure protects that portion of the wrench which is in the path of the flame jets projected across the drawing opening.

—W. C. H.

Insulators; Manufacture of high-potential porcelain and glass —. *Insulator.* F. M. Locke, Victor, N.Y. U.S. Pats. (A) 1,127,042 and (B) 1,127,044, Feb. 2, 1915. Date of appl., Mar. 9, 1909.

(A). A VITRIFIABLE base and a boron compound or derivative are moulded and fired to form a homogeneous body which serves as a high potential insulator. (B). The insulator is formed of silica or a fusible silica base and a boron compound which are fused together into a homogeneous body.

—W. C. H.

Bodies or small particles of substances [glass, etc.]; Method of producing —. E. Morf, Zürich, Switzerland, Assignor to Metals Coating Co. of America, Boston. U.S. Pat. 1,128,175, Feb. 9, 1915. Date of appl., Dec. 2, 1912.

SEE Eng. Pat. 28,001 of 1912; this J., 1913, 792.

IX.—BUILDING MATERIALS.

Wood; Rapid drying and preservation of — by *Nodon's electrical process.* C. Dantin. Le Génie Civil, 1914, 65, 98—101. Bull. Bureau Agric. Intell., 1914, 5, 1650—1652.

NODON'S process for drying and preserving timber consists in stacking it to a height of 3—5 ft. and

inserting an electrode mat between each layer. The mats are made of pliable galvanised iron wire netting covered with strong jute cloths, and are saturated with water and so connected to the conductors conveying the alternating current, that the latter passes through the thickness of each layer of timber. The treatment lasts one or two days, and on its completion the wood is dried by exposure to the air for a few weeks. The cell sap is completely oxidised by the treatment so that only resinous substances remain; the cellulose is so modified that it does not readily putrefy; inherent fungi, germs, etc., are destroyed, and the heated product is unaffected by injurious insects. One cubic metre (35 cu. ft.) of wood requires 150 ampère-hours, with an E.M.F. of 40 volts for wood in full sap and 80—100 volts for unbarked wood that has been kept for some time. The cost of treatment is given as about $\frac{3}{4}$ d. per cu. ft. when the process is carried out in the forest, and 1d. in factories. Wood of all kinds can be treated. The Municipality of Bordeaux has stated officially that "Nodonised" wood used for road paving is more durable than untreated wood.—E. H. T.

PATENTS.

Concrete and the like; Mixing machines for —. F. L. J. Albert and P. M. J. Cossé, Nantes, France. Eng. Pat. 2582, Jan. 31, 1914.

PADDLES rotating in a cylindrical mixing chamber are provided with large rectangular, shovel-like blades, with smooth surfaces, shaped so as to pick up the concrete from the edge of the cylinder, compress it, allow it to fall freely, and intimately mix it; the blades are inclined at a suitable angle to avoid excessive friction and jamming. Controlling arrangements are provided by which a skip is caused to raise material and eject it into the mixing chamber, the paddles are made to rotate and mix the materials and are then stopped, and the mixing chamber is rotated to eject the mixture and return to its original position. The paddles may be driven through a suitable planetary speed reducer, and the concrete chamber may be locked and a definite amount of water admitted. The paddles are arranged on a common shaft, in sets of two or more at the centre and singly at each end.—W. C. H.

Clinker; Apparatus for cooling — in the manufacture of cement, and for like cooling purposes. G. M. Park, Blackburn. Eng. Pat. 2661, Feb. 2, 1914.

THE material is conveyed by a shoot into a rotary tank containing water and provided with plates and screens to lift the material while rotating, and with a casting curved outwards or a drip flange with trough at its inlet to carry away excess water. The shoot through which the material is delivered into the tank is connected with a conduit leading to a chimney for carrying off escaping steam. From the rotary tank the material passes to a series of revolving annular trays provided with open air spaces between them. The exits in the peripheries of the trays are so arranged that the material has to traverse a sufficient distance to obtain the necessary cooling.—W. C. H.

Wet grinding [of cement materials]; Process of —. H. E. Rüsager, Frederiksberg, Denmark, Assignor to F. L. Smidth and Co., New York. U.S. Pat. 1,126,085, Jan. 26, 1915. Date of appl., April 18, 1912.

THE cement materials together with water are placed in a rotary drum, and the consistence of the slurry is regulated by varying the radial distance of the outlets for the water and the slurry in the discharge head of the drum.—W. H. C.

Manufacture of moulded objects from blast-furnace slag. Ger. Pat. 275,197. See X.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Steel; Sound — for rails and structural purposes. R. A. Hadfield. J. Franklin Inst., 1915, 179, 119—140.

STEEL ingots made by the author's feeding method (this J., 1912, 987) are free from blowholes, pipes, and segregation, the presence of the cavity in the head giving visible evidence of the soundness of the ingot. Close upon 40,000 tons of ingots have been produced by the method, and every ingot has been absolutely sound. By cutting up over 100 ingots made by this method the possibility of manufacturing perfectly safe steel shell with only 10 to 12% discard has been demonstrated. —T. St.

Carbon [in iron and steel]; Experiments with H. de Nolly's apparatus for the determination of —. R. Lepsoe. Chem.-Zeit., 1914, 38, 1137—1138.

THE method of de Nolly for the rapid determination of carbon in iron and steel (this J., 1911, 688, 1216) gives very accurate results, and is suitable for the control of Martin and electric steel furnaces. It is applicable to all kinds of steel, 1—2 grms. of sample being mixed with 0.1—0.2 grm. of lead peroxide or bismuth trioxide. Pig-irons and ferro-alloys must be passed through 80-mesh and 120-mesh sieves respectively, and burnt on a layer of 1—2 grms. of pure iron containing 0.05—0.08% C. —T. St.

Platinum in litharge. F. Michel. Chem.-Zeit., 1915, 39, 6.

LITHARGE (62.5 grms.) was reduced by flour (15 grms.) with a flux composed of 3 parts each of pure sodium and potassium carbonates, 1.5 of pure borax and 1.5 of pure sodium chloride. The buttons from 8 charges of the same sample, i.e. from $\frac{1}{2}$ kilo., were scorified together, the resulting button cupelled, and the remaining platinum, gold, and silver estimated. The amounts (a) of Pt, Au, and Ag found in three different samples of litharge, together with the amounts (b) found in the litharge formed during the scorification of these samples, are shown in the table.

Litharge from	Pt, mgrms. per kilo.		Au, mgrms. per kilo.		Ag, mgrms. per kilo.	
	(a)	(b)	(a)	(b)	(a)	(b)
Freiberg	0.417	0.123	0.916	0.200	25.33	5.988
Frankfurt a/M.	0.350	0.060	1.950	0.362	11.22	2.606
Mülheim ..	0.111	0.034	0.666	0.142	10.00	2.446

—T. St.

[*Silver-copper ore; Chloridising blast roasting and leaching [low-grade —].* G. A. Keep. Eng. and Min. J., 1915, 99, 265—269 and 315—322.

DETAILS are given of the treatment of low-grade refractory ore (argentiferous copper-lead-zinc sulphides, etc.), some of which was formerly used as mine filling at Park City, Utah. A mixture of the crushed ore with coal dust (2—3%), common salt (7—8%) and sufficient water (5—10%) to render the mass more porous than when dry, is charged to a depth of 6—7 ft. on to a bed of red-hot fuel through which an upward blast of air is maintained. Combustion and chloridising proceed gradually and simultaneously from the bottom to the top of the column, the action being localised

and losses by dusting and volatilisation prevented by the combined blanketing effects of the cake formed immediately above the roasting zone (by the cementing action of the salt) and the moisture condensed in the upper portion of the charge. The roasting is usually completed in 3—5 hours, the gaseous products being passed through water or mill solution and the resulting "lower acid" (containing sulphurous, sulphuric, and hydrochloric acids and chlorine) employed for leaching the roasted material. The yield of acid, which depends on the proportions of sulphide in the ore and salt in the charge and also on the nature of the gangue, is increased when necessary by the addition of pyrites to the charge, in which case the proportion of coal dust is reduced. The addition of pyrites to ore containing lime is essential to neutralise (sulphate) the lime before leaching; but the process is generally not suitable for the treatment of calcareous ores. The red-hot, chloridised product, which should be readily friable, is sluiced from the roaster to the leaching tanks by means of acid mill solution maintained at 30° C. or above, the solution from the tanks being passed over copper to precipitate the silver, and over iron to recover the copper and part of the lead, and then re-acidified for leaching further charges; no trouble is experienced by fouling, the iron content of the mill solution remaining practically constant at 1—2 lb. per ton. In the case of auriferous ores, complete chloridising of the gold is ensured by the addition of bleaching powder (0.25—0.5%) to the roasted product while the latter is being sluiced into the tanks. With most ores the extractions of silver, copper, and gold obtainable by this process are 85—90, 90—98, and 90% respectively. The cost of roasting and chloridising in the concrete furnaces originally employed was 93.3 cents (3s. 10 $\frac{1}{2}$ d.) per ton of ore, this amount including 32 cents (1s. 4d.) for salt; by the adoption of the Holt Dorn roaster the cost per ton of ore has been reduced to 17.9 cents (8.95d.) exclusive of salt. The cost of leaching varies from 17 to 41 cents (8 $\frac{1}{2}$ d. to 1s. 8 $\frac{1}{2}$ d.) per ton according as the acid required is condensed from the roaster fumes or purchased. A small experimental plant for testing ores as to their suitability for treatment is also described, together with the results of an investigation of the process made at the Utah School of Mines.—W. E. F. P.

Colloidal gold and silver; Experiments with —. E. S. Bastin. J. Wash. Acad. Sci., 1915, 5, 64—71.

THE mineral chalcocite (Cu_2S) and such metals as zinc, copper, tin, and cadmium precipitated gold from warm dilute (N/10) aqueous solutions of auric chloride as a dark-brown or black coating. In the presence of an emulsoid sol of gelatin stable colloidal solutions of gold resulted, which were deep blue by transmitted and bright brick red by reflected light in the first three cases, while tin yielded "purple of Cassius" solution and cadmium gave a solution which was dark brick red by reflected and purple by transmitted light. In some cases the precipitation of the gold was similarly delayed in the presence of a colloidal solution of silica. On the other hand, minerals and metals such as pyrites, galena, and bismuth, which precipitated gold in the lustrous yellow or orange condition, failed to give colloidal solutions in the presence of the gelatin or silica sol. It is hence suggested that the dark-brown or black gold represents a state of fine division approaching that of a coagulated colloid. Analogous results were obtained in precipitating silver from silver sulphate solutions. The author concludes that transport of these metals in the colloidal condition may occur in the process of primary ore deposition. —J. R.

Copper and its important alloys (bronzes and brasses) and aluminium; Welding of — with the oxyacetylene flame. I. Carnevali. *La Metal. Ital.*, 1914, 139. *Annali Chim. Appl.*, 1915, 1, 62.

THE microstructure and mechanical properties of copper and its alloys are deteriorated markedly by oxyacetylene welding. Copper becomes coarsely crystalline, whilst the alloys show a minute heterogeneous structure with discontinuities produced by oxides and blow-holes. The tensile strength of copper is reduced by 50% and the elongation by one-tenth. The strength of the welded joint is not notably improved by mechanical treatment (e.g. hammering), but only by prolonged annealing. Aluminium is affected much less than copper by welding. Its mechanical properties are not altered to any considerable extent, except that the metal is rendered somewhat more brittle; the effects of the welding may be removed by both mechanical and thermal treatment of the joint.

—A. S.

Zinc and manganese; Alloys of —. N. Parravano. *Gaz. Chim. Ital.*, 1915, 45, 1, 1—6.

ALLOYS containing up to about 30% Mn were examined. They are hard and brittle, and when containing from 5 to 20% Mn are usually traversed by fissures. Two compounds, $MnZn_7$ and $MnZn_3$, are formed, and there is a general resemblance to the corresponding alloys of zinc and iron (see this J., 1907, 153). Photomicrographs of alloys containing respectively 5.3, 15.6, 21.4, and 28.3% Mn are given.—A. S.

Ionisation of metals by cathode rays. N. Campbell. *Phil. Mag.*, 1915, 29, 369—383.

EXPERIMENTS on the ionisation of platinum by cathode rays, described previously (*Phil. Mag.*, 1914, 286) have been extended to other metals, and to higher speeds of the incident rays. The changes in the ionisation, found to take place on heating platinum, can also be produced in platinum, copper, and nickel by making the metal one electrode of an electric discharge in air, oxygen, hydrogen, or petrol vapour at about 2 mm. pressure; the changes were greatest in copper. In aluminium hardly any change could be produced. The changes appear to be connected with "sputtering" of the metal, which gives rise to a roughened surface. The highest ionisation is shown by the metal after polishing, and it is suggested that in this state the surface of the metal is covered by a layer of gas. The metal may also be in various other states, one of which—characterised by exhibiting the next highest ionisation to the polished metal—can be reproduced from any of the others by bombarding the metal with cathode rays; the condition corresponding to the polished metal cannot be reproduced by such treatment.

—B. N.

Electric synthesis of colloids. Mukhopadhyaya. See VII.

Action of hydrogen peroxide on metals and its use for disinfecting instruments. Eichholz. See XIXB.

PATENTS.

Steel; Manufacture of chrome nickel — for armour plates, projectiles, and the like. Comp. des. Forges et Acieries de la Marine et d'Homécourt, Paris. Eng. Pat. 16,687, July 13, 1914. Under Int. Conv., June 23, 1914.

FROM 0.15 to 0.30% of titanium is added to the chrome-nickel steel known as "33-metal" (C 0.65—0.80, Cr 3.00—4.00, Ni about 2.5%; see Eng. Pat. 25,742 of 1907, this J., 1908, 944) to raise the critical cooling point and improve the machining and other qualities of the alloy.—W. E. F. P.

Metallic articles; Method of manufacturing composite —. J. Kirby, Pittsburgh, Pa. U.S. Pat. 1,126,484, Jan. 26, 1915. Date of appl., Nov. 28, 1913.

IRON or steel is coated by heating to about 1500° F. (815° C.) and immersing in a molten bath of Cu, Al, and V, maintained at about 2100° F. (1149° C.). —T. St.

Iron, boron, carbon, and copper alloy. E. D. Clason, New York, Assignor to Neu-Metals and Process Co., Long Island City, N.Y. U.S. Pat. 1,126,629, Jan. 26, 1915. Date of appl., Dec. 31, 1912.

AN alloy of Fe, B, and Cu, containing approximately 80% Fe and boron in excess of the quantity required to combine with the copper. Some of the carbon primarily present in the iron is retained in the alloy.—T. St.

Tungsten [wire]; Manufacture of —. C. Gladitz, London. Eng. Pat. 24,028, Oct. 23, 1913.

DRAWN tungsten or other wire is wound for the subsequent heat treatment on a bobbin containing deep V-grooves, so that when the wire is slackened somewhat it cannot get entwined. A metallic pin, the barrel of which is cut away at one side to form a flat surface, passes through the flanges of the bobbin parallel to the axis. The pin is provided at one end with a butterfly wing head, and a locking device prevents unintentional rotation. By rotating the pin the wire wound on the spool may be tightened or slackened, the size and shape of the pin being preferably chosen to give an increased length of coil of about 6% when the convex portion is turned outwards. To prevent the edges of the pin from chafing the wire, a shield of spring steel which fits into suitable slots is provided. The pin is turned with its convex surface outwards when the wire is received on the spool, but before introducing the latter into the furnace the flat side of the pin is turned outwards. The wire thus remains slack during the heat treatment even if its coefficient of expansion is less than that of the metal of the spool, and sufficient freedom is ensured for the recrystallisation process. After treatment the pin may again be turned so that the wire is tightened for re-spooling or re-drawing.—T. St.

Wires of refractory metals; Process for cleaning and reducing the diameter of —. S. Burgstaller and P. Schwarzkopf. Ger. Pat. 278,415, July 10, 1913.

WIRES of refractory metals, such as tungsten or molybdenum or their alloys, are cleaned and made thinner by leading them through a series of electrolytic baths in which they act as intermediate electrodes. The baths are arranged in pairs, those of each pair containing respectively an alkaline liquid, preferably a dilute solution of potassium hydroxide, in which the wire acts as anode, and an acid liquid, preferably very dilute sulphuric acid, in which it acts as cathode.—A. S.

Aluminium and alloys containing it; Flux for use in the welding or soldering of —. E. Thaulow, Frederiksberg, Denmark. Eng. Pat. 5356, March 2, 1914. Under Int. Conv., Dec. 16, 1913.

A FLUX for use in welding or soldering aluminium and its alloys, and having a lower melting point than aluminium, is composed of a borate and one or more bisulphates of alkali metals. An example is borax 96 and sodium bisulphate 4 parts.—T. St.

Smelting-furnace. T. M. Kekich, Assignor to C. Hanssen, Aire Libre, Mexico. U.S. Pat. 1,126,028, Jan. 26, 1915. Date of appl., July 3, 1912; renewed June 25, 1914.

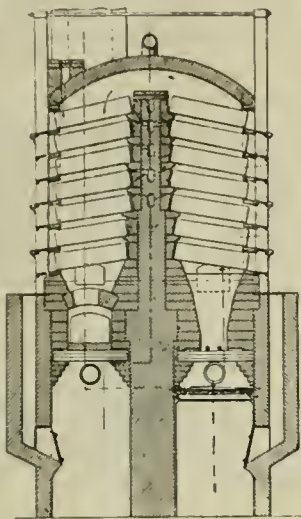
IN a blast-furnace of the type wherein the constituents of the charge are arranged in layers, two

sets of tuyères controlled independently are arranged on opposite sides of the furnace and at different levels.—T. St.

Smelting [reloft] furnace. E. V. Lanyon and F. A. Curnow, Pittsburgh, Kans. U.S. Pat. 1,127,261, Feb. 2, 1915. Date of appl., April 11, 1914.

THE furnace (see fig.) comprises a pair of refoft-heating chambers, arranged back to back, and communicating at the top. Heating gases from a fire-box at the lower part of the first (right-hand) chamber traverse the two chambers in succession and pass out at the bottom of the second. A system of pipes along the exterior of the furnace delivers air under the fire-box and to the inner sides and top of the second chamber, which is connected with the stack by two flues adapted to be used alternately.

—W. E. F. P.



Carnotite ores; Method of treating complex —. C. W. Danforth and W. T. Martersteck, Youngstown, Ohio, and W. P. Samuels, New Castle, Pa. U.S. Pat. 1,126,182, Jan. 26, 1915. Date of appl., May 1, 1914.

THE finely divided ore is roasted, treated while hot with a strong solution of sulphuric acid, and the mixture filtered; vanadium and uranium are recovered from the filtrate and radium from the insoluble residue.—W. E. F. P.

Platinum metals; Process of recovering native —. R. E. Lyons, Bloomington, Ind. U.S. Pat. 1,126,646, Jan. 26, 1915. Date of appl., Nov. 19, 1914.

THE material is treated with zinc amalgam and acid to produce an "alloy" of platinum, etc., and zinc which is subsequently recovered by amalgamation.—W. E. F. P.

Ores [blende]; Process of treating —. J. W. Emerson, Salida, Colo. U.S. Pat. 1,126,965, Feb. 2, 1915. Date of appl., Feb. 19, 1914.

CONCENTRATES containing blende are passed in a thin layer on an endless belt through an acid bath of such a strength that just enough gas is developed on the blende particles to produce clumped blende aggregates, which rise a little above the other material. The aggregates are then removed by an arrangement similar to an endless chain of dredger buckets.—T. St.

Mill-scale [containing tungsten]; Method of treating —. F. M. Becket, Assignor to Electro Metallurgical Co., Niagara Falls, N.Y. U.S. Pats. (A) 1,127,162 and (B) 1,127,163, Feb. 2, 1915. Date of appl., April 8, 1914.

(A) TUNGSTEN alloys are prepared from high-speed mill-scale containing tungsten by removing a portion of the iron, then treating with an acid reagent to remove phosphorus, and finally reducing by means of a non-carbon reducing agent. (B) Mill-scale containing tungsten is subjected to a reducing operation at a temperature below the melting point of the reduced product, and the

tungsten concentrated by removing a portion of the iron. Phosphorus is then removed by treating with an acid reagent, and the purified concentrate is fused in an electric furnace in presence of silicon.—T. St.

Flue dust; Sintering process for the recovery of metallic oxides from —. G. F. Downs, Buffalo, N.Y. U.S. Pat. 1,127,209, Feb. 2, 1915. Date of appl., Aug. 6, 1914.

A CONTINUOUS stream of flue dust is heated progressively in a slightly inclined, rotary kiln, and near the outlet end is subjected to a number of air-blasts by which it is violently agitated and simultaneously nodulised or sintered by heat developed by combustion of the contained carbon.

—W. E. F. P.

Cobalt-silver ores; Process for treating —. W. Phillips, Swansea. U.S. Pat. 1,127,506, Feb. 9, 1915. Date of appl., Oct. 7, 1913.

THE raw ore is smelted with iron matte and copper residue to produce argentiferous copper matte and speiss, and the latter is re-smelted with successive fresh portions of iron matte until free from silver and copper. The purified speiss is treated for the recovery of nickel, cobalt, and arsenic, and the argentiferous iron matte smelted with a further quantity of raw ore.—W. E. F. P.

[Lead-copper-nickel] alloy. G. C. Holder, Altoona, Pa. U.S. Pat. 1,127,624, Feb. 9, 1915. Date of appl., May 29, 1914.

AN alloy containing Ni 3—9, Cu 20—30, and Pb 61—77, with or without As 0.25%, Fe and Mn (if present) not exceeding 0.5 and 0.3%, respectively. As much as possible of the nickel is added in the form of Monel metal, the permissible amount of which is determined by the content of iron and manganese.—W. E. F. P.

Catalysing materials [metals]; Method of treating —. C. B. Morey, Assignor to Larkin Co., Buffalo, N.Y. U.S. Pat. 1,127,911, Feb. 9, 1915. Date of appl., March 2, 1914.

THE pyrophoric property of a catalytic material is reduced by subjecting the material repeatedly to the successive action of a partial vacuum, a period of rest, and an inert gas, and simultaneous heating.—T. St.

Blast-furnace slag; Manufacture of moulded objects from —. E. Risch. Ger. Pat. 275,497, March 2, 1912.

ASPHALTUM is added to molten blast-furnace slag before, during, or after pouring into moulds. The moulded pieces are less brittle than those made from slag alone.—A. S.

Iron; Deposition of —. S. O. Cowper-Coles, London. U.S. Pat. 1,127,966, Feb. 9, 1915. Date of appl., Aug. 1, 1914.

SEE Eng. Pat. 12,683 of 1913; this J., 1914, 925.

Metals from ores; [Electrolytic] process of separating —. H. A. Wagner, East Orange, N.J., U.S.A. Eng. Pat. 14,374, June 15, 1914.

SEE U.S. Pat. 1,115,351 of 1914; this J., 1914, 1161. The depolarising material may contain manganese dioxide, mercuric, and a hydrogen-absorbing agent such as palladium black.

Metallic coating and process of making same. Method of plating or coating with metallic coatings. M. U. Schoop, Hôngg, Switzerland, Assignor to Metals Coating Co. of America, Boston. U.S. Pats. 1,128,058 and 1,128,059, Feb. 9, 1915. Dates of appl., Apr. 1, 1910, and Aug. 7, 1911.

SEE Eng. Pat. 5712 of 1910 and Fr. Pat. 426,882; this J., 1911, 291, 1068.

XI.—ELECTRO-CHEMISTRY.

Electric synthesis of colloids. Mukhopadhyaya.
See VII.

Rapid drying and preservation of wood by Nodon's electrical process. C. Dantin. See IX.

PATENTS.

Furnace; Electric —. J. G. Marshall, Assignor to Union Carbide Co., Niagara Falls, N.Y.
U.S. Pat. 1,127,475, Feb. 9, 1915. Date of appl., April 9, 1913.

Two electrodes are supported adjustably side by side, close together, and extend downwards into the hearth of the furnace. Each is surrounded by a jaw clamp, connected with a pair of closely associated movable conductors. The two pairs of conductors are arranged close to and in non-inductive relation to each other, one member of each pair extending between the electrodes, and these two members are arranged in non-inductive relation to each other. An alternating current transformer is fixed near the base of the hearth, with multiple and interlaced conductors connecting it to the movable conductors.—B. N.

Electrolytic apparatus. I. H. Levin, Newark, N.J., U.S.A. Eng. Pat. 3654, Feb. 12, 1914. Under Int. Conv., May 9, 1913.

SEE FR. Pat. 467,945 of 1914; this J., 1914, 971.

Preparation of di-secondary glycols. Ger. Pat. 277,392. See XX.

XII.—FATS; OILS; WAXES.

Mutton tallow; Solidifying point of —. R. Meldrum. Chem. News, 1915, 111, 98—99.

SOLID glycerides were separated from mutton tallow by treatment with ether, and their solidif. pt. determined by Dalcan's method, the mass being melted at 80° C. and stirred while cooling to 55° to 47° C., and the thermometer then fixed 1½ in. from the bottom of the tube. The solidifying pt. ranged from 49.7° to 50.3° C., with a rise of 3.4° to 4.0° C. The presence of suspended matter and the method of stirring had no influence on the results, and no secondary stationary point was observed. Erratic variations of the "zero" solidifying pt. (i.e., the temperature to which the thermometer falls before the rise commences) and of the rise were much smaller in the case of the solid glycerides than of the original tallow, this being attributed to the influence of the greater proportion of liquid glycerides in the latter. Such variations do not occur with mixtures of stearic and oleic acids (this J., 1913, 1077). Fluctuations of the m.pts. of glycerides appear to be due to errors of manipulation, whilst the solidif. pt. is influenced by the speed of crystallisation. Constant results are obtained when a constant amount of substance crystallises per unit of time. Glycerides require supercooling to start rapid crystallisation, and each glyceride appears to have a specific "zero" point of incipient solidification. When glycerides (especially mixtures of solids and liquids) are supercooled, the latent heat of fusion may be insufficient to raise the temperature of the mass to the normal solidif. pt. (see also this J., 1915, 184).—C. A. M.

Fat from animal carcasses. H. Dubovitz. Seifensiederzeit., 1914, 41, 1026—1027. Z. angew. Chem., 1914, 27, Ref., 655.

THE fat obtained in the installation at the Budapest municipal abattoir varies considerably in colour,

composition, and titer value (solidif. pt. of fatty acids). By treatment with powdered charcoal or a mineral decolorising powder, a pale yellow, nearly odourless fat can be obtained. The decolorised fat had the following characters: water, 0.11%; unsaponifiable matter, 0.57%; acid value, 27.5; iodine value, 60.6; saponification value, 196.8; refractive index of fat at 40° C., 1.4599; refr. index of fatty acids, 1.4514; titer value, 39.4° C. It is suitable for soap making, being easily saponified and yielding a pale-coloured soap of good lathering power.—A. S.

Olive oil; Notes on the refining of —. M. Degli Atti. Annali R. Scuola Sup. Agric., Portici, 1913, 11. Annali Chim. Appl., 1915, 1, 75—76.

WHEN the maceration of olive pulp is prolonged unduly, oil is obtained which, although otherwise of good quality, is strongly coloured. Tests with various decolorising agents showed that to decolorise such oil, treatment with 5% of finely powdered animal charcoal for seven days gives the best results.—A. S.

Sesame' oil; Colour reaction of —. A. T. Bosch. Merck's Rep., 1914, 96. Pharm. J., 1915, 94, 321.

A GREEN coloration is obtained when a drop of sesame' oil is dissolved in 1 c.c. of ether, benzene, or chloroform and an equal volume of a mixture of 2 vols. of sulphuric acid and 1 vol. of hydrogen peroxide solution added.—T. C.

Fat from the seeds of Nigerian Trichilia. P. Ammann and J. Vuillet. L'Agron. Coloniale, 1914, 2, 34—36. Bull. Bureau Agric. Intell., 1914, 5, 1593—1594. (See also this J., 1914, 147).

SEEDS of *Trichilia emetica* from E. Africa have for a long time been imported into France under the name of "mafuraies": they contain much fat suitable for soap and candle manufacture. The seeds of various species from French W. Africa were analysed, and the best, which were long and orange-coloured, and consisted of 58.2% of kernels and 41.8% of shells, contained 43.7% of fat in the kernels and 51.9% in the shells. These fats were of a light brown colour, and contained respectively 90.3% and 92.0% of fatty acids, of which the melting points were 51.5° C. and 44° C., and the solidifying points 47.2° C. and 40.5° C.; the glycerides solidified at 15°—16° C. and about 13° C. The acidity (as oleic acid) was 2.82 and 3.05% respectively. The annual supply of such seeds would be at least several hundred tons.—E. H. T.

Fat extraction tube; A simple —. C. A. Butt. J. Ind. Eng. Chem., 1915, 7, 130—131.

THE tube is similar to an ordinary filter-tube except that the stem is wider (15 mm.), to allow free passage of the vapour upwards and the condensed liquid downwards. The extraction thimble is placed in the wider part of the tube on a coil of wire or a piece of gauze to allow free passage of the vapours. The tubes have proved more efficient than the usual form.—A. S.

Glycerol [in fats]; New method of determining —. S. H. Bertram. Chem. Weekblad, 1913, 10, 237. Chem.-Zeit., 1914, 38, Rep., 461.

TWENTY grms. of the fat is saponified, the fatty acids liberated with acetic acid and separated, the filtrate neutralised with potassium hydroxide, and organic substances precipitated with lead acetate. The filtrate and washings are diluted to one litre, and 100 c.c. is treated with a large excess of 2N potassium hydroxide solution and with cold 10% copper sulphate solution until a permanent precipitate is obtained. The liquid

is then filtered, the filtrate acidified with acetic acid, potassium iodide added, and the liberated iodine titrated with $N/10$ thiosulphate solution (1 mol. $\text{Na}_2\text{S}_2\text{O}_3 = 2$ mols. glycerol).—C. A. M.

Candelilla wax. R. Berg. Chem.-Zeit., 1914, 38, 1162—1163.

THE pure red or brown variety of candelilla wax can only be bleached after the addition of large quantities of paraffin wax. It is used for inferior varnishes, for insulating telephone wires, and especially for shoe polishes. The original method of separating the wax by boiling the twigs with water has in some works been replaced by extraction with chloroform. From 2.5 to 6% of wax is recovered, and it is purified by straining and melting in water containing 0.5 to 1% sulphuric acid. From $\frac{1}{2}$ to 2 tons of wax per annum are derived from about 0.4 hectare. Some of the extraction plants have a capacity of about 5 tons a day. The crude grey product contains up to 6.5% water, 3 to 15% dirt, and 0.5 to 1.5% ash, mainly calcium carbonate. The light yellow or brown waxes are probably extraction products. A sample of crude grey wax had: M. pt., 80° — 88°C .; acid value, 9.8; and saponif. value, 53.8. Brown wax had the following characters: Sp. gr. at 15°C ., 0.9860; m. pt. 68.5° ; solidif. pt., 65°C .; refraction at 70°C ., 1.4558; acid value, 11.6; saponif. value, 63.1; Buchner value, 5.5; iodine value (Wijs), 57.6; unsaponif. matter, 67.5%, with acetyl value 63.7. *Fatty acids* (29.4%): Neutralisation value, 149.6; mol. weight, 375.4. The high iodine value was due to 19 hours being allowed for the absorption. With $1\frac{1}{2}$ to 3 hours' absorption the iodine value was 14.5, which agreed with recorded values. The unsaponifiable matter contained about 50% of two hydrocarbons (m. pts. 68° and 84° to 85°C . respectively), a small quantity of an alcohol (m. pt. 88° to 89°C .) which did not give the cholesterol reaction, and which was present in the wax as an ester, a non-acetylisable substance (m. pt. 243°C .) which gave a purple red solution with sulphuric acid and acetic anhydride, and about 10% of two cholesterol which could be separated as acetates (see also this J., 1910, 1021, 1396; 1911, 1266; 1912, 692; 1913, 875).—C. A. M.

Emulsification and detergent action. S. H. Shorter. J. Soc. Dyers and Col., 1915, 31, 61—69.

EMULSIFYING agents either tend to prevent the coalescence of oil droplets, or to cause, for the same degree of shaking, a finer subdivision of the oil. Their action is closely connected with the question of the stability of bubbles and films. Gibbs has proved from thermodynamical considerations that if the addition of a solute lowers (or raises) the surface tension of the solvent, the solute will exist in a higher (or lower) degree of concentration in the surface layers than in the body of the solution. The author has found that the thickening of the surface layers formed by solutions of saponin, peptone, and albumin, proceeds without sign of equilibrium for several weeks. The substance forming the surface layer separates from the body of the solution at a rate practically independent of the thickness of the surface layer already formed, so that the process is thermodynamically irreversible, and therefore outside the scope of Gibbs' theory. Donnan has stated that two droplets of an oil in an emulsion are prevented from coalescing by the formation of a contact layer in which the concentration of the dissolved substance is doubled owing to adsorption; this surface tension effect could, however, only be temporary, as prolonged contact would result in a uniform distribution of the dissolved substance. The author accepts the explanation of emulsification, suggested by Pickering (this J., 1908, 88), that

coalescence is prevented by the quasi-solidity of the surface layer. The most striking examples of emulsification are those which occur when an animal or vegetable oil (*e.g.*, olive oil) is poured on to a dilute aqueous solution of an alkali. The adsorption layer in this case consists of soap; it is plastic, and the cylinder of oil formed extends until it splits into drops. If a soap solution is used in place of alkali, adsorption is extremely slow on account of the slowness with which the colloidal soap particles diffuse into the surface layer; hence in the case of a soap solution a rapid extension of the interface thins the soap layer so that the interface becomes practically "normal." In the case of an alkaline solution, on the other hand, the alkali diffuses rapidly into the surface layer, so that the formation of the adsorption layer of soap keeps pace with the extension of the interface. The practically spontaneous nature of the emulsification by alkali is therefore due to the rapidity of formation and the plasticity of the soap layer. With the same amount of shaking, the emulsions formed in different cases differ widely in the degree of fineness of the droplets, *e.g.*, soap solutions form finer emulsions than solutions of saponin, probably due to the difference in the mechanical properties of the surface layer, a highly rigid surface layer being unfavourable to the fine subdivision of the oil. The stability of an emulsion towards dilution with water depends on the solubility of the adsorbed material in water. Emulsions produced by means of alkali or soap are unstable, whereas, if albumin has been used, drastic treatment only causes the droplets to coagulate without coalescing. This explains the action of substances like gelatin in stabilising emulsions, as many colloids form very stable adsorption layers. The relative parts played by the alkali liberated by hydrolysis and the undecomposed soap solution in producing the emulsification necessary for detergent action is being investigated. It has been found that, although the addition of oleic acid to benzene lowers the tension against water, this addition has practically no effect on the tension against soap solution, indicating that the alkali liberated by hydrolysis has no specific surface action similar to that exerted by ordinary alkali. For many purposes it is desirable that a soap should exert no alkaline effect, and it is possible that experiments on the above lines may be valuable for testing the "detergent neutrality" of a soap—a quality essentially different from chemical neutrality.

—F. W. A.

Utilisation of the fish waste of the Pacific Coast. Turrentine. See XVI.

Preparation of Wijs' iodine solution. Dubovitz. See XXIII

PATENTS.

Oils or fats; Apparatus for use in saturating or impregnating—with a gas or gases. A. H. Charlton, Brentford. Eng. Pat. 1410, Jan. 19, 1911.

SATURATION is effected in a closed rotating drum provided on its inner periphery with blades which break up the oil and bring it into intimate contact with the gas (*e.g.*, hydrogen), which is introduced under pressure through a flexible tube and a reducing valve from a cylinder attached to the drum and moving with it. Steam is admitted to an outer casing of the drum through a passage in one of the trunnions and escapes through the other trunnion. The drum is preferably made to rotate nearly a complete revolution alternately in opposite directions.—C. A. M.

Oil; Flavouring —. N. Sulzberger. New York. U.S. Pat. 1,127,545, Feb. 9, 1915. Date of appl., Aug. 31, 1911.

A SMALL addition (3%) of peanut (arachis) oil or other oil of distinctive flavour is added to cottonseed oil or other edible oils or fats to obtain a practically tasteless and odourless mixture.

—C. A. M.

Soap mixture; Manufacture of —. H. Wade, London. From A. J. Musselman, Chicago, U.S.A. Eng. Pat. 18,523, Aug. 10, 1914.

FINELY divided soap (1 part) is intimately mixed with sawdust (6 parts) in the absence of heat or moisture to obtain a detergent toilet soap.

—C. A. M.

Soap; Apparatus for the manufacture of —. P. Krebitz, Munich, Germany, Assignor to Krebitz Process Co. of America, Aurora, Ill. U.S. Pat. 1,126,787, Feb. 2, 1915. Date of appl., Nov. 14, 1913.

THE apparatus comprises a mixing tank containing an agitator, a reaction tank into which liquid may be drawn from the mixing tank, and a grinding mill receiving solid material excavated from the reaction tank. The granulated material from the mill passes to an elevator which delivers it into a conveyor passing across the top of an extraction tank and discharging into a soap kettle. In the bottom of the conveyor casing is a trap door through which material may be discharged into the extraction tank; a shoot near the bottom of the latter discharges the material again into the boot of the elevator.—C. A. M.

Unsaturated fatty acids and their esters; Process for converting — into saturated compounds. W. J. Mellersh-Jackson, London. From De Nordiske Fabriker De-No-Fa Aktieselskap, Christiania. Eng. Pat. 21,477, Sept. 23, 1913.

SEE Fr. Pat. 462,905 of 1913; this J., 1914, 324.

Concentration of wool scouring and like liquors and recovery of grease therefrom. Eng. Pat. 13,005. See V.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Lithopone. W. J. O'Brien. J. Phys. Chem., 1915, 19, 113—144.

MANY specimens of lithopone when used as a pigment turn grey when exposed to light and moisture, owing to reduction of the zinc sulphide to metallic zinc. The reaction is not reversible, but the white colour is restored by oxidation of the metal on exposure to air in the dark. Barium sulphate is not a necessary factor in producing the darkening but it favours the reaction by adsorption of the zinc sulphide, causing increased surface exposure. Salts which form soluble zinc salts accelerate the darkening, while those which form insoluble zinc salts retard or prevent it. In patented processes for the prevention of the darkening, an insoluble film is formed around the particles of zinc sulphide, and it is impossible to make a lithopone which will not darken unless there is a protective film of some kind. Effective protection may be afforded by the film of zinc oxide naturally formed in the process of heating the lithopone to dehydrate the precipitated zinc sulphide. Although an excessive proportion of the oxide depreciates the value of the pigment, between 3 and 5% may be thus formed with considerable advantage as regards stability of colour; quenching the red-hot lithopone in water controls the extent of oxidation, assists the

disintegration of the pigment-mass, and removes most of the soluble salts. The protective film of oxide is removable by boiling with concentrated zinc chloride solution and the sulphide then becomes sensitive to light; sodium chloride has a similar effect in a minor degree. A film of aluminium oxide precipitated from an aluminium salt at the same time as the zinc sulphide, has a protective effect similar to that of zinc oxide; sulphur also protects to some extent.—J. F. B.

Linoleum; Effect of moisture on —. W. Storp. Veröffentl. Geb. Militär-Sanitätsw., 1914, 57—76. Chem.-Zeit., 1914, 38, Rep., 480.

WATER-SOLUBLE acids are formed in linoleum in the presence of moisture, their production being checked by the presence of acids and promoted by bases. Hence, moist linoleum, although originally containing only a slight trace of free acid, has a disintegrating action upon marble slabs.—C. A. M.

PATENTS.

Turpentine process. Turpentine-retort. J. G. Gardner, Assignor to Southern Rosin-Turpentine Co., Daytona, Fla. U.S. Pats. (A) 1,124,606 and (B) 1,124,607, Jan. 12, 1915. Dates of appl., March 20 and April 21, 1913.

(A) THE finely divided material is heated in a retort by the downward injection of steam until all air is expelled, and the temperature is then raised until the turpentine begins to separate, when the steam is cut off. Heavier vapours condense within the retort, whilst the lighter pure turpentine vapours are conducted to an exterior condenser. (B) The retort has an annular head with an inner ledge near the top provided with a groove to support the flanged head of the basket in which the material is placed.—C. A. M.

Phenol and formaldehyde; Production of anhydrous reaction products of —. F. G. Wiechmann, Assignor to Fenoform Corporation, New York. U.S. Pat. 1,126,926, Feb. 2, 1915. Date of appl., Nov. 28, 1913.

A MIXTURE of phenol and formaldehyde is heated to a temperature below that at which any considerable heat of interaction is produced, the resulting liquid anhydrous product is mixed with a reagent promoting the reaction, and the heating continued until a thick anhydrous syrup practically insoluble in water is obtained. Alternatively the reagent promoting the reaction may be added to the original mixture.—C. A. M.

Fluid-tight joints for shafts and the like of agitators of paint and the like dipping tanks. Eng. Pat. 27,111. See I.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Rubber [trees]; Some notes on the manuring of —. H. H. Smith. The Rubber Industry, London, 1914, 58—70.

THE main object to be achieved in manuring rubber is to develop trees of large girth, surmounted with a vigorous and well-balanced crown of foliage of considerable area, but not straggling. The composition of the manure must be suited to the individual case, according as root stimulation, the encouragement of bark formation, or invigoration of leaves and latex is needed. The necessity in most cases of a liberal application of lime before the other manures is referred to, and the composition of various mixtures which have been recommended is given. The following results were obtained with *Manihot Glaziovii* trees planted in 5 plots about 13 ft. × 13 ft. apart, each plot including

about 55 trees. The manures were applied in October, 1911.

Manure per acre.						Period Oct. 1911 to Oct. 1913.
Potassium sul- phate (49.7% K ₂ O).	Potassium magnesium sul- phate (26.5% K ₂ O).	Superphosphate (15% P ₂ O ₅).	Bone meal (28.1%).	Ammonium sul- phate (20.5%).	Lime.	Weight of dry rubber per tree.
lb. 178	lb. —	lb. 161	lb. 62	lb. 187	lb. —	grms. 218.1
—	339	161	62	187	—	177.7
—	—	161	62	187	—	199.6
178	—	161	62	187	892	193.7
Control plot						143.2

—E. W. L.

Rubber ; Recommendations by the Rubber Growers' Association for the treatment of latex and curing of —. India-Rubber J., 1915, 49, 292—293.

THE recommendations, which are given in considerable detail, relate to the precautions to be observed in the collection and transport to the factory of the latex and scrap, and in its reception, coagulation, and subsequent handling in the factory. In collection and transport, the use of clean and suitably designed utensils, the avoidance of copper, and the need for rapid transport to the factory, are insisted on, and the use of formalin or sodium sulphite to prevent spontaneous coagulation in very dry weather is advocated. The three grades which should be recognised at this stage are (1) clean, uncoagulated latex; (2) lump, coagulated in the cups; (3) rinsings from the cups. In the factory the same cleanliness is necessary; all latex should be bulked, and care exercised in straining it. In preparing pale crêpe a solution of $\frac{1}{4}$ lb. of sodium bisulphite in 1 gallon of water should be stirred into 40 gallons of undiluted latex before coagulation. The coagulant consists of (a) for crêpe: one part of 98—100% acetic acid in 20 parts water, one part of this solution being added to 50 parts of undiluted latex; (b) for sheet: one part of 98—100% acid in 200 parts water, one part of the solution being added to 5 parts of undiluted latex. In the subsequent processes care is necessary to avoid excessive working of the rubber on the rolls, irregularity in thickness of sheet, irregularity in smoking, oil streaks from the bearings of rolls, dark streaks due to oxidation in the absence of sodium bisulphite, mottling, etc., due to slow drying, tackiness due to exposure of rubber or scrap to sunshine, over-smoking, and the use of oily material for smoke-production. The grading of the finished product should be according to the following classification: (1) Fine sheet, or crêpe made from the free latex. (2) Clean light brown crêpe, made from lumps which do not pass the strainer, and skimmings. (3) Scrap crêpe, made from tree-scrap. (4) Dark crêpe, from bark shavings and the lower quality of scrap crêpe. Earth rubber and tacky rubber should be packed separately. Instructions for careful packing are also given.—E. W. L.

Latex of wild and plantation Hevea ; Observations and comparative tests of —. F. Ripeau. The Rubber Industry, London, 1914, 124—129.

CONFIRMING the view that the high quality of Brazilian hard cure Para may be due to coagulation by the carbon dioxide present in the smoke employed, the author found that, on coagulating

Hevea latex by means of carbon dioxide obtained by burning charcoal, a product was obtained equal to plantation smoked sheets, whilst freer from the impurities which impart to the latter its dark colour. The process would not be easy to carry out in practice. Good results were obtained by adding a dilute solution of creosote to the latex. Many advantages are claimed for this process. Coagulation should be allowed to occur naturally and not be hastened by heating or by the addition of acids, and the coagulum should not be subjected to any mechanical working.—E. W. L.

Latex of Hevea Braziliensis ; Coagulation of — and its bearing on the strength of rubber. N. W. Barritt. The Rubber Industry, London, 1914, 130—136. (See also this J., 1914, 289.)

EXPERIMENTS were made to ascertain whether the influence of the conditions of coagulation on the properties of the protein constituent of the latex may extend, through the protein, to those of the vulcanised rubber. Nine samples of rubber were prepared, in the coagulation of which the concentration of salt (sodium sulphate) and acid (acetic) varied in the coagulating latex from N/1 to N/22, and from N/5 to N/240 respectively. Considerable differences of breaking strain were shown by the vulcanised samples, but no general tendency could be deduced from the results.—E. W. L.

Rubber exports from the Amazon basin in 1914. Board of Trade J., Feb. 25, 1915.

THE exports of rubber from Pará, Manaós, Iquitos, and Ita-Coatiara, *via* Pará, during 1914 were as follows in metric tons:—

Grade.	To Europe.	To U.S.A.	Total.
Fine	8875	9791	18,666
Medium	1111	1646	2757
Coarse	1443	5504	6947
Cauchu	4475	4378	8853
	15,904	21,319	37,223

PATENT.

Vulcanisation of rubber and production of vulcanised-rubber products. F. Hofmann and K. Gottlob, Elberfeld, Germany, Assignors to Synthetic Patents Co., New York, U.S. Pat. 1,126,469, Jan. 26, 1915. Date of appl., Oct. 16, 1913.

SEE Eng. Pat. 11,530 of 1913; this J., 1913, 1078.

XV.—LEATHER; BONE; HORN; GLUE.

Chestnut wood ; The tannin of —. L. Bernardini. Annali R. Scuola Sup. Agric., Portici, 1913, 11. Annali Chim. Appl., 1915, 1, 73—74.

THE tannin content of chestnut wood increases with the age of the tree and diminishes gradually from the base of the tree upwards. In trees of the same age the tannin content of wood from different parts does not differ much. The bark is particularly rich in tannin, and the tannin-content is higher in spring than in winter, a difference not observed in the case of the wood.—A. S.

Pine-twig extract. R. Rieder. Ledertechn. Rundschau, 1914, 345—350. J. Amer. Leather Chem. Assoc., 1915, 10, 107—108.

ANALYSES of pine twigs show from 4.37% to 7.03% tannin, and from 4.08% to 4.59% sugar. An

extract of the twigs would be unsuitable for use alone, but in combination with quebracho extract or other extract with a low non-tannin content, it would give good results. Large quantities of extract could be produced from the annual waste from the German pine timber harvest.—F. C. T.

Triacetin; Tanning power of —. P. Falciola. *Annali Chim. Appl.*, 1915, 1, 32—36.

EXPERIMENTS on the laboratory scale and on a small working scale showed that triacetin dissolved in or emulsified with water, or dissolved in aqueous alcohol or alcohol, is capable of tanning calf, lamb, and sheep skins, giving a soft, light-coloured leather resistant to cold water, but, like alum-tanned leather, not resistant to hot water. Tanning proceeds rapidly, the greater part of the triacetin absorbed being taken up in the first few hours. For example, using 500 grms. of triacetin and 5 kilos. of water, 3 kilos. of skin was tanned in 4 hours. The egg yolk in the mixtures commonly employed for alum tannage may be replaced by triacetin (1.5% of the weight of the skins).

—A. S.

Glue; A study of various tests upon —, particularly the tensile strength. A. H. Gill. *J. Ind. Eng. Chem.*, 1915, 7, 102—106.

THE viscosity and tensile strength of glue and the results obtained by the jelly test (Lipowitz) bear no relation to one another. Results of determinations of tensile strength show a variation of 10%: minute details for the preparation of the glue solution and wood surfaces, and for applying the glue solution are given, and a machine for holding the joint under pressure during drying is described and illustrated. More concordant results are obtained by soaking absorbent paper in the glue solution and measuring the increase of bursting strength (in a Mullen paper tester) of the treated over the untreated paper (compare Setterberg, this J., 1899, 55); the results are not comparable with the tensile strengths but are useful as a basis for grading different specimens according to quality. (See also Trotman and Hackford, and Watson; this J., 1904, 1072, 1189.)—A. S.

Analysis of lactic acid. Faust. See VII.

PATENT.

Hides; Composition for and process of treating —. J. H. Yocum, East Orange, U.S.A. Eng. Pat. 8837, April 7, 1914. Under Int. Conv., April 17, 1913.

SEE Fr. Pat. 470,774 of 1914; this J., 1915, 190.

XVI.—SOILS; FERTILISERS.

American soils; Inorganic composition of some important —. W. O. Robinson. U.S. Dept. Agric., Bureau of Soils, Bull. No. 122, Aug. 24, 1914, 27 pages.

SOILS of various textures and degrees of fertility, selected from important agricultural types and from different districts, were analysed, especially for the presence of the rarer elements. Rare earths (0.01—0.08%), Cr (trace to 0.025%), V (0.01—0.08%), Zr (0.003—0.08%), Ba (0.004—0.360%), Sr (0.01—0.11%), Li (traces) and Rb (0.001—0.01%) were found in all the soils examined. The existence of tourmaline in 18 soils and of micas in 24 soils, indicated the presence of boron and fluorine respectively. Molybdenum was detected in two soils, and caesium only in one. The presence and amount of copper, nickel, and cobalt

could not be gauged with accuracy, owing to possible contamination from the analytical utensils. Silica, phosphorus, and manganese are more plentiful in the surface soil, aluminium, iron, and, generally, titanium in the subsoil. The average sulphur content was equivalent to 0.13% SO₂. The mineralogical examination confirmed the conclusion that the more important rock-forming minerals were everywhere present; potassium minerals were particularly abundant, the amount present ranging from 43 to 2000 tons per acre-yard.—E. H. T.

Aldehydes [salicyl-aldehyde] in soils; Harmful effects of —. O. Schreiner and J. J. Skinner. U.S. Dept. Agric., Bureau of Soils, Bull. No. 108, Aug. 5, 1914, 26 pages.

EXPERIMENTS with chemically prepared salicyl-aldehyde on wheat, corn (maize), rice, etc., grown in water- and pot-cultures, with and without the addition of nutrients, gave results confirming those obtained with aldehydes isolated from the soil (see this J., 1914, 975). The aldehyde was used in quantities varying from 10 to 200 parts per million, and the toxic effects increased progressively with the quantity used. There was a marked diminution in the amounts of nitrogen, potash, and, to a lesser extent, of phosphoric acid, absorbed by the plants when the aldehyde was present. Calcium carbonate diminished the toxic action on the roots but not on other parts of the plant. Salicyl-aldehyde greatly diminishes the yield of crops in the field; it persists for months, but increased soil-oxidation would probably prevent its formation or accumulation.—E. H. T.

Humus; Formation and decomposition of — and its influence on nitrogen assimilation. F. Löhnis and H. H. Green. *Zentralbl. Bakt.*, 1914, [11.], 40, 52. *Chem.-Zeit.*, 1914, 38, Rep., 589.

OF a number of materials mixed with sand, stable manure was most rapidly converted into humus, followed in the order given by green manure and straw; sugar and turf were only very slightly attacked. Semi-anaërobic conditions were the most favourable. With free access of air a considerable amount of the nitrogen of stable and green manure was nitrified and much free ammonia escaped. On treating the humus with caustic soda solution and hydrochloric acid, most nitrate was obtained from green manure humus and from the humus of stable manure formed with free access of air, whilst the humus of stable manure produced under anaërobic conditions contained considerably less. The humus from straw had the same inhibiting effect on nitrification as the undecomposed straw. The fixation of nitrogen by azotobacter in mannitol solution was favourably influenced by the addition of small amounts of humus, particularly stable dung humus, probably as a result of the improved nutrient medium thus produced.—T. C.

Fish-waste of the Pacific coast (U.S.A.); Utilisation of the — for the manufacture of fertiliser. J. W. Turrentine. U.S. Dept. Agric., Bureau of Soils, Bull. No. 150, Jan. 23, 1915, 71 pages. (See also this J., 1914, 270.)

THE salmon-packing industry is mainly conducted in the districts around Columbia River and Puget Sound, also in S.E. and W. Alaska. The waste produced is from 25 to 50% of the original weight of the fish, and for 1913 amounted to 120,000 tons valued at about £375,000 in the United States and 20,000 tons, value £63,000, in British Columbia. The fresh material is quite clean and inoffensive. Alaskan samples gave: H₂O 64.6, N 3.02, P₂O₅ 1.59, and oil 10.43%; or when dry, N 8.65, P₂O₅ 4.44, and oil 28.74%

respectively. The oil is concentrated in the head and the nitrogen in the roe of the fish. The calculated value of the dry, raw waste is about £4 per ton, of which about three-quarters is recovered by the present methods of manufacture. The treatment consists in cooking with steam in upright vertical cylinders, hydraulic pressing of the hot mass into hard cakes, and steam-drying. The 1913 output was 1630 tons of dried scrap and 286,000 gallons of oil, from five working plants. Treated waste contained H_2O 4—5, N $7\frac{1}{2}$ — $9\frac{1}{2}$, P_2O_5 $5\frac{1}{2}$ —12, and oil 8—20%. In addition to its use as a fertiliser, it would be suitable for cattle and poultry feed. Glue prepared from it is inferior, but the oil fetches 30 cents (1s. 3d.) a gallon. Detailed suggestions are given for treatment on a very large scale, and it is recommended that during the "off" season, the factories should be used for treating the giant "kelps" which abound on the Pacific coast, and of which some are rich in fertilising constituents. A mixture of fish-scrap and treated kelp would make a valuable compound manure. Small quantities of scrap are produced from herrings, tunas, and whales, and much waste is discarded in the halibut fisheries.

—E. H. T.

Nitrogen of "processed" fertilisers. E. C. Lathrop. U.S. Dept. Agric., Bureau of Soils, Bull. No. 158, Nov. 10, 1914. 24 pages.

The fertiliser investigated was of the "base goods" type, manufactured by the action of sulphuric acid upon nitrogenous organic trade wastes mixed with mineral phosphate. The nitrogen was mainly in the form of primary protein decomposition products, showing that the original protein had been almost completely hydrolysed. The following nitrogen compounds were isolated: lysine, histidine, arginine, leucine, tyrosine, two purine bases, guanine, hypoxanthine, and a proteose-like substance composed of acid amide radicles and monamino- and diamino-acid radicles. Most of these compounds have already been shown to be available and beneficial to plant life. The conclusion is drawn that the water-soluble nitrogen of the fertiliser had an availability equal to, if not greater than, that of the nitrogen of dried blood. The availability of the nitrogen in such "processed" fertilisers is conditioned by the extent to which the original protein compounds have undergone hydrolysis in the course of manufacture.

—E. H. T.

Acid phosphate [superphosphate]; Manufacture of —. W. H. Waggaman. U.S. Dept. Agric., Bureau of Soils, Bull. No. 144, Dec. 24, 1914. 28 pages.

In the United States, superphosphate is made from the amorphous phosphates found in enormous quantities in Florida, Tennessee, Utah, Idaho, Wyoming, and Montana; smaller quantities come from South Carolina, Arkansas, and Kentucky. Roller mills having a capacity of 10—12 tons per hour are used for crushing the rock so that 80—90% will pass through a 60-mesh sieve; less soluble phosphates are ground so that 80—85% passes through an 80-mesh sieve. The fine material is mixed with about its own weight of sulphuric acid of 50° — 55° B. (sp. gr. 1.515—1.596) in a cast-iron revolving pan 4—8 ft. in diameter and 1—2 ft. deep, fitted with a stirring device, and after 2—5 minutes the product is discharged either into a "den" (a closed brick-lined chamber holding 50—300 tons) or conveyed to an open "dump." In the "den" system the reactions are complete in 24—36 hours, and the superphosphate is obtained in a dry, porous state, practically ready for shipment. In the "open dump" method, automatic dump cars carry the product either direct to the storage shed, where open piles are formed, or into a partly open bin,

from which after 8—10 days standing, it is taken up by elevators and put on the storage pile. At least a month must then elapse before it can be shipped. When carefully made, especially by the "den" method, superphosphate seldom requires any subsequent drying, but if, owing to faulty manufacture, it is sticky or wet, small amounts of phosphate rock, limestone, ground peat, or calcined gypsum are added; drying by hot air under pressure is not practised. Storage for long periods in large piles may cause "reversion," i.e., formation of phosphate insoluble in water. It is usually necessary to disintegrate the fertiliser before transporting. Material of good quality is thrown with shovels on to inclined sieves, but inferior material has to be treated in a disintegrating machine. The cost of production of superphosphate containing 16% citrate-soluble P_2O_5 is given as \$6.75—8 (28—33s.) per ton for inland towns; near the coast it is \$6.20—7.50 (26—31s.) exclusive of office expenses. Double superphosphate is made in S. Carolina where low-grade phosphate is mined, the phosphate rock being decomposed into phosphoric acid and calcium sulphate by means of dilute sulphuric acid (16° B., sp. gr. 1.121), the mixture filter-pressed, the phosphoric acid solution concentrated to 56° — 58° B. (sp. gr. 1.615—1.653), and then used to convert a further quantity of phosphate rock into monocalcium phosphate (double superphosphate).

—E. H. T.

Basic slag; Comparative analyses of — by the methods of Lorenz, Naumann, and Popp. W. Holle. Chem.-Zeit., 1914, 38, 1083.

ANALYSES of 20 samples of basic slag showed that Naumann's method yields results which are on an average 0.21% higher than those found by the Lorenz method (see this J., 1912, 259); Popp's method (this J., 1912, 831) also yielded results higher (by 0.24%) than those of the Lorenz method. When applied to pure sodium phosphate, the same differences were found in the results obtained by the three methods; the Lorenz method gave the quantity of P_2O_5 required by theory (see also this J., 1914, 1101).—W. P. S.

Fertiliser value of citric-soluble phosphoric acid and potash [from felspar, etc.]; Production and —. W. H. Waggaman. U.S. Dept. Agric., Bureau of Soils, Bull. No. 143, Nov. 13, 1914. 12 pages.

EXISTING methods of making fertilisers from felspar and phosphatic minerals by fusion with other materials, either involve the loss of much potassium by volatilisation, or are economically unsound owing to the cost of maintaining the high temperatures necessary; moreover, but a small fraction of the valuable constituents is obtained in a form soluble in 2% citric acid. In the method here described, which has been worked out in the laboratory, small amounts of iron oxide (hematite) and manganese dioxide are added to the mixed minerals, in order to lower the melting point and to promote fluidity. The best product was obtained by heating at about 1400° C. for 40 minutes. It contained 7.21% P_2O_5 , and 6.18% K_2O , all of which was soluble in 2% citric acid, and fairly soluble in water saturated with carbon dioxide. Pot tests on wheat seedlings in typical soils demonstrated its fertilising value; though the effects were, of course, inferior to those produced by superphosphate and potassium sulphate.—E. H. T.

Nitrogen; Direct assimilation of atmospheric — by plants. E. Mameli and G. Pollacci. Atti Istit. Botan. Univ. di Pavia, 1914, 14, 156—257. Annali Chim. Appl., 1915, 1, 67—69.

EXTENSIVE experiments have shown that the property of assimilating atmospheric nitrogen is

not restricted to a particular class of plants, but is exhibited generally by all kinds of chlorophyll-containing plants ranging from phanerogams to algæ. The plants were grown in sterilised nutrient media free from nitrogen compounds, and the amount of nitrogen combined was determined by analysis of the plants and, in some cases, by analysis of the residual air. *Azolla caroliniana* and *Salvinia natans* were found to be specially active in assimilating free nitrogen. It is suggested that the nitrogen combines directly with hydrogen in the chlorophyll-containing cells under the influence of an enzyme or a catalyst present therein.—A. S.

Manganese ; Influence of — upon [the nitrifying] bacteria of leguminous plants. M. D. Olaru. Comptes rend., 1915, 160, 280—283. (See also this J., 1914, 560.)

NITRIFYING bacteria from the root nodules of leguminous plants were cultivated in a sterilised broth prepared from haricot beans with the addition of 2% of sucrose. To 100 c.c. of this medium, from 0.01—1.0 mgrm. manganese sulphate was added, and after keeping at 19° C. for 48 hours, the gain of nitrogen was determined. The maximum increase, 75.5%, was obtained when 0.5 mgrm. manganese was added, the control showing a gain of 3.5%. Other experiments with a slightly weaker broth, containing less initial nitrogen, and extending over 50 and 114 days, showed that the optimum quantity of manganese was 2.0 mgrm. in each case, and the percentage gains of nitrogen 38.4 and 31.2 respectively; the controls gave 8.8 and 5.6%.—E. H. T.

Sulphur ; Action of — on plant growth. T. Pfeiffer and E. Blanck. Landw. Versuchsstat., 1914, 83, 359—383. Chem.-Zeit., 1914, 38, Rep., 506.

SULPHUR neither increases plant growth nor enables the nitrogen in the soil to be utilised more fully. On the contrary, a very small, insignificant, injurious effect was observed.—T. C.

Radioactive substances ; Use of — as fertilisers. W. H. Ross. U.S. Dept. Agric., Bureau of Soils, Bull. No. 149, Dec. 11, 1914. 14 pages.

ALTHOUGH useful results may be obtained with radioactive substances in botanical research, and possibly also in greenhouse practice, the utilisation of radioactive materials in general farm work is economically out of the question. To double the amount of radium in an acre-foot of average soil would require 0.75 ton of carnotite, containing 2% U_3O_8 and costing \$80 (about £16 10s.) per ton. The so-called "radioactive manures" are prepared from the residues left after the extraction of the radioactive elements from the ore, and the quantity usually recommended for application contains only about 1% of the amount of radium normally present in an acre-foot of the soil. The radioactivity cannot be intensified by mixing with farmyard or other manures, because this property is independent of the surrounding medium and of the state of combination of the radioactive element. Much of the research work on this subject has been inexact, and the conclusions drawn from it erroneous and conflicting. Evidence is adduced to show that the action of uranium ore on plant life is due to its chemical and not to its radioactive properties.—E. H. T.

Notes on the manuring of rubber trees. Smith. See XIV.

Influences affecting the protein content of wheat. Shaw. See XIXA.

PATENTS.

Phosphate rocks ; Process for rendering available the phosphoric acid in —. A. H. Cowles, Assignor to The Electric Smelting and Aluminium Co., Sewaren, N.J. U.S. Pat. 1,126,408, Jan. 26, 1915. Date of appl., Dec. 24, 1912.

A MIXTURE of potash felspar and calcium phosphate rock (preferably in proportion to contain 2 mols. CaO to 1 mol. SiO_2) is heated to at least a sintering temperature and the product treated with solvents, such as sulphuric acid, which do not produce insoluble phosphates or aluminates.—F. SODN.

Ammoniated acid phosphate [superphosphate] and process of making same. T. L. Willson and M. M. Haff, Ottawa, Assignors to Southern Investment Co. of Canada, Ltd., Montreal. U.S. Pat. 1,127,810, Feb. 9, 1915. Date of appl., June 23, 1913.

ACID phosphate is dried, preferably so as to contain 6—7% of moisture, and treated with ammonia gas to yield a product substantially free from insoluble phosphate.—F. SODN.

XVII.—SUGARS ; STARCHES ; GUMS.

Sugar beet ; Cultivation of — in Norfolk and Suffolk. C. S. Orwin and J. Orr. J. Board Agric., 1915, 21, 969—987.

FROM figures collected by the authors, it appears that the average yield of roots (washed) which has been obtained in Norfolk and Suffolk is 12 tons per acre, and that the total average cost of growing (including cultivation, seed, manure, rent, and rates) is £9 7s. 8d. per acre. It may be assumed that for three or four years the price of sugar will be high owing to the disorganisation of the industry in Germany, France, and Belgium, and if the price of beet be taken as 25s. per ton f.o.r., as it was in 1914, a crop of 12 tons will give the farmer a return of £15 and a profit of £5 12s. 4d. per acre, less the cost of placing the crop on rail. So far, therefore, as the immediate future is concerned there is the prospect of farmers being able to start the industry on a sound and remunerative basis. The scarcity of sugar resulting from the war will, however, probably cease in a few years, and with the increase in supply the price of beet will fall. It is necessary to consider the possible effect of such a contingency on the position of farmers who may have devoted a part of their rotation to beet growing, but during three or four years of high prices farmers would gain experience which should enable them to reduce the cost of growing and to secure a somewhat heavier and steadier yield. They will then be in the position in which they are to-day as producers of corn, wool, and other commodities, in competition with other countries, and there seems to be no reason why they should not hold their own. The authors express the opinion that while the production of sugar in England in relation to the total amount consumed might not be very large, yet, as in the case of wheat, it is in the interests of the consumer that there should be as many sources of supply as possible. It is unnecessary to anticipate the actual circumstances in which a scarcity might arise, but it is well to recognise that scarcity from various causes is not beyond the bounds of possibility.—J. P. O.

Sugar and the war. E. R. Davson. J. Roy. Soc. Arts, 1915, 63, 262—271.

DURING 1913 the sugar imported into England from Germany and Austria amounted to 894,150

and 324,000 tons respectively, a total of 1,218,150 tons, or about 60% of the total quantity imported; and it is calculated that for the production of this amount 700,000 acres demanding the employment of 350,000 men were required. As a means of encouraging the growth of sugar within the Empire, the author recommends Government support for a sufficient number of years along the following lines: (1) the excise on home-grown beet sugar should still remain unimposed; (2) a sufficiently large sum of money, say £250,000, should be guaranteed for the establishment of a large factory and for the security of farmers raising the necessary quantity of roots, private capital thus being encouraged for the erection of other works when the anticipated success is ensured; and (3) the duty on sugar grown in the British Colonies entering the home market should be withdrawn. In the discussion, C. S. Parker stated that there was no antipathy on the part of British Colonial sugar manufacturers towards the production of beet sugar in England, the belief prevailing that there would be scope for both branches of the industry. J. J. Eastick expressed the opinion that the increase of the area from which sugar might be produced in the British Colonies and at home, with the aid of the scheme proposed by the author, would have the effect of lowering the price.—J. P. O.

Sugar cane: Deterioration of —. H. Pellet. Intern. Sugar J., 1915, 17, 86—88.

WHEN cut cane is exposed to the air, the loss of weight is dependent upon the size and straightness of the stalks, the density of the heap, the temperature and the movement of the atmosphere, but it is not always proportional to the degree of deterioration. The deterioration depends largely upon the kind of cane; while one variety may hardly deteriorate at all on exposure, another may show a decrease in purity of 5°—7°, the loss of weight in both cases being about the same. In selecting a suitable kind of cane for propagation, it is necessary to ascertain not only the yield per acre and the sucrose content and purity of the juice, but also the keeping quality after cutting.—J. P. O.

Reducing sugars: Determination of — in cane molasses. J. A. Verret. Intern. Sugar J., 1915, 17, 85—86.

THE results obtained by Munson and Walker's gravimetric method of determining reducing sugars (J. Amer. Chem. Soc., 1906, 663; this J., 1906, 656) are too high if the cuprous oxide be weighed as such, but are more accurate when the cuprous oxide is oxidised to cupric oxide. As a result of a number of comparative experiments carried out by a committee of the Hawaiian Chemists' Association, Peters' modification of the iodide process (J. Amer. Chem. Soc., 1912, 34, 422) is recommended, in which the cuprous oxide obtained by the Munson and Walker method is dissolved in nitric acid, the lower oxides of nitrogen removed by boiling with talcum powder, and the copper in the solution determined volumetrically, after the addition of potassium iodide, by titrating with standard thio-sulphate solution.—J. P. O.

PATENTS.

Sugar juice and similar liquids: Method and apparatus for separating impurities from raw —. C. D. van Raalten, Gempolkrep, Java. Eng. Pat. 30,099, Dec. 31, 1913.

THE impure juice is fed on to an oscillating sieve, in the form of a horizontal trough, to which simultaneously a vertical and horizontal oscillating motion is imparted, after the principle of an oscillating conveyor, so that the solid impurities travel over the separating surface, while the clear liquid passes through.—J. F. B.

Evaporation and concentration processes, as in the manufacture of sugar: Apparatus for use in —. O. Söderlund, T. Boberg, and Techno-Chemical Laboratories, Ltd., London. Eng. Pat. 3456, Feb. 10, 1914.

IN working evaporating plant of the type described in Eng. Pats. 12,462 and 22,670 of 1911 (this J., 1912, 971; 1913, 183), in which evaporation is maintained by compressing the vapour of the liquid, the power required for driving the compressors is derived from a steam turbine, the exhaust steam from which is utilised for supplying the steam requirements of all the other portions of the installation.—J. F. B.

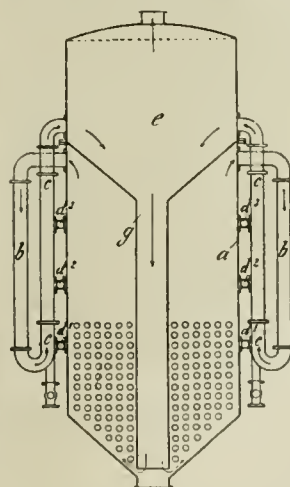
Golden syrup, invert sugars, and glucose: Manufacture of —. J. J., J. C. N., and A. G. Eastick, London. Eng. Pat. 5900, Mar. 9, 1914.

INVERT sugar and starch glucose are decolorised by adding decolorising carbon to the acid liquid during the process of inversion, and agitating the liquid in presence of the carbon, preferably by means of a current of air or oxygen. The carbon is separated by filtration and may be revived, and the decolorised filtrate is neutralised.—J. F. B.

Crystallising process for after-product massecuites. L. Hirt. Ger. Pat. 275,126, Jan. 4, 1912.

THE massecuite when leaving the concentrating apparatus, or entering the crystallising vessel, or at some intermediate point, is mixed with a quantity of a diluting liquid sufficient to compensate the supersaturation of the syrup at the crystallising temperature.—A. S.

Massecuite: Apparatus for producing a vigorous circulation of the liquid, especially — in vacuum evaporators or the like. E. Lehne. Ger. Pat. 278,587. July 6, 1913.



THE vapours from the evaporating chamber, *a*, pass into the pipes, *b*, and thence into the pipes, *c*, into which liquid from the evaporating chamber also flows through the slide-valves, *d1*, *d2*, *d3*. The mixture of liquid and vapour rises through *c*, into the separating chamber, *e*, where the vapour is evolved, the liquid flowing back into the evaporating chamber through the pipe, *g*.

—A. S.

XVIII.—FERMENTATION INDUSTRIES.

A starch-forming enzyme [hemicellulase] from malt: its action on hemicelluloses and its commercial application to brewing. C. B. Davis. J. Ind. Eng. Chem., 1915, 7, 115—118.

THE author claims to have discovered in malt a new enzyme, hemicellulase, which hydrolyses hemicelluloses, such as granulose, starch cellulose, and amylose, and also amylopectin, pentosans, and hexosans, transforming them permanently into gelatinised starch. Its optimum temperature is 82.5° C., and it is active between 15° and 90° C.

It appears to possess the character of a peptone, in that it is not coagulated on boiling, nor precipitated by zinc sulphate, but precipitated by phosphotungstic acid and by Tanret's reagent. It was isolated by macerating 300 grms. of ground barley malt with 700 grms. of water in presence of 1% of toluene at 60°–70° F. (15.5°–21° C.) for 4½ hours and then heating the expressed liquid (450 grms.) at 81° C. for 5 mins. to destroy the diastase. From the clear filtered liquid (375 c.c. at 21° C.) the enzyme was separated by two successive precipitations with alcohol, and the precipitate was washed with alcohol and ether, dried in a desiccator, extracted with water, and the aqueous extract allowed to evaporate over calcium chloride: the residue (0.0574 grm.) was capable of transforming 1000 times its weight of hemicellulose into starch. Figures are given showing that in mashing barley malt the maximum yield of extract is obtained between 75° and 85° C., i.e. above the temperature at which diastase is destroyed; the worts give a blue starch reaction with iodine. To utilise hemicellulase on a commercial scale, mashing is preferably effected in a water-jacketed machine. The machine is charged with cold water, crushed malt, and raw grain (maize, barley, rice, etc.), and the mash is heated to 80° C., then cooled to below 75° C., and a further quantity of malt added. It is stated that 3.5% more beer is produced than by laboratory methods and 8% more than by the methods at present used on a commercial scale. The grains are not pasty and draining proceeds very rapidly owing to the conversion of the cell walls by the hemicellulase.—A. S.

Ferment [enzyme]; Influence of the hydrogen [ion] concentration upon the optimum temperature of a —. A. Compton. Roy. Soc. Proc., 1915, B, 88, 408–417. (See this J., 1914, 977.)

SOLUTIONS containing constant proportions of maltose and takadiastase, but different concentrations of added acid or alkali, were maintained at various temperatures for 16 hours, and the proportion of maltose hydrolysed was taken as a measure of the activity of the maltase. The optimum temperature was found to vary considerably with the reaction of the medium. The highest optimum, 49° C., corresponded to a concentration of hydrogen ions between $10^{-7.2}$ (the natural reaction of the takadiastase at the concentration employed) and $10^{-6.8}$. When the acidity was raised to $H^+ = 10^{-3}$ the optimum temperature fell to 35.5° C. On the other hand the faintest alkalinity of the medium, corresponding to $H^+ = 10^{-7.5}$, lowered the optimum temperature to about 45° C., but the enzyme was so weakened that the investigation was not extended further in this direction.—J. H. L.

Glycerol; Influence of — on alcoholic fermentation and the inversion of sucrose. G. Rossi. Boll. Chim. Farm., 1914, 53, 657. Annali Chim. Appl., 1915, 1, 81–82.

A CONCENTRATION of 42% of glycerol is necessary to prevent alcoholic fermentation; at lower concentrations than 10% there is no appreciable effect. At a concentration of 50%, glycerol kills the yeast, but does not inhibit the action of the invertase.—A. S.

Wines; Lactic acid in Italian —. C. Mensio and E. G. Canina. Le Staz. Sper. Agrar. Ital., 1914, 47, 385–409. Bull. Bureau Agric. Intell., 1914, 5, 1665–1666.

A STUDY of some of the finest Piedmont wines has shown that the lactic acid content increases with their age, and although at first beneficial, and in certain cases essential, it may become harmful.

The acid is found in all wines (up to 5–6 grms. per litre) and is due to bacteria analogous to *Bacterium gracile* (Müller-Thurgau), which converts malic into lactic and carbonic acids. This fermentation considerably reduces the acidity of the wine. Acidity may be diminished by retarding the racking, by keeping the cellar warm, and by dispensing with sulphurous compounds. Malo-lactic fermentation is of great importance for ordinary wines, particularly when poor in alcohol, and the determination of lactic acid should always be carried out.—E. H. T.

Aniline dyes in wine; Detection of —. F. Wohack. Chem. Zentr., 1914, 1, 1976. Pharm. J., 1915, 94, 321,

(1). A SAMPLE of wine is extracted with amyl alcohol and the amyl alcohol extract warmed on the water-bath with a woollen thread. In presence of an aniline dye the wool is coloured pink and the colour is not changed to green on the addition of ammonia. (2). The wine is shaken with mercuric oxide to remove natural colouring matters, filtered, and made slightly acid with hydrochloric acid, any precipitated mercurous chloride being filtered off, and the solution heated with the addition of a few woollen threads, on which any dye present is fixed.—T. C.

Yeast; Manufacture of pressed or bakers' —. A. C. Reavenall. J. Inst. Brewing, 1915, 21, 97–110.

IT is estimated that before the war about 50% of the bakers' yeast used in the United Kingdom was obtained from the Continent. Brewery yeast is considered unsuitable because of its hop-flavour and the slight coloration it imparts to the bread, and ordinary distillery yeast is generally too exhausted to be of service. The manufacture of bakers' yeast therefore constitutes a special branch of the distilling industry in which the alcohol is regarded as a secondary product. The choice of raw materials is a very wide one, certain starchy materials, e.g., maize, being preferably digested in large converters under high steam-pressure. For saccharification a low-kilned or even green malt of high diastatic power is preferred. Malt coombs and bran are often added to afford suitable nutrition. The grist, finely ground, may consist of 15–25% of malt and about 20% of barley, rye, oats, or wheat; the mash is set up at 125°–130° F. (52°–54.5° C.) and 50–80% of maize, "converted" in a separate digester, is then added. Mashing is finished at 150° F. (65.5° C.) at a dilution of 3 barrels per quarter, without boiling. An addition of "bub" (a separate mash acidified by lactic fermentation) is made at some suitable stage, to protect the yeast from foreign organisms; this mash is sometimes also employed to bring the pitching yeast into condition. Two methods of yeast-cultivation are in vogue. In the Vienna process the whole mash is fermented, the yeasty skimmings being strained through sieves to remove the grains and allowed to settle. This process gives high yields of alcohol but the yield of yeast is low and it is often weak. In the aeration process the mash is drained, preferably in filter-presses, and the wort collected at a gravity of 1035°. It is pitched at 75°–78° F. (24°–25.5° C.) with a large quantity of strong yeast, and air is pumped through the wash during the whole period of fermentation; powerful attenuating coils are usually provided. The yeast is generally collected in centrifugal separators and the "cream" pressed into cakes. The yields of yeast and alcohol vary reciprocally. The author gives the following numbers taken from practice: Vienna process, pressed yeast 12.5–20.0% of the weight of grist; alcohol, 6.0–6.8 galls. proof

spirit per cwt. Aeration process, pressed yeast, 22.0—35.0%; alcohol, 4.9—5.8 galls. proof spirit per cwt.—J. F. B.

Utilisation of sulphite-cellulose yeast lyscs, especially for the manufacture of alcohol. Landmark. See V.

PATENTS.

Beer; Apparatus for brewing —. B. A. Koppitz, Detroit, Mich., and P. Sherrer, Cleveland, Ohio. U.S. Pat. 1,127,899, Feb. 9, 1915. Date of appl., Nov. 30, 1912.

THE brewing kettle is provided with a steam jacket below the bottom, and steam is supplied to the jacket and then circulated by means of a pump through an external superheater and a coil arranged inside the brewing kettle so as to be wholly submerged and out of contact with the walls.—J. F. B.

Fermentation gases; Apparatus employed for compressing —. J. F. Wittemann, Lakewood, N.J., and R. W. Wittemann, Brooklyn, N.Y., Assignors to Amaranth Machinery and Supply Works, Inc., New York. U.S. Pat. 1,128,265, Feb. 9, 1915. Date of appl., Aug. 25, 1911.

A gas conduit leads from a closed fermentation vessel to a compressor, to which cooling water is supplied by a valve-controlled conduit. The water and gas are discharged from the compressor through a conduit fitted with a thermostat, from which the valve controlling the supply of cooling water is operated. In the discharge conduit means are provided for separating the gaseous products from the cooling water; the gases are led from the upper part of the separator to a gas storage vessel, and the waste cooling water is discharged automatically as it accumulates.—J. F. B.

Apparatus for impregnating liquids with gases [carbon dioxide]. U.S. Pat. 1,128,264. See I.

XIXa.—FOODS.

Milk; Condition of casein and salts in —. L. L. van Slyke and A. W. Bosworth. J. Biol. Chem., 1915, 20, 135—152.

SERUM prepared from fresh milk by filtration through a Pasteur-Chamberland filter is yellow, with a faint greenish tint and slight opalescence; it contains in solution the whole of the lactose, citric acid, potassium, sodium, and chlorine present in the milk, whilst albumin, inorganic phosphates, calcium, and magnesium are partly in solution and partly in suspension. Albumin in fresh milk appears to be adsorbed to a considerable extent by casein, and, consequently, only a part of it passes into the serum; in the case of sour milk, or milk to which formaldehyde has been added, the serum contains practically all the albumin. The insoluble portion of milk, separated as described above, is greyish to greenish-white in colour, of a glistening, slime-like appearance, and gelatinous consistence; when shaken with water it forms a milky suspension which is neutral to phenolphthalein. It consists of neutral calcium caseinate (casein.Ca_2) and neutral dicalcium phosphate (CaH_2PO_4); these two compounds are not in combination with each other. By treating fresh milk with formaldehyde and centrifuging, the phosphates may be separated nearly completely from the casein. Both fresh milk and the serum from fresh milk show a slight acid reaction to phenolphthalein, but are strongly alkaline to methyl orange; the acidity is probably due to soluble acid phosphates. The authors suggest the

following as representing the principal constituents of milk: fat, 3.90; lactose, 4.90; proteins combined with calcium, 3.20; dicalcium phosphate (CaH_2PO_4), 0.175; calcium chloride, 0.119; magnesium phosphate ($\text{MgH}_2\text{P}_2\text{O}_8$), 0.103; sodium citrate ($\text{Na}_3\text{C}_6\text{H}_5\text{O}_7$), 0.222; potassium citrate, 0.052; dipotassium phosphate (K_2HPO_4), 0.230%; total solids, 12.901%.—W. P. S.

Milk; Effects of certain condensing and drying processes used in the preservation of — upon its bacterial contents. S. Delépine. Report to the Local Gov. Board, 1914, Food Report No. 21, 1—19.

THE total number of bacteria present in mixed cows' milk, such as is usually supplied to town consumers, was found to be considerably reduced when the milk was concentrated or dried by certain methods, e.g. (A) manufacture of sweetened condensed milk, (B) drying of milk on heated revolving cylinders, (C) drying by spraying the milk into a current of hot air. The reduction was greatest in the case of method A and least with method C. In each of the three methods of treatment there was a stage at which the total number of bacteria was much smaller than in the finished article ready for sale; the increase in the final stages was due to the exposure of the product to sources of infection by which bacteria were re-introduced. The reduction in the number of bacteria was almost entirely due to the destruction of *Streptococci*, *Staphylococci*, *Sarcinae*, bacilli of the *B. coli* type, *Streptothrichae*, yeasts, etc. In all three methods the amount of heat to which the milk was submitted was insufficient to destroy several saprophytic and some pathogenic bacteria, and at none of the stages of preparation was the milk found to be completely sterile. Among the saprophytic bacteria, which were invariably found to resist pasteurisation, those most commonly detected were sporing bacilli of the types included under the term *B. mesentericus*; some *Streptothrichae* appeared in certain cases to have survived, but the evidence on that point was not conclusive. Of the pathogenic bacteria, some living tubercle bacilli of bovine origin survived the treatment of method B; method C, which yields a product having a higher total number of bacteria than method B, probably has even less effect on tubercle bacilli. The same bacilli resisted the process of pasteurisation which forms part of method A. The tubercle bacilli, which survived pasteurisation in method A and drying by heat in method B, were still capable of producing progressive tuberculosis in guinea pigs inoculated subcutaneously with milk containing these bacilli, but the course of the disease was very much slower than that of the disease produced by inoculation with the same amount of untreated tuberculous milk. The tuberculosis produced by the heated bacilli was latent or occult for some four weeks; young rabbits fed with milk containing these modified bacilli did not contract tuberculosis. In fixing bacterial standards for preserved milk, the fact of re-contamination during manufacture should be kept in mind; by the exercise of proper care such re-contamination might be almost entirely prevented. If this were done, the total number of aerobic bacteria present should seldom exceed 100 per gm. of preserved milk.—W. P. S.

Wheat; Influences affecting the protein-content of —. G. W. Shaw. Univ. California Public. Agric. Sci., 1913, 1, 63—126. Bull. Bureau Agric. Intell., 1914, 5, 1583—1581.

INVESTIGATIONS, extending over six years, upon the effect of external conditions upon the protein content of wheat, have shown that the chief factor is climate, and particularly the moisture supply in the later stages of growth, excess of moisture

lowering the amount of protein and also accelerating the tendency of the wheat to pass from a glutenous into a starchy condition. Starchy wheat may change to an entirely glutenous condition in a single season, and *vice versa*, according to the seasonal conditions. The protein-content is greater from late-seeded than from early-seeded grain; retardation of growth by cooling of the atmosphere (cold nights) also increases it. The amount of sunshine received by the plant has a direct, if slight, influence upon the protein content, but the latter is practically unaffected by allowing the grain to stand on the straw in the field until fully ripe. The quantity of available nitrogen in the soil is of no practical importance provided it be not below the normal. The deficiency of Californian wheats in protein is not due to soil exhaustion, but to early seeding, the long period of growth, and the use of seeds with a low gluten content.—E. H. T.

Ensilage; The preparation of — F. Samarani. Boll. del Minist. di Agric., 1913, 13, 87—103. Bull. Bureau Agric. Intell., 1914, 5, 1625—1626.

THE changes in grass silage during the first few days in ordinary silos are due to acetic and lactic fermentations. In the acetic fermentation the sugars of the cell-substance are converted into alcohol and carbon dioxide by an intracellular process; the subsequent acetification of the alcohol is due to chemical or physiological action, and not, as in the case of the lactic fermentation, to bacteria. The predominance of acetic acid in normal sour silage is caused by the high temperature (40°—60° C.), but if the lactic ferment has free sugar at its disposal, it can produce more acid than the acetic ferment. Hence the addition of lactose, in dilute solution, is recommended. By accelerating the production of acid this addition inhibits any further bacterial fermentation, thus preventing putrefaction and the formation of ammonia, butyric acid, etc. The use of mechanical pressure, immediately after stacking, is advocated, for by excluding air, overheating is avoided, the acetic fermentation is reduced, and the lactic fermentation encouraged. Silos fitted with mechanical presses yield a fodder the total free acid of which contains 70% of lactic acid and 20% of acetic acid, whereas with ordinary non-mechanical pressing the proportions are reversed. An experiment on the ensilage of beet slices also showed the necessity of air-exclusion by heavy pressure, and the utility of adding lactose.

—E. H. T.

Meats, etc.; Detection of antiseptics [benzoic acid and its derivatives] in preserved — F. Marre. Ann. Falsif., 1915, 8, 16—27.

Two samples of a German preservative sold under the name "Cordin" were found to consist of: (1). a mixture of *m*-dinitrobenzoic acid, cinnamic acid, and sodium chloride; (2). a mixture of sodium chloride, 20. potassium nitrate, 35, and an amino derivative of benzoic acid, 45%. Samples of corned beef, lunch and ox tongues, sausages, ham, and various other tinned or potted meats imported to France from America and Germany were all free from boric acid, formaldehyde, sodium bicarbonate, salicylic acid, and fluorides, but derivatives of benzoic acid were detected in two samples of corned beef, two tins of lunch tongues, and in various makes of sausages. The following method is recommended for the detection of derivatives of benzoic acid in meats, etc. An average sample of 20 grms. is dried completely, mixed with sand, and extracted with benzene or carbon tetrachloride to remove fat. The material is then heated to evaporate the solvent, moistened thoroughly with water, and extracted with hot water. The aqueous extract is shaken with ether,

the ethereal solution evaporated, and the residue dissolved in a small quantity of aniline faintly coloured with magenta, adding water and hydrochloric acid sufficient to dissolve the aniline. The mixture is filtered and the filter washed with water; if benzoic acid was present in the sample, the filter paper is coloured blue owing to the formation of aniline-blue. Benzoic acid may be detected in the presence of nitrates by extracting the meat with water, evaporating the aqueous extract to a small volume, transferring this to a test-tube, and evaporating it to dryness; when the residue is incinerated, an odour of bitter almonds indicates the presence of a benzoic acid derivative. A similar odour is noticed when the alcoholic extract of a meat containing an amino derivative of benzoic acid is evaporated and the residue incinerated.—W. P. S.

Phosphoric acid; Method for the determination of inorganic — in certain tissues and food products. R. M. Chapin and W. C. Powick. J. Biol. Chem., 1915, 20, 97—114.

THE substance is extracted with an aqueous picric acid solution containing a small quantity of hydrochloric acid, and the phosphoric acid in the extract is precipitated as ammonium magnesium phosphate, which is converted into ammonium phosphomolybdate under the conditions prescribed by Lorenz (see this J., 1912, 259). A portion of the substance, containing from 8 to 80 mgrms. P_2O_5 , is ground with 20 grms. of dry sand and then mixed with 200 c.c. of water and 10 c.c. of 2.5N hydrochloric acid; 5 grms. of picric acid is added, the mixture is shaken continuously for 30 minutes, filtered, and 100 c.c. of the filtrate used for the determination. The total volume of the solution is corrected for the amount of water introduced in the quantity of substance taken for the analysis; when this cannot be determined accurately, a known weight of potassium iodide may be added to the total mixture, and a determination of the concentration of this substance in the extract will give the volume of the liquid in which it, and consequently the P_2O_5 , was dissolved. Determinations of phosphoric acid in eggs showed that the inorganic phosphoric acid increases with the age of the eggs; fresh eggs were found to contain 0.062 to 0.070% of inorganic P_2O_5 (calculated on the dry substance), whilst eggs in an advanced stage of decomposition contained 0.414%.

—W. P. S.

Carbon oxysulphide; Detection and determination of small quantities of — in carbon dioxide, [mineral waters,] and well-gases. L. Dede. Chem.-Zeit., 1914, 38, 1073—1075.

CERTAIN mineral waters containing much carbon dioxide, although originally failing to respond to the usual tests for hydrogen sulphide, developed appreciable amounts of that substance upon keeping; the gases from these waters, including one particular specimen of carbon dioxide used commercially for aerating purposes, behaved similarly. The presence of sulphur was established and its amount determined in the original gases by fixation as lead sulphate, according to Dennstedt's combustion method. No sulphide was produced from dissolved sulphate either in the presence of ferrous bicarbonate or of cork fragments, even after keeping for long periods; its formation is ascribed to the presence of small amounts of carbon oxysulphide in the waters. The decomposition of this substance by water, being a reversible process, occurs very slowly in the presence of carbon dioxide: $COS + H_2O \rightleftharpoons H_2S + CO_2$. When water containing 0.05% of sodium bicarbonate was saturated with carbon dioxide containing 0.02% of carbon oxysulphide and preserved in stoppered bottles,

the odour of hydrogen sulphide became perceptible after about four days. Carbon oxysulphide was most conveniently detected and determined by aspirating a slow stream of the gas through a Lunge bulb-tube containing a dilute (1:1000) solution of palladous chloride acidified with hydrochloric acid and kept at 50° C.: $\text{COS} + \text{PdCl}_2 + \text{H}_2\text{O} = \text{PdS} + 2\text{HCl} + \text{CO}_2$. In the presence of fairly large amounts of hydrocarbons and other reducing gases which cause the separation of metallic palladium, stronger solutions of palladium chloride (up to 4:1000) were necessary. The precipitate was collected, washed, and dissolved in hot 10–15% hydrochloric acid containing a little potassium chlorate, the bulbs being washed out with the same reagent. The amount of sulphate in the diluted solution was estimated by precipitation with barium chloride. Three successive quantities of 25 litres of the commercial carbon dioxide mentioned above yielded, respectively, 0.0057, 0.0059, and 0.0048 grm. BaSO_4 , corresponding to 0.0029% COS by weight. The gas obtained directly from a well by means of a partially immersed bell-jar and a 25-litre aspirator gave, similarly, 0.0037, 0.0031, 0.0038, 0.0035, and 0.0039 grm. BaSO_4 per 25 litres, corresponding to 0.0019% COS by weight. It is suggested that the change in the physiological action of certain mineral waters upon storing may probably be connected with the gradual decomposition of small amounts of carbon oxysulphide.—J. R.

Determination of small quantities of boric acid. Halphen. See VII.

Utilisation of the fish waste of the Pacific Coast. Turrentine. See XVI.

Manufacture of pressed or bakers' yeast. Reavenall. See XVIII.

Determination of sulphur in organic substances [foods, etc.]. Krieger. See XXIII.

PATENTS.

Casein from buttermilk; Process for making —. R. Eilersen, Copenhagen, Denmark. U.S. Pat. 1,126,429, Jan. 26, 1915. Date of appl., Mar. 19, 1914.

BUTTERMILK is heated to 40°–65° C., the curd is separated, washed with cold water, then mixed with a quantity of water equal to the volume of the whey, and dissolved by the addition of sodium bicarbonate. The solution is freed from butterfat and albumin and acidified with hydrochloric acid, and the precipitated casein is washed with cold water.—W. P. S.

Milk product [glycerophosphate milk powder]; Desiccated — and process for producing same. A. A. Dunham, Bainbridge, N.Y., Assignor to Casein Co. of America. U.S. Pat. 1,126,734, Feb. 2, 1915. Date of appl., April 16, 1914.

MILK concentrated to about 15° B. (sp. gr. 1.116) is mixed with sodium glycerophosphate in the proportion of 5 parts to every 95 parts of dry milk solids, and the mixture is dried to a solid form.

—W. P. S.

Milk and milk compositions; Method of dehydrating —. J. M. W. Kitchen, East Orange, N.J. U.S. Pat. 1,127,778, Feb. 9, 1915. Date of appl., Jan. 24, 1914.

SKIMMED milk is added gradually to cereal granules rich in vegetable fat, the mixture being stirred and exposed to dry air at 150° F. (66° C.) during the addition so as to produce a coating of dried milk on the surface of the granules. The mixture is then dried.—W. P. S.

Milk preparation partly or entirely free from carbohydrates and salts; Manufacture of a —. Deutsche Milchwerke, Dr. A. Sauer. Ger. Pat. 275,366, Oct. 11, 1912.

WHOLE milk or its equivalent is heated to 80° C. and rendered homogeneous by one of the known methods. It is then curdled by means of acid, for example, by lactic acid fermentation, and the whey separated partly or completely. For use the separated whey is replaced by a corresponding quantity of water.—A. S.

Foodstuffs from sulphite cellulose waste liquors; Process of making —. J. König, Munster, Germany. U.S. Pat. 1,128,154, Feb. 9, 1915. Date of appl., Mar. 24, 1911.

SEE Fr. Pat. 469,768 of 1914; this J., 1915, 47.

Apparatus for impregnating liquids with gases [carbon dioxide]. U.S. Pat. 1,128,264. See I.

Flavouring oil. U.S. Pat. 1,127,515. See XII.

XIXB.—WATER PURIFICATION; SANITATION.

Bleaching powder and thiosulphate; The reaction between — in the purification of potable waters. H. Strunk. Veröffentl. Geb. Militär-Sanitätsw., 1914, 28–38. Chem.-Zeit., 1914, 38, Rep., 456.

THE products of the reaction between bleaching powder and thiosulphate in the absence of free acid are sulphuric and tetrathionic acids. When thiosulphate is present in moderate excess, half of it is oxidised to sulphuric and half to tetrathionic acid, but in presence of a larger excess of thiosulphate the reaction proceeds irregularly. If free acid, e.g., carbonic acid, is present, less or even no tetrathionic acid is formed. One mgrm. of active chlorine requires 0.87 to 1.58 mgrms. of sodium thiosulphate, according to the nature of the water to be purified; any reducing action the water may have must also be taken into account.—T. C.

Hydrogen peroxide; Action of — on metals, and its use for disinfecting instruments. W. Eichholz. Med. Klinik, 1913, No. 51. Chem.-Zeit., 1914, 38, Rep., 514.

PURE hydrogen peroxide solutions do not attack iron and other metals, except silver, but corrosion is induced by the small amount of impurities present in peroxide sold for medicinal purposes. A 3% solution of the pure peroxide should be used for the disinfection of iron, nickel, and copper instruments. The reaction with iron is so characteristic that it can be used as a test for the purity of hydrogen peroxide preparations, provided that pure distilled water and glass vessels which do not yield any alkali are used.—J. H. J.

Firedamp testers. Beckmann and Steglich. See IIA.

Purification of paper mill effluents. Kershaw. See V.

Further applications of the boric acid method [for determining ammonia]. Winkler. See VII.

Detection and determination of small quantities of carbon oxysulphide in carbon dioxide, [mineral waters,] and well gases. Dedé. See XIXA.

Determination of nicotine in tobacco and tobacco preparations. Baggessaard-Rasmussen. See XX.

PATENTS.

[Water] filters. J. P. Candy, Sutton, Surrey. Eng. Pat. 27,581, Dec. 1, 1913.

A CYLINDER valve having two connected pistons of different areas and provided with connections

for unfiltered and filtered water, wash water, and waste, is used for controlling the working and washing of the filter. The valve is operated by a system of levers actuated by the difference of pressure between the filtered and unfiltered water, which varies when the filter becomes dirty. When this happens a differential apparatus allows water to flow into a suspended bucket and thereby starts the reversing gear. The filtration is then interrupted and washing takes place; when this is completed the valves are again reversed and filtration proceeds.—W. H. C.

Organic material; Process of preserving — R. D. Elliott, San Francisco, Cal. U.S. Pat. 1,126,430, Jan. 26, 1915. Date of appl., Mar. 9, 1914.

THE material is sterilised by the action of ozonised air, and the air from the sterilising chamber is then circulated through an apparatus containing substances which will absorb ozone, and returned to the chamber. The material is stored in this ozone-free, aseptic atmosphere.—W. P. S.

Determination of substances in gases or liquids [e.g., carbon monoxide in mine air]. Eng. Pat. 250. See XXIII.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Opium alkaloids; Determination of — J. Gsell and B. Marschalkó. Z. anal. Chem., 1914, 53, 673—678. Chem.-Zeit., 1914, 38, Rep., 590.

CODEINE, thebaine, papaverine, narcotine, and narceine can be determined rapidly, with an accuracy at least as high as given by other methods, by determining the amount of methoxyl group present, using the ordinary Zeisel method (this J., 1886, 335).—T. C.

Morphine; Resistance of — to putrefaction. F. Doepmann. Chem.-Zeit., 1915, 39, 69—71.

SEPARATE quantities of 1 kilo, of chopped, lean horseflesh were mixed with 200, 100, 50, and 20 mgrms. respectively of morphine hydrochloride and 200 grms. of the mixture investigated after 1, 2½, 5½, and 11 months. The putrefying mass was thoroughly extracted with very dilute acetic acid, first cold, then warm, and finally on the water-bath. The acid extract was concentrated, precipitated with alcohol, the alcohol-free filtrate precipitated with lead acetate, excess of lead removed by hydrogen sulphide, and the solution concentrated, made alkaline with ammonia, and extracted repeatedly with warm chloroform. The residue from the chloroform extract was dissolved in dilute sulphuric acid and extracted with pure amyl alcohol to remove colouring matters, then made alkaline with caustic soda, and extracted with a small amount of chloroform to remove ptomaine bases, and finally made alkaline with ammonia and repeatedly extracted with warm chloroform. The pale yellow varnish left on evaporating the chloroform gave in every case the characteristic reactions of morphine.—T. C.

Papaver somniferum; The function of the alkaloids of — A. Müller. Arch. Pharm., 1914, 252, 280—293. Chem.-Zeit., 1914, 38, Rep., 506.

THE seeds of *Papaver somniferum* contain no alkaloids until about 14 days after germination. The alkaloid content of the growing plant increases until the accumulation of albumin reserves in the seeds begins after the flowering period. As the seeds ripen the alkaloid content diminishes, so that the alkaloids probably form reserve stores of nitrogen which are subsequently used for albumin

formation and are thus not specific excretory products. (See also this J., 1914, 885.)—T. C.

Tobacco; Transformation of the nitrogenous constituents in the curing of — L. Bernardini. Rend. Soc. Chim. Ital., 1914, 6, 223. Annali Chim. Appl., 1915, 1, 76.

DURING the curing of tobacco leaves by direct fire there is a considerable loss of dry substance; about one-fourth of the nitrogenous constituents disappears; the loss occurs mainly in the first stage of the curing. In leaves from mature plants, the nitrogenous constituents, with the exception of nicotine, consist almost entirely of proteins. In the first stage of the curing process the protein content is reduced by about one-third, of which a small fraction is lost, whilst the remainder is found in the form of amino-compounds, asparagine predominating. The transformation of the protein does not proceed further in the second stage of the curing but a small part of the amino-nitrogen disappears. The loss of nicotine is about 22%, mainly in the last stage of the process; the loss during the second stage is three times greater than during the first stage. The content of nitrates is not affected notably, but ammonia—present only in traces in the fresh leaves—is formed in appreciable quantities during the curing.—A. S.

Tobacco and tobacco preparations; Determination of nicotine in — H. Baggesgaard-Rasmussen. Chem.-Zeit., 1915, 39, 25.

TOBACCO and tobacco preparations are extracted with 20% sodium hydroxide solution and then with a mixture of ether and light petroleum. The latter extract, containing the whole of the nicotine, is shaken with dilute hydrochloric acid, and the nicotine is determined by precipitation with silicotungstic acid, the precipitated salt, $2C_{10}H_{14}N_2 \cdot 2H_2O \cdot 12W_3SiO_2 + 5H_2O$, being dried at 120° C. and weighed as $2C_{10}H_{14}N_2 \cdot 2H_2O \cdot 12W_3SiO_2$.—J. R.

Digitalis preparations; Relative strengths of — R. Robert. Apoth.-Zeit., 1914, 29, 761. Chem.-Zeit., 1914, 38, Rep., 509.

DIGITALIS tinctures prepared from fresh leaves with 96% alcohol are more stable than when prepared by the German official method and also more active in physiological tests. Such tinctures, unlike the official tinctures, in nearly all cases had no hæmolytic action. Tinctures prepared from leaves which had been plucked 4 days previously were distinctly less active than those prepared from fresh leaves. Summer leaves are preferable to October leaves. If the leaves must be dried, this should be done *in vacuo* with a rising temperature. (See also this J., 1915, 100.)—T. C.

Coumarins; Research on — [Constitution of scopoletin.] G. Bargellini and L. Monti. Gaz. Chim. Ital., 1915, 45, 1, 90—98.

BY the action of a persulphate in cold alkaline solution on a phenol, a hydroxyl group is introduced into the benzene nucleus in the para position to the original hydroxyl, or if this position be occupied, in the ortho position. Coumarin, in like manner, when treated with alkaline potassium persulphate yields 5-hydroxycoumarin, whilst 4-methoxycoumarin (the methyl ether of umbelliferone) yields 4-methoxy-5-hydroxycoumarin, the monomethyl ether of æsculetin, identical with that prepared by Tiemann and Will (Berichte, 1882, 15, 2075) by the partial esterification of æsculetin. The other monomethyl ether of æsculetin is scopoletin (see Moore, this J., 1910, 1330; Power and Rogerson, this J., 1912, 45, 299),

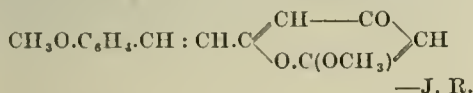
and the authors' work thus affords confirmation of the constitution, viz., that of a 4-hydroxy-5-methoxy coumarin, ascribed to this compound by Moore (this J., 1911, 710).—A. S.

Cinnamein; Optical activity of —. L. Rosenthaler. *Schweiz. Apoth.-Zeit.*, 1914, 52, 273. *Chem.-Zeit.*, 1914, 38, Rep., 453.

CINNAMEIN was isolated from a number of samples of genuine Peru balsam by extracting with ether in presence of caustic soda solution; in most cases the product was dextrorotatory. When 10 grms. of balsam was mixed with 10 grms. of caustic soda solution and 10 grms. of water, and shaken with 50 grms. of ether, the ethereal solutions from *Hardeickia pinnata* balsam, gurjun balsam, Maracaibo copaiba balsam, and Para copaiba balsam had optical rotations of -1.3° , -20.78° , $+0.4^\circ$, and -0.83° respectively.—T. C.

Kawa root; Constituents of —. W. Borsche and M. Gerhardt. *Riedels Arch.*, 1914, 50. *Chem.-Zeit.*, 1914, 38, Rep., 472.

IN addition to the resin, gonosan, the root of the kawa plant (*Piper methysticum*) contains an alkaloid, an amorphous acid, and a number of glucosides, including the readily purified substances methysticin and yangonin. Methysticin, $C_{15}H_{14}O_5$, is the methyl ester of γ -piperonylene-acetoacetic acid (compare this J., 1908, 708). Yangonin yields *p*-methoxycinnamic acid and anisacetone (or anisaldehyde and acetone) on warming with caustic alkali, and is probably a γ -pyrone derivative of the constitution:



Kawa resin in gonosan; Determination of —. L. Hess. *Riedels Arch.*, 1914, 57. *Chem.-Zeit.*, 1911, 38, Rep., 463.

TEN grms. of the sample is distilled with 200 c.c. of saturated sodium chloride solution in a current of steam until drops of oil cease to appear. The oil is extracted from the distillate with ether, the solution dried with sodium sulphate and evaporated, and the residue (which should be about 7.5 grms.) weighed. It should agree in sp. gr., santalol content, and solubility in 70% alcohol with pure sandal-wood oil. The residue in the distillation flask is extracted with ether, the ethereal solution dried and evaporated, and the residue (about 1.7 grms.) weighed. It should have the odour and taste of kawa resin and give a deep red coloration with strong sulphuric acid. Normal pure gonosan contains 80% of sandal-wood oil and 20% of kawa resin, whereas by this method only about 75 and 17% respectively are separated, the differences being due to loss and decomposition. Genuine gonosan with 20% of kawa resin has a refractive index of 1.5190 at 20°C .; mixtures containing 15%, 1.5158; with 10%, 1.5130; with 4% 1.5087, etc. Samples giving readings outside the limits 1.5060 and 1.5200 may be condemned as adulterated without further examination.—C. A. M.

Lemon oils; Concentrated —. A. Parrozzani. *Ann. R. Staz. Sperim. Agrumic. di Acireale*, 1914, vol. II. *L'Ind. Chim.*, 1915, 2, 87.

CONCENTRATED lemon oils are frequently adulterated with citral from lemongrass oil; hence the citral content is worthless as a means of judging the quality. The most useful data are the content of terpenes and sesquiterpenes and the ratio of esters to aldehydes.—A. S.

Thymol; The present scarcity of —. *Bull. Imp. Inst.*, 1914, 12, 599—605.

PRIOR to the war ajowan seeds (*Carum copticum*, Benth.) formed almost the sole commercial source of thymol, which was manufactured nearly entirely in Germany. In addition to the possible new commercial sources of thymol mentioned by Unney (this J., 1914, 1073), attention is called to *Ocimum viride*, Willd. ("mosquito plant"), which occurs abundantly both wild and cultivated in all parts of Sierra Leone and also in other parts of W. Africa and in the W. Indies: the oil distilled from the leaves contains up to 65% of thymol. Carvacrol, which is nearly as powerful an antiseptic as thymol (see Martindale, this J., 1910, 1470), is the chief constituent of certain origanum oils (see this J., 1913, 378), and is also present in *Monarda fistulosa*, L. (wild bergamot) oil (52—58%), *Satureia hortensis*, L. oil (38—42%), and *S. montana*, L. (white thyme) oil (up to 65%). The iodide of carvacrol ("iodocrol") is odourless and is estimated to have a bactericidal power five times greater than that of iodoform.—A. S.

Salicyluric acid [in presence of salicylic acid]; Determination of —. A. Baldoni. *Arch. Farmacol. Sperim.*, 1914, 18, 1. *Annali Chim. Appl.*, 1915, 1, 65.

SALICYLURIC acid when present together with salicylic acid, in urine for example, may be determined by first extracting the two acids together with ether, and then separating them by extraction with chloroform, which dissolves salicylic acid much more readily than it does salicyluric acid.—A. S.

Benzoic acid in urine; Determination of —. G. W. Raiziss and H. Dubin. *J. Biol. Chem.*, 1915, 20, 125—128.

ONE hundred c.c. of fresh urine is acidified with 1 c.c. of concentrated nitric acid, then saturated with ammonium sulphate (from 50 to 60 grms. is required), and extracted with four successive portions (50, 40, 30, and 30 c.c. respectively) of pure toluene. The combined toluene extracts are washed twice with 100 c.c. of saturated sodium chloride solution containing 0.05% of concentrated hydrochloric acid, and the benzoic acid in the toluene solution is titrated with N/20 sodium ethoxide, using phenolphthalein as indicator. The sodium ethoxide is prepared by dissolving 2.3 grms. of metallic sodium in 2 litres of absolute alcohol. Four analyses of human urine by this method showed the absence of benzoic acid. Hippuric acid, if present, is not extracted by toluene.—W. P. S.

Benzaldehyde; Alleged existence of an optically active —. G. Bredig and M. Minaeff. *Chem.-Zeit.*, 1915, 39, 73.

THE so-called optically active benzaldehyde stated by Erlenmeyer to be formed when benzaldehyde is boiled with an alcoholic solution of tartaric acid, consists of a mixture of ordinary benzaldehyde with a small amount of a compound of benzaldehyde and tartaric acid to which the optical activity is due. This compound can be removed from the optically active mixture by hydrolysing with sulphuric acid or separated by treatment with sodium bisulphite which combines with the benzaldehyde.—T. C.

Pharmaceutical products of which the Patents have expired. *Chem. and Drug.*, Jan. 30, Feb. 20, Feb. 27, and Mar. 6 and 13, 1915.

THE following are particulars of some recently expired British patents, given in alphabetical order of the trade names.

Acocine. Di-*p*-anisyl-monophenethylguanidine hydrochloride (local anaesthetic). Patent 24,287 of 1897. Prepared from carbon bisulphide or a thiourea and aminophenol, with or without the use of a desulphurising agent.

Airol. Bismuth oxy-iodogallate (substitute for iodoform). Pat. 22,902 of 1894. Obtained by heating bismuth oxyiodide with gallic acid or by treating bismuth gallate with hydriodic acid.

Alumole. Aluminium naphtholsulphonate (astringent and mild antiseptic). Pat. 10,668 of 1892. Produced by the action of aluminium sulphate on the barium salt of β -naphtholdisulphonic acid R.

Argentamin. Ethylenediamine silver nitrate (antiseptic and astringent). Pats. 8429 of 1893 and 10,845 of 1900. Silver nitrate is added to an aqueous solution of ethylenediamine and the gelatinous product is dried.

Argonin. Silver-casein. Pat. 22,191 of 1894. A salt of casein is treated with silver nitrate solution.

Aristochin. Carbonylquinine (medicinal properties similar to quinine, but tasteless). Pat. 16,564 of 1898. Obtained by the action of phosgene on quinine.

Aristol. Dithymol iodide. Pat. 5079 of 1889. Thymol is treated with iodine and an alkali iodide in presence of alkali.

Benzosol or *Phthiosol.* Guaiacol benzoate (intestinal antiseptic; also in incipient phthisis). Pat. 5366 of 1890. A salt of guaiacol is heated with benzoyl chloride or benzoic anhydride.

Chinaphenin. Phenetidine-quinine carbonic ester. Pat. 22,285 of 1899. *p*-Phenetidine is treated with phosgene and the product is combined with quinine.

Chloralamide or *Chloralformamide* (hypnotic). Pat. 7391 of 1889. Obtained by the action of chloral on formamide.

Creosotal. Creosote carbonate. Pat. 19,074 of 1890.

Dermatol. Bismuth subgallate (dusting-powder, and for diarrhoea, etc.). Pat. 6234 of 1891. Neutral bismuth nitrate is dissolved in dilute nitric acid. Gallic acid is added, the solution is neutralised and the salt precipitated by means of sodium acetate.

Duotal. Guaiacol carbonate (used in phthisis, typhoid, and rheumatoid arthritis). Pat. 19,074 of 1890. Guaiacol is treated with phosgene.

Eucaine. Benzoyl-vinyldiacetonalkamine (local anæsthetic). Pat. 20,697 of 1896. The vinyldiacetonalkamine obtained by reduction of vinyldiacetonamine, is crystallised from benzene or ether, or its hydrochloride is extracted with absolute alcohol. The base of m. pt. 138° C. is benzoylated (see also this J., 1915, 150).

Eumydrin. Methylatropine nitrate (mydriatic). Pat. 25,804 of 1891. A solution of atropine in methyl alcohol is heated with methyl nitrate.

Euphthalmin. Phenylglycolyl-*N*-methyl- β -vinyldiacetonalkamine hydrochloride (mydriatic). Pat. 20,697 of 1896. A mandelic acid derivative of β -eucaine.

Euquinine. Quinine ethylcarbonate ("tasteless quinine"). Pats. 1991 of 1896 and 22,639 of 1899. Quinine is treated with a solution of chloroformic ethyl ester in benzene.

Europhen. Isobutyl-*o*-cresyl iodide (substitute for iodoform). Pat. 18,021 of 1890. Isobutyl-cresol is treated with iodine and alkali iodide.

Ferratin. Sodium ferri-albuminate (used in anæmia and chlorosis). Pats. 818 and 15,714 of 1895. Obtained from albumin and iron tartrate.

Ferropyrrine (*ferripyrrine*). Antipyrine ferric chloride (haemostatic and astringent). Pat. 2656 of 1895. Antipyrine and ferric chloride are allowed to interact in aqueous solution.

Gujasanol. Diethylglycooll guaiacol hydrochloride (deodoriser, and for tuberculous diarrhoea). Pat. 23,435 of 1898. Chloroacetylguaiacol (obtained

from guaiacol, monochloroacetic acid, and POCl_3) is mixed with diethylamine, and the product is treated with soda solution and extracted with ether.

Hedonal. Methylpropylcarbinol urethane (hypnotic). Pat. 18,802 of 1899. Methylpropylcarbinol is heated under pressure with urea nitrate.

Hektokresol. Cinnamyl-*m*-cresol (dusting powder in surgical tuberculosis). Pat. 9713 of 1898. A mixture of *m*-cresol, cinnamic acid, and phosphorus oxychloride is heated in presence of an indifferent solvent.

Ichthalbin. Ichthyl albuminate (for eczema and in nervous intestinal affections). Pat. 11,344 of 1897. Albumin and ichthyl are condensed together in presence of sulphuric acid.

Ichthylol. Ammonium sulpo-ichthyolate (for rheumatism and skin affections). Pat. 10,523 of 1884. Obtained from the sulphonation product of shale oil, etc.

Iodoformogen. Iodoform albumin (antiseptic for wounds). Pat. 18,178 of 1897. A solution of iodoform in alcohol and ether is added to an aqueous-alcoholic solution of albumin.

Iodopyrine. Antipyrine iodide (analgesic). Pat. 19,576 of 1890. Potassium carbonate and iodine are added successively, in small quantities, to a boiling solution of antipyrine.

Iodolen. Tetra-iodopyrrole-albumin (wound dressing). Pat. 16,353 of 1899. An alkaline solution of tetra-iodopyrrole is added to an aqueous solution of albumin and the mixture is immediately neutralised.

Iodothyric. Thyro-iodine (used in myxoedema, etc.). Pats. 12,295 and 20,827 of 1895 and 9576 of 1896. A product of the thyroid gland.

Lactophenin. Lactylphenetidine (analgesic and antipyretic). Pat. 12,166 of 1892. Obtained by heating *p*-phenetidine lactate.

Organic products; New British.—

THE "British and Colonial Druggist," in its issue of Feb. 26th, 1915, states that there is evidence of British firms producing large or small quantities of the following:—Acetanilide, acetylsalicylic acid, anidol, anethol, benzaldehyde, citral, citronellol, cocaine, β -eucaine, eugenol, formaldehyde, hexamethylenetetramine, methylsulphonal, phenacetin, quinol, salicylic acid, salvarsan, sodium salicylate, sulphonal, terpineol, thymol, triacetin, vanillin.

Azolisation by chloroamine. Forster. See III.

Constitution and synthesis of scutellarein. Bargellini. See IV.

Further applications of the boric acid method [for determining ammonia]. Winkler. See VII.

Tests for determining suitability of glass for medicines. Kroeber. See VIII.

PATENTS.

Menthol cones and the like; Manufacture of.— W. A. Whatmough, Surbiton. Eng. Pat. 10,198, April 24, 1914.

METHOL is melted, mixed with not more than 10% of a natural wax, fat, oil, or fatty acid, or fatty alcohol or ester, and the mixture is moulded. —W. P. S.

Alcohols [glycerol]; Method of condensing polyhydric.— H. Hibbert, Assignor to E. I. du Pont de Nemours Powder Co., Wilmington, Del. U.S. Pat. 1,126,467, Jan. 26, 1915. Date of appl. Dec. 5, 1913.

A LIQUID polyhydric alcohol, e.g., glycerol, is brought into contact with iodine and then heated under reduced pressure.—W. P. S.

Glycols; Preparation of di-secondary——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 277,392, May 6, 1913.

DI-SECONDARY glycols are obtained by the electrolytic reduction of saturated aliphatic aldehydes at metallic cathodes in an acid medium.—A. S.

Alkylaminoacydylcatechols; Preparation of——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 277,540, June 6, 1913.

ARYLSULPHONIC acid halides are allowed to act upon salts of aminoacydylcatechol ethers and alkali carbonates, in presence of an inert solvent, such as acetone, water being added gradually as the reaction progresses. The resulting arylsulphamino-derivatives are alkylated and the arylsulphoalkylaminoacydylcatechol ethers saponified.—A. S.

Acetylsalicylic acid chloride; Preparation of——. R. Wolffenstein. Ger. Pat. 277,659, Dec. 20, 1911.

ACETYSALICYLIC acid is heated with a solution of thionyl chloride in benzene or other inert solvent, preferably at the boiling point of the mixture, until evolution of hydrochloric acid and sulphur dioxide ceases.—A. S.

Glycerol-halogenhydrins and esters of polyhydroxy-fatty acids; Preparation of——. A. Grün. Ger. Pat. 277,901, Oct. 10, 1913. Addition to Ger. Pat. 272,337.

THE reaction between triglycerides of hydroxy-fatty acids and hydrohalogen acids described in the chief patent (this J., 1914, 667) may be effected at atmospheric pressure.—A. S.

Ethers; Preparation of——. Chem. Werke vorm. H. Byk. Ger. Pat. 278,777, May 31, 1911.

ALCOHOLS in the form of vapour, or ethylene hydrocarbons mixed with water and/or alcohol, are led over heated alum. The reaction proceeds at a lower temperature than when alumina is used as catalyst. When ethyl alcohol or ethylene is used, the reaction product is a mixture of ether and alcohol containing 25–50% ether; the alcohol can be recovered and again subjected to the treatment.—A. S.

ω-Aminomethylquinolines; Manufacture of——. Verein. Chininfabr. Zimmer und Co. Ger. Pat. 279,193, March 6, 1913.

ω-AMINOMETHYLQUINOLINES, useful for therapeutic purposes and for the preparation of other pharmaceutical products, are obtained by reducing nitriles of the quinoline series by the usual methods.—A. S.

Esters of hydroxybenzoyl-o-benzoic acids, their homologues and substitution products; Preparation of——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 279,201, July 12, 1913. Addition to Ger. Pat. 269,336 (this J., 1914, 277).

ALKYL esters of 3-hydroxybenzoyl-o-benzoic acid, its homologues, or substitution products, with the exception of the methyl ester, are obtained from the corresponding derivatives of 3-aminobenzoyl-o-benzoic acid by introducing a hydroxyl group in place of the amino group by the usual methods. This method is preferable to that described in the chief patent (*loc. cit.*) for the compounds in question, since 3-aminobenzoyl-o-benzoic acid can be readily obtained and easily esterified.—A. S.

Lobelia; Process for obtaining the total alkaloids of——. Chem. Werke vorm. H. Byk. Ger. Pat. 279,553, July 15, 1913. Addition to Ger. Pat. 267,219.

THE process for extracting the total alkaloids of *ipeacuanha*, described in the chief patent (this J.,

1914, 43), is applied to the *lobelia*. The alkaloids are preferably recovered as hydrochlorides, using chloroform or the like as solvent.—A. S.

Lymphs for inoculation against certain infectious diseases; Preparation of sterile——. Heirs of A. Jaeger, A. Jaeger, I. Jaeger, F. Fiehn, and G. Günther. Ger. Pat. 279,693, Jan. 9, 1912.

BACTERIA adhering to and contaminating the lymph are destroyed by treatment with acetone.—A. S.

Alkali salts of the 3,3'-diamino-4,4'-dioxarsenobenzene combined with silver and process of making same. P. Ehrlich and P. Karrer, Frankfurt, Assignors to Farb. vorm. Meister, Lucius, und Brüning, Höchst, Germany. U.S. Pat. 1,127,603, Feb. 9, 1915. Date of appl. Jan. 27, 1914.

SEE Eng. Pat. 1247 of 1914; this J., 1914, 942.

Manufacture of selenofluoresceins. Ger. Pat. 279,549. See IV.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

PATENTS.

[Photographic] particoloured screens; Methods of making——. C. L. A. Brasseur, Orange, N.J., U.S.A. Eng. Pat. 28,631, Dec. 11, 1913.

A TRI-COLOUR element of plastic material such as celluloid, is produced either by cementing together strings of the three different colours, or more easily by cementing together three coloured sheets and then making transverse sections. These elements are then assembled lengthwise and cemented together by pressure. Sections are cut at right angles to the length of the elements. Uniform screens are thus obtained, irregular in pattern, but without aggregations of grains of the same colour. For the production of long lengths of such film for cinematograph use a cylinder is built up of blocks of tri-colour elements, the length of the elements being arranged radially; a continuous section is then cut from the surface of the cylinder by a veneering machine or similar appliance.—B. V. S.

Sensitising composition for photographic paper—F. I. Rubricius, New York. U.S. Pat. 1,126,872, Feb. 2, 1915. Date of appl., May 31, 1913.

THE sensitising solution contains ferric ammonium citrate, gum arabic, citric acid, silver nitrate, uranium nitrate, and alcohol.—B. V. S.

XXII.—EXPLOSIVES; MATCHES.

PATENTS.

Explosive. A. B. Cole, Bloomsburg, Pa. U.S. Pat. 1,126,401, Jan. 26, 1915. Date of appl., July 2, 1913.

AN explosive yielding no material excess of oxygen, carbon, or hydrogen, is prepared by mixing granulated sugar (25%), finely-divided carbonaceous mineral matter (22%), potassium chlorate (30%), sodium nitrate (20%), wood alcohol (2%), potassium permanganate (0.5%), and lamp black (0.5%).—C. A. M.

Match ; Waterproof — and method of making same.
F. van Dyke Crusier, Barberton, Ohio, Assignor to the Diamond Match Co., Chicago, Ill. U.S. Pat. 1,127,410, Feb. 9, 1915. Date of appl., Feb. 17, 1914.

A GELATINOUS ingredient is mixed with the match composition, and the match heads are subsequently exposed to formaldehyde vapours or solution to produce an insoluble and waterproof coating.—C. A. M.

XXIII.—ANALYTICAL PROCESSES.

Gases ; Determining the specific gravity of — and correcting the volume to normal. M. Hofsäss. J. Gasbeleucht., Jan. 30, 1915. J. Gas Lighting, 1915, 129, 388—389.

Specific gravity. The apparatus (see fig.), for the continuous control of the gas passing through a main, depends on the Bunsen effusion principle and consists of an inverted U-tube, closed by taps, A and B, and having attached to one limb a pressure gauge, H, and, at the bend, a tap, D, in the bore of which is the effusion orifice. The ends of both limbs communicate with a horizontal tube in the middle of which is a tap, E, this tube being connected with the gas supply so that when E is closed and A, B, and C open, gas flows through the apparatus in the direction of the arrows. To make a determination, E is opened and A and B closed, thus trapping gas at the pressure in the main in the space between A and B; D is now opened and the time required for the liquid in the pressure gauge to fall from an upper to a lower mark observed. If necessary the liquid in the gauge may be raised to the upper mark by the aid of the levelling vessel, G. The lower mark of the pressure gauge is adjustable, and is set so that the time of efflux of air is exactly 1 minute, the density of the gas, relative to air, being then equal to the square of the time of efflux of the gas, in minutes. The effect of temperature on the accuracy of the determination is negligible for variations of from 3° to 5° C.; otherwise the lower mark on the gauge must be set for air at the temperature required. To allow of re-setting without stopping the flow of gas, A and B are three-way taps by means of which the U-tube may be put in communication with the atmosphere.

Correction of volume to normal. A chart is given for correcting volumes of gas (measured saturated) and calorific powers, to 0° C. and 760 mm., dry, which may be used in place of the ordinary tables.—W. E. F. P.

Fractional distillation with regulated stillheads. I. M. A. Rosanoff and C. W. Bacon. J. Amer. Chem. Soc., 1915, 37, 301—309.

THE vapour from the still was passed upwards through the closed annular space between the

walls of a large, double-walled cylinder of tinned copper, contained in a thermostat. Consecutive fractions were collected and examined in the manner previously described (see this J., 1914, 1027). Mixtures of carbon bisulphide and acetone, ethyl iodide and ethyl acetate, and chloroform and acetone were investigated; with the first two mixtures the boiling-point curve passes through a minimum and with the third mixture through a maximum. The stillhead had no effect when its constant temperature was above that of the boiling-point of the liquid in the still; in every other case the liquid furnished a series of fractions of constant composition, in agreement with that point on the dew (vapour-composition) curve corresponding to the temperature of the stillhead. For instance, with the stillhead at 40.02° C. a mixture of carbon bisulphide with a small proportion of acetone gave seven successive fractions containing 75.1 mols. % CS_2 , while a similar mixture with 71 % of acetone gave 15 successive fractions having 55.4 mols. % CS_2 .—J. R.

Pyrometer ; A new optical —. W. Allner. J. Gasbeleucht., 1913, 56, 1145—1150. Chem.-Zeit., 1914, 38, Rep., 469.

A RADIUM preparation replaces the electric lamp as the standard source of light, and calibration is accomplished by means of a gas-heated, absolutely black substance, the temperature of which is ascertained with a platinum-rhodium thermometer. Results were obtained in good agreement with those yielded by a Wanner pyrometer.—J. R.

Copper titrations ; Economy and rapidity in —. E. A. Slagle. Eng. and Min. J., 1915, 99, 285.

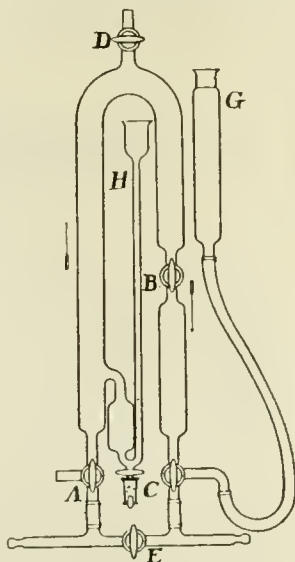
IN the iodide method, the nitric acid solution of the copper is neutralised by the addition of zinc acetate (instead of sodium carbonate, followed by acetic acid) and the titration then conducted as usual, the end point under these conditions being "permanent" for only 5—10 mins. The mixed lead and copper iodides may be recovered from the solutions by precipitation with lead nitrate in the presence of an excess of sodium thiosulphate.—W. E. F. P.

Aluminium associated with iron : The separation and determination of —, by the action of acetyl chloride in acetone. H. D. Minnig. Amer. J. Sci., 1915, 39, 197—200.

ALUMINIUM chloride can be quantitatively precipitated and separated from ferric chloride in concentrated aqueous solution by adding, with stirring, a mixture of four parts of acetone with one of acetyl chloride; about 15 to 20 c.c. of the mixture is required for 0.02 gm. Al_2O_3 . The precipitate is washed with the precipitating mixture in a perforated crucible, dried, and ignited to convert the chloride into oxide. The iron may be estimated in the filtrate by diluting with water and precipitating with ammonia. If the acetyl chloride contain phosphorus compounds, aluminium or ferric phosphate may be formed, causing high results. Acetyl chloride free from phosphorus compounds may be prepared by passing a rapid stream of hydrogen chloride through a mixture of glacial acetic acid and phosphorus pentoxide or, preferably, through purified acetic anhydride at 100° C. Phosphorus compounds are removed readily from acetic anhydride by distillation over anhydrous sodium acetate.—W. C. H.

Sulphur ; Determination of — in organic substances [coal, coke, foods, etc.]. A. Krieger. Chem.-Zeit., 1915, 39, 22—23.

A MODIFICATION of the method of Holliger and Dennstedt (this J., 1909, 357; also Z. angew.



Chem., 1909, 33, 677) is recommended for the determination of sulphur in coal and coke. The weighed sample (0.5 to 1 gm.) is distributed throughout the combustion boat, which is preceded in the combustion tube by a 10 cm. copper spiral; the customary packing of platinum scrap is replaced by a 10 cm. layer of flint. Combustion is effected in a stream of oxygen, the copper spiral and the flint being kept at a dull red heat. The resulting sulphuric acid is absorbed in $N/5$ sodium hydroxide solution and estimated volumetrically. The heating of the boat is so regulated that an excess of oxygen is continuously recognisable in a sodium hydroxide wash-bottle following the absorption apparatus. In the presence of lime, small amounts of sulphur are retained in the ash, e.g., 0.03 to 0.05% in a coal containing 0.20% CaO . For organic substances, plants, and foods, oxidation with concentrated nitric acid is preferable to the above process. The dried substance (1 grms.) contained in a 400 c.c. Kjeldahl flask is well mixed with nitric acid (20 c.c. of sp. gr. 1.18) and dissolved by heating over a small flame, whereupon the acid is partially removed by boiling. The residue is diluted with hot water (200 c.c.), filtered, and precipitated while hot with barium chloride. The barium sulphate is collected and weighed. Silica is not dissolved from plant materials under these conditions.—J. R.

Wijs' iodine solution; Preparation of —. H. Dubovitz. Chem.-Zeit., 1914, 38, 1111.

To prepare Wijs' $N/5$ iodine monochloride solution, 7.8 grms. of iodine trichloride and 8.5 grms. of iodine are required per litre. Most standard text books, copying an error (corrected in the last edition) in Lewkowitsch's book, prescribe 9.4 grms. of iodine trichloride and 7.2 grms. of iodine per litre; the solution thus prepared is much less stable than that containing the correct amounts.

—C. A. M.

A comparison of various modifications of the Kjeldahl method with the Dumas method of determining nitrogen in coal, with notes on errors in the Dumas method due to nitrogen evolved from the copper oxide. Fieldner and Taylor. See IIA.

Firedamp testers. Beckmann and Steglich. See IIA.

Determination of gasoline vapour in air. Burrell and Robertson. See IIA.

Determination of benzol in gas. Krieger. See IIA.

Determination and drying of bitumen and other viscous substances. Bornemann. See IIA.

Determination of the degree of "ripeness" of viscose. Hottenroth. See V.

Volumetric determination of free sulphurous acid. Sander. See VII.

Analysis of lactic acid. Faust. See VII.

Determination of small quantities of boric acid. Halphen. See VII.

Further applications of the boric acid method [for determining ammonia]. Winkler. See VII.

Detection of bromides in presence of thiocyanates, cyanides, and ferrocyanides. Curtman and Wikoff. See VII.

Methods of analysis of sulphur. Levi. See VII.

New reaction of free oxygen. Binder and Weinland. See VII.

Experiments with de Notty's apparatus for the determination of carbon [in iron and steel]. Lepsoe. See X.

A simple fat extraction tube. Butt. See XII.

Colour reaction of sesame oil. Bosch. See XII.

New method of determining glycerol [in fats]. Bertram. See XII.

Comparative analyses of basic slag by the methods of Lorenz, Naumann, and Popp. Holle. See XVI.

Determination of reducing sugars in cane molasses. Verret. See XVII.

Detection of aniline dyes in wines. Wohack. See XVIII.

Detection of antiseptics [benzoic acid and its derivatives] in preserved meats, etc. Marre. See XIXA.

Determination of inorganic phosphoric acid in certain tissues and food products. Chapin and Powick. See XIXA.

Detection and determination of small quantities of carbon oxysulphide in carbon dioxide, [mineral waters,] and well gases. Dede. See XIXA.

Action of hydrogen peroxide on metals and its use for disinfecting instruments. Eichholz. See XIXB.

Determination of opium alkaloids. Gsell and Marschalko. See XX.

Determination of nicotine in tobacco and tobacco preparations. Baggesgaard-Rasmussen. See XX.

Determination of kawa resin in gonosan. Hess. See XX.

Determination of salicylic acid [in presence of salicylic acid]. Baldoni. See XX.

Determination of benzoic acid in urine. Raiziss and Dubin. See XX.

PATENT.

Gases or liquids; Determination of substances in — [e.g., carbon monoxide in mine air]. J. Harger, Gateacre, Lancs. Eng. Pat. 250, Jan. 5, 1914.

THE method consists essentially in converting the substance to be determined into or replacing it by an equivalent quantity of an acid or alkali, and passing a solution of this through a small primary cell provided with a galvanometer. To determine carbon monoxide in mine gases, etc., the gas is passed through bromine-water, potassium hydroxide, sulphuric acid, or phosphorus pentoxide, and then brought into contact with iodine pentoxide heated to 150° – 170°C .; the liberated iodine is collected in arsenious acid solution which is passed through the cell. The apparatus is calibrated so that a zero reading is given for the potential difference of the electrodes in the arsenious acid solution before the iodine is introduced. The iodine pentoxide may be heated by placing it in a tube in the space between the gauze and the bonnet of a miner's safety lamp of modified form. Substances other than carbon monoxide may be determined in a similar way after they have been absorbed in suitable solutions. The galvanometer may be connected with an alarm device adapted to operate when a pre-determined amount of substance is present in a gas. (Reference is directed in pursuance of Sect. 7, Sub-sect. 4, of the Patents and Designs Act, 1907 to Eng. Pats. 14,342 of 1903 and 1776 of 1913; this J., 1903, 1085; 1913, 1171.)—W. P. S.

Trade Report.

Export prohibitions.

Great Britain. By an Order in Council, dated March 2nd, the exportation of paraffin wax and prussiate of soda is prohibited to all destinations other than British Possessions and Protectorates.

Germany. The exportation of collodion and of solutions of thorium and cerium salts is prohibited by a decree dated Feb. 15th.

Competition with Germany and Austria-Hungary. Board of Trade, March 5th and 10th, 1915.

IN connection with the campaign undertaken by the Board of Trade on the advice of their Advisory Committee on Commercial Intelligence to assist British manufacturers and merchants to secure trade formerly in the hands of German or Austro-Hungarian firms, the Board continue to receive a large number of inquiries for the names of sellers or buyers of articles of which the sources of supply or markets have been interfered with by the war. Special arrangements have been made in the Commercial Intelligence Branch of the Board of Trade for dealing with these inquiries, and lists 10 and 11 of articles which inquirers desire to purchase may be obtained by United Kingdom manufacturers and traders. British firms interested, as suppliers, in any of the goods mentioned should communicate with the Director of the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, London, E.C. A recent list of goods which firms in this country are prepared to supply is also obtainable from the Commercial Intelligence Branch.

Export and import licences; War Trade Department for dealing with —. Board of Trade J., Feb. 25, 1915.

A DEPARTMENT under the Treasury (to be called the War Trade Department) has been formed to replace the Committee on Trade with the Enemy so far as concerns the work of dealing with applications for export and import licences. The Department will also embrace an Intelligence Division which will serve as a Clearing House for all war commercial information. All communications should be addressed to the Secretary of the Department at 4, Central Buildings, Westminster, S.W.

Books Received.

THE CHEMISTRY OF PETROLEUM AND ITS SUBSTITUTES. By C. K. Tinkler, D.Sc., and F. Challenger, Ph.D., B.Sc., Lecturers in Chemistry, Birmingham University, with an Introduction by Sir Boverton Redwood, Bart. Crosby, Lockwood and Son, 7, Stationers' Hall Court, Ludgate Hill, London, E.C. Price 10s. 6d. (336+16 pages, 8½ x 5½ in.)

THE appearance of this volume will be appreciated by many who have felt the need for a work containing a certain amount of technological matter, together with an outline of the purely chemical principles, of which a knowledge is essential to a comprehension of the methods of the petroleum industry. The earlier chapters deal with petroleum products and the manipulation of inflammable liquids generally, and include sections on shale distillation and the cracking process. Further chapters are added on coal tar and its products, hydrogenation, alcohol and its derivatives, wood distillation, saponifiable oils, and thermo-chemistry. Sir Boverton Redwood writes as follows in the introduction:—"The authors have aimed primarily at providing a text-book for students who desire to become proficient in the

chemical technology of petroleum, and they have admirably achieved their object. . . . The book is much more than a mere aggregation of facts, for it is a highly commendable and successful attempt to bridge over the gap between the academic and the practical treatment of the subject, and it should do much to pave the way to a better understanding of the intimate relations between pure and applied science, as well as of the extent to which the latter depends upon the former."

THE CHEMISTRY OF CYANOGEN COMPOUNDS AND THEIR MANUFACTURE AND ESTIMATION. By HERBERT E. WILLIAMS, J. and A. Churchill, London, 1915. Price 10s. 6d. iv.+423 pp.

THE scope and purpose of this book may be characterised by a quotation from the preface, in which the author says that, dissatisfied with the frequently incorrect and misleading statements about cyanogen compounds to be found in existing books, he has tried "to rescue the information scattered through the scientific press, to check the composition and properties of the compounds described as far as possible and to add a small quota to our knowledge of these compounds." The first half of the book is devoted to chemistry, the second half, in approximately equal parts, dealing with manufacture and analysis of cyanogen compounds. The substances described are:—Cyanogen, the cyanogen haloids, cyanamide and their derivatives; hydrocyanic, cyanic, cyanuric, fulminic, fulminuric, thio- and seleno-cyanic acids and the numerous simple and complex salts derived from them. The information to be found about each compound is, in most cases, confined to a statement of its empirical formula and brief directions for its preparation together with a qualitative statement of its solubility, colour, and appearance. Within these limits, it appears to be accurate and reliable, but it may be regretted that the author has not seen his way to carry through more thoroughly the first part of the programme outlined above. To mention a few examples taken at random, the solubilities of sodium and potassium ferrocyanides are not given, recent investigations of the composition of the ions of complex cyanides in solution are entirely neglected, the researches of Morrell and Burgen and of Grube and Krüger on the polymerisation of cyanamide and Walker's work on the formation of urea from ammonium cyanate are not referred to—the list of omissions might easily be extended. In reading an account of the bewilderingly numerous and apparently unrelated double and complex cyanides, the need of constitutional formulae is vividly felt, if only as an aid to memory; a systematic application of Werner's theory would have added to the interest of the book, and a freer use of ordinary constitutional formulae in dealing with the derivatives of cyanuric acid and cyanamide would have been helpful. The difficult question of the individuality of many of the amorphous ferrocyanides seems to the reviewer to merit more critical attention than the author has given it.

The portion of the book dealing with manufacture may be more unreservedly commended. The chapters dealing with the recovery of ferrocyanides from coal gas and with the manufacture of Prussian blue, in which the author appears to be writing largely from first-hand knowledge, are especially interesting. The same remarks apply to the analytical portion of the book, which should be very serviceable to anyone who has to take up this kind of work.

There is an unfortunately large number of misprints of proper names, especially in the second half of the book.

T. E.

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Birmingham Section.

Meeting held at Birmingham University on
Thursday, March 4th, 1915.

MR. H. T. PINNOCK IN THE CHAIR.

THE CHEMICAL INDUSTRIES OF GERMANY.

BY PROF. PERCY F. FRANKLAND, F.R.S.

It is remarkable that the Royal House of Prussia has during many centuries been associated in one way or another with chemical enterprises of various kinds. Thus already the second ruler of the country, the Markgraf John (1608—1619) was actually surnamed "the Alchemist" in consequence of the zeal with which during many years he pursued his investigations on the transmutation of metals, whilst a number of his successors exhibited great interest in the same problem—the manufacture of gold—which has never failed to fascinate the needy princes—and what princes are not needy?—of all ages and all nations. The Great Elector (1640—1688), who did so much to advance the power of Prussia, was a patron of chemistry, which was just then beginning to emerge as an experimental science from the obscurantism of alchemy. He provided the celebrated Kunkel with a laboratory and glass furnaces on an island in his park at Potsdam, and it was there that in 1678 Kunkel made the discovery of ruby glass, produced by means of traces of gold, and which is still an unsurpassed method of colouring glass for ornamental purposes. Kunkel also rediscovered phosphorus, which had previously, in 1669, been obtained by the alchemist Brand of Hamburg, who had quite accidentally produced it in the course of his attempts to extract the Philosopher's Stone out of urine. But whilst the discovery of yellow phosphorus is thus of German origin, its production on an industrial scale was, until 20 years ago, only carried on in England and France. In 1892 the manufacture of phosphorus by electro-thermic means was introduced into Germany by the Chem. Fab. Griesheim-Elektron at Frankfurt.* Red phosphorus was discovered by Schrötter, an Austrian chemist, in 1818, and was adapted for safety-matches by the German Böttger in the same year. His invention was first taken up in Sweden, and was not adopted until 10 years later in Germany. The match industry has assumed its largest dimensions in Germany. Thus the German annual production in 1912 was £4,600,000.† The value of all matches (British and foreign) consumed in Great Britain in 1910 is estimated at £1,293,750—about 9 matches per day per head. Messrs. Bryant and May's (by far the largest English concern) turned out 1152 million boxes in 1907. This represents about $\frac{1}{2}$ the British output. In 1907 the total value of British production was £775,000, of which £76,000 worth was exported.‡ The British export of matches is diminishing. It is worthy of note that Japan in 1901 exported matches to the value of £1,200,000.

* The author has much pleasure in acknowledging the assistance he has received from the valuable compilation by Professor Lepsius of Berlin, "Deutschlands Chem. Industrie 1888—1913," and from that by Dr. Dulaberg, of Elberfeld, "Wissenschaft und Technik," 1911.

† Molinari, "General and Industrial Inorganic Chemistry," 1912.

‡ Clayton.

Porcelain.—Another great German industry owes its origin to alchemistic studies made by Böttcher in the reign following that of the Great Elector, namely, that of Frederick III. (1688—1713) first King of Prussia. Having succeeded in making gold before witnesses, Böttcher was seized by order of the Elector of Saxony and was "interned" at Dresden, where, although he did not succeed in making the much-desired gold, he founded, along with the physicist Tschirnhaus, the celebrated Dresden porcelain industry.

The astute Frederick the Great (1740—1786) was anxious to manufacture the Dresden ware at Berlin and to this end commissioned his court apothecary, Johann Heinrich Pott, to institute investigations. These attempts were, however, all unsuccessful.

The Great Frederick placed much faith in secret agents and it was by means of spies that he succeeded in discovering the secrets of the Dresden porcelain manufacture, for at his instigation an enterprising merchant, bearing the name of Gotzkowski, with the assistance of a Saxon workman, brought the secrets of the Dresden process to Berlin and established a porcelain factory in the Leipzigerstrasse, which still remains the warehouse for the Berlin porcelain goods. But Frederick later stopped the pecuniary assistance with which the factory had been subsidised, and Gotzkowski was forced to sell the concern to Frederick for a sum of about £30,000, and so was established the celebrated Berlin Royal Porcelain Factory, amongst the products of which are the well-known crucibles and evaporating basins. The flourishing state of the German porcelain and pottery manufacture is attested by the fact that during the past 25 years the number of works has increased from 228 to 359, and the number of workpeople employed from 37,000 to 66,000. In 1912 the German exports of china, earthen and stoneware were valued at upwards of 3½ million sterling.

Glass.—Even still more important is Germany's glass manufacture, for which she has long been pre-eminent. The annual export in recent years has been over seven million pounds.

Cyanide industry.—In the early 18th century an accidental discovery was made by Diesbach, a Berlin colour-maker, which has proved of great industrial importance. Diesbach was preparing what is known as Florentine lake, a red pigment obtained by precipitating a solution containing cochineal extract and an iron salt with caustic potash. It so happened, however, that the potash used by Diesbach had been in contact with bone-oil, containing some cyanide, and the result was that, instead of the result he anticipated, a magnificent blue colouring matter was obtained. This substance, which is still known as Berlin or Prussian blue, was the first cyanogen compound to be discovered.

The cyanogen compounds have played a most conspicuous part in the development of organic chemistry, and every source of cyanogen has been exploited for obtaining them. In recent years the demand has increased enormously owing to the employment of sodium and potassium cyanides in the extraction of gold. To meet this demand a number of synthetical methods for their preparation have been super-added.

Germany's annual production of cyanides is estimated at 10,000 tons, of value £650,000, or about half of the world's production.

Beet sugar industry.—Another industry also had its beginnings in the 18th century during the reign of the Great Frederick, and was the

outcome of the laborious researches of Marggraf (born in Berlin in 1700, and a pupil of Stahl) on the occurrence of sugar in the vegetable kingdom. Of the numerous plants investigated from this point of view he found that the beetroot (*Beta vulgaris*) contained the largest proportion of saccharine material and that the sweet-tasting substance was identical with that present in the tropical sugar cane (*Saccharum officinarum*).

It was not, however, until some 50 years later that the observations of Marggraf led to the first beet-sugar factory in the hands of Franz Karl Achard, who was subsidised in this venture by the Prussian King, Frederick William III. (reign 1797—1840), who was also the founder of the University of Berlin.*

The beet-sugar industry had to contend with strenuous competition on the part of the cane-sugar manufacturers, who were chiefly English and who are said to have endeavoured to corrupt Achard by heavy bribes. The industry was, however, greatly promoted when, in 1806, Napoleon issued his famous edict closing the European ports to British goods. The vast extent of this industry at the present time can be gathered from the following figures:—

Total sugar crop for 1912-13: Cane sugar, 9,211,755 tons; beet sugar, European (one-third German), 8,310,000 tons; beet sugar, U.S.A., 624,064 tons; total, 18,145,819 tons.

The sugar industry should give us food for serious reflection when we consider the following facts:—United Kingdom spends annually £23,000,000 on 1,700,000 tons imported sugar. Germany produces £36,000,000 worth of beet sugar on 1,300,000 acres, France produces £13,000,000 on 570,000 acres; all continental countries together produce £116,000,000 on 6,000,000 acres.† In the United Kingdom there is only one small experimental beet sugar factory in existence. The beet sugar industry is of particular interest in connection with the present European crisis, inasmuch as it is a most notable example of an industry which largely owed its successful inception to a state of war which disturbed the previously established order of things in the matter of sugar-supply.

In this country agriculture is well known to be productive of a conservative frame of mind, but that it is not so in Germany is well illustrated by the extraordinary progress which has been made in the cultivation of the sugar-beet under the guidance of systematic scientific research. Thus in 1840 100 kilos. of beet gave 5.9 kilos. sugar; in 1850, 7.3; in 1870, 8.4; in 1890, 12.5; and in 1910, 15.8 kilos. In 1871 the mean production of beet per hectare‡ was 246 quintals,§ and in 1910, 300 quintals. In 1867 the consumption of coal for 100 kilos. of beet was 35 kilos.; in 1877, 24; in 1890, 10; and in 1900, 7 kilos. Further economy in coal has been effected by means of the Kestner concentrator.||

Sulphuric acid, soda, and bleaching powder industries.—Sulphuric acid was discovered by the German alchemist Basil Valentine in the 15th century. The production of this fundamental acid, however, on any considerable scale took its origin in Birmingham, where Dr. Roebuck in 1746 introduced the classical leaden chamber process.

At the beginning of the 19th century it became an industry of great importance, more especially in England, because of this acid being required for the manufacture of carbonate of soda by the Le Blanc process.

The manufacture of Le Blanc soda was taken up in England in 1814, especially in connection with soap-making, and it was in England that this manufacture assumed the largest proportions. The enormous advances made in this manufacture during the past century may be gathered from the fact that the price of carbonate of soda in 1818 was about £42 per ton, whilst to-day it is only about one-tenth of that amount. One of the determining factors which made England the principal home of soda manufacture was the great development of our cotton industry during the 19th century.

During a large part of the last century England manufactured Le Blanc soda, sulphuric acid, and bleaching powder* for most of the world. But during the latter half of the century the rival ammonia soda process made its appearance. The original discovery of the reaction on which it depends—it was first patented in England by Dyer and Hemming in 1838—is ascribed to several different persons, but the process was first made an industrial success in Belgium by M. Ernest Solvay. The Couillet Works were founded with a capital of about £6000 in 1863; the numerous affiliated works are now to be found in Belgium, England (Brunner, Mond and Co.), Germany, France, Italy, Spain, Austria-Hungary, Russia, and North America. They employ 35,000 persons. During the 50 years the price of soda has been reduced from £16 to £4 a ton. The displacement of Le Blanc soda by ammonia-soda involved the introduction of new methods of chlorine manufacture. After numerous abortive attempts in various directions, the successful production of electrolytic chlorine has been achieved, and about half of the bleaching powder in the world is now made by this means.

Electrolytic chlorine is now often converted into liquid chlorine (6d. a kilo.), of which large quantities are used at Stassfurth for the annual preparation of 500,000 kilograms of bromine, and the Badische Anilin und Soda Fabrik used in 1900 more than 1 million kilos. for the preparation of chloracetic acid employed in the manufacture of synthetic indigo.

In the manufacture of sulphuric acid, again, the old-established English or leaden chamber process has not been allowed to remain unchallenged, for since the beginning of the present century it has had to meet the competition of the so-called contact process. This is based on a long known reaction,† which, however, remained almost unutilised until the meticulous industry of German chemists and the courageous enterprise of German manufacturers developed it into a commercially successful process, which was elaborated in the works of the Badische Anilin und Soda Fabrik at Ludwigshafen.

The ammonia-soda and the contact sulphuric acid‡ processes, although carried out in this country, have been largely instrumental in making other countries, more especially Germany and the United States, independent of the English production of these all-important chemicals.

In 1882 the world's consumption of soda was 700,000 tons (160,000 am. soda), and in 1902 1,760,000 tons (250,000 Le Blanc). In England, in 1876, £7,000,000 was invested in the industry,

* There was no University in Berlin until 1809, but the following figures will show how Prussia has made up for lost time in this respect. In 1913-14, there were 7613 male and 770 female matriculated students, and 4113 male and 89 female non-matriculated students. The annual income was £246,310, of which £204,650 came from the State, £40,900 from fees, etc., and £760 from other sources. The annual expenditure was £246,310, of which the teaching staff accounted for £104,790; departmental expenses, £100,140; building expenses, £10,610; reserve, £6680; administration, bursaries, etc., £24,090. "Minerva," 1914.

† C. W. Fielding, "Morning Post," Jan. 23, 1915.

‡ Hectare=2.5 acre. § 1 quintal=100 kilograms.

|| Molinari, "General and Industrial Org. Chem.," 1913.

* Discovered by Tennant in 1799.

† This reaction had for many years been used by Messel in England, but only for manufacture of SO₂.

‡ The Clayton Aniline Co. and Nobel's Explosives Works have contact sulphuric acid plant.

which gave employment to 22,000 workpeople. In 1880 the British output was 430,000 tons, and in 1896 800,000 tons. North America in 1886 produced 1100 tons, and in 1898 300,000 tons; and Germany in 1878 made 42,000 tons, in 1901 300,000 tons, and in 1910 400,000 tons.* The first soda works in Germany was only erected in 1813 by Hermann at Schönebeck, near Magdeburg, and the first leaden chamber by Kunheim in 1814 on the Tempelhof Plain, near Berlin.

*Production in tons, 1910.**

	Germany.	England.	France.	United States.	Europe.	World.
Sulphuric acid (H_2SO_4)	1,250,000	1,000,000	500,000	1,200,000	3,700,000	5,000,000
(of this by contact process)	400,000			250,000		
Soda	400,000	700,000	200,000	250,000		2,000,000
(of this Le Blanc Soda)	30,000	120,000				150,000
Saltpetre consumption	786,000	93,000	337,000	523,000	1,740,000	2,360,000
(of this for nitric acid)	150,000			50,000		
Hydrochloric acid (30%)	450,000	†				
Bleaching powder	100,000					300,000
(of this electrolytic)	70,000					150,000

* Duisberg, "Wissenschaft und Technik," 1911.

† Already in 1895 the estimated production of hydrochloric acid in England was 1 million tons, and for the whole of Europe 2 million tons. (Molinari.)

Hydrogen industry.—The electrolytic production of soda and chlorine is of course attended with the evolution of enormous volumes of hydrogen. At first this gas was allowed to go to waste, but gradually interesting and important uses have been found for it; (1) Dirigible balloons, rendered possible by taking advantage of the lightness of the internal combustion engine. One horse-power engine is but little heavier than 1 kilogram. 27,000 cub. metres of hydrogen is required for a modern airship. The balloon sheds are often established near electrolytic soda works, or the gas may be transported in steel cylinders compressed to 150 atmospheres. 500 cylinders containing 2750 cub. metres of gas are placed on one railway wagon, and more than 8 such wagon-loads are required for the filling of a single Zeppelin. (2) Autogenous welding with oxyhydrogen flame. These most important applications of hydrogen were introduced at the beginning of this century by the Chemische Fabrik Griesheim-Elektron. The oxy-acetylene flame is now more commonly used. (3) Artificial gems by means of oxy-hydrogen flame. Some 30 years ago C. V. Boys succeeded in fusing quartz with the oxyhydrogen flame and then drawing it out into incredibly thin fibres, which have proved of the highest value for certain physical experiments of extraordinary delicacy. The same source of heat was much later, in the nineties, employed by the French investigator, Michaud, to reconstruct rubies from small fragments of this gem. At the beginning of this century Verneuil and Paquier, in Paris, succeeded in making synthetic rubies. A little later Wild, Miethé, and Lehmann in Germany elaborated methods for producing synthetic corundum, rubies, amethysts, and sapphires, which are manufactured by the Elektrochemische Werke at Bitterfeld. These products are identical in chemical composition and physical properties with the natural gems, and the rarest varieties of these can be obtained at will. Fused alumina (very pure) gives corundum; fused alumina + 2½% chromic oxide gives ruby; fused alumina + magnesia and titanium oxide and ferric oxide gives blue sapphire. These synthetic gems are now manufactured to the extent of about 6 million carats annually (1 carat = 0.205 gram), or 1230 kilograms or more than one ton. Experienced connoisseurs can, however, distinguish between the natural and artificial gems, with the result that the former have not diminished

in value. Natural rubies or sapphires of 2—4 carats cost £20—£50, and larger stones up to £150, whilst the artificial would only cost 1/500—1/1000 of those amounts.

A still more recent and much more important application of hydrogen is for the hardening of fats, which depends on the transformation of unsaturated into saturated acids by means of hydrogen in the presence of a catalyst (nickel, palladium, etc.).

Industries connected with artificial illumination.—

The world is greatly indebted to Germany for inventions which have largely revolutionised artificial illumination, firstly, in connection with gas and more recently in respect of electric lighting.

Thus, one of the most remarkable discoveries in this domain was that of incandescence gas lighting, which was made by the Austrian Count Dr. Carl Auer v. Welsbach of Rastfeld in Styria, as the result of lengthy, laborious, and ingenious researches. The now so familiar gas-mantles are prepared by the ignition on the cotton frame of a mixture of thorium nitrate, 99; cerium nitrate, 1%.

The source of these rare earths is monazite-sand, the elaboration of which has become a very important industry depending on fractional crystallisation, which already many years ago was brought to such a high pitch of perfection in the laboratory of Sir Wm. Crookes. Out of this monazite-sand, Otto Hahn, in 1910, succeeded in extracting mesothorium, and the process is carried out on a large scale at the works of Dr. O. Knöfler und Co., at Plötzensee near Berlin. Radium bromide is worth about £17 a milligram, mesothorium about £7 10s. a milligram. The mesothorium is only present in the monazite sand in extremely small proportion, about 1 part in 150 million parts of the mineral.

I may also refer to Auer-metal, a preparation of iron (Fe 30%) containing cerium, which sparks when scratched with hard steel, and which is familiar as a substitute for matches.

Electric light metallic filaments.—Another outlet for the use of hydrogen has been in reducing the rare-metals osmium (m. pt. 2500° C.), tantalum (m. pt. 2300° C.), and tungsten (m. pt. 2850° C.).

In 1903 the Auer Company showed that the carbon filament of incandescence electric lamps could be replaced by an osmium filament with an economy of 50—60% of current. In 1905, Siemens und Halske showed that a tantalum filament was cheaper and more advantageous, and in 1906 that the tungsten filament was even still better. Tungsten occurs in sufficient quantity in nature as wolframite (iron tungstate) and scheelite (calcium tungstate) to enable the metal to be now sold as filament-metal for 6s.—7s. a kilogram.

Some idea of the enormous and increasing scale on which the incandescence lighting manufacture

is carried on in Germany may be gathered from the following figures:—

	1911.	1912.
Metallic filament electric lamps	47,211,892 pieces	76,185,721 pieces
Carbon filament electric lamps	24,791,196 „	20,975,348 „
Incandescence gas mantles	126,050,954 „	135,320,173 „
Arc-lamp carbons	10,740,025 kilos.	11,093,154 kilos.

According to V. B. Lewes, the consumption of gas-mantles in 1912 was:—Germany, 100,000,000; America, 60,000,000; England, 38,000,000; France, 16,000,000; Belgium, 3,500,000; Italy, 3,000,000; Russia, 1,500,000.

The special tax imposed in Germany on lighting apparatus realised from the above sources in 1912 was £800,000. This remarkable tax was one of those extraordinary financial expedients resorted to by Germany during recent years to provide the wherewithal for the stupendous national effort to subjugate Europe of which we are the witnesses to-day.

Ammonia.—Of the commoner inorganic chemicals which are produced on the largest scale, one of the most important is ammonia, which has for so many years been obtained as a by-product in the manufacture of coal gas.

So backward was this industry in Germany, that actually even as late as 1874 the ammoniacal liquor from their gas works was run to waste. All the more remarkable is the state of affairs to-day as betrayed by the following figures. The world production of ammonium sulphate was 210,000 tons in 1890, 500,000 tons in 1900, and 1,330,000 tons in 1912. Germany's production of ammonium sulphate in 1912 was about 370,000 tons.

The principal use of sulphate of ammonia is as a nitrogenous manure, as which it competes with Chili saltpetre: they may be taken as of equal money value per unit of nitrogen. In this connection Germany's manure bill is interesting:—

	1888.	1912.
	tons.	tons.
Chili saltpetre*	225,000	650,000
Sulphate of ammonia	50,000	500,000
Superphosphate	250,000	1,800,000
Basic slag	250,000	2,200,000
Crude potash salts	160,000	3,000,000
Lime	500,000	800,000
Other manures		500,000
Total value		£30,000,000

* The total import of Chili saltpetre into Germany in 1912 was 800,000 tons, of which only 150,000 tons was used for manufacture of potassium nitrate and nitric acid.

It is the ambition of the Germans, firstly, to make themselves independent of the industrial products of other countries, and secondly, to produce in excess of their own needs and to impose this surplus on the rest of the world. Thus, they pride themselves on displacing more and more of the foreign Chili saltpetre by home-made sulphate of ammonia, and in 1911 they used in agriculture 75,000 tons of ammoniacal nitrogen against 70,400 tons of foreign saltpetre-nitrogen. This partial success they look forward to making complete and decisive by developing new methods of producing ammoniacal nitrogen and nitrates which can be carried out in Germany. Of such methods there are already two in operation, and they are associated with that great problem which

confronts mankind as a whole. How to supply the combined nitrogen which will be necessary to build up the food-stuffs for the teeming millions of the future, after the deposits of Chili saltpetre are exhausted? This is the same problem as that of fixing the nitrogen of the air, which long ago, before anything was known of nitrogen at all, man had solved empirically by growing leguminous plants in the rotation of his crops, thereby increasing the fertility of the soil, although the mechanism of this time-honoured procedure was only experimentally demonstrated in the last decades of the 19th century by the German investigators, Willfahrt, Hellriegel, and Nobbe.

Fixation of atmospheric nitrogen by inorganic means.—This has been successfully accomplished by:—

(1) The Birkeland and Eyde electric furnace, and the Schönherr electric furnace of the Badische Anilin und Soda Fabrik. These are simply realisations on the industrial scale of laboratory experiments made by Cavendish 130 years previously. This method is applicable only in Norway or other countries where abundance of water power renders the production of cheap electrical energy possible. It is being carried on by an international company at Notodden in Norway. They propose to use 300,000 horsepower capable of yielding 150,000 tons lime-saltpetre (15–20% N) or about $\frac{1}{2}$ of the total amount of Chili saltpetre used by the world. Germany possesses but little water-power so that this process is of only indirect interest in connection with German chemical industry.

(2) Fixation of nitrogen by calcium carbide at high temperatures. This discovery was made by the German chemists Frank and Caro. £5,000,000 capital is already embarked in this industry by various companies of Europe and America. About 120,000 tons is produced annually, about one-quarter of which in Germany. The crude calcium cyanamide (about 20% N) may be used directly as a nitrogenous manure or may be made to yield ammonia. The production of calcium carbide involves the use of the electric furnace and hence cannot be carried on economically on a very large scale in Germany owing to the limited water-power available.

(3) Combination of nitrogen and hydrogen at higher temperature and especially under high pressure. The long known fact that the reaction, $N_2 + 3H_2 = 2NH_3$, is realised to a very small extent at high temperatures has been investigated in recent years by Haber and Le Rossignol at Karlsruhe, and, guided by the principles of modern physical chemistry, Haber has elaborated, after overcoming extraordinary technical difficulties, an industrial process which promises to be of great importance in the future. The most advantageous conditions were found to be:—Pressure 200 atmospheres; temperature, 500° C.; catalytic agent, osmium, uranium, etc.

Production of ammonia by the Haber process has been carried out on a commercial scale by the Badische Anilin Co. since the summer of 1913, and a plant capable of yielding 130,000 tons of sulphate of ammonia per annum was to have been ready during the present year. Inasmuch as the German Colour Syndicates have severed their connection with the Norwegian nitre undertaking, it would appear that they regard the Haber ammonia process as being more likely to be capable of capturing the inorganic nitrogen market of the world.

This synthetic production of ammonia obviously involves cheap hydrogen. I have already referred to electrolytic hydrogen, but there are cheaper sources. Thus water-gas contains theoretically equal volumes of hydrogen and carbon monoxide; the carbon monoxide (b. pt.—192° C.) can be

removed by liquefaction from the hydrogen (b. pt. -253° C.). Similarly the nitrogen required for the process is obtainable from the fractional distillation of liquid air. The synthesis of ammonia thus dovetails with the possibilities of cheap low temperature production for which the world is so largely indebted to the German engineer Carl von Linde of Munich.

The German ambition to make their combined nitrogen at home does not stop at the production of synthetic ammonia, for there are still large requirements in respect of nitrates (Germany produces upwards of £1,500,000 of nitric acid annually from Chili saltpetre) which have to be satisfied from foreign sources. They hope, however, to fill this gap in the home-production of combined nitrogen by utilising a reaction discovered by Kuhlmann* as long ago as 1839, in which ammonia and air burn to nitric acid in the presence of platinum as a catalytic agent.

Potash salts.—Germany appears to be alone in possessing vast deposits of potash salts, whilst the enormous value of these to agriculture was first demonstrated by Liebig and made public by him in his "Application of Chemistry to Agriculture and Physiology" in 1840. This work may without question be regarded as the foundation stone on which agricultural chemistry has been raised. The celebrated deposits of potash salts were accidentally discovered in 1857, when boring for rock-salt at Stassfurth, near Magdeburg, in Prussia. Their industrial exploitation on an ever increasing scale was begun in 1861 by Grüneberg and Adolf Frank. In 1861 the production of crude potash salts was 2000 tons; in 1912, 11,000,000 tons, worth £8,800,000. 90% is used as manure (about one-third in Germany itself), and 10% in industries (about two-thirds being worked up in Germany for carbonate, caustic, nitrate, alum, chromate, and chlorate, etc.). America is now experimenting with a view to obtaining potassium chloride from feldspar by the method used in the laboratory for determining alkalis in insoluble silicates, and which consists in heating the silicate with a mixture of lime and calcium chloride. Whether it has any commercial future remains to be seen.

This is a matter of prime importance in the United States as potash salts are there used on an enormous scale, especially for agriculture, thus they consumed in 1900 Stassfurth potash salts worth £840,000; in 1910, £2,440,000; and in 1911, £3,040,000.†

Explosives.—I have already mentioned the importance of nitrates and of nitric acid, and have referred to the employment of the greater part in agriculture; of the remainder the major part goes in the manufacture of explosives and in the coal tar colour industry.

Black powder or gunpowder is said to have been discovered by the English monk Roger Bacon (1214-1294). Gun-cotton was discovered by Schönbein in Basle and Christian Böttger in Frankfurt in 1846.

Nitroglycerin was discovered by Sobrero in Pelouze's laboratory in Paris in 1847, and first manufactured on a large scale as an explosive by the Swede Alfred Nobel in 1862.

The disruptive properties of gun-cotton are greatly moderated by gelatinising by means of solvents (acetone, acetic ester, alcohol and ether, etc.), and by mixing with nitroglycerin ballistic materials like cordite, and other smokeless powders are obtained. There is another class of explosives which combine great safety in handling with enormous disruptive effect. Picric acid (discovered by Woulfe of London in 1771), but first used by the French under the name of

Melinite for filling shells in 1881, and later by the English under the name of Lyddite. More recently this has been replaced by trinitrotoluene, first proposed by Haeussermann in 1891 for filling shells and used by our Service under the mark "T.N.T." It is even less sensitive to shock than picric acid. "Ammonal," used by the Austrians for shell-filling, is a mixture of T.N.T. with ammonium nitrate, charcoal, and aluminium powder. It is both very safe and very powerful. T.N.T. is much used for demolishing bridges. It is so insensitive to shock that it is not exploded on being struck by a rifle-bullet, and when in a shell it withstands the impact of the latter piercing an armour plate.*

Tetra-nitro-aniline, obtained by Flürscheim, enjoys the unique position among explosives of having been discovered in this country. It is said to be equally safe and even more powerful than trinitrotoluene.

According to the late Oscar Guttman the production of nitroglycerin explosives in 1909 was as follows:—United States, 20,000; Germany, 10,300; England, 8,100; Transvaal, 8,000; Canada, 5,000; Spain and Portugal, 3,500; Austria-Hungary, 2,300; France, 1,500 tons; Switzerland, Australia, Norway and Sweden, 600 tons each; Russia, Italy, Holland, Belgium, 500 tons each; Greece, 175 tons.

Explosives are of enormous importance also in civil life—in mining and engineering modern explosives have greatly accelerated progress and have rendered possible such works as the Panama Canal. They are also being now employed with great advantage in afforestation for loosening the ground in which trees are to be planted. The manufacture of explosives in Germany is very highly developed. The total German production of 40,000,000 kilos. includes dynamite explosives, 10,000,000; ammonium nitrate explosives, 16,000,000; and black powder, etc., 14,000,000 kilos. There were exported in 1908 value about £1,000,000; and in 1912, £3,000,000.

The world-production of explosives is now about 400,000,000 kilos. or 10 times the German total output. We have at Ardeer, in Scotland, the largest explosives factory (Nobel's) in the world, covering 850 acres, employing 1800 men and 700 women, and producing annually about 16,000 tons of all kinds of high explosives.

Artificial silk.—An eminently peaceful industry which is closely related to that of explosives is the production of artificial silk and celluloid. The manufacture of artificial silk has grown up during the past 25 years, for this product was first shown by Count Hilaire de Chardonnet at the Paris Exhibition of 1889; he discovered the method of its preparation whilst a student in the Ecole Polytechnique at Paris, and in 1891 formed a company at Besançon with a capital of £240,000 for its manufacture.

The chief kinds of artificial silk are:—(1) Nitrated cellulose (soluble in alcohol-ether) silk (denitrated by ammon. sulphide) (Chardonnet silk). (2) Ammoniocupric oxide cellulose silk (Pauly, Fremery, or Urban silk, of the Vereinigte Glanzstofffabrik, Elberfeld, 1897). (3) Viscose-silk (CS, in presence of NaOH or Ca (OH)₂ on cellulose), (Cross and Bevan). (4) Acetate-silk (acetic acid on cellulose), (Cross and Bevan).

Germany produces about 2,000,000 kilos., value about £1,200,000, exports 600,000 kilos., and imports 1,800,000 kilos.; the imported is principally "alcohol silk," due to disadvantageous alcohol tax in Germany. Germany is the principal user of artificial silk, although the fundamental discoveries upon which the manufacture is based are largely due to French and English chemists.

* Ann. Chem. und Pharm., 1839, 29, 230.

† Molinari.

* Macnab, "Explosives" Inst. of Chem. Lecture, 1914.

The world production is estimated at about 7,000,000 kilos.

The distribution of the industry may be gathered from the following:—France, 7 factories; Germany, 8; Belgium, 3; England, 2; Spain, 1; Austria-Hungary, 4; Russia, 3; America, 3; Japan, 1.

Great profits have been made out of artificial silk (some of the companies have paid 50–100% dividends), and the price has greatly fallen since its introduction from 28s. to 32s. per kilo in 1903, 16s. in 1906, and 12s. (poorer qualities, 6s. to 8s.) in 1910.

The cellulose industries furnish a particularly striking example of the manner in which chemical research and invention are able to enhance the value of the kindly gifts of the earth. Thus, 1 cub. metre of wood has value as fuel about 6s.; (after boiling with lime, soda, and sulphite) as paper pulp, £1 12s.; ditto as paper, £2 16s.; pulp converted into artificial silk, £80 to £240.

Industries dependent on synthetic organic chemistry.—It is out of the profound study of synthetic organic chemistry which has been made during the past 60 years that the industries of artificial dyes, drugs, and perfumes have incidentally arisen. The earlier and pioneering achievements in synthetic organic chemistry are well distributed amongst the nations of Europe,* but during the major part of the 60 years the great bulk of the discoveries in this domain have been made in Germany. Organic chemistry is, perhaps, the branch of science which more perfectly suits the German mind and temperament. It involves the possession of those qualities in which Germans are so pre-eminent—the capacity for taking an infinitude of pains, the capacity to anticipate difficulties and organise means to circumvent them. It is, moreover, only possible to make substantial advances in the problems of organic synthesis if the master has at his disposition a number of highly qualified and docile assistants and apprentices; in a word, the master must be at the head of a large and efficient school of research. It is in the possession of such schools of research, both in the universities and in the chemical factories, that Germany has by two generations the lead of all other countries in the world. Whilst most of the professors of chemistry in our own universities and colleges have under great difficulties and without any sort of encouragement been more or less successful in building up such schools of research, which are, however, by no means slavish imitations of the German model, the chemical manufacturers of this country have, with some notable exceptions, failed to establish anything worthy of the name of research laboratories in connection with their works.

It is in respect of the works research laboratory that there is the greatest contrast between the chemical industries of Germany and those of other countries, and it is not surprising, therefore, that the present war should have served to emphasise the class of chemical products for which we are almost entirely dependent on Germany.† It is precisely those products—artificial dyestuffs, artificial drugs, and artificial perfumes, which are the outcome of the works research laboratories, that are now in many cases unobtainable in consequence of the cutting off of the German sources.

The seriousness of the situation is apparent from the following figures, relating to dyestuffs alone:—The value of dyestuffs consumed in England annually is £2,000,000, and the value of trade in which these dyestuffs are employed is £200,000,000, whilst upwards of 1½ million workmen are depen-

dent upon these industries. The total value of dyestuffs imported into the United Kingdom in 1913 was £1,892,055, of which Germany contributed £1,730,821.

Perhaps the most concise way of conveying a superficial idea of these industrial products of organic synthesis will be by means of the following classification.

I. Artificial products.—Colours first obtained from aniline by Runge in 1834, by the action of bleaching powder. Aniline colours: Mauve was discovered by Perkin in 1856, and Magenta by Verguin in 1859. Azo-colours* were discovered by Griess in 1859, and introduced on an extended scale in 1878. The azo-colours have achieved an enormous importance and have practically banished cochineal and logwood from the dyeworks. Some 2000 azo-colours in use. Congo-colours, substantive cotton dyes, were discovered by C. Böttiger in 1884.

It must not be supposed that British colour manufacturers have been idle from the days of Perkin; thus in 1880 a very original departure was made by Messrs. Read, Holliday and Sons, who introduced the principle of developing azo-dyestuffs on the fibre with their so-called ingrain or ice colours. Some of these have achieved a great success, thus 2000 tons of *p*-nitraniline are now annually manufactured for the production of nitraniline-red and similar colours.† Again, the discovery of Primulin and the colours which can be derived from it by A. G. Green in 1887, is another very notable achievement.

Eosin colours were discovered by Caro in 1873.

II. Artificially produced natural products.—This group contains substances occurring in nature and long valued by man. The chemical nature of these substances has been carefully ascertained by chemists who have then deliberately set to work to devise methods for their artificial preparation at such a cost as to compete with and ultimately supplant the natural product. These campaigns against the commerce in the products of nature undoubtedly constitute one of the most remarkable phenomena in the history of the world. Bear in mind, it is the production and supply to man of the actual products of nature, but more cheaply than they can be produced and supplied by Nature herself. These endeavours have already been successful on a very large scale.

Alizarin (the essential principle of the madder root) was first synthesised by Graebe and Liebermann in 1869. At the time of this discovery, the world production of madder was 50,000,000 kilos. roots (1–1½% alizarin), representing ½–¾ million kilos. alizarin, value, £2,250,000. In 1870 France had 20,000 hectares (50,000 acres) under madder cultivation, which soon disappeared after the introduction of the artificial product.

The production of artificial alizarin was: 1873, 100,000; 1877, 750,000; 1884, 1,350,000; 1900, 2,000,000 kilos. (four-fifths of this was produced in Germany).

A great number of most valuable artificial dyestuffs, more or less closely related to alizarin, but not occurring in nature, have been prepared by chemists, and the total value of the alizarin-colour exports of Germany at the present time is about £1,000,000.

Indigo.—This most highly prized blue dyestuff of both the ancient and the modern world was first artificially synthesised by Adolf Baeyer in 1880, but it required 17 further years of unremit-

* Both azo and eosin colours were kept as secret products, but the colours were investigated by Hofmann and their mode of production published, to the great consternation of the inventors.

† O. T. Morgan, "Modern Dyes and Dyeing," Roy. Dublin Society, 1914. Cain and J. F. Thorpe, "The Synthetic Dyestuffs and Intermediate Products," 1913.

* England and France were, however, more especially to the fore.
† Only about 1/10 of the annual value of dyestuffs consumed in England is produced in our own country.

ting and laborious investigation in the works of the Badische Anilin und Sodafabrik at Ludwigshafen, and the investment of nearly £1,000,000 before laboratory synthesis was translated into a commercially successful industry, for it was in 1897 that the artificial indigo was put on the market.*

In 1896 the world production of plantation indigo (100%) was 6,000,000 kilos., value £4,000,000: four-fifths of this was British, obtained from 1,500,000 acres in British India. In 1901 only 500,000 acres was under cultivation, and in 1913, only 300,000 acres.

	British East Indies.		Germany.	
	Exports.		Imports.	Exports.
	Cwt.	Value, £	£	£
1896	188,337	3,569,670	1,036,000	319,550
1899	135,127	1,980,319	415,450	392,250
1902	89,750	1,234,837	184,350	923,100
1905	49,252	556,405	60,100	1,286,050
1908	32,490	424,849	44,100	1,932,750
1911	16,939	225,000	22,300	2,091,500
1913-14		60,000-70,000		

The price of indigo (100%) in 1897 was 16s. per kilo. and in 1913 7s. per kilo.

By varying the ingredients in the indigo-synthesis, many very valuable dyes related to indigo have been obtained. Thus the chlorine and bromine substituted indigos are manufactured as Ciba-blue. Brilliant-indigo, and Bromo-indigo. Again with sulphur instead of oxygen. Thio-indigo-red, and Thio-indigo-scarlet. Moreover, by using the anthracene-grouping in the indigo-synthesis a number of most important colours have been obtained, e.g., Indanthrenes, of extraordinary fastness to light; Alizarin-indigo; Algal-colours (Rob. E. Schmidt), in all varieties of colour, and of the greatest fastness to light. The discovery of these valuable dyestuffs provoked zealous emulation on the part of the azo-colour chemists, who responded by placing some very excellent new products on the market under the name of Benzolight colours.

Antique or Tyrian Purple was perhaps the most highly prized of all colours in the ancient world. We know from Pliny that this dye was obtained from a rather rare snail living in the Mediterranean, and which he describes under the name of "purpurea." Paul Friedländer, of Darmstadt, succeeded in 1909 in extracting this colour from certain glands of two different species of snail—*Murex brandaris* and *Murex trunculus*—which appeared to correspond to Pliny's description of "purpurea." He removed these glands from 12,000 individual snails, developed the colour by a short exposure to sunlight, extracted it with suitable solvents and recrystallised it from quinoline. In this manner he obtained only 1½ gram. of the colouring matter, so that its extreme costliness, which Friedländer estimates at about £2000 a kilo., is not surprising.

On investigating the chemical nature of this colour he found that it was identical with the already known synthetical compound 6,6'-dibrom-indigo.

Drugs and perfumes.—Not less remarkable are the achievements of organic synthesis in connection with pharmaceutical and perfumery products.

The production of artificial drugs and perfumes is in general only a branch of the artificial colour industry, for in many cases the raw materials

are the same, whilst the methods of investigation and synthesis are of course identical. But whereas the artificial colour industry started in England, that of artificial drugs is entirely of German origin, and may be said to begin with the discovery by Liebig of chloroform in 1831, and of chloral hydrate in 1832. It was in 1869 that the chemical works of Schering, on the suggestion of O. Liebreich, produced chloral hydrate as a commercial article.

In 1887 began the discovery of artificial antipyretic drugs, the rivals of the natural quinine. The first of these was antifebrin, the properties of which were discovered accidentally in consequence of a mistake. A specimen of acetanilide in a Strassburg pharmacy was erroneously supposed to be naphthalene, and was served out as such for some pharmacological experiments by Kahn and Hepp. On being taken, internally, its antifebrile effect was observed. Fortunately there was enough left for analysis, and it was found that the supposed naphthalene was the long known acetanilide, which soon acquired a great vogue for this purpose. About the same time antipyrin was discovered by Knorr, who erroneously thought that it was chemically related to quinine, and that it would, therefore, not improbably possess antifebrile properties. Direct experiment showed that it did actually possess these properties in a high degree, but subsequent research showed that it was in no way chemically related to quinine. These and numerous other artificial antipyretics have been a great source of income to their inventors in consequence of the continued prevalence of influenza during the past quarter of a century.

During the period that antipyrin was protected by patent it was sold at £6 per kilo., whilst on the expiration of the patent the price was reduced to £1 per kilo., which still allows a good margin of profit.

These discoveries have led to the systematic study by direct experiment on animals and human beings of innumerable chemical compounds with a view of ascertaining their physiological properties. The enormous amount of most laborious work which has been carried out in connection with synthetic drugs may be gathered from the fact that up to 1912 about 5000 artificial products had been found to possess therapeutical value of one kind or another, but of course comparatively few of these have permanently established themselves in medical practice. Time does not permit me to do more than refer briefly to some of the simpler and better known synthetic drugs.

Thus of antipyretics, which have or have had some considerable vogue, are: antipyrin; tolypyrin (dimethyltolylpyrazolone); salipyrin (antipyrin-salicylate); antipyrin mandelate (tussol, for whooping cough); neopyrin; pyramidon (three times as strong as antipyrin) (dimethylamino-antipyrin); antifebrin; phenacetin (cheapest antipyretic excepting antifebrin, about 6s. per kilo., and less poisonous than antifebrin); lactophenin, lactyl-p-phenetidine; aminophenacetin or phenocoll (also has an antiseptic action).

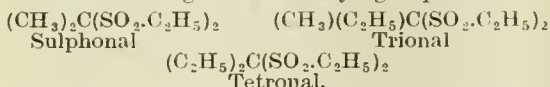
The above series derived from aniline affords a good illustration of the dependence of physiological properties on chemical constitution. Aniline itself is a powerful antipyretic but is extremely poisonous owing to its ready absorption and action on hæmoglobin. By introducing the acetyl group the toxic properties are much reduced owing to its greater stability, although acetanilide is slowly hydrolysed with liberation of aniline, so that after a time the symptoms of aniline poisoning may supervene. The observation that acetanilide is partially oxidised in the system to *p*-aminophenol led to derivatives of the latter being tried. Thus phenacetin has been found to possess

* Bayer's first patent for the synthesis of indigo from *o*-nitrocinamic acid was taken out in 1880, and by 1907 there had been no less than 316 patents obtained in Germany for processes connected with the preparation of indigo.

powerful antipyretic and greatly reduced toxic effects.*

Hypnotics.—Sulphonal was accidentally discovered to possess hypnotic properties in connection with experiments on the transformations of sulphur compounds in the animal system. A dog, which had been dosed with the newly discovered sulphonal, in Baumann's laboratory at Freiburg, i. B., was found to fall into a deep sleep.

More powerful hypnotics were found to result from introducing further ethyl groups:—



In connection with the manufacture of sulphonal, I may refer to an interesting difficulty which was experienced by the Elberfeld Colour Works (Bayer und Co.) owing to the appalling smell of the mercaptan from which it is prepared, and of which Emil Fischer and Penzoldt have shown that the human nose is still capable of appreciating 1/400,000,000 mgrm. In spite of this, German thoroughness has been successful in so perfecting the apparatus in which the manufacture is carried on that no nuisance is occasioned.

Veronal (diethylbarbituric acid) (E. Fischer and Mering, patented by Merck in 1903) is one of the most widely used hypnotics. Although it was formerly supposed to be practically free from toxic properties, in recent years cases of veronal poisoning have been known to occur.

Antineuralgics.—Salicylic acid, one of the first drugs to be artificially prepared (Kolbe 1860), acetyl-salicylic acid (aspirin), and salol (phenyl-salicylate), though extremely simple synthetic products, are almost exclusively made in Germany, with the result that their price has now greatly increased. Even synthetic phenol, which is necessary for the above preparations, was exclusively made in Germany and kept down the price of coal-tar phenol. The price of phenol has now enormously increased from 3½d. per lb. to 1s. 4d. per lb., and is likely to go higher. (Pharm. Journal, 1915.)

Anti-gout drugs (Uric acid solvents).—Piperazine (discovered by Hofmann in 1890), lysidine, urotropine (hexamethylene tetramine), atophane (α -phenyl-cinchonic acid).

Suprarenine.—This is of special interest. The active principle of the suprarenal glands known as adrenaline† had for some years been found to be of great value for increasing the blood-pressure, contracting the blood-vessels, and arresting hæmorrhage. It requires the suprarenal glands of 40,000 oxen to prepare 1 kilo. of adrenaline, but this substance has been artificially synthesised by F. Stolz, and is put on the market as suprarenine by the Höchst Colour Works. The synthesis of adrenaline may be represented thus:—



Natural adrenaline is lævo-rotatory; the synthetic can be resolved by tartrate; the lævo is 15 times as potent as the dextro.

The German colour manufacturers are organised into two principal groups or trusts (Interessengemeinschaft). (1) Badische Co., of Ludwigshafen; Bayer Co., of Elberfeld; Berlin Aniline Co. (2) Cassella Co., of Frankfurt; Meister, Lucius, und Brüning, of Höchst.‡ §

The share-capital of the above two groups in 1911 was £8,000,000, paying a dividend of 25·8%, and probably now about £12,000,000, dividend, 28%.

* "Chemistry of Synthetic Drugs," P. May, 1911.

† Discovered by Takamine in 1901.

‡ "German Coal Tar Companies," Textile Mercury, Jan. 9, 1915.

In 1860–70, Germany imported about £2,500,000 worth of dyes per annum, while in 1912, Germany exported about £10,000,000 and produced about £12,500,000 of dyes.

The composition of the personnel who carry on these German colour works is at the bottom of their success. Take the Works of Messrs. Meister, Lucius, und Brüning as an example. In 1913 the composition was as follows:—Workmen, 7680; managers, 374; expert chemists, 307; technologists, 74; commercial staff, 611. Contrast with the above the fact that the six English factories now producing dyestuffs employ altogether only 35 chemists, whilst evidence of their relative activities is again furnished by the circumstance that between 1886 and 1900 the English firms took out only 86 patents, whereas the six principal German firms were responsible for 948 during the same period.

Having shown that these German coal-tar colour manufacturers are without rivals from the commercial point of view, I feel it to be my duty to point out also that their industry is carried on under conditions of labour which are highly creditable to the management.

This vast and highly organised industry of dyestuffs and fine chemicals, which is certainly one of the most outstanding manifestations of the modern German spirit, was formerly very dependent on England for its chief raw material, coal-tar, and it is interesting to see how effectually Germany has emancipated herself from a control which might at any time become irksome or even paralyzing.

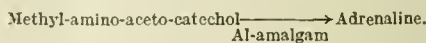
German coal-tar production.

	Coke ovens.	Gas manufacture.
	tons.	tons.
1897	52,000	
1900	93,000	
1904	277,000	225,000
1908	632,400	300,000

In 1908, 40,000 tons was still imported from England, and in 1909, 18,000 tons, but 35,000 was also exported.

In 1900 the German production of coal tar was only about one-half of that produced in England, whilst by 1912 it had equalled if not surpassed the English production. Again, in 1880, Germany used 1400 tons of pure anthracene, of which only 200 tons was of German origin, whilst at the present time the 5000 tons now employed in Germany is all produced there.

The phenomenal increase in the German coal tar production has depended on a similarly rapid development of the German iron and steel industry, which has entailed an enormous demand for



metallurgical coke in the production of which the greatest attention has been devoted by Germany to the recovery of the by-products—tar, gas, ammonia, etc.

In England the quantity of coal-tar treated was 175,000 tons in 1870, and 640,000 tons in 1880; at present over 750,000 tons is treated.

With regard to the synthetic perfume industry, the facts are in many respects essentially similar to those in connection with the artificial dyestuffs. The production of artificial perfumes, in many cases the identical substances which are produced by nature, has assumed very large proportions in Germany, the annual output being estimated at about £2,500,000. It is again particularly noteworthy that one of the first steps in the realisation

of this remarkable achievement of artificially building up the natural perfumes was also made by William Henry Perkin, who in 1868 succeeded in synthesising coumarin, the highly valued odoriferous principle of the woodruff (*Asperula odorata*).

The effect of artificial synthesis on the price of natural perfumes may be gathered from the following examples :—

	Price of 1 kilo.	
	Natural.	Synthetic.
Coumarin	£25	£1 5 0
Vanillin	£50	£1 10 0
Heliotropin	£150	10 0

The facts which I have brought forward speak for themselves and proclaim in the most convincing manner the stupendous progress which has been made by Germany in the chemical industries during the past 40 years. It is equally certain that England, once pre-eminent for chemical manufactures, has not progressed at the same rate and is at the present moment suffering much inconvenience through being so largely dependent on German chemical products of one kind and another. The country is now reaping the harvest of humiliation which it has sown for itself in spite of the warnings repeated *ad nauseam* by the chemical profession during a whole generation. The systematic neglect of chemical science and the failure by manufacturers to utilise the services of highly qualified chemists, could only lead to the result that all the industries which are dependent on a profound knowledge of chemistry should tend to disappear from our midst and pass into the hands of those who are prepared, not only to apply new chemical discoveries to industry, but even to prosecute the most varied chemical investigations in the hope of sooner or later making discoveries which shall be of advantage to their commercial undertakings. The mischief caused through the neglect of chemistry by practical men in this country has been so subtle that to a large extent it has remained concealed from the average man of intelligence and from the governmental classes. During the past 40 years our country has been accumulating wealth in an altogether unprecedented fashion, so that the loss or restriction of some industries appeared a matter of unimportance to political observers taking only a broad and superficial survey of the national resources. The whole of our arrangements have evolved during the past half century, on the assumption that this country would never again be engaged in a European war, whilst still more recently the new democracy has vainly boasted that it could prevent such a war by means of a general strike. The year 1914 has seen the dissolution of many fool's paradises and has given the *coup de grace* to all these vain imaginings, with the result that we find our vast textile industry in serious peril because the much smaller dyestuff industry has been complacently allowed to slide into the hands of our sagacious and more painstaking enemies. The same carelessness and want of foresight had even allowed us to become dependent on Germany for some of the most important materials used as explosives, e.g. trinitrotoluene, and for many of the most valued drugs required alike by our Army, Navy, and civil population.

The complete breakdown in our supply of fine chemicals, which is the direct outcome of the disregard of the constant warnings emitted by scores of British chemists, has led the Government of the day to intervene and attempt to remedy

the intolerable state of affairs which has arisen in connection with the supply of coal-tar colours.

We devoutly hope that success will attend the endeavour to establish the coal-tar colour industry in these Islands on the largest possible scale. Whatever the ultimate scheme adopted may be, I would venture to point out that it must be based on a clear understanding of the following considerations :—

1. That the provision of the required chemicals during the continuance of the war is one thing, and that their production on a commercial basis after the cessation of hostilities is quite another matter.
2. It appears to me that in order to provide the needful supply during the war, the only reasonable course is to assist in every possible way those firms which are already making similar or closely allied products so as to enable them to produce their present goods on a larger scale, and as far as practicable to undertake the manufacture of others which are urgently required. The immediate problem will be also greatly facilitated by utilising supplies obtainable from neutral powers, and more especially from Switzerland, which is the only country, other than Germany, in which the manufacture of dyestuffs and similar chemical products has been vigorously prosecuted. As a matter of fact, Mr. Runciman admitted in the House a short time ago that the Government had granted licences to trade with the enemy in the matter of dyestuffs.
3. As regards the prospects of the home industry after the war, it will require "nursing." I use the term advisedly in order to obviate the employment of another and much more familiar one which is so dear to some politicians and so hated by others; it will require nursing for a much longer period of time than has hitherto been mentioned. In this connection I would point out that the sum of £10,000 a year for 10 years, which it has been proposed to guarantee for research purposes, is absurdly inadequate.
4. If the industry is to prosper it will not only have to manufacture materials already known, but also continually to be introducing new products of its own discovery, as well as constantly to be seeking to produce more economically a great number of auxiliary chemicals required in the manufacturing processes. It is also essential that the undertaking should branch out into the manufacture of other materials as occasion may arise for advantageously utilising by-products.
5. The competition which the industry will have to suffer from Germany is likely to be much more serious than is generally supposed, because it must be remembered that England only takes, as we have seen, about one-fifth of the total German exports of dyestuffs, so that it would be comparatively easy for German firms specially to reduce the price of the goods sent to England. They have already done this in America when attempts have been made to start an aniline industry there. It is particularly significant, and augurs ill for the prospects of this scheme to rehabilitate the coal-tar colour industry, that the latter has failed to flourish anywhere excepting on German soil, and that countries with fiscal systems entirely different from our own have been no more successful in this respect than have we ourselves.
6. It will certainly be necessary that expert chemical knowledge should in the future be much more highly remunerated than it has been in the past, otherwise the supply of able and properly qualified men will not be forthcoming. The flow of men of high grade intelligence into a profession is determined by the prizes which the profession has to offer, in the form of money and social position. Consider the great stream of able men who are attracted to the English Bar, in which profession the prizes, although limited in number, are of the most substantial kind, with the result that the successful leaders are selected by the fiercest competition in a very wide field.

If there is to be a large influx of high intelligence into the chemical profession, it will be necessary that there should be some very different prizes from the paltry bait which is offered at the present time, for the study of chemistry in this country now only draws those men who either have or think they have an overpowering zeal and passion for the science, to which they devote themselves against the advice of their friends, and in spite of the warnings of the professors of chemistry by whom they are initiated. Notwithstanding the absence of material inducements, I venture to say without fear of contradiction that there is more original investigation being prosecuted in this country by chemists than by any other body of British men of science, and this I attribute to the fact that such a large proportion of our number have either been at German Universities or are the pupils of those who have been at these centres of research. Nor are any of us, I am sure, even during this unfortunate crisis, unmindful of the hospitality and the inspiration which we have received in the schools of the enemy.

7. If the proposed undertaking is to succeed, real chemists must be on the directorate, and in a sufficient proportion to give effect to their views. Many men of science are excellent business men. What does experience teach in the case of flourishing chemical industries which we fortunately still have amongst us? What does not the firm of Messrs. Brunner, Mond and Co., for example, owe to the late Dr. Ludwig Mond, F.R.S.? 8. In attempting to establish a commercially successful coal tar colour company on a large scale in this country, I venture to think that the Government have undertaken a task which they will find to be surrounded with difficulties of quite a different order from those which they have had to encounter in some of their most striking previous legislative acts, such as the provision of salaries for members of Parliament, the granting of Old Age Pensions, and the establishment of a compulsory system of Insurance. These are matters in which if the Government dictate we are obliged to obey, but the commercial success of an industry which is based upon progressive scientific investigation depends upon factors so subtle and elusive that they cannot be coerced even by a majority of the House of Commons.

9. If the chemical industries are to be rehabilitated in this country, there must be a complete change in the attitude of mind towards science in general, and towards chemical science in particular, amongst the influential classes of the population, and it will certainly not be effected by following the precept "business as usual," but by pursuing a policy which is the exact opposite of what is implied by that vulgar and undignified phrase.

London Section.

Meeting held at Burlington House on Monday, February 1st, 1915.

MR. W. F. REID IN THE CHAIR.

Mr. J. J. EASTICK moved the following resolution:—

"That in the opinion of this Meeting representing the London Section of the Society of Chemical Industry, the Council of the Society should petition the Government to take such steps as will tend to the permanent production and refining within the Empire of sugar sufficient for the Empire's consumption."

He said that he was firmly convinced that with a trade to be captured equal to £18,000,000 sterling there was ample room for both beet and cane, and for all their Colonies.

Unfortunately in the past no united efforts of an Imperial nature had been made to formulate a comprehensive scheme that would serve the interests of the whole Empire. That was now necessary if supplies of sugar at a normal price to the consumer were to be secured. The present cost was equivalent to an enormous tax on the consumer and the manufacturer. Sugar was the only food in which the British working-classes were being penalised more than their enemies. They had become dependent upon Germany and Austria for a million and a quarter tons of sugar every year. That was the bulk of their supplies. The Board of Trade returns showed that 80% of their sugar was beet-grown sugar from the Continent, and only 20% represented cane, a very small proportion of which 20% was from the colonies.

In competing with the enemy's trade or industry, in many cases they were handicapped by patents, but in the sugar industry they lacked nothing. Their engineers, both English and Scotch, made the most substantial sugar machinery in the world. Their agriculturists had made successful experiments in cultivating sugar-beets. Their cane-fields only required permanent conditions to expand rapidly. Every civilised nation with a suitable climate, except Turkey and Persia, had succeeded in providing for the bulk of their sugar supplies within their own borders, and why should not the British Empire do likewise? They had to look forward at once for supplies. Even if they were in peaceful communication with the Continent in a few months, it would be a long time before the beet industry could get in full working order. The factories in Belgium, France, and Russian Poland were practically demolished. There were a few isolated cases where they were working, but it would be a long time before normal days came again.

He thoroughly and firmly believed in the desirability and feasibility of producing their own beet sugar in England at a profit. No excise duty had yet been levied on sugar, although the Anglo-Netherlands Company had been in operation three years.

Captain COURTHOPE, M.P., in seconding the Resolution, said that he cordially agreed there was plenty of room in the British Empire for both beet and cane. The United Kingdom consumption of beet sugar alone represented a value of roughly some £20,000,000, or upwards, per annum, and it was the product of over a million acres of land each year. The Cantley factory was built about three years ago by an English company entitled the Anglo-Netherlands Sugar Corporation, and was financed very largely from the Continent. They had had three years of uphill work, in contending with unforeseen difficulties, but he hoped they were on the way to the establishment of the industry and ultimate prosperity.

They had had also to overcome the reluctance of the farmer to start a new crop. It was particularly important from the farmer's point of view that the beet industry should be established. If the beet industry were established here, it would unquestionably have the effect of largely increasing their production of white straw crops, and the arable acreage. The arable farmer had to work out his profit and loss account, not on a single crop of a single year, but over four years of his rotation, or whatever the period was. There was hardly a case where wheat, by itself, if it was ever brought to harvest at all, did not show a profit; but there were thousands of cases in which the profit on the wheat, oats, or barley was so small that it was swamped or more than swamped

by the loss on the necessary cleaning crop, which the farmer had to face. Beet was the best cleaning crop he had ever come across. He did not say that beet could be grown at a very large profit, but certainly at a profit, even taken by itself. That at once rendered profitable wheat production possible over a very large acreage, where profit was so problematical now, that it was not worth the farmers' while to speculate by putting grassland back under the plough. Beet cultivation involved a far greater use of artificial manures than was common practice with any other form of cleaning crop, and a very considerable proportion of those artificial manures remained at the end of the beet crop as unexhausted manurial value in the soil when the white straw crop followed. That had been seen with the barley crops in the Eastern Counties which had followed the beet crops grown for the Cantley factory. Another substantial advantage was that one cultivated at a greater depth for beet than for any other ordinary cleaning crop. The subsoiling should be done to a depth of 14 inches; below that there was a deep aeration of the soil from the extraordinary long and persistent form of tap-root which the sugar beet threw out.

Mr. C. SANDBACH PARKER, speaking in support of the resolution, said that in every one of the tropical possessions of the British Empire, there was suitable land for the production of cane sugar. The industries of this country required a cheap supply of raw sugar and a supply which should not be artificially cheap and liable to be artificially dear, but a supply which should be naturally cheap and drawn from a large enough area and from a sufficient number of sources to make it likely that the competition between those sources would prevent any violent fluctuations in price. America, many years ago, had seen the advantage of developing her own sources of supply in sugar, and the marvellous development that had taken place in Cuba since the Spanish-American war showed the effect that it had. This year Cuba was expecting to make over 2½ million tons of sugar, whereas their crop was reduced to 250,000 tons at the time of the Spanish-American war. The British Empire could do exactly the same. He had suggested that it was impossible to develop the sugar industry either in Great Britain or in the British Colonies for the supply of the British market, unless there was some security in the British market that they would not be met with and drowned out by the dumped surplus of foreign markets. All their competitors had their own markets secured to themselves, walled in by high tariffs. They charged their own customers their own price, and they produced on a very large scale, which cheapened the cost of production, dumping their surplus over here as being the only country in the world, with the exception of Turkey and Persia, that would admit sugar free. The Colonial producers of sugar had been practically shut out of the United Kingdom for 35 years past. He had proposed that they should establish a preferential tariff between their imports of foreign sugar, and imports of British grown sugar. His idea was that they should impose a duty about the same as that imposed in the South African war, namely, about a ½d. per lb., and that the British Colonies should come in at a considerable preference, there still being a slight margin of duty against it as compared with the beet sugar production of this country; he believed the odds against which the beet sugar industry in this country had to contend at the present time, required Government assistance to establish that industry on a sound paying basis.

Mr. W. T. CHADWIN (Secretary, the British Sugar Beet Council) said that every year two million

tons of sugar was used in this country, so that the relative amount of sugar that the beet growers would produce here was exceedingly small. They had no chance of growing anything like two or three million acres of sugar beet. They could grow a sufficient quantity to produce sugar that would steady the market, and would probably to some extent lower the price. At present the rate of increase in the consumption of sugar throughout the world averaged about three-quarters of a million tons a year, and the total consumption of sugar practically doubles in from 20 to 30 years. That meant that they were in measureable distance of requiring sugar from half a million acres of land added every year to the previous year's production. Looked at from that point of view, he thought there was ample evidence that they ought to begin producing sugar of their own. In recent years France, which at one time exported large quantities of sugar to this country, had practically ceased to be an exporter. Germany used to export three-quarters, or rather more, of her total production. Of recent years she had more than doubled her home consumption, and had reduced her exporting surplus to one-third. Russia had never exported any large amount of sugar to this country: he believed that in five years she had only exported about 140,000 tons, and that only when prices were abnormally high. So that he thought the bogey of surplus dumping from the Continent was disappearing. At the same time he most fully agreed that this country should have some means of securing to itself a stable market. He thought they might have a preferential duty such as Mr. Parker suggested until they were firmly on their feet. He believed the manufacturers could produce sugar in this country as cheaply as anyone could do on the Continent.

Mr. BUCKMASTER (London & South Western Railway) said that his Railway Company had started a campaign through their own territory with a view to inducing farmers to take an active interest in the beet question.

On the motion of Dr. ORMANDY the discussion was adjourned.

At the meeting on March 1st the discussion was resumed, with Prof. Hodgkinson in the chair.

Dr. W. R. ORMANDY said that in 1890 the price of sugar in Germany was about 5d. per lb. on the average for small quantities. That meant, he believed, that whilst beetroot cultivation was being developed in Germany, and beetroot was giving 7 to 8% of crystallisable sugar instead of 17 or 18% that was now obtainable, the German people were being penalised to pay for the development of that industry. On the other hand, a great number of the industries which we in this country had been able to bring to a very high degree of perfection, such as jam and sweet making, confectionery and cakes, could not be developed by the Germans, because owing to the fact that we got sugar from Germany at a price which was a quarter of that which the German population was paying for it, we had become the largest sugar consuming nation in the world. The average consumption of sugar per head in this country was about 110 grms. per day, about a quarter of the total amount of carbohydrates necessary for the average human consumption. If the whole of the German nation were willing to pay 5d. a lb. for sugar in order that they in England could get it for 1½d., there was something to be said for accepting this sacrifice of the German population for our benefit. Again, with 40 million people we could not possibly make what 80 million people had been making. That being so, a certain amount of selection had to be exercised; and the question that had to be considered was whether the cultivation of beetroot was the most profitable, or one of the most profitable; direction

in which to work. Captain Courthope had omitted to put a very considerable number of further advantages that would accrue from the growing of beetroot, such as, for instance, the possibility of recovering considerable quantities of potassium from the schlempe, and that industrial alcohol could be made from the residuals at a very low price.

Dr. E. J. RUSSELL said that all the experiments made at Rothamsted and elsewhere in connection with the growth of sugar beets, had shown conclusively that they could be grown profitably in this country at the price offered by the factories, viz., 25s. per ton. But there was a difficulty owing to the scarcity of casual farm labour. The main advantage of growing sugar beet was that it introduced greater diversification into farming. The advantage which could be shown to have accrued to German and French agriculture in the growth of sugar beet lay largely in this fact. It would be a relatively simple matter to put in sugar beets, and there would be distinct advantages to British agriculture through the general introduction of another crop of that sort. But the difficulty was that a sugar beet factory required a large supply of roots and was not able to work on a small scale. Owing to difficulties of transit, that meant that the farms near the factory had to concentrate themselves on sugar beet, and produce it in very considerable amounts. The farmer could grow sugar beet so long as it was only going to be subsidiary, but no large scale experiment had yet demonstrated that it would be worth his while to scrap his present main product and take sugar beet as his main industry instead. Mr. C. S. Orwin, of Oxford, had showed recently that in the districts under investigation in Norfolk the cost of growing sugar beet was somewhere about 21s. a ton. The price paid by the manufacturer was 25s., which left a profit of 4s. Taking the crop at 10 tons an acre, that was a profit of £2 per acre, which was not big, and not sufficient to induce a man to give up a business he understood and take on a business he did not. As to the possibility of growing sugar beet on waste land, such land was extraordinarily difficult to deal with; as a rule if land lay waste, it was because it had never been worth the while of anybody to enclose. Examination of the soils of commons showed that the land left to the public was land on which nothing could profitably be grown in the old days. In the time of the Napoleonic wars wheat was selling at well over 100s. a quarter, and it probably did not cost more than 40s. to grow, so that the temptation to enclose land was enormous. The agricultural value of waste land might be gauged from the fact that it did not get enclosed, even in those days when wheat was at that high price. A man who owned waste land might let it for shooting, and also arrange to let it for a low type of agriculture; but if he converted it into agricultural land, he would want a total rent which was at least equal to the two rents he had previously got, and sufficient in addition to repay the amount he had spent on it.

Dr. L. T. THORNE said that he was greatly in sympathy with the resolution in the main, but this discussion had resolved itself into a cloak to support an attempt to create artificially in Great Britain a large production of beet sugar. Beetroot could only be cultivated on really good soil, or else the development of the soil would cost far more than the value of the beet cultivated on it. Again, if a factory were to deal satisfactorily with the production of beet sugar, it must deal with it on a large scale, and it must deal with beetroot grown within a reasonable distance of the factory. In Germany, Holland, Russia, and France, where the beetroot sugar industry had developed in a fairly satisfactory way, there were very large tracts

of land suitable for this cultivation. In England there were not those large tracts of land. There might be considerable tracts in Lincolnshire, and parts of Suffolk; but even there they were not so large or available as to be converted with advantage to beet sugar cultivation. In the Continental countries where beet sugar growing was carried on to any extent, the rotation was in all cases three, and in most cases four years; so that three to four times as much land must be under cultivation as would in one year produce the amount of beet necessary for the economic working of the factory. Then the climatic conditions were less consistent in this country than they were on the Continent. For beet sugar cultivation they undoubtedly wanted both a satisfactory amount of sunlight in the course of the growth, and a satisfactory amount of moisture. The beet sugar industry on the Continent was not the great money-making thing it was supposed to be. It had been developed largely at the cost of the inhabitants of those countries by the duty imposed. The cost of refined sugar in Paris 15 or 16 years ago, within half a mile of the factory where it was made, was 6d. per lb., and that same sugar was to be obtained at the same time on the London market at 1½d. There was therefore an artificial bolstering up of the industry for a very long time. In the large beet sugar districts of Prussia, they had a very intense and scientific cultivation of the soil for the different crops. The rotation of beet cultivation necessary was one where during part of the year the true agricultural work was predominant, but at other parts of the year the factory part was predominant. In Germany they had workmen accustomed to an interchange from farm labour to factory labour, an interchange which in England was quite unusual and would be very difficult to create. In addition, the dairy side of the beet sugar works was a very important item indeed; and it was that careful and thorough combination of industry which had made it successful in Germany to a considerable extent, but even then only at the cost of the inhabitants of the country. He therefore felt that conditions in England were not such as would allow of the commercially successful cultivation and production of beet sugar. He doubted whether, if they could balance up their losses and gains, even France and Germany had made much out of the beet sugar industry. On the other hand the growth of the sugar cane might be extended in many parts of the Empire to such a degree as to go far towards supplying the needs of the Empire.

Professor H. E. ARMSTRONG moved that the resolution be discharged. He thought the Society was not competent to go forward with such a resolution. It was not a resolution which dealt with the chemistry of the subject but with a purely economic and political question and one of expediency. If they were to act in matters of that kind, they must act with extreme circumspection.

It had not been shown that it was possible both to grow beet and manufacture beet sugar, on any scale, in this country and to overcome the labour difficulties, or that the by-products could be made use of. It was only by making use of the by-products that the industry was carried on satisfactorily on the Continent. There was no comparison possible between Germany and the United Kingdom. Germany was quite right in growing beet for the purpose of getting sugar, and she must continue to do so as long as she had not countries at her disposal in which she could grow sugar cane with advantage. France, again, was in a different position. Both countries were under conditions which made it possible for them to grow beet from year to year with advantage. They had Continental climates, whereas we had an island climate. In this country, it was never certain

what the percentage of sugar would be; the beet was always coming to the stage of ripeness and then beginning to grow again, so that if they could not pick it at one particular moment, the yield might go down to a very considerable extent.

Having seen something of the sugar industry in the Southern States of America, in Queensland, in Java, and in India, he had definitely come to the conclusion that, as far as the British possessions were concerned, sugar ought to be made under tropical conditions; and that under the conditions of labour which obtained in this country, it would be altogether uneconomical on their part to undertake the growth of beet for the purpose, bearing in mind that the margin of profit was very small and that they could not afford the ground for the purpose. There was not the least doubt that farmers could grow crops, with very great advantage, which would be much more valuable to them than beet, if they were not so conservative. He thought it would have been of advantage if a resolution of this kind had been carried after the matter had been gone into with absolute thoroughness, so as to place the matter before the Government; but unless some very serious pressure were brought to bear, such as an absolute failure of the sugar supply would afford, similar to that prevailing in the case of dyes at the present moment, it was obvious that it was useless to go to the Government. In India particularly the sugar industry was in a very primitive state of development at the present time, and there was not the least doubt that the output might be far greater. Java was making $1\frac{1}{2}$ million tons a year at least, but Java had a population of over 30 millions, and labour was worth 5d. a day at the outside. Those were conditions under which it was possible to make sugar. The crop in Java was a good one on the whole; the factories were well worked and had good machinery; growers were now aiming at obtaining better results by using improved varieties of cane and so on. But nothing of that kind had been done yet in India. At the present time, the sugar in India was produced largely by native methods; so that they did not know what India could do, and there was no doubt a great work before the Government of India to improve the sugar industry.

For the various reasons he had given, it seemed to him it was impossible to go forward at the present time with a resolution of the kind before them, and he therefore moved the "Previous Question"—in other words, that the motion be discharged.

Mr. T. C. CLOUD pointed out that the resolution was a question of the production of sugar within the Empire, and the discussion had resolved itself into a question as to whether they could grow sugar beet in England. They ought to know more about the possibilities in the other parts of the Empire which were making sugar; for instance, Queensland could produce very much larger quantities than she was doing.

Mr. E. J. BOAKE asked whether there was any reason why as long as Continental countries were prepared to pay us anything from 1d. per lb. upwards to consume their sugar we should take any steps to alter the *status quo*. We had many suppliers of sugar, and the price was thus kept down by competition amongst themselves.

Mr. REID said he thought the English climate was the best in the world. Continental beet growers had their disadvantages. When he was in Silesia, where an enormous amount of sugar beet was grown, a frost had come weeks before it was expected, and great efforts had to be made to get the beetroots in before the evening. He believed that the beet was originally a root which grew on the sea shore, and was therefore accustomed to moisture.

Mr. C. SANDBACH PARKER said that the European beet sugar industry had been built up in countries without any particular natural advantages, entirely by the efforts of the Continental Governments, and he could not believe that those countries had suffered by creating this industry. On the contrary, he was satisfied that they had benefited immensely, and that the British Empire could benefit in the same way by adopting a somewhat similar course within its borders.

As regards the beet sugar industry in this country, he agreed that it was a very serious thing to ask farmers to substitute beet for their main crops. But there was also the question of the capital required for the necessary sugar factories. This involved by far the greatest expenditure of all. It would be difficult to induce the capitalist to invest money for that purpose when there was the possibility that the farmers would not supply the necessary raw material. If this country required a cheap supply of sugar, in his opinion they must develop the sugar producing industry within the Empire, and add the Empire to the number of countries competing to supply it. They here had to consider whether this was not a favourable opportunity to do something to encourage the extension of an industry which already existed to a fairly large extent in various parts of the Empire. He believed that within the British Empire they could produce sugar as cheaply and as well as it could be produced in any other part of the world. What was wanted was some inducement to put capital into the factories necessary for its production, and sugar producers were not disposed any more than the aniline dye people to find the capital, unless they knew they were not going to be exposed to the same kind of competition after the war was over as they had been exposed to before.

Dr. BERNARD DYER said he did not think the growth of sugar beet would mean the imposing of another main enterprise on English farmers. It would mean no fundamental change in the work of the farm, except with regard to labour at a certain season of the year. With regard to waste land, he said there was no suggestion that the area of arable land should be increased in order to grow beet. The English farmer now grew roots once in every four years on his arable land, so that one quarter of his arable land every year was under root cultivation. The question was whether it would not be to his advantage in suitable localities to grow beet, not as an additional crop, but in place of root crops which he already grew, such as turnips and mangolds. As Dr. Thorne had said, beet growing on the Continent was associated with very high dairy farming. To make up for the mangolds or swedes which otherwise would have been grown, the farmer would get the beet-root pulp back from the factory, and would use a certain quantity of the molasses from the factory. Those two things together enabled him to keep up his farm stock. There was plenty of land in the country where excellent beetroot could be grown. The point was, whether it would pay the farmer at the price which a factory could afford to give him. He could not see why the farmer should not grow beet as a rotation crop, if there was any facility for getting it to a factory within a reasonable distance.

Mr. EASTICK said the discussion had developed into one regarding growing beet in England. In his resolution it was the Empire that was considered. But he failed to see that there was any Society in the country which could deal so impartially with the subject, because they were made up of all branches of industry.

On Professor Armstrong's motion, viz., "The Previous Question," being put to the meeting, it

was carried by 25 votes to 7. The original resolution was therefore not put.

Mr. EASTICK adds in a subsequent communication that the main object of moving his resolution has been secured. The cane and beet sugar sections have joined hands in public, and as these representatives are the leaders they have practically solved the most difficult problem to be faced—that is, to secure combined action and a uniform platform.

Manchester Section.

Meeting held at the Grand Hotel, on Friday, March 5th, 1915.

MR. JULIUS HÜBNER IN THE CHAIR.

CHEMICAL EXAMINATION OF GHEE.

BY KAPIBRAM H. VAKIL.

Indian ghee is a form of clarified butter obtained from cow's milk or from buffalo's milk. Ghee from the latter source is generally and extensively used in India, but it has only been examined twice. Lewkowitsch, in his chapter on butter fat, has given two observations on buffalo fat by Pizzi and Petkow. Similar work has been done by F. Strohmer and W. Fleischmann, but these observations refer mainly to Egyptian and Bulgarian buffalos. In 1910 Bolton and Revis contributed a paper to the Analyst (Vol. 35, pp. 343—345; see this J., 1910, 1076); three samples were examined, but it is not stated whether they were made from cow's or buffalo's milk. A. Kesava Menon (this J., 1910, 1428) gives the results of analyses of cow and buffalo ghee, but it seems that only one sample of each was examined.

A summary of the results of these authors is appended:—

Author.	Sample.	Butyro-refractometer 40° C.	Saponif. value.	Reichert-Meissl value.	Acid value.
Bolton and Revis ..	1	41.4	228.8	30.58	—
	2	41.4	228.7	30.42	—
	3	41.5	229.1	31.50	—
Menon ...	Cow	40.6	218.25	25.70	1.49
	Buffalo	44.5	206.8	18.24	2.00

The author has examined a number of samples obtained from different ghee-producing districts. The following table represents the analytical results of ten typical samples:—

	Butyro-refractometer at 40° C.	Saponification value.	Reichert-Meissl value.	Acid value.
(1) Bombay A.	44.0	232.2	23.98	1.67
(2) " B.	44.2	229.8	23.43	2.24
(3) " C.	—	226.1	21.87	1.98
(4) " D.	44.3	231.0	23.10	1.67
(5) Porbunder A. ..	45.0	230.0	23.76	1.68
(6) " B. ..	44.8	218.0	20.46	2.37
(7) Surat A.	43.5	227.2	25.30	1.71
(8) " B.	44.0	231.0	24.53	1.49
(9) Bulsar A.	45.0	224.0	22.11	3.63
(10) " B.	—	220.0	21.78	2.89
Average	44.35	226.9	23.05	2.14

Sample (4) was specially prepared for analysis. The acid values are not oleic acid values.

From these figures it will be seen that the principal difference is in the Reichert-Meissl values, the highest recorded being that of Bolton and Revis, viz., 30.80, and the lowest, 18.24, by Menon. This abnormally low figure was explained in the discussion of Menon's paper, by Bolton, who suggested that the sample was heated until quite free from water and might have been over-cooked, whereas the manufacturer, whose object was to obtain the minimum loss, would heat it just sufficiently to drive out the water and thus often under-cooked it.

There is no doubt that the samples from the manufacturers are under-cooked, but it was surprising that it should make such a difference in the Reichert-Meissl values. The results obtained by the author are within fairly narrow limits, the highest being 25.51 and the lowest 20.46. This may indicate that the commercial samples are uniformly cooked.

Menon's paper also shows an abnormally low figure for saponification value, viz., 206.8.

The acid values, obtained by the author, if converted into oleic acid values, will be found to be very low. This is quite natural, as the samples examined were all fresh. The high values obtained by the previous authors are due to their samples being old.

Nottingham Section.

Meeting held at University College, Nottingham, on Wednesday, February 24th, 1915.

MR. JOHN WHITE IN THE CHAIR.

GRINDING AND CRUSHING MACHINERY.

BY M. A. CROSBIE.

Presumably the first method used to powder material was to lay it upon one piece of rock and hit it with another, possibly choosing a hollowed out stone for the bottom, to prevent losing the material. This method remains to-day in the pestle and mortar of the pharmacist.

Another method adopted by prehistoric man, and still in daily use, is that of rubbing the material between two flat stones. This remains in its original form in the more primitive parts of the world as the quern, where two flat discs of stone are used, the upper of which (having a central hole through which corn is fed) is twisted with a semi-rotary motion with a stick handle. It is in every-day use in India and Africa, where one native squats working the stones, while another drops in the corn grain by grain, and it is this type referred to in the Biblical phrase, "two women grinding at a mill." Its more modern equivalent is the horizontal mill, and this was until recently the only mill used for preparing flour.

Another method consists of crushing the material by rolling a cylindrical stone over it, as exemplified by the edge runner, where the stones roll over a flat bed, and the rolls, where two rollers run together crushing the material between them.

Of course metal has often been substituted for stone, but these three methods remained the only means at our disposal, until the introduction some forty years ago of the "percussive" grinder or "disintegrator." Here the material to be powdered comes in contact with rapidly revolving arms or beaters, and is ground by reason of its

inertia. The underlying principle of all these methods consists of stressing the material by applying either a compressive or a shearing strain, or a combination of the two.

Proceeding now to describe each method more fully, noting the different varieties of each type, there is first the *pestle and mortar*, the hand variety of which is familiar to all, whilst for little jobs just too big for hand the mechanical mortar is employed, where the pestle is rotated by machine, being loaded with weights to suit the material, and sometimes given a spiral path in the mortar. Or the pestle may have a rotary path and the mortar a reciprocating motion.

The stamp mill is another variety of this type; here the pestle is lifted by machinery and dropped by gravity, by means of a revolving arm engaging with a flange on the stamp rod, this arm giving a twist to the stamp rod as well as lifting it.

The *stonebreaker* really belongs to this class. Here a crank or eccentric rocks a chilled iron or manganese steel plate, crushing the material between it and a stationary plate, which latter can be adjusted to give any desired opening at the bottom through which the crushed material drops.

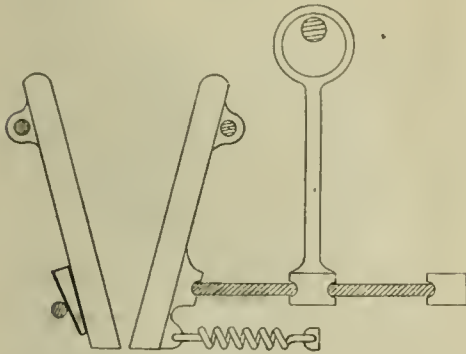


FIG. 1.
Stonebreaker.

Fig. 1 shows a simple type which, however, suffers from the defect that some materials tend to slip up again rather than receive the full nip, but this defect can be overcome by compounding the motion or altering the fulcrum position.

Gyratory crusher. Another type of rock breaker, more rapid than the "stonebreaker," but yielding a less regular product, is the gyratory crusher, again an adaptation of the pestle and mortar, where the pestle has a motion akin to that of an expiring pegtop, inside a fluted mortar open at the bottom to allow the exit of the crushed material.

The second method, that of grinding between two flat surfaces, exists as the quern, already mentioned, and the *horizontal or flat stone mill*, which consists of two stone discs, one of which (usually the upper) revolves, while the stock to be ground is fed through a central hole in the upper stone. These stones vary from soft Derbyshire grit stone to the hardest French or German buhr (a quartz). These latter are built up of wedge-shaped pieces cemented together, with iron binding hoops shrunk on, and a backing of cement and small stones to give extra weight. These stones are dressed by cutting groves or "furrows," the shape of which varies considerably with different classes of work. Specimens of dress are shown in Fig. 2, and a sectional elevation of a mill in Fig. 3. Both top and bottom stones are dressed alike while lying side by side, so that when the top stone is inverted and in position the furrows lay across one another, and when running give a scissor-like

action to the "land" or grinding surfaces between these furrows. The furrows have a steep back, but run off to a feather edge in the direction of

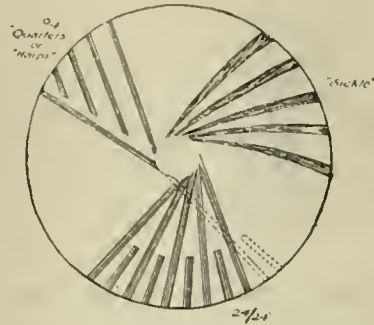


FIG. 2.
Specimens of Horizontal Millstone Dress.

travel, up which the stock rolls; it is then swept forwards by the running stone, gets nipped between top and bottom land, falls into the next furrow, and so on, all the time working outwards by centrifugal action, pursuing a spiral course until it reaches the edge, where it is swept round to an opening, and so leaves the mill. The safety of a

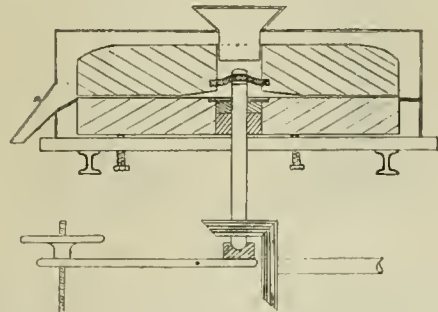


FIG. 3.
Horizontal Mill.

built-up stone depends entirely upon the shrunk-on rings, and if these, by attrition or rusting, become weak, they must be replaced, and also care must be exercised to prevent these mills racing, about 120 revs. per minute being the normal speed of 4 ft. or 4 ft. 6 in. diameter stones. Care must also be exercised to prevent these mills running empty, for besides damaging the faces, wearing away the dress, they might set fire to the material lying round the outside, which is a grave risk in a flour or rice mill, as here the spouts from the mills are connected to a stove room filled with cereal dust and air, a highly explosive mixture. A flame started by sparks from a mill running empty travelling up the spout and firing such a mixture, has wrecked many a mill.

Variations of this mill are legion. The grinding surfaces are sometimes made of an emery or other hard composition. Fluted chilled iron plates are often used, and are sometimes made conical instead of flat, fitting one within the other. The domestic pepper mill is a minute specimen of this type. Such composition or iron mills are more often turned on their side, so that an outside bearing can be easily fitted. A diminutive specimen of this type is the coffee mill used in provision shops. These lead up to another variety of iron

mills, having annular teeth instead of tangential grooves, but these are best considered when dealing with disintegrators.

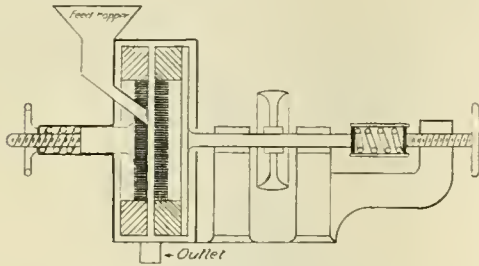


FIG. 4.
Combined "Stone" and Iron Vertical Mill.

"Edge runners" or "chasers." Here two stone discs roll round on a flat bed as shown in Figure 5. The stones used in this country are usually grey Aberdeen granite, varying from a few cwt. up to three tons or more apiece, very occasionally even six tons each. It will be noticed that while both the outer and inner edges of the runner must of necessity travel at the same rate, yet for each

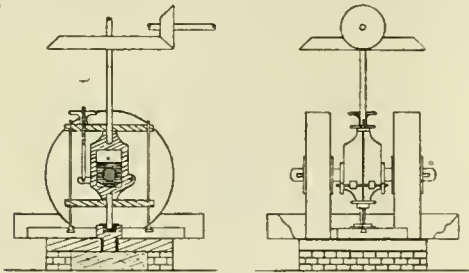


FIG. 5.
Edge Runner—Side and Cross Sectional Elevations.

revolution round the bed they have covered different length paths on the bedstone, so that runners and bed are not in simple rolling contact, a twisting motion being set up, and the nearer the stones are to the centre the greater is the difference

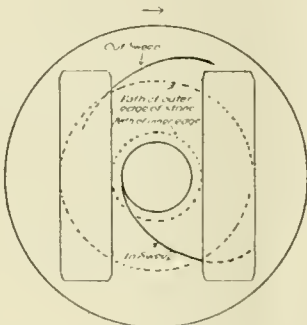


FIG. 6
Plan of Edge Runner—Showing Insweep and Outsweep position and path of stones.

between the two paths; consequently the twisting action is increased, and with it the efficiency of the mill. For rough work, such as mortar mixing, iron is substituted for granite, and it is then the pan which revolves, and the mill is usually under-driven.

Two scrapers or "sweeps" are fitted, one to carry the material under the stones and the other (which can be raised or lowered at will) to throw the material out when sufficiently ground. Provision is often made for lifting the cross shaft and so relieving part of the weight of the stones off a material which would otherwise clog, whilst occasionally the stones are tapered, making the circumference of the stone equal or proportional to its path, thus eliminating the twist and leaving only the rolling motion; this is, however, unusual and only used for special work. These mills are used for a variety of articles, *e.g.*, drugs, chemicals, minerals; even such substances as lead or aluminium can be ground to a fine powder in a mill with 5 ft. 6 in. or 6 ft. diameter stones weighing about two and a half tons apiece. They are also used in many trades for crushing and kneading, such as cider apple pulping, clay kneading for pottery and brick making, mortar mixing, etc. For paint and ointment mixing these mills are apt

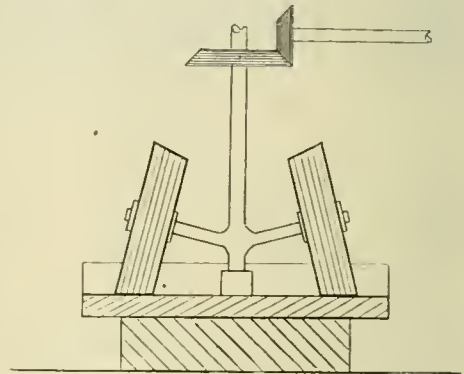


FIG. 7.
Special Edge Runner giving Rolling Contact only.

to skid, pushing the material in front of the stones instead of rolling over it, so a bevel wheel is sometimes made fast to the toe-pot or vertical shaft bearing housing, meshing with bevel wheels fastened to the sides of the runners, so that the stones cannot rotate without revolving. The author has seen one of these mills used for grinding and levigating earth colours, such as rouge, where an impalpable powder was required. The mill was entirely submerged in a tank of water, a steady stream of which, admitted at the bottom, caused a continual overflow carrying away to a settling tank those particles light enough to float. Fire risk with these mills is practically non-existent. The stones are usually secured on the cross shaft by cotters strong enough to withstand the end thrust at their normal speed of 14 to 19 r.p.m., but it is as well to make sure that they will stand the increased strain due to accidental racing.

"Rolls" are used where one "bite" is sufficient, as in linseed crushing, where prolonged pressure would start the oil, making a greasy mass. They consist of two chilled iron or porcelain rollers, sometimes of equal size, sometimes one large and one small, either plain or, if there is any difficulty in getting a grip on the material, fluted or spiked; whilst for crushing material such as sugar cane they often resemble spur gears, but are very wide compared with their diameter. Sometimes the rollers are compounded, being four or five high, the material passing between the first and second rolls, back again between second and third, again between third and fourth, and so on; this method is adopted for paint rolling and also for seed crushing before pressing for oil. Another method of adding to the efficiency of rolls is to supplement their

purely crushing action by reciprocating one or both of the rollers laterally, or by passing the material between a single roll and a shaped block, which is

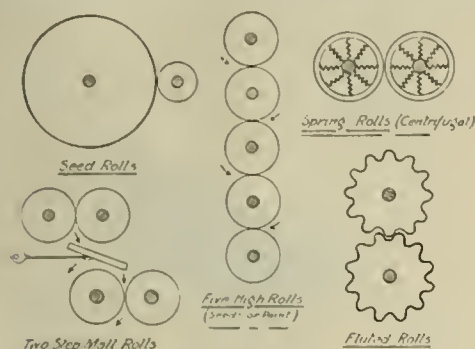


FIG. 8.
Rolls of various types.

continually moved backwards and forwards across the face of the roll. This gives the required combination of compression and shear necessary for fine grinding.

Occasionally it happens that to crush a seed so that every particle is fine enough for use entails the softer part being too finely crushed; this occurs with malt for brewing, and in this case the grain is given a preliminary nip through one pair of rolls, falling on to a sieve which separates the fine, while the coarse passes over the end of the sieve and through another pair of rolls, giving a much harder nip, crushing the rest sufficiently. With rollers running at equal speeds the material is only subjected to a squeeze or nip which tends to flatten out a soft material rather than reduce its size, so differential rolls are used, where one roller revolves faster than the other, imparting a rubbing as well as a flattening action. Again, these rollers may be either plain or grooved, and it is these fluted differential rolls that have of recent years displaced the horizontal for flour grinding. The horizontal mill grinds all the constituents of the wheat berry together, but the consensus of opinion is that the husks and germ are best removed, so that after cleaning (a process involving sifting and winnowing to remove stray seeds, stones, chaff, etc., knocking about to break up lumps of dirt, soaking in water to wash and

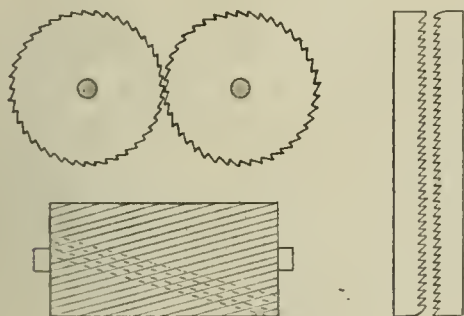


FIG. 9.
Fluted Differential Rolls.

toughen the husk, brushing with rotary brushes to help remove the dirt, drying, and passing over a magnet to remove any stray iron), the wheat is subjected to treatment designed to liberate the

flour from the husk and germ, at the same time keeping the cells unbroken as far as possible. This is achieved by the use of fluted differential rolls of the type shown in Fig. 9, where the size of fluting is exaggerated for the sake of clearness. These grooves are cut at an angle of about 15° , as shown, and give a scissor-like cut, and are so shaped as to leave a series of teeth (from 8 to 40 per inch, according to conditions) on the face of the rolls, with one straight and one sloping edge like saw teeth. Both rolls of a pair are cut to the same hand, so that when in position the teeth are face to face, both rollers running inwards and so in opposite directions. Now if the roll with teeth facing forwards is the fast roll, it overtakes the sharp faces of the teeth on the slow roll, and the teeth pass face to face, setting up a sharp cutting action accentuated by the guillotine or scissor action, due to the grooves being cut spirally and lying at an angle of 30° to each other. If it is the roll with the teeth set backwards that is the fast one, it overtakes the teeth on the slow roll from their back, and the teeth thus pass back to back, setting up a rubbing or squeezing action.

This can be clearly seen in the figure, where two saw blades have been substituted for the rollers. Both these actions are made use of, the latter method being adopted in the first "break," where the wheat is subjected to a light nip, sufficient only to burst it open, and liberate the "crease dirt" being, as its name implies, dirt contained in the fold or crease in the skin which cannot be removed by any preliminary cleaning. To prevent the large grains being unduly broken, or the small grains not being sufficiently crushed, this first break or reduction is performed in two machines, the wheat being graded and the larger grains passing through one pair of rolls set wider apart than the pair through which the smaller grains are passed. Grooved differential rolls must never touch or the teeth would be spoilt; they are carefully set to the requirements of the stock passing through. In the first break the teeth are parallel to the axes of the rolls, so that there is no scissor action. The stock from these two pairs of rolls is passed to a "scalper" or sieve to remove this crease dirt, and the coarse crushed wheat is passed on to the second break, where the first-mentioned method is used, which lightly detaches flour and germ from the husk. From here it goes to another scalper and the coarse particles pass on to the third break where the process is repeated, and so on through a fourth (and perhaps a fifth) break, by which time the husk has been entirely separated from the flour and germ. This process is sometimes completed in four breaks, and sometimes extended to six. The method adopted to separate the germ clearly shows the difference between differential and equal speeded rolls. The "chop" or fine crushed stock sifted out after the second and subsequent breaks is sifted collectively or separately, according to requirements, into "semolina" and "middlings," and the various products are separately run through equal speeded smooth rolls, which, while reducing the starchy matter to a uniform product, flattens out and increases the size of the soft, oily germ, which is then sifted out and the flour finished off by a final grinding between smooth faced differential rolls.

The sifting or "purifying" is a complicated process involving both sifting and aspirating, but no grinding principles.

Centrifugal rolls. Here the rolls consist of metal sleeves, or tyres, held in position on their shafts by radial springs, instead of being solid. A large lump passing through attempts to displace the shell, and should the combined effect of spring and centrifugal force be sufficient the lump is crushed (a stray hammer head which would wreck a jaw crusher would

pass through without damage). Obviously the faster these rolls are run (within safe limits) the more powerful they become, yet there is no need for them to be run faster than is required just to crush the material, hence the speed should be adjusted to suit each job to obtain their highest efficiency.

The next type of roll to consider is entirely different in construction but may also be called the centrifugal roll. Here a pair, or sometimes four, rollers working in slotted arms fastened to

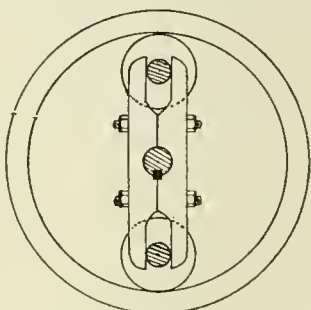


FIG. 10.
Centrifugal Rolls.

a shaft, are rotated inside a stationary ring against which they roll, being held out by centrifugal action. Steel rollers are used weighing about 60 lb. apiece, travelling at about 300 r.p.m. inside a steel ring 2 ft. internal diameter. One variety has a vertical spindle, being fed from above while the powder leaves at the bottom, while another has a horizontal shaft as shown in Fig. 10, and in this case the powder is exhausted from the mill by a fan the speed of which is varied according to the material and fineness of powder required, while steel balls are used in some types instead of

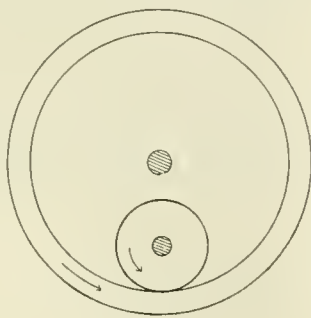


FIG. 11.
Self-Contained Rolls.

rollers. A connecting link between this type and those already considered is to be found in a mill consisting of a small solid roll revolving inside a larger hollow roll which also revolves (see Fig. 11). This type has recently been revived and patented, with the important improvement of having the axes of the rolls set "on the cross."

This mill also forms a connecting link with another type of mill, namely the *ball mill* (see Fig. 12), where a cylindrical iron drum containing a number of loose rollers, balls, or sea-shore pebbles, revolves on trunnion bearings, the grinding being done between the surfaces of the rollers or balls as they move one on the other, or on the inner surface of the container as this latter is revolved. The type generally adopted consists

of an outer shell of boiler plate fitted with a renewable porcelain or quartz lining (to prevent iron taint) and about half filled with pebbles and the

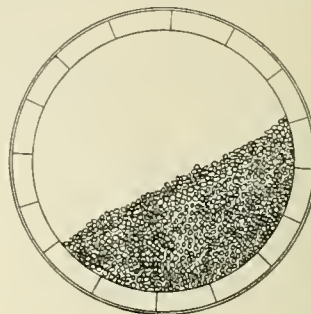


FIG. 12.
Ball Mill.

interstice filled with crushed material; a dust-tight manhole cover is fitted and the drum set revolving for anything from a day to a week, when the stones rolling over and over on the stock grind it to powder. At first sight this does not seem a very business-like method, but in practice it works extremely well; it is dustless and requires little attention, and many materials can be ground sufficiently fine to dispense with sifting, except through a coarse grid to separate the powder from the stones. Such mills are in great favour with chemical manufacturers on the Continent, whilst for grinding the ingredients for high-class porcelain they are invaluable, being equally suitable for both wet and dry grinding and, being porcelain-lined and using porcelain balls, no possible taint can accrue. Another variation of this principle is the *tube mill* (Fig. 13), which is

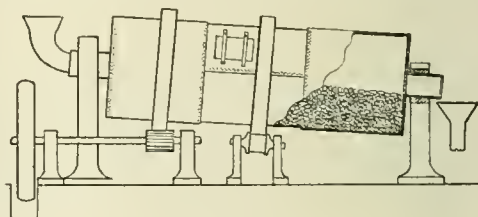


FIG. 13.
Tube Mill—partly in section.

simply a ball mill of extreme width or length, slightly inclined and fitted with hollow trunnions through the higher of which the material is fed, and by the time the stock has worked its way to the lower end and out through the trunnion it is sufficiently ground, the rate of feed determining the fineness of the product. Such mills from 20 to 30 ft. long and from 5 to 6 ft. in diameter, containing four to five tons of pebbles, have superseded all others for cement grinding, the banks of the Thames round Northfleet being littered with old horizontal stones thrown out within the last few years to make room for tube mills. The pebbles used must be hard without being too brittle, and Belgian sea-shore pebbles are the most suitable, even being exported to America. They do not wear appreciably unless they break, when they are quickly reduced to powder which is of no consequence in cement; in fact as pebbles are considerably cheaper than cement replacements cost nothing (this, by the way, also occurs with barley ground for cattle feed in very soft-stoned horizontal mills).

Another type of ball mill, the *continuous feed and discharge ball mill*, is very similar to that first considered, except that the grinding drum is unlined and perforated and enclosed within another drum which acts as a sieve, the material being fed through a hollow trunnion; in this type the inner surface of the drum is not cylindrical but built up in a series of steps as shown in Fig. 14. The

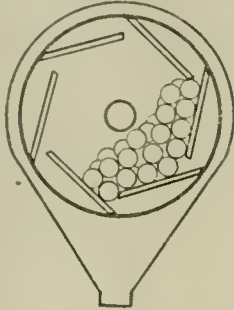


FIG. 14.
Continuous Feed Ball Mill.

action is akin to rolling the material and a number of steel balls down an interminable staircase, each tread of which is perforated, letting the fine particles through on to a sieve underneath, the finest passing through and away, whilst the larger particles are returned to the bulk a few steps lower down. The construction makes the use of steel imperative, but the actual wear is so slight as to render the iron taint negligible.

There are one or two types which form connecting links between the disintegrator and the horizontal mill. In *bar or cage disintegrators* both discs revolve, but in opposite directions, thus doubling the effective velocity without increasing the speed. The discs have a number of bars projecting from their faces, forming a number of concentric rings alternately attached to one disc or the other, as shown in Fig. 15. The material

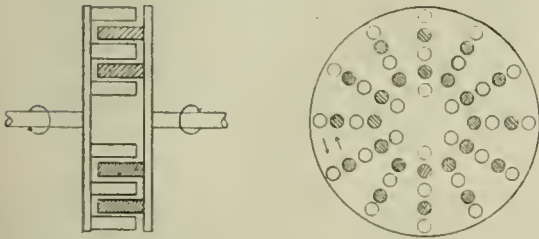


FIG. 15.
Bar or "Cage" Mill.

is fed into the centre through a hole in one of the discs, and in passing outwards is struck by the bars and knocked first in one direction and then the other, being struck by perhaps eight sets of bars before it leaves the mill. The action can best be likened to a series of squirrel cages one within the other and rotating in alternate directions; hence the name, cage mills. A mill has been designed for rock crushing in which the material was to be its own grinding medium; it consisted of two funnel-shaped discs running mouth to mouth in opposite directions, the idea being that the material (broken down in a stone-breaker) on being fed into the mill would fill up these funnels which would then act as millstones (see fig. 16).

Eccentric disc mills. Here one disc is smaller than the other, and has a central hole through

which the feed reaches the mill. This disc is driven, carrying round with it the lower disc, setting up a shearing action, while pressure can be regulated by raising or lowering the bottom

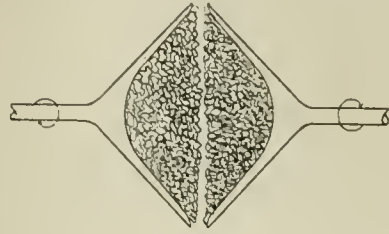


FIG. 16.
Auto-Grinder.

disc. Sometimes the top disc is convex, and the lower one concave. The *end runner mill*, which belongs to this class, is somewhat similar to, but much more efficient than the mechanical mortar (see fig. 17).

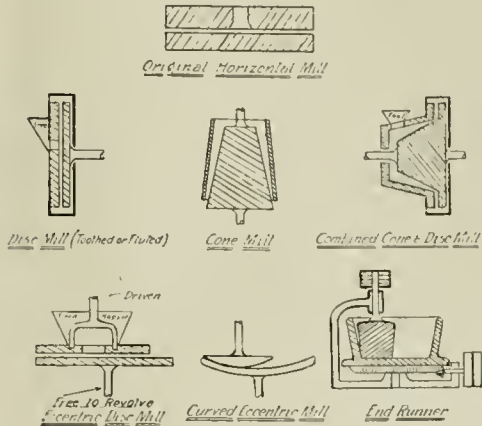


FIG. 17.

The now obsolete "*pulveriser*" had two shafts in line revolving in opposite directions, on the inner extremities of which were fitted bosses carrying arms, at the ends of which were hand plates set at an angle as shown in fig. 18,

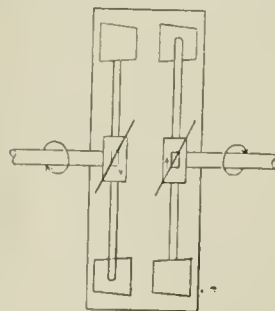


FIG. 18.

"Hand Plate" Pulverizer.

so that a particle struck by one hand would be deflected into the path of a hand travelling in the opposite direction and smashed, these smaller pieces being in turn flung back at the other set of plates and further reduced, and so on until the

particles were small enough to be carried out of the mill in a current of air. First of all the hand plates were abandoned as useless, and later one set of arms was omitted as unnecessary, it being found that the arms themselves did the grinding. This simplified construction constitutes the present day *disintegrator* as shown in fig. 19. The boss is

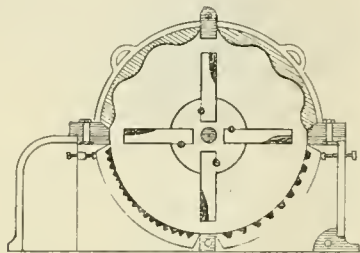


FIG. 19.
Disintegrator.

supported by a bearing on each side instead of being overhung, as was necessary where two sets of beaters were employed, and these beaters are made of Lowmoor iron with a facing of hard steel welded on to resist wear, and fit into mortices in the boss, being secured by cotters. The fluted top is made of chilled iron and by its shape deflects the material back into the beater path, and the sides are made of the same material and also fluted for the same purpose. The powder escapes between the bars shown, which are of steel held in cast-iron frames, the gaps between the bars varying from 1 in. down to $\frac{1}{8}$ in. according to the fineness of powder required. The mill runs at a high speed, depending on its size, all sizes having the same peripheral speed, about 3 miles a minute, and at this speed acts as a powerful fan, thus preventing blow-back through the feed intake, and the air leaving the mill through the grids or screens carries the powder with it, thus rendering a settling chamber necessary.

These mills are highly efficient and will deal with most classes of material, but unless properly erected can constitute a grave fire risk, and should be well isolated from main buildings. As an instance the disastrous explosion and fire at Liverpool in 1911 started from the breaking of a driving belt of a disintegrator when grinding linseed cake. The belt in its recoil struck and burst the dust-settling chamber, liberating the air containing fine particles of linseed cake which became ignited, the explosion wrecking and firing the factory. At least two big fires have been caused by grinding resin in these mills.

Owing to the rigidity of all the parts, this type of mill suffers considerably in the event of stray metal of any size entering accidentally, and a mill designed to obviate this has the beaters hinged and constructed without grids; the beaters stand straight out by centrifugal action in the ordinary course of grinding, but hinge back when a large mass of metal is encountered. Such a mill is useful in crushing articles such as horse hoofs, where an occasional horse-shoe is encountered which would wreck an ordinary machine, or in grinding house refuse, as is done by some municipal bodies; this consists in the main of tea-leaves, fish skins, ashes, etc., but an occasional flat iron or dumb-bell has to be reckoned with. One section of the casing is hinged and held in place by an easily opened catch, and upon the attendant hearing the noise caused by such a stray article he at once opens the catch with a long pole, standing well aside and out of the way of the ejected material. I once saw a piece of metal, which had

originally been a bolt, leave such a mill almost white hot, and become imbedded in a wall fifteen feet away.

Multiplex disintegrators, of which there are many varieties, have several sets of beaters mounted upon one shaft, becoming progressively larger from feed end to delivery end, the idea being that the preliminary crushing is done by the small set of beaters, and the final fine grinding by the last set, whilst occasionally a wing fan is mounted on the shaft beyond the last set of beaters to draw the powder through (see fig. 20). As a class these

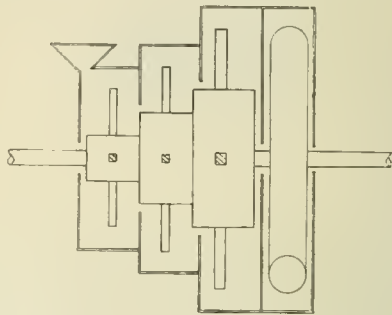


FIG. 20.
Multiplex Disintegrator.

mills are successfully used on soft materials such as sugar, although it is questionable if they are more efficient than the single type even on such articles, but they are out of the question for the general run of work, for if one set of beaters is running at the right speed the rest must of necessity be wrong, and as considerations of safety limit the speed it is the largest which is correctly speeded and consequently the others are all running too slowly and working inefficiently, and the material only partly crushed is speeded up by one set before passing to the next, thus reducing its effectual speed. Experience shows that the larger the piece which can be fed into the mill with safety the finer the resultant powder, which is only to be expected from a consideration of the underlying principle. For instance, large pieces of liquorice root fed into an ordinary disintegrator can be ground to a fine powder, whereas crushed root would only be reduced to fine splinters, while the large pieces if fed into a Multiplex would either wreck it or hopelessly clog it.

DISCUSSION.

The CHAIRMAN asked what was meant by two stones or rollers being cut to the same hand. How many grindings did it require to convert wheat into white flour? Was wheat ever ground so as to produce a particular offal (sharps)?

Mr. J. T. WOOD asked what mill was used in grinding aniline colours? Was a variety of mills used or only one?

Mr. CROSBIE: A variety.

Mr. WOOD said he knew that ball mills were used because sometimes steel balls were found in the colours.

Mr. ANDREW SMITH asked if the author could suggest any way by which the flat stones could be superseded. Earth colours and oxide of iron must be ground wet: could the author suggest a mill that would do it?

Dr. CAVEN said he had always understood that metals such as lead and aluminium could be powdered better if they were heated till they were brittle. He understood Mr. Crosbie to say that they were ground cold.

Mr. CROSBIE, in reply, said the meaning of the phrase "cut to the same hand" was that both

top and bottom stones were dressed exactly alike as they laid side by side: when the top stone was turned over the furrows would be in opposite directions, so that when it was twisted round there was a scissor-like action between the stones. The "land" was the ground between the furrows. The mill with the interminable staircase was a Krupp mill. "Sharps" was a mixture of flour and fine bran thrown out because it could not be separated. About 10% of very fine sharps was produced in milling. Aniline colours were usually ground in ball mills if there were sufficient colour to justify it: in case of one or two cwt. only, it was ground in an edge-runner mill. He suggested to Mr. Smith that rock emery or composition stones might be used instead of continental quartz or English mill stones, and grinding dry, or wet ball mills. Flat stones were often used for grinding basic slag. In reply to Dr. Caven, there was no cause to heat lead or aluminium in any way. He had ground compo pipe, lead foil, and so on without any treatment. The aluminium ingots were roughly broken up into ounce or half-ounce pieces and could be ground into particles of 1/20,000 sq. inch. The temperature in the mill was never high, though it might rise locally to 40° C.

Meeting held at University College, Nottingham, on January 27th and February 24th, 1915.

MR. J. T. WOOD IN THE CHAIR.

DISCUSSION ON THE EFFECT OF THE EUROPEAN WAR ON THE CHEMICAL INDUSTRY OF GREAT BRITAIN.

The CHAIRMAN, having referred to the Government scheme for the manufacture of dyestuffs, and enumerated some of the objections to the scheme,

Mr. J. H. DUNFORD, in describing the effect of the war on bone works, said they were considerably hampered by a number of imported raw materials, such as bones and pyrites for sulphuric acid making, being put on the prohibited list by practically all European countries. Moreover in certain articles manufactured from raw materials supplied by the bone industry, they had to accept half the usual price from the English manufacturers, as this class of work was mainly in the hands of the French and Germans. British fertilizer works had been badly hit by the lack of potash mainly supplied by German mines. On the other hand, opportunities offered themselves of stimulating the production in this country of cheap potato spirit and beetroot sugar. Given a low-priced spirit and freedom from restrictions, the English manufacturers could compete in many lines with his foreign rivals. One of the cheapest raw materials for the production of this spirit was potatoes. Poor sandy land in cold and damp localities would do very well for raising those kinds of potatoes suitable for distilling. Such potatoes needed little manuring and did not prove exhausting to the soil. Ordinary potatoes contained about 15% of starch, whereas one of the varieties—the Blue Giant—suitable for distilling contained up to 25%. The growth of sugar beet was of the greatest importance to this country, and we ourselves could very easily supply the greater part of our sugar requirements. In Holland the area under beet had been nearly doubled in 10 years because it paid, and with practically identical conditions there was no reason why it should not pay England to do likewise. The Dutch grew 170,000 acres of mangolds

but they found that the deeper rooting beet with its greater penetration of the subsoil and also because of its great crop of leaves, which were either ploughed in or eaten by stock, was a steady improver of the land.

In the Netherlands, the rural population was only about one-half that of London and yet they had twenty-seven beet sugar factories—three of the largest belonged to the farmers themselves. We could not at present expect the Government to take it up directly, but the Development Commission might profitably turn its attention to the most promising opening yet offered.

Germany produced in 1913 11,607,510 metric tons of crude potash salts of which she exported about 50%. The United Kingdom consumed in 1913 about 100,000 tons. In the past farmers had bought the bulk of their potash in the form of kainit which had a high chlorine content. It was estimated that in Scotland in 1913 25,000 tons of kainit was sold as against only 500 tons of high grade potash salts. Chlorine exerted a disastrous influence on the physical constitution of the soil and on vegetation. Calcium chloride was formed, and being very soluble in water, was lost in the drainage. Chlorinated manures robbed soil of its lime. It had been estimated by Mercker that a given weight of kainit caused the soil to lose an equal weight of lime, and that therefore as much quick lime as kainit should be applied to the soil to balance the loss. The comparative cheapness of kainit before the war was thus illusory. In marshy or wet lands simultaneous application of lime was necessary, as potash salts were rapidly robbed of their acid, so that in absence of lime chlorine formed free hydrochloric acid which was most injurious to plant life. Lime was also a corrective of the secondary effects of crude potash salts to prevent nitrification in the soil. Lawes and Gilbert proved that potash salts could be replaced with good results by other salts.

Lime and gypsum released potash from soils containing hydrated silicates of alumina and potash. Free or quick lime acted as a liberator of potash in all but the lightest of sandy soils. In the Caucasus there were 24 factories producing potash from the stems of sunflowers. In 1907 14,500 tons was produced. Other sources of potash were suint from wool-washing, farmyard manure, various cake meals, fresh guano, Peruvian guano, and mother liquors from the preparation of salt from sea water. Beet sugar residues contained $\frac{1}{2}$ % potassium calculated on weight of roots. The spent wash was neutralised by chalk and decanted, evaporated and calcined: the crude ash left contained about 50% potassium salts. Weeds, prunings, hedge clippings, brush wood, bracken, leaves and vegetable refuse contained up to 15% potash. Thistles contained $\frac{1}{2}$ %; chrysanthemums $2\frac{1}{2}$ %, and absinth stems or fumitory 7 to 8% potash, and active steps were now being taken towards the commercial production of potash. Two hundred tons of bracken ash were being used for the first test. A ton of fresh weed should yield 20 to 30 lb. of potash—enough to manure from $\frac{1}{4}$ to $\frac{1}{2}$ an acre of potatoes. Canada exported potash fertilizer in the form of wood ashes.

According to the U.S. Agricultural Dept. the Searles dried-up lake in California contained about six million tons of potassium chloride. Seaweed was used in the Channel Islands, south-west of England, and parts of Scotland, very extensively as a manure. According to Hendrick, seaweed and superphosphate gave even better yields than dung and superphosphate. It decomposed in the soil more readily than dung and had the advantage of containing no injurious seeds of weeds or spores of disease organisms such as finger and toe, etc. It should either be calcined for its ash or mixed with dung in a concrete pit. According to a report of

the Board of Agriculture for Scotland [Cd. 7564], in the U.S.A. a large company was now manufacturing potassic salts from kelp on a commercial scale. Norway exported in 1913 2521 tons of kelp ash. For agricultural purposes the seaweed ash ground to a fine powder would be a most suitable form for application to the land. Canada and British Columbia contained large deposits of granite felspars, pegmatites, and leucites estimated to contain billions of tons of potash. Norway exported in 1913 53,047 tons of potassic fertilizers in the shape of ground felspar and 32,796 tons of other felspar. Sweden in 1913 exported 37,655 tons felspar. In this Journal of October 31st, 1914, attention was drawn to a process developed by Wood and Wynants in Eng. Pat. 3185, Dec. 30th, 1857, for the extraction of potassic salts from felspar which was stated to give good results.

Mr. H. SIMPSON said that so far as the soap trade was concerned, there was not much doubt that the war had brought increased business during the past six months. The cloth mills of the West Riding of Yorkshire used some hundreds of tons of soap per week in normal times, but whilst the war had been on, these mills had been working practically continuously making cloth for the allied armies and hence had used much larger quantities of soap. The various armies and navies had also required large supplies of hosiery, and this meant a large demand for soap by the hosiery finishers in Leicester and Nottingham. He did not think there had been any diminution in the trade of soaps for household, toilet, and laundry purposes. At the outbreak of war, markets for raw materials were about normal, but during August, September, and October, prices fell to a very low level, notwithstanding that the soap trade generally was brisk. This was due to the fact that a large quantity of grease, tallow, and oil which, in the ordinary way, would have been exported to the Continent, had to be disposed of on the home market. During the early stages of the war, the only fatty materials to advance were coconut oil and palm kernel oil. A large proportion of the palm kernel oil used in this country was, before the outbreak of war, crushed from the kernels in Hamburg, though he saw no reason why these kernels, which came from West Africa, could not be crushed equally well in the Liverpool district. In July palm kernel oil could be bought at £35 per ton, but early in August it had advanced to about £52; since then it had receded somewhat, to-day's price being £47. In July caustic potash cost about £19 or £20 per ton, but quickly advanced to £50, £60, £70; to-day, however, it could be bought at prices varying from £45 to £50 per ton. He believed some was coming from Russia, and possibly some was coming from Germany through neutral countries. During the last month or six weeks all oils, tallow, and greases had advanced £6 or £7 per ton. This was due to several causes: 1st. High freights had affected the prices of all imported tallow from Australia, New Zealand, and the Argentine. 2nd. Shortage of bones in this country had reduced the supply of bone greases, etc. 3rd. The public generally had been more careful and there was not so much kitchen fat wasted as before. There had been a good demand for glycerin. The Government had been large buyers of dynamite glycerin and also commercial qualities for use in the water jackets of machine guns and motor transport waggons. Large quantities of chlorophyll were used in normal times for colouring various soaps, but there was great difficulty in obtaining supplies now, as the bulk of this material came from Germany. Prices and supplies of essential oils had remained fairly normal, but synthetic perfumes, which came chiefly from Germany, were becoming very scarce and dear.

Mr. TIMMANS said that the sulphuric acid consumption of Nottingham district was reduced during the latter part of August. The week ending August 24th it was down 30%, and by the end of the month it was down 60%, owing to the textile trade of the district being in such an unstable state. In November, matters had improved and improvement had continued ever since. The aniline dye industry required large quantities of sulphuric acid, and the Government also required large quantities in the manufacture of explosives. In face of these conditions the cost of production had increased, owing to the advanced freightage and the cost of raw materials. Lead, for instance, went up in the first week of the war and still remained very high.

Mr. B. COLLITT thought the dye industry could be set up with protection of some kind for a number of years. The dye industry in Germany was the best paying of the whole of the chemical trade.

Mr. SMITH said that the Bradford Dyers' Association, who had withdrawn from the Government scheme, had put forward a very thoughtful alternative programme in place of the Government scheme. They suggested that scientific research should be endowed and manufacturers be subsidised.

Dr. CAVEN thought the fundamental problem was one, not of tariffs, but of scientific training, and of co-operation between research chemists and chemical manufacturers. The synthetic colour industry furnished the outstanding example of the way in which Germany, to her great profit, pursued the course which we had missed because of our divorce between "science" and "business."

Mr. F. J. R. CARULLA wrote: There appears to be one cause of our failure to retain the more intricate branches of chemical industry that have so much enriched the German nation, which is apt to be forgotten, namely, the lack of workmen trained in elementary knowledge of the right kind. The position of English synthetic chemical industry regarded by the side of that of Germany seems in some respects comparable with the condition of the mechanical arts in India. Can it be supposed that Germany would have acquired her pre-eminence in the chemical field we are considering without an army of intelligent workmen ready to obey and carry out the instructions of the much vaunted chemists? We possess chemists of quite equal if not of superior quality. In a comparatively recent case where a simple open mercury syphon pressure gauge had been attached to an ammonia plant, the man in charge on the particular occasion reported that the mercury had been sucked into the apparatus, completely puzzling one as to the true conditions, for this indicated a vacuum tendency of unexpected extent. Close examination disclosed globules of mercury in corners and depressions in the neighbourhood of the instrument, showing that exactly the opposite condition had existed, viz. excessive pressure, which led to the proper adjustment of the plant.

A body of workmen sufficiently instructed in the design, use, and operation of the ordinary instruments of observation, weights, and measures, the thermometer, barometer, hydrometer, pressure gauges, and all similar instruments, especially those relating to steam and electricity, ready to obey the instructions of a superior to the very letter, these are the men that the scientific chemist needs if we are to succeed in the contest that is upon us.

Mr. J. T. WOOD said that on February 22nd he had attended a meeting of the Light Leather Trades Federation in London to discuss the question whether they should support the Government dye scheme or not. The Government would not listen to the question of protection: their hands were tied.

His firm had supported the scheme because there was not a better one before them. We in England wanted aniline colours, and unless something was done we should soon be without a supply. The general tone of the discussion was that the scheme should be managed entirely from the business side. That, however, seemed to him to be a very sad state of things.

Mr. MERRIMAN said that he understood that Germany obtained a lot of raw material from this country. If we used it ourselves their output would be limited to some extent.

Mr. WOOD said that under this scheme any surplus English raw material was going to be sent to Swiss works and they were to return an equivalent quantity of dye to this country. The rest of the raw material was to be kept at home, so that in any case Germany would get far less raw material in the future, whether the scheme were successful or not, after the war. Firms who did not subscribe to the scheme would not get any dyes while the war lasted.

Scottish Section.

Meeting held at Glasgow on Tuesday, 26th January, 1915.

MR. ROBERT HAMILTON IN THE CHAIR.

THE FRACTIONAL COLLECTION OF CRUDE TAR.

BY GEO. THOMSON PURVES, A.M.I.C.E.

The complete collection of crude tar in fractions does not appear to have received the attention which its importance justifies. Apart from the purely commercial aspect, it is worth considering how far the primary separation of the crude tar into the usual first fractions in the closed condensing system would be helpful to the reduction of atmospheric pollution. In some tar works the gases evolved from the tar are burned direct and in others passed through purifiers. In the case of direct fractionation this gas would go to augment the volume of permanent gas produced.

If the tar can be collected in the ordinary practice of the carbonising work, in those fractions into which the distiller ultimately splits it up, this would clearly be a desirable attainment provided the cost of so doing is not excessive. And considering the cost in wages and fuel and possibly transit which the primary distillation in the tar works involves, there would seem considerable scope for the successful practice of direct fractionation. It is a well-known fact that in the distillation of tar decomposition of certain products occurs, and the content of free carbon is increased. I have distilled a sample of heavy crude tar which was liquid at ordinary temperature, but after remixing the fractions, warming and allowing to cool the product was solid, showing considerable alteration in the component products. Such a change in the tar might in some cases be beneficial but in others would be objectionable. Direct fractional collection avoids the submission of the heavy tar to the high temperatures obtaining in the still towards the end of the distillation. The object in this paper, however, is to consider the question from the carboniser's rather than the tar distiller's point of view.

In gas works practice the crude gas from the retorts is very commonly drawn through a liquor

seal in the hydraulic main and here heavy pitchy tar is deposited; later in the slow condensing main, then in the final coolers and tar extractors, and lastly in the distribution system lighter and lighter fractions are separated, in each case by cooling and frictional scrubbing. This is distinctly fractional separation of tar. Further it would be a difficult matter to get other than fractional separation. But so little is it the intent that the carboniser carefully runs his fractions into the common tar well.

It will be interesting to consider one or two factors which have governed practice in tar extraction and the effects of these on the gas, on by-product recovery, and also on the trend of development towards complete direct fractionation. Before doing so, however, I wish to refer to a point in regard to the nature and the removal of tar fog. When the fog is first precipitated in the gas it must be in an extremely fine state of division, and the question arises, how fine? In a recent descriptive paper on the "Electrical Detarring of Crude Gas" as applied at the Smet-Solvay Coking Installation, Detroit,* the following statement is made in referring to the paper stain method of determining the amount of tar fog present in crude gas. "When the gas carries large quantities of tar mist the aspirator bottle will be full of the dense brown fog which has passed through the papers," i.e., two filter papers. In the face of this no practical tar scrubber could be expected to remove such fog completely. At the actual moment of condensation the minute drops of a liquid would all be of the same size and consist of the smallest number of molecules which could satisfy the conditions of equilibrium for the liquid state. In order to remove tar fog it is necessary to allow sufficient time to elapse for the elementary liquid drops to agglomerate to the relatively very large drops which we are able to deal with in practice. The size of the globules will be increased not only by aggregation but also by the solution in them of other vapours from the gas. I find a recognition of this principle in the work of Henry Aitken, a collaborator of Wm. Young. In the Aitken process, patented in 1874, "the settling of tar fog was promoted by sending gas at 190° F. into a very large settling chamber and keeping it there for as long as possible at that temperature."† The conclusion I wish to draw from this is that tar fog cannot be simultaneously precipitated in the gas and removed by frictional means from it.

In former years, when the candle-power of town's gas was higher than it is to-day, slow cooling of the gas was favoured as a means of keeping up this candle-power by retaining in the gas as vapour a larger amount of the illuminating condensable hydrocarbons. In the Saxon industry where lignite is carbonized for its valuable tar products we find "the cooling effect is produced solely by external air, and it is important that the vapours should pass through as long a track of tubing as possible. It has been found that if the vapours are artificially cooled (by water) in a short condenser to the same temperature as is attained in the atmospheric condenser, they still contain condensable constituents, whereas these are almost entirely absent when air is used. The most important point in the condensing process is the gradual cooling."‡ Exactly opposite results are thus apparently claimed for the same operation. As the crude gas from the retorts cools down its dew points with respect to different hydrocarbons, etc., are reached one after another, and the substances settle out as constituents of tar fog. The minute drops comprising the fog float

* The Gas World, Oct. 31st, 1914.

† Wm. Young, an appreciation by Alfred Daniels.

‡ Shale Oils and Tars, by Dr. W. Scheithauer.

in the gas for a considerable time, depending largely on their specific gravity and the amount of frictional resistance encountered. This tar fog has a solvent action on those hydrocarbons, etc., still present in the gas as vapours provided the temperature is not above their boiling points, and it will dissolve a proportion even when the gas has not cooled down to its dew point with respect to the particular substance. If the fog remained in the gas for a sufficient time, a state of equilibrium as regards solution would be established when the vapour pressure of the substance in the fog equalled the partial pressure of the substance in the gas; hence by passing the gas through a slow condensing main where the fog-globules will coalesce and settle from the gas slowly, the gas is largely denuded of its light oil constituents as is claimed in the lignite industry. Lignite carbonising being a low temperature process, a considerable proportion of the tar produced is very light specifically, and so the fog is slow in settling from the gas. The explanation of how the slow condensing main of the gas works helps to keep the lighter hydrocarbons in the gas is to be found partly in the nature of the tar produced, but more largely in the higher outlet temperatures at which the slow condensing main is operated. By fractionally collecting the tar I found in a particular test that the gas produced was capable of carrying as vapour at atmospheric temperature and pressure all the light oil produced. The cooled gas contained 3.5% of hydrocarbons absorbable by fuming sulphuric acid. All the tar present as fog at 80° C. was scrubbed out and amounted to about 2.75% of the weight of coal carbonised, and contained only a trace of solvent naphtha. By further quick cooling and scrubbing in cold water sprays to about 20° C., about 0.13% of crude naphthalene crystals is obtained. So that by the time the gas has cooled to 80° C. about 95.5% of the tar which has to be removed by the extractors has separated out as fog. If now such a crude gas at 80° C. was passed through a slow condensing main, the fog would be steadily removed while the gas cooled relatively very little, and so the tar fog would have a much reduced opportunity of exerting any solvent action on the hydrocarbon vapours in the gas, with the result that these would be largely retained by the gas and the candle-power enhanced. As the temperature at which the slow condensing main is operated is lowered, increasing amounts of benzene vapour, etc., would be removed from the gas. It is probable, however, that at temperatures even considerably below 80° C. little benzene would be removed, for the gas is considerably below the saturation point with regard to this vapour. The principle involved is clearly the retarded cooling of the gas while the bulk of the tar fog is removed. The time occupied in the operation does not appear to be a material factor. The ideal state would be the complete removal of all tar fog before the gas reached the temperature at which the light hydrocarbons would be dissolved. This is fractional tar collection in a degree. Prof. Lewes writes "it was realised that sudden cooling of the gas and condensation at too early a period affected the illuminating power more than slow cooling. This is partly due to the tar being thrown out as a whole, while with slow cooling some of the benzene is carried away as vapour by the gas, etc."* It is not, however, speed of cooling but rather one of time contact between tar fog and cooled gas that is the material factor. For—as has been shown above—the crude gas can be quickly cooled, and the condensable tar removed almost wholly in one and completely in two operations with prac-

tically no removal of benzene. At Granton Gas Works, the slow condensing main is on the counter current principle, and so the condensed tar has the minimum opportunity for solvent action on the gas. The slow condensing main at the Greenock Gas Works is on the direct current principle, and so the condensed tar has here the maximum opportunity for solvent action on the gas. The important point in the working of the slow condensing main is that the outlet temperature shall not be low enough to permit of the benzene, etc., being absorbed. Dr. H. Colman, when working on the removal of the heavy tar fog from the hot gas (about the year 1897), had two special objects in view—1st, to remove the naphthalene more completely from the gas in the condensers, and, 2nd, to retain more of the vapours of the light oils in the gas and thereby increase the illuminating power. To effect these results one factor which he proposed* was to pass the hot gas through a "Cyclone" extractor. The gyratory motion imparted to the gas in such an apparatus causes a centrifugal action which is much greater in the case of the tar drops than in that of the surrounding gas owing to their higher specific gravity. The tar drops are therefore thrown to the periphery of the centrifugal separator, where they coalesce and can be drained away. With the ratio of naphthalene to light oils obtaining in those days these objects were achieved. But with the larger production of naphthalene in later carbonising practice it was found that the crude naphthalene, etc., came down in a semi-solid mass in the condensers and blocked them. In Dr. Colman's method partial tar fractionation was thus used as a means of overcoming two definite carbonising troubles.

As we would expect, the writings of William Young are rich in reference to fractional condensation of tar. In the Young and Aitken process the central feature was the analyser in which fractional condensation was carried out. No effort was made, however, to collect separately the tar fractions deposited in the different sections of the analyser. The tar was allowed to flow downwards from section to section, so allowing the gas to take up as much of the lighter constituents of the tar as possible, this being the principal intent in the process. Fractional condensation with a counter current flow of condensed products thus took the place of sending the gas and condensed products in the same direction. In an address Mr. Young gave to the West of Scotland Association in 1876 on "Condensation," he showed that to retain the highest lighting value in the gas we must keep the gas and condensed tar warm until they have physically separated, and in order that the tar particles will settle out the crude gas must be kept warm and allowed to travel slowly, and further, that the tar be allowed to cease contact with the gas only at such a temperature that it could not absorb the lighter hydrocarbons.† In other words, there must be the shortest time contact between condensed tar and cooled gas. It will be shown later that all this is effected in complete fractional tar collection. In later years, when the ratio of naphthalene to light oils in the gas had largely increased, Mr. Young abandoned the principle of the Aitken and Young process on account of the fact that when it was applied the cooled gas was saturated with naphthalene vapour. With possibly the exception of the gas produced in continuous vertical retorts, complete tar fractionation will always leave the gas saturated with naphthalene vapour when a high carbonising temperature is applied.

* British Patent No. 4742/1899.

† William Young, an appreciation, by Alfred Daniell.

* The Carbonization of Coal, by Vivian B. Lewes.

The failure of Brunck's direct ammonia recovery process was principally due to the presence of large deposits of tar in the saturator, resulting in highly discoloured and unmarketable sulphate. This difficulty was overcome in the Koppers semi-direct process by cooling down the gas, then removing the tar, and after reheating the gas passing it through the saturator. Reverting to the original idea of Brunck, Dr. Hilgenstock, of the "Otto" Company, perfected his process of scrubbing the crude gas with a spray of hot tar and so completely removing the tar fog, without cooling the gas below its dew-point temperature with regard to water, then passing it through the saturator. After passing the saturator naphthalene and light oils are removed by cooling and scrubbing with cresote oil. In the Simon-Carrès direct recovery process, before the gas reaches the saturator tar is removed in two separate fractions based on their different specific gravities principally, but also partly on different temperatures. The first is removed in a "cyclone" on similar lines to that used by Dr. Colman (Messrs. Henry Simon owned the original patent rights of the Cyclone dust collector), and the second in a patent "dynamic extractor," where a much more intense centrifugal action is used and the remaining tar fog completely removed from the gas. We thus see that the success of the direct ammonia recovery process is dependent on fractional separation of the tar.

In 1907 Walther Feld proposed* to scrub the crude gas in his patent washers successively at 160° C., 80° C., and 60° C., and so obtain as separate fractions pitch, heavy oil, and a lighter oil. He further developed his process to include the extraction from the gas of naphthalene, ammonia and cyanide; etc. His process is applied at a number of Continental gas works, but I do not know with how much success. To get the first, the pitch fraction, the gas from the collecting main is passed through heat-insulated pipes into the first washer at a temperature from 200° C. to 160° C. This latter temperature is given by Feld as the dew-point temperature of the high-boiling-point hydrocarbons constituting the pitch. The washing oil in the upper part of the washer is a solution of pitch in a portion of the next condensate, and in the bottom chambers the pitch fraction itself. Before the gas enters this washer it must have deposited an almost solid pitch containing a large proportion of the free carbon. It is difficult to see how this can be worked up with the true pitch fraction on the lines of the Feld process. This appears to be borne out to some extent by the fact that soft pitch produced by the Feld process contains only 1% to 3% of fixed carbon, which is less than is usually found in crude tar. If the crude gas enters the first washer at the higher temperature and the fall of 40° C. takes place in there, it is fairly certain that some of the fog then produced would pass this washer and so lower the efficiency of the fractionation. This difficulty would be experienced in each washer where a fall of temperature occurred. Such a procedure is in fact attempting simultaneous production and removal of fog. Feld seems to have expected, or else found, this difficulty, for he proposed to improve the fractionation and to lower the temperature of the gas at one stage by pumping into it a portion of the product extracted at a later stage. This on evaporating would leave behind some of the former fraction which had been carried forward. In this way he no doubt partially helps the fractionation.

Two years ago Dr. Davidson expressed the view that the partial fractionation of the tar by the sensible heat of the crude gas could be simply

effected in vertical retort and coke oven installations.* He also described a method of producing in the gas-collecting main a distinct and marketable pitch fraction in addition to the crude tar, which would certainly be lower in free carbon than that obtained in ordinary practice. Briefly his method is as follows. In the collecting main of the Dessau retorts an agitator works continuously. A few minutes before the draw, tar is run into the main to a depth of 10½ inches, and when the charging of the nine retorts is complete the level of the tar in the main is brought down to 4 inches. During the ensuing carbonising period the remaining tar, due to addition of pitch from the gas and to distillation, is converted to pitch, which at the high temperature of the main (350° F.) is liquid. By regulation of the amount of tar added and run off, a soft or hard pitch may be obtained free from ammonium chloride. Obviously tar fog carrying free carbon will pass from the collecting main to the condensing system, and so the whole pitch fraction will not be obtained. Undoubtedly, however, a distinct pitch fraction is produced. It will be noticed that the temperature in the Dessau main, i.e. 350° F., is much below the final temperatures obtaining in tar stills, and so the process is more one of evaporation than distillation. In my opinion Dr. Davidson's collecting-main method of producing the pitch fraction is superior to Feld's.

In the "Cava" process† for the distillation of tar the highest temperature to which the tar is subjected is from 200° to 250° C., according to whether a soft or a hard pitch is required. In this process the distillation, or, more correctly, evaporation of the tar is effected by passing heated air over the tar contained in a horizontal retort. Blades mounted on a revolving central shaft plunge into the tar and expose thin layers of it to the oxidizing and evaporating action of the brisk current of air. Some of the lighter products are oxidized, and so the amount of the bituminous substances in the pitch increases, and likewise the yield of pitch, and it is claimed that on account of the low working temperature there is no increase in free carbon. The evaporated products are condensed and treated in the usual way. Dr. Davidson's method involves at least the principle of the "Cava" process, but the separation of the tar products is limited to the pitch fraction, and this is not quite all recovered.

In order to carry out the complete direct fractionation of the tar within the condensing system, and also the evaporation and fractionation of a further quantity of crude tar by means of the sensible heat of the crude gas, I would suggest the following method, using the plant indicated diagrammatically in Fig. 1. Briefly the method is as follows. The crude gas from the collecting main passes by the upstand pipe, A, and the foul main, B, to the scrubber at C. Here the gas is scrubbed by a screen of anthracene oil containing some pitch, and all the tar fog containing the free carbon removed. The oil, etc., collecting in the receiver below flows to the pump, D, to be re-circulated, and there is also a continuous flow of the oil into the collecting main. The amount passing into the collecting main would be just what is necessary to maintain the bulk in this main which would tend to decrease by the removal of pitch at E, and by evaporation. The gas passing C, after further partial cooling, is scrubbed in F for the removal of anthracene oil. The oil collecting in the receiver here is circulated by the pump, G, and all the surplus flows to the pot, H, and from there to the storage. The pot, H, being in communication with the inlet to the pump, D,

* Transactions, Scottish Junior Gas Association (Western District), 1913-14.

† British Patent No. 29,897, 1912.

* British Patent No. 20,139, 1907.

allows the anthracene oil to keep up the bulk in the first scrubbing system which would tend to be reduced by the flow into the main and also by evaporation. Several fractions, depending on the

main of a coke oven installation may reach 300°C . The temperature to which the gas must be reduced before reaching the first scrubber, is about 150°C . to 170°C . This reduction would be largely

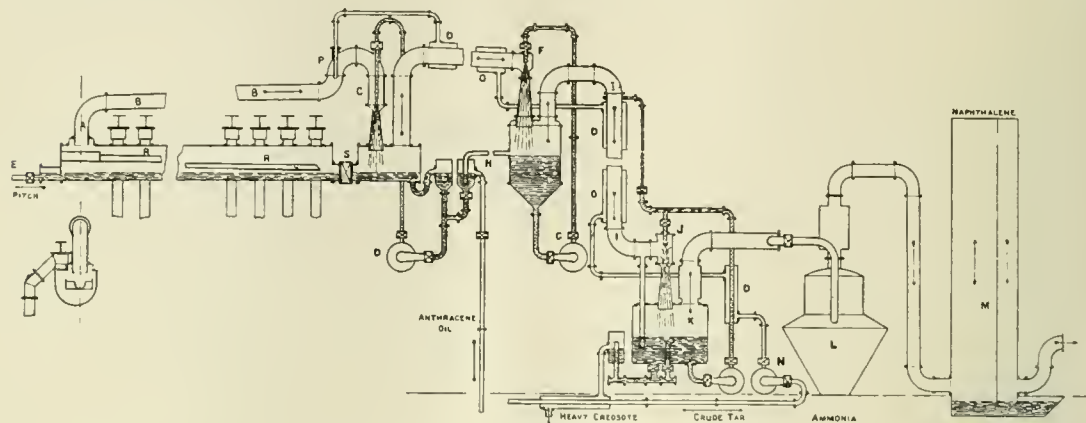


Fig. 1.

Combined Evaporation and Fractionation of Tar.

lowering of the temperature of the gas by successive stages, could still be separated, but the separation of only one more fraction above the water dew point of the gas will be considered. After passing F, the gas is cooled in the down pipe, I, to its water dew point and all the fog removed in the scrubber, J, by means of a spray of ammoniacal liquor. The tar oil collects in the receiver, K, separates from the liquor, and then flows to the storage. The liquor remains in the circulating system. The gas, completely freed from tar fog but still carrying all the water as vapour, is passed without further cooling through the direct recovery saturator, L, where the ammonia is removed. It is then quickly cooled in one section of M and naphthalene removed in the other. The naphthalene collects in the settling tank beneath as crude crystals. The gas now passes through the exhaustor and is forced through the usual creosote scrubbers for the recovery of benzol, etc.

As has been stated the crude gas is successively cooled between the different scrubbing systems. This is partly done by air cooling but also as far as possible by an externally applied counter current flow of crude tar brought in from other carbonising installations. This tar is forced by the pump, N, through the successive heat exchangers, O, into the foul main at its highest point, P. It would now flow down against the crude gas, cooling the same and being itself further heated. It would here yield up to the gas the bulk of its lighter constituents and finally reach the gas collecting main by the open tray, R. The work which has been done in the "Cava" process and by Dr. Davidson shows how simple and practical it is to produce pitch in such a vessel as the collecting main—it is sometimes too easy. In both of these methods the hot pitchy tar is kept mixed by mechanical agitators. This is not difficult in a short main such as is used with the "Dessau" retorts or in the "Cava" still which is only about six metres in length. But when dealing with say a 60-oven coking plant having a collecting main about 200 ft. long it is quite a different matter. To obtain the necessary agitation here several jets of high pressure steam blowing into the body of the liquid tar would be effective. Very little steam would be required, and after doing its work would pass away with the gas and be finally condensed. The gas leaving the collecting

effected by the crude tar entering the foul main at P and partly by external air. It would probably be advantageous to lag these mains and use all the sensible heat of the gas for heating and evaporating added tar. The oil from the first scrubber flowing in by the sluice valve, S, mixes with the highly heated tar in the collecting main. From the conditions of working, the tar in the collecting main would consist almost solely of pitch and anthracene oil, and in flowing to the outlet weir valve, E, would be evaporated by the heat of the crude gas till only pitch remained. By regulating the flow of pitch from E a soft or a hard pitch would be obtained. The crude gas, carrying as fog a portion of the pitch hydrocarbons and free carbon, would be cleaned in the first scrubber with oil at a temperature somewhat below the dew point temperature of the gas with regard to the lowest boiling compound of the pitch fraction. The gas temperature would vary with the conditions of carbonising, with the nature of the pitch required, and with the amount of added tar evaporated. Without added tar it would probably be about 150°C . With added tar, however, the dew point temperature would rise corresponding to the richness of the added tar in the lower boiling point members of the pitch fraction required. It is quite possible, therefore, that the proper working temperature at this point would vary by 20° or 30°C . between the conditions of working hard pitch with added tar and soft pitch without added tar. The lowest temperature at which this section could be worked would be that which would just maintain the oil level in the receiver. The type of scrubber proposed for cleaning the gas here is the "Otto" spray but using instead of crude tar the fraction here collected. A large proportion of the pitch fraction is deposited from the gas in the collecting main and the balance would be extracted in the first scrubber. This balance dissolves in the scrubbing oil and flows continuously into the collecting main. With these conditions the pitch fog is removed, not with the pitch fraction itself, but with a solution of a portion of the same dissolved in anthracene oil. This oil when sprayed through the gas in the scrubber would be partly evaporated and collected in the next scrubbing section. The temperature of the gas is lowered by this evaporation and more fog produced. But I have determined by experi-

ment that the bulk of this fog goes forward with the gas. The time during which the fog remains in the spray after its formation is too short for the drops to get big enough for extraction. The oil carrying the pitch into the collecting main is evaporated and comes down again in the condensing systems. There is thus a continuous circulation of anthracene oil carrying the balance of the pitch fraction back to the collecting main. An issuing pressure of 20 lb. per sq. inch would be sufficient in the first scrubber, this pressure being raised in a pump of the "Albany" or the "Drum" type.

The gas from the first scrubber is now cooled as explained above to the dew point temperature for the anthracene oil fraction and scrubbed with this oil. This oil flows through the pot, H, to the storage. Since the pot, H, is connected to the inlet of the first scrubber pump, the oil will naturally keep up the bulk in the first section. In this way the temperature of the scrubbing oil in the first scrubber will be lower than the temperature of the gas which it has to clean. As the temperature falls I have found the fog which is produced more and more difficult to extract. But I consider a spray pressure of 30 lb. per sq. inch would be sufficient in this section. The extraction temperature here would likewise vary with the carbonising conditions, but would be somewhat over 100° C.

The gas now enters the down pipe, I, at a temperature of at least a few degrees above the temperature at which ammonium chloride deposits occur, about 93° C. It is now cooled by the external counter current flow of tar as already described and also by ammoniacal liquor sprayed into it, which dissolves the ammonium chloride formed and so prevents deposits of that salt. This liquor returns to the receiver by the sealed dip pipe. In cooling the gas it will become itself heated above the working temperature and this is corrected in the heat exchanger. The gas, now cooled to its dew point with regard to water, is scrubbed in J by a jet of ammoniacal liquor at about 90 lb. per sq. inch pressure. This high pressure is necessary to extract the lightest fog. For the first two sections the "Otto" spray scrubber was suggested and the method of operation is similar to the usual practice, using, however, different scrubbing fluids. For this third section, however, in order to utilize the work done on the gas by the high-pressure jet, I think the best type of scrubber would be one designed on similar lines to the Körtling ejector condenser. This would reduce considerably the work to be done by the exhaustor. In the receiver, K, the tar oil would separate from the scrubbing liquor and float on the top of it, finally passing away by the overflow to the storage as a heavy creosote oil. The liquor would remain in the circulating system. During the past year or two on the Auchengiech direct recovery plant I have made a number of experiments with the "Otto" spray tar extractor, and using creosote oil, liquor, and tar and liquor mixed at varying temperatures I have got efficient tar extraction. The most important point is to ensure that the fog which is to be extracted is present in the gas before it reaches the scrubber. The extraction temperature in this section would be from 70° to 80° C. according to carbonising conditions. From this point the gas is treated in normal direct recovery manner. For instance it is first freed from ammonia in the direct recovery saturator, L, and then naphthalene removed in, say, an "Otto" water spray naphthalene extractor, M. The gas is then forced by the exhaustors through the usual creosote scrubbers for the recovery of light oils. If the gas was required for town lighting, however, purifiers would take the place of the creosote scrubbers. In this particular case it is to be

remembered that the gas would be saturated with naphthalene vapour and any fall of temperature would cause a deposition. The content of naphthalene could be reduced by anthracene oil in the following way, somewhat on the lines of the Young and Aitken process and using the plant indicated diagrammatically in Fig. 2.

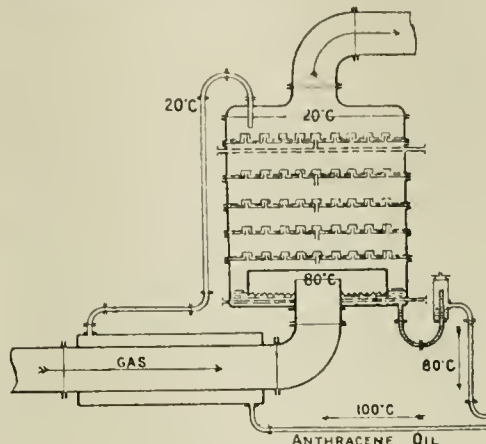


FIG. 2.
Naphthalene Washer.

The cooled gas or a proportion of the total bulk after being heated to 80° C. passes into the bottom chamber of a washer similar in principle to the Young and Aitken analyser. Exhaust steam, or the sensible heat of the recovered tar fractions, or both could be used for this heating. This is not indicated in the diagram, but a heat exchanger is shown in which the washing oil is cooled from its recovery temperature to the temperature of the gas, the gas being itself partly heated. The cooled anthracene oil fills each of the trays up to the level of the overflow and runs through the washer in a continuous stream. In the bottom of the washer by means of a steam coil the oil is maintained at 80° C., at which temperature it leaves the washer. At 80° C. the anthracene oil cannot dissolve benzene and in fact, so far as examination of direct recovery tar extracted at this temperature indicates, very little solvent naphtha even is removed from the gas. This is no doubt due to the fact that the light oil vapours are far from saturating the warm gas. It is quite likely, therefore, that such a washer could be operated considerably below 80° C. without material effect on the benzene content in the gas; the lowest practical temperature could be found only by experiment. This oil outlet temperature being much below the boiling point of naphthalene, the anthracene oil will dissolve some of this hydrocarbon. The cold anthracene oil falling from tray to tray will be heated by the gas to 80° C. and the gas cooled. To ensure the gas being in contact with the oil at atmospheric temperature in the final tray, a cold water coil is placed in the gas space under the top tray. When the oil in the washer is saturated with benzene either by admixture or by extraction from the gas, no further action on the benzene in the gas can take place.

Referring again to Fig. 1, the plant from the third scrubber on is already applied in the direct ammonia recovery process, so that it is only that part between the collecting main and this third scrubber which is added to the ordinary direct ammonia recovery plant, for the fractionation of the tar. The cost of this addition, together with

the plant for dealing with the inbrought tar, for an installation carbonising 360 tons of coal per day would probably not exceed £3000 and would serve for the fractionation of all the tar produced and added. The inbrought tar which could be dealt with might possibly reach 75% of that produced from the coal carbonised. The main attendants already required on such a coking installation could quite well look after the two extra pumping sets, etc. The storage tanks required would be the same as those used in a tar distillery of the same capacity.

On account of the increased demand for benzene and toluene at the present time, there is added interest in the fractional method of recovering the tar products. In the ordinary condensing practice these products are divided between the tar and the cooled gas, so that to recover the whole of each, washing of the gas and also distillation of the tar must be resorted to. With direct fractionation only one operation, the washing of the gas, is required. Anything tending to increase the output of toluene, either by better recovery methods or by increased production per ton of coal carbonised, is highly desirable at the present time, not only on account of the better financial return but also on account of national requirement. The required conditions in carbonising would seem to be such as would give a high partial pressure of methane at the moment of destructive distillation. From experiments I have made on ammonia production in bulk carbonisation I consider the ratio of toluene to benzene produced will follow the yield of ammonia.

I have endeavoured above to show that in many of the special methods applied for the extraction of the tar, fractional separation has been an underlying factor. The condition "that the tar should leave contact with the gas only at such a temperature that it could not dissolve the light oils" which Mr. Young stated in 1876, is fulfilled in direct tar fractionation. Mr. Young abandoned the principle of the Young and Aitken process on account of the trouble with the condensers, etc., due to the greater amount of naphthalene produced in later carbonising practice but, as I have indicated above, an extended application of this principle using naphthalene-free anthracene oil would overcome this difficulty. I consider the method advocated by William Young so many years ago is still the correct one for gas works condensation practice and particularly so with carbonisation in continuous vertical retorts. In a number of works using these retorts, surprisingly low candle-power of the gas has been found on account of the light tar fog persisting with the gas till almost the final stages of cooling and so removing from it illuminating hydrocarbons.

DISCUSSION.

Mr. McLEOD said, in regard to counter current *versus* direct current flow in condensation, that it was really a temperature question. There was only a thin trickle of liquor and tar running down the slow condensing main, so that the actual contact was comparatively slight and there could be no very great scrubbing action: hence, provided the temperature did not fall—and in Greenock it did not fall below 140°—whether there were direct current flow or counter current flow did not make much difference. In Greenock Gas Works the naphthalene problem had been solved by putting down a separate washer with special washing oil, and in addition to that vaporising a little low boiling point oil into the gas after washing was finished. The system described by Mr. Purves was, however, a much simpler process.

Mr. VASS thought that there would be a saving of the fuel required to re-heat the tar. To apply

the system to gas works would involve a serious alteration in the mains.

Prof. THOMAS GRAY said that the method proposed by Mr. Purves for the fractional condensation of coal tar appeared to be quite practicable. It involved no new principle, as the method of separating liquids by bringing their vapours into equilibrium with condensates at different temperatures had long been practised in column stills; and the means which was proposed for establishing this equilibrium was one which had been in regular use for several years in connection with the Otto direct system of recovering by-products from coal distilled in coke ovens. He found it difficult to accept Mr. Purves' statement that the work in connection with the plant, involving as it did the regulation of temperatures in a somewhat elaborate system of heat interchangers, could be supervised by the same operative who takes charge of the simpler Otto plant. In order to ensure uniform results in practice it would be necessary to exercise very careful supervision and to employ more highly skilled labour. It would be interesting to have estimates of the costs of installation, upkeep, and working of a plant of the size proposed, for comparison with the corresponding figures for a plant designed to collect the tar in one fraction, combined with stills for the distillation of 15 tons of tar per day. While Mr. Purves was not in a position to give actual figures, he might be able to give some indication of the working costs from his experience in handling the "Otto" plant.

Mr. MOORE said that he had seen Feld's first plant in operation in Austria about six years ago, and which had failed, not because the process of condensation was a failure, but because in Austria they could not use the products and on account of duty charges they could not send them into Germany. Since then he had seen Feld's process successfully at work in Germany. It could produce pitch quite easily with a melting point varying from 70° C. to 90° C. A new plant on the Feld system in course of erection last year at Sterkrade was estimated to cost £60,000.

He considered the plant proposed by Mr. Purves would prove difficult to work as at present arranged, and saw no reason why a much simpler plant after the style of the bubble washer could not be used. That washer would require considerable pressure to force the vapour through the columns, but he thought the same result would be obtained.

Mr. W. H. COLEMAN asked whether the various condensates were obtained in a marketable condition. If they had to be distilled before they could be sold, then it was questionable whether it would not be more profitable to collect the whole in one fraction and distil at once rather than to collect and distil them all separately. He would like to know exactly what Mr. Purves meant by the statement that the yield of toluene followed the yield of ammonia. He thought he was right in saying that the yield of toluene decreased as the temperature increased, that is to say, when carbonising at a higher temperature the tar contained larger quantities of benzene than low temperature tar. He had examined some hundreds of samples recovered from coke ovens, and on the average there was three times as much toluene per ton of coal in the gas as there was in the tar recovered from that same ton of coal; so that if all the toluene were recovered from the gas there would be very nearly enough for the purposes for which it was required to-day.

Mr. ROBERTSON said that if the main were used for the purpose of making pitch, its life would be greatly reduced owing to the much higher temperature and the serious trouble that might arise, due to the presence of ammonium chloride in the tar; this substance when distilled acted strongly upon iron. With such a long main,

having regard to the danger of pitching-up, due to irregular working, and the fluctuating atmospheric temperatures, it would be difficult to keep the main at the requisite high temperature, and these difficulties would hinder very much the proper working of the coke ovens. By using steam to keep the pitch liquid, more water vapour would be carried away by the gas, and would be condensed out again on cooling the gas to remove the naphthalene, thus increasing the quantity of waste liquor to be dealt with. Mr. Purves had said that the benzol was divided equally between the tar and the gas: 95% existed in the gas, and the remaining 5% in the tar.

The CHAIRMAN said that the process proposed by Mr. Purves was rather a delicate one in respect of the balance that must be attained and maintained between the amount of heat carried into the condensing system and the cooling effects of that system. A difficulty that might upset all calculations was variation in atmospheric conditions. At any season of the year there might be a considerable variation in conditions within a few hours caused by a change from wet stormy weather to dry still weather. Moreover, he would expect a different rate of working necessary as between summer time and winter time. Manufacturers of pitch were asked to make it in various states of hardness. Some of it was wanted so soft as to be really thick tar, while, from the States, there was a demand for a quality so hard that it had lost all plastic qualities and become a very brittle substance. To produce such differences in hardness must call for great variation in the conditions of working, and he should be very doubtful whether these extreme varieties could be produced by the proposed process. He did not think the "Cava" process would be a good one for distilling tar, because the evaporation was done by means of heated air: some of the products were oxidised and a larger yield of pitch obtained. His own experience of blowing air through heated tar was that the free carbon was increased and the plastic and cohesive properties of the pitch were impaired, so he should not expect to obtain a good quality of pitch from the "Cava" process, but the principle might be usefully applied if hot gas could be used as in the hydraulic main. Mr. Purves proposed to wash out naphthalene with anthracene oil kept at a sufficient temperature to leave the benzol in the gas, but that seemed to him to depend on a rather narrow margin, and he thought it would be simpler to wash out everything and then put back sufficient benzol to give the illuminating power required. By working in that way it was possible that purification of the gas would be assisted. For instance, by washing with blast furnace oil, which was a splendid solvent for naphthalene, benzol, and carbon bisulphide, it might be possible to remove practically the whole of these substances.

Mr. PURVES, in reply, agreed with Mr. McLeod that it mattered little whether the slow condensing main was on the direct current or the counter current principle. The effect on the gas of the small quantity of condensed tar in the main was trivial compared with that of the tar fog. In regard to the suggestion made for dealing with the naphthalene problem, his intention was to show that an extended application of Young's counter current condensing practice would overcome the principle difficulty which had caused him to abandon his process. In addition to the saving in fuel which successful direct fractionation would effect, the fractionation of added tar from other carbonising plants would yield a further fuel economy. Prof. Lewes had quoted ("Carbonisation of Coal") 9.2% as the proportion of the heat applied in carbonisation, which was carried away by the gas, tar, and water. In coke oven practice

with wet coal the proportion was probably somewhat higher. As Dr. Gray had stated, the method proposed for the fractional collection of the tar involved no new principle. It was all covered by the work of William Young. The application of fractional tar collection in modern practice was, however, almost wholly the work of foreign chemists, as witness the Feld process and the direct and semi-direct ammonia recovery processes. It appeared well worth while to have a discussion on the subject by our own chemists. He selected the "Otto" tar spray for the removal of the tar fog because after practical experience with several types of tar fog extractors he considered it easily the best. The regulation of the temperature of the gas to the water dew point, as was required in the Otto process, was quite simple and was done by the man in charge of the exhausters. The controlling of the other two temperatures could quite well be done by the "main" attendants, as their ordinary duties would be done away with in such a process as this.

As Mr. Moore had remarked, the benzene and toluene were not fractionally condensed. He would draw a very distinct line between condensation of tar and absorption by tar. These two products, benzene and toluene, were not, properly speaking, condensation products. Since the permanent gas was quite able to carry the whole of each by saturation at ordinary temperature, the presence of these in the crude tar was entirely due to solution, the gas and tar having cooled sufficiently in contact with each other. He did not share Mr. Moore's opinion of the equal suitability of bubble washers. With a large bubble washer it would be more difficult to maintain constant temperature with a simple tar spray.

The fractions obtained in direct fractionation would differ somewhat from those obtained in the ordinary tar distillation and partial destructive distillation process. Comparing the products solely within the scope of direct fractionation, he would hardly expect a difference of a few degrees in the extraction temperature to make a material difference in the composition of the product. He had not actually obtained all these condensates. The process was really only a suggested one. But judging from those fractions which had been obtained and from the efficiency of the tar extractor, he was confident that the fractional separation of the products would be quite clean; for instance, the anthracene oil would not be contaminated with the tarry matter of the previous fraction. The heavy tars were more easily separated than the lighter ones. After scrubbing the hot crude gas with a hot tar spray he had seen the sulphate produced, by the direct method, snow white and later the naphthalene extracted bright yellow in colour. The melting point range of the latter was found to be 69–72° C. as against 70–73° C. for that separated from creosote in a tar distillery. He agreed that the future of such a process would depend on the cleanness of the fractionation. In regard to the yield of toluene, he did not mean that those conditions which would give the highest possible yield of ammonia would also give the highest possible yield of toluene. In order to get the highest commercial return from a carbonising plant it was necessary to work within a certain range of temperature and other conditions. Within that range the yield of ammonia varied in the same direction as the yield of methane. As a high partial pressure of methane at the time of carbonising would seem to be the required condition for good yields of toluene, he would expect the ratio of toluene to benzene produced to vary in the same direction as that of the ammonia and the methane. The ratio Mr. Coleman gave for toluene in the gas to that in the tar was, he thought, much too low. The ratio,

however, might be anything, as it was purely a function of the method of condensation.

The temperature in the main would not be higher than that already found in mains without dip pipes and working with all tar conditions. In regard to possible corrosion from ammonium chloride, he thought too much was generally made of this factor and he could not agree that any corrosion at all would occur. At the high temperature occurring here ammonium chloride would not exist at all as such, and its free radicals would not combine until the temperature fell to somewhat under 100° C. The free hydrochloric acid could not corrode the iron, as the crude gas was dry until the temperature fell and the water dew point was between 60° C. and 75° C. Once formed and dissolved the chloride was always present in excess of ammonia, and as there was no question of dissociation, there was no evidence of internal chloride corrosion in the plant after fully four years' continuous working. There would be no greater danger of pitching up than there was with other collecting mains working under all tar conditions, and the problem was not to keep the main at the requisite high temperature, but rather to bring the temperature down. The use of steam in the collecting main would certainly increase the amount of condensate ultimately produced, but this condensate was not a noxious product such as was produced from ammonia stills. He did not say that the benzol was equally divided between gas and tar and thought the proportion stated by Mr. Robertson was about correct. With direct recovery practice, however, no benzol, etc., occurred in the tar. He understood that if proper care were taken in the working of the Cava process no increase of free carbon occurred. The washing of the gas to free it partly from naphthalene as carried out in gas works was done solely to reduce the tendency to choking in the distribution system, and simple washing was cheaper than combined washing and distillation of the absorbing oil.

Meeting held at Glasgow on Tuesday, 23rd February, 1915.

MR. ROBERT HAMILTON IN THE CHAIR.

MOLASSES AS A SOURCE OF ALCOHOL FOR THE PRODUCTION OF POWER.

BY T. H. P. HERIOT.

The suitability of alcohol for generating power in the internal combustion engine has been sufficiently established by exact tests and by practical experience of alcohol motors for general purposes. The conclusion thus drawn is that, although the calorific value of alcohol is little more than half that of petrol, the efficiency per b.h.p. is from 28% to 31% compared with from 16% to 20% for petrol. This higher efficiency of alcohol is due to several factors, namely:—The volume of air required for complete combustion is about one-third of that required by petrol, thus reducing the waste of heat in the exhaust. This smaller dilution with air ensures more perfect admixture before the explosion, and, consequently, favours complete combustion. The mixture can be subjected to a pressure of 200 lb. per sq. inch in the cylinder without spontaneous ignition; the safety limit for petrol is 80 lb. Mixtures of alcohol vapour and air, containing from 4 to 13.6% alcohol, are all explosive, whereas the explosive range of petrol is from 2 to 5%, thus requiring more exact adjustment of petrol and air in the cylinder. The exhaust from the alcohol engine is smokeless and nearly odourless, and the products of combustion do not clog the cylinder valves.

In view of the rapid development of the internal combustion engine, and the increasing cost of petrol,

which may be expected to rise considerably as the limited supplies become partially exhausted, it is reasonable to regard alcohol as the fuel of the future, and to inquire whether it might not compete successfully with petrol to-day if produced from the cheapest raw material, and freed from existing taxes which artificially increase its cost far beyond the actual cost of production.

The raw materials now available are starch, cellulose, and sugar. In the case of starch, the cost of alcohol includes that of raising the crop, harvesting, and transport to the distillery before the conversion of starch into alcohol commences. In the production of alcohol from sugar, however, the by-product of an existing industry is available, namely, molasses. The cost of raising, harvesting, and transporting the cane or beet crop is rightly charged to the sugar. This comparison between starch and molasses is well illustrated by Peck, of Hawaii. "If the 21 million gallons of molasses produced in these islands in 1913 had all been converted into alcohol, over 9 million gallons of 90% alcohol would have been produced. A bushel of corn yields 2.8 gallons of 90% alcohol, and an average yield of corn is 30 bushels per acre. Therefore, to produce 9 million gallons of alcohol, 3,248,000 bushels of corn would be required, representing a crop from 108,000 acres, an area only 5000 acres less than that from which the 21 million gallons of molasses were derived together with the main crop of 500,000 tons of sugar shipped." Similarly, a bushel of potatoes yields 0.73 gallon alcohol and an average crop gives 205 bushels per acre. Thus, 9 million gallons of alcohol would require a crop from 60,000 acres, or 53% of the acreage required in Hawaii to produce the same quantity of alcohol plus 50,000 tons of sugar.

Another point in favour of molasses is that it has only to be diluted in order that fermentation may commence. In tropical distilleries adjoining the sugar factories, the air-borne yeast is sufficient to cause vigorous fermentation within a few hours after dilution or, as it is called, "setting up the wash."

The manufacture of alcohol from molasses is a long established industry, and in many countries a distillery forms an adjunct to the sugar factory and is worked under the same management. Hitherto, the manufacture of rum has been the object in view, although methylated spirit is produced in some countries. But, owing to the small demand for rum and the cost of freight and containing vessels, other methods of utilising molasses have been adopted and are referred to below. In some countries, molasses is literally a waste product, and the problem is how to get rid of it. The erection of large distilleries in sugar growing centres might solve this problem if there were a steady market for alcohol as fuel and cheaper means of transport than those now employed.

Cane molasses.

The possible production of alcohol from this source may be calculated from the statistics and analyses given in Tables I., II., and III.

TABLE I.
The world's production of sugar.

	1909-10.	1910-11.	1911-12.	1912-13.	1913-14.
	tons.	tons.	tons.	tons.	tons.
Cane	8,349,000	8,354,000	9,067,000	9,177,000	9,905,000
Beet	6,587,000	8,560,000	6,820,000	8,966,000	9,128,000
Total	14,936,000	16,914,000	15,887,000	18,143,000	19,033,000

Average for cane = 9 million tons. Average for beet = 8 million tons.

Table I. shows the production of cane and beet sugars for the years 1909 to 1913. The average annual production for these years was very nearly 17 million tons, 53% of which was cane sugar.

TABLE II.
Production of cane molasses.

	Million gallons.	Per cent. on sugar made.
Hawaii	16	19.5
Java	52	25.4
Cuba	90	27.3
Queensland	6½	24.4
Egypt	1½	22.0
Average	—	23.7

Table II. gives the production of cane molasses in a few typical countries, also the percentage by weight of molasses on commercial sugar produced. This percentage varies with the purity of the raw juice, which, in turn, is influenced by climate, soil, and variety of cane cultivated. Excluding some higher percentages due to antiquated processes or inferior machinery, the above figures average 23.7% of molasses on weight of sugar. The world's production of 9 million tons of cane sugar includes 2½ million tons of Indian "gur" from which no molasses is separated, but which represents the total solid matter of the juice after evaporation of the water. This native sugar is partly consumed as such, or partly refined by the consumer. Only a few modern factories and refineries exist where this crude product is worked up into white sugar yielding molasses. Of the molasses thus produced, about 5% is converted into alcohol, another 10% is consumed in the raw state, and the remainder is used for mixing with tobacco.

As there is little prospect of modernising the sugar industry of India, her contribution of molasses is too uncertain to reckon upon in calculating the possible production of alcohol. Deducting India's contribution of sugar, there remains 6½ million tons of cane sugar yielding 23.7% by weight of molasses, or 1½ million tons of cane molasses.

The composition of molasses varies with the purity of the juice extracted from the cane; the following limits for each constituent are given by Deerr in his treatise on "Cane Sugar": water, 15 to 25%; sucrose, 25 to 40%; reducing sugars, 5 to 30%; ash, 7 to 15%; gums, 3 to 5%; other organic non-sugars, 10 to 20%. The value of molasses to the distiller depends solely on the contained sugars, and these percentages are given in Table III.

TABLE III.
Composition of cane molasses.

	Sucrose.	Reducing sugar.	Total as glucose (dextrose).
	%	%	%
Hawaii (25 factories) .	36.0	14.0	52.0
Java (70 factories) ...	33.2	23.6	58.5
Cuba (1914 crop)....	33.4	18.1	53.3
Louisiana	27.0	29.0	57.4
Mexico	39.2	16.8	58.0
Demerara	35.0	30.0	67.0
Average	—	—	57.7

Sucrose, although not directly fermentable, is rapidly inverted by the invertase of yeast with formation of fermentable sugars. Column 3 of the

Table gives the total sugars expressed as glucose, and the average is 57.7%. On 1½ million tons of cane molasses, this represents 865,500 tons of glucose (dextrose).

Theoretically, glucose yields 51.1% by weight of alcohol. The lower yields obtained in modern distilleries are due to the following causes: Incomplete fermentation of the sugar present owing to lack of nutrition of the yeast cells; bacterial infection causing decomposition of sugar without formation of alcohol, or producing toxic acid substances which retard or prevent the development of the yeast; insufficient aeration during fermentation; the presence of unfermentable reducing substances in molasses which are reckoned as fermentable sugar by the usual methods of analysis; losses of alcohol during distillation.

The investigations of Deerr and Peck proved that 83% of the total sugars present in molasses can be converted into alcohol. From 5 to 6% is consumed in the formation of glycerol and other by-products of fermentation, and about 6% apparent loss is due to unfermentable substances reckoned as sugar.

The possible production of alcohol from cane molasses is, therefore, 83% of 865,500 tons = 718,365 tons glucose, yielding 51.1% alcohol, or 367,000 tons.

Beet molasses.

The average yield of commercial sugar % on roots was 15.38 in ten European countries during the 5 years ending 1911. The highest yield was 16.32% in Germany, and the lowest 13.18% in France. The yield of molasses varies from 3 to 4% on the weight of roots. Taking the lower figure, there would be obtained 19.5 tons of molasses per 100 tons of commercial beet sugar. This ratio has been much reduced by various methods of extracting the uncrystallisable sugar from molasses; thus, a modern German factory extracted 16.6% commercial sugar and obtained only 1.33% of molasses, or 8% molasses on weight of sugar. But, when molasses is to be converted into alcohol, such further treatment is not profitable and the above ratio of 19.5 may therefore be adopted.

Beet molasses contains from 48 to 53% sucrose, 10 to 12% ash, 18 to 20% organic non-sugars, and about 20% water. As this forms a very viscid material, it is usually diluted somewhat before leaving the factory. The theoretical yield of alcohol is 53.8% of the contained sucrose, and the practical yield may be put down at 83% of this, as in the case of cane molasses.

The possible production of alcohol from beet molasses is, therefore, as follows: 8 million tons of beet sugar yielding 19.5% or 1.56 million tons of molasses, containing 50% or 780,000 tons of sucrose: 83% of this is 647,000 tons yielding 53.8%, or 348,000 tons absolute alcohol. Total possible production from cane and beet molasses = 715,000 tons, or 200 million gallons.

This estimate is considerably lower than that which appeared in the "Fuel Supplement" to "The Times" of December 1st, 1913, from which the following extract is taken. "On the assumption that 18 million tons of sugar are produced annually, half being cane and half beet, and that for every 100 tons of cane sugar, 30 tons of molasses containing 50% sugars are produced, this represents 2½ million tons of cane molasses available for fermentation. Assuming 90% of the theoretical yield of alcohol to be obtained in practice, this would yield 650,000 tons of absolute alcohol. In the case of beet, it is assumed that for every 100 tons of beet sugar, 17.4 tons of molasses, containing 50% sucrose, are produced. This represents 1,566,000 tons of beet molasses capable of yielding 350,000 tons of absolute alcohol. Total from cane and beet molasses is one million tons."

The production of cane molasses appears to be over-estimated by assuming that the sugar produced in India yields the normal proportion of molasses. Further, the assumption of 90% of the theoretical yield of alcohol appears excessive.

Actual production of alcohol from molasses.

In the article just referred to, it is further estimated that the equivalent of 52,000 tons of absolute alcohol is annually produced in the form of rum from cane molasses. Deerr estimates this production at not less than 20 million gallons of spirit, containing 75% alcohol. This corresponds closely with the above estimate. The actual production of alcohol from cane molasses is, therefore, 14% of the possible production, based on the data given above.

Statistics relating to the production of alcohol from molasses alone are scanty, but the following few examples are of interest. In 1905, the United States of America produced rum equivalent to 896,000 gallons of absolute alcohol, and other spirits equivalent to 6 million gallons of absolute alcohol from molasses, probably both cane and beet. The total production from grain, molasses, and other materials was 74 million gallons, so that the molasses-alcohol represented 9.3% of the total. In 1902, Peru produced 2 million gallons of alcohol from cane molasses only, and exported 600,000 gallons. In Mexico, the annual production from cane molasses is about 22 million gallons. In 1904, France produced 13.8 million gallons from beet molasses out of a total production of 49.6 million gallons, or 27.8% from molasses. In the same year Germany produced 2.45 million gallons of 95% alcohol from beet molasses out of a total production of 101.8 million gallons, or 2.4% from beet molasses.

Molasses compared with other raw materials.

The practical yield of alcohol from different raw materials, and the approximate cost of each per gallon of 90% alcohol produced from it, is shown in Table IV.

TABLE IV.

Practical yield of alcohol from different raw materials.

	Gallons absolute alcohol produced per ton.	Percentage of theoretical yield.	Cost of raw material per gallon 90% alcohol.
Cane molasses (57.7% total sugars)	69	83	Nil to 8d.
Beet molasses (50% sucrose)	63	83	Nil to 8d.
Potato (20% starch) ..	30	77	7½d.
Beetroot (15.4% sucrose)	20	87	1/1
Maize (60% starch and sugar)+8% malt ..	84	87	11½d.
Rice (75% starch) ..	80 to 90		
Wood sawdust	28 to 45		
Nipa-palm sap (14-16% sucrose)	5.6% by vol.	74	6d.

The yield from molasses of the above composition and of 1.47 density may also be expressed by volume, as follows:—

1 gallon of absolute alcohol is obtained from 2.2 gallons cane molasses, or 2.5 gallons of beet molasses;

1 gallon of 90% alcohol is obtained from 2 gallons cane molasses, or 2.3 gallons of beet molasses.

The value of molasses varies from nil, when it is thrown away, up to a maximum of about 4d. per gallon, so that at this highest value, the cost of molasses per gallon of alcohol obtained would be 8d.

Beet molasses has about the same value as cane molasses per gallon of alcohol obtained therefrom. The variable value of cane molasses may be illustrated in the case of Cuba. Prinsen-Geerligs states that by far the greater part of Cuban molasses is sold to the Whisky Trust of the United States, but some is sent to Europe, some is distilled locally, and the remainder thrown away as useless. When sold, the price varies from 3 to 8 cents per gallon, according to its percentage of sugar. The market price of molasses further depends on its value for other purposes than the production of alcohol, which may be briefly mentioned. When used for feeding stock on the sugar estate, the contained sugars are converted into work and the fertilising constituents, namely, potash and nitrogen, can be returned to the fields in the form of dung, thus utilising the molasses to the fullest extent with a minimum of labour. Or, the molasses may be sold for the same purpose, either in the raw state or mixed with other materials, as in the well-known cattle foods sold under the names of "Molascuit" and "Molassine." The former is a mixture of molasses and finely divided cane-fibre; in the latter, dried moss is substituted for cane fibre. Both products can be manufactured on the sugar estate or in the locality, and the meal thus produced can be shipped in sacks.

Molasses is also frequently used as fuel when the supply of crushed cane from the mill is insufficient to supply steam to the sugar factory. The carbohydrates are thus utilised, but the fertilising constituents in the residual ashes are either lost or rendered unavailable to the plant by fusion in the furnace.

As a fertiliser, molasses is very troublesome to handle and the carbohydrates are lost by fermentation in the soil, which tends to produce acidity and sourness when the soil is deficient in lime.

There remains the possibility of first converting the sugars into alcohol and then utilising the residual liquid as fertiliser, or extracting the potash and nitrogen from it.

Peck states that the loss of potash in molasses exported from Hawaii or run into the sea amounts to one-third of the total potash annually imported to the United States from Germany. That supply being now cut off, the recovery of potash from molasses becomes more urgent. A long ton of Hawaiian molasses contains 89 lb. potash, 14 lb. nitrogen, and 4 lb. phosphoric acid. These constituents were formerly valued locally at 6, 20, and 2 cents per pound respectively, giving a total value of \$8 per long ton of molasses, whereas the market value was \$6.6. The value of potash salts has since increased five-fold. On burning, molasses yields a charred residue containing about 20% potash, but the nitrogen is lost. If the molasses be first fermented and distilled, and the residue evaporated and burnt, this evaporation increases the cost of recovering the potash. In countries where the sugar cane is irrigated, the dilute distillery residue can be discharged into the irrigation canals and thus distributed over the fields without labour or expense. But, in other cases, the liquid must be concentrated as far as possible to facilitate transport. Complete evaporation of the water is difficult, and, as the solid matters are hygroscopic, a marketable article is not easily obtained. A method of treating the residue from distilleries working with beet molasses is to mix the highly concentrated liquid with superphosphate, which absorbs it, forming a fairly dry product.

Cost of producing alcohol.

If the potash and nitrogen are recovered after fermentation and production of alcohol, their fertilising value covers all expenses of distillation, leaving alcohol as a by-product, free of cost. Assuming, as we may, that the future production

of alcohol from molasses would be on a larger scale than in the distilleries now producing rum, this complete utilisation of molasses would be more practicable than at the present day. The profits which might be expected are indicated by the following balance-sheet, which is reproduced from a paper on "The cost of manufacturing alcohol from molasses," by Antoni, of Hawaii.

Distillery Balance Sheet.

Daily expenses, treating 2000 gallons of molasses—	
Oil for distilling 870 galls. alcohol = 335 galls.	
„ evaporating 8000 galls. water = 200 „	
	035 galls. at 4 cents = \$25.40
4 men at \$1.50	6.00
Distiller at \$10	10.00
	41.40
For crop lasting 175 days, treating 350,000 gallons of molasses	\$7,215
Depreciation and repair = 10% } 20%	2,000
Interest and taxes = 10% }	755
Incidental expenses	
	10,000
Denaturing agent, 15,000 galls. at 20 cents	3,000
Total expenses	\$13,000
Returns—165,000 galls. denatured alcohol of which is used for:—	
Ploughing the estate 25,000 galls. at 10 cents...	\$2,500
Hauling cane to factory 50,000 galls. at 7.5 cents.	3,750
Sold outside .. 90,000 galls. at 15 cents.	13,500
	\$19,750
175,000 galls. fertiliser syrup at 9 cents.	15,750
Total	35,500
Expenses	13,000
Profit	\$22,500

Taking as an example a sugar plantation of 5000 acres, producing 12,500 tons of sugar and 350,000 gallons of molasses during a crop season of 175 days, the distillery has to treat 2000 gallons of molasses per day, or 10,000 gallons of diluted molasses after fermentation.

The chief item of expense is fuel; but a modern sugar factory can usually supply sufficient steam for distillation as well as for sugar manufacture from the crushed cane leaving the mills, a fuel which costs nothing.

But it is here assumed that oil fuel is used both for distillation and for the subsequent concentration of the distillery refuse to the form of syrup which can be used as fertiliser on the estate. For distillation, not more than half a gallon of oil is required to produce 1 gallon of strong alcohol, while for evaporation by multiple effect, 200 gallons of oil is required to evaporate 8000 gallons of water from the distillery residue, leaving 1000 gallons of fertilising syrup.

The total working expenses for the crop are \$13,000, while the fertilising syrup is valued at \$15,750, showing a profit of \$2,750 on this item alone. Of the denatured alcohol produced, a portion is used for producing power for ploughing and for hauling canes to the factory, the remainder being sold at 15 cents per gallon. Alcohol motors of 35 H.P. are sold in Honolulu for \$4500 and require 13.5 oz. alcohol per H.P.-hour. A 40 H.P. locomotive, burning oil fuel, consumes 30 oz. oil per H.P.-hour. Thus, 1 gallon of alcohol in the motor does as much work as 2 gallons of oil in the locomotive, making alcohol worth twice as much as oil, or 7.5 cents per gallon. On this basis, 50,000 gallons of alcohol would be required to haul 100,000 tons of canes to the factory. Motor-driven ploughs consume 5 gallons of petrol per acre, and, if the whole estate be ploughed once a year, this will consume 25,000 gallons of petrol. Alcohol substituted for petrol is worth 10 cents per gallon.

If the factory had sold its molasses at the average market price of \$6 per ton, it would have received

\$12,000. The apparent value of the molasses is therefore \$11.25 per ton, or 6.4 cents per gallon.

Another Hawaiian authority, Peck, shows how the profits of the distillery vary according to the following conditions.

Case 1. The sugar factory has sufficient fuel or crushed cane to supply steam for distillation and for recovery of potash and nitrogen from the residue. The profit per ton of molasses will then be \$15.7, and the molasses is worth 9.1 cents per gallon.

Case 2. The sugar factory has no surplus steam, so that distillation is done by oil fuel, and the distillery residue is discharged into the irrigation canals without further treatment. This shows a profit of \$15 per ton of molasses, or 9 cents per gallon.

Case 3. Oil fuel must be used for distillation and also for concentration of the residue. This shows a profit of \$13 per ton of molasses, or 8 cents per gallon.

In all three cases, the whole of the alcohol is sold at 25 cents per gallon, and consequently shows a higher profit than in the estimate previously quoted. But, viewed from another standpoint, the alcohol could be sold at the distillery at 9, 10, and 13 cents per gallon under the conditions 1, 2, and 3 respectively, in order to realise the normal value of \$6 per ton of molasses treated.

Such estimates must necessarily be based on local market values and conditions, but are of sufficient general interest to be mentioned. Most of the distilleries attached to cane sugar factories are only equipped for producing alcohol, and are generally on too small a scale to permit of the economic recovery of potash and nitrogen from the residue. This is therefore discharged into the nearest stream.

The cost of producing rum in Demerara may serve as an illustration, and the process of manufacture may first be briefly described. The molasses is diluted with water to a density of 1.06, the "wash" is acidified by the addition of 1 gallon sulphuric acid per 1000 gallons, in order to prevent bacterial growth which may interfere with the alcoholic fermentation. Nitrogenous food for the yeast is also added in the form of 10 lb. of ammonium sulphate per 1000 gallons, in order to accelerate the fermentation, which is complete in from 2 to 3 days. The density then falls to about 1.010, and this fall or attenuation is a measure of the alcohol produced. Multiplying the initial and final densities by 1000, every 5 degrees of attenuation indicate the formation of 1.06 gallons of proof spirit per 100 gallons of wash. For distillation, continuous stills are largely used, but vat or "pot" stills produce a more palatable rum owing to less perfect rectification. The working expenses are very small. Two men are required for setting up the wash in the fermenting vats, and two boys are sufficient to operate the still. No expert distiller is necessary, but the work is under the supervision of the chemist in the sugar factory, who records the quantity of sugars in the molasses used, and thus has a control on the yield of alcohol obtained. The alcohol from the still is coloured by the addition of caramel, prepared on the spot by burning molasses or low-grade sugar, and then has an apparent strength of 40 overproof. The heaviest expenses are incurred after the alcohol has been produced, namely, for puncheons to contain it, and for freight abroad.

Actual figures for a Demerara distillery show that the total cost of rum, landed in England, is \$24 per 100 gallons, or 1s. per gallon. Of this total, the cost of puncheons, freight, and commission amounts to \$19, while the working expenses, including labour, coal, and acid, amount to only \$5 per 100 gallons, or 2½d. per gallon of rum, equal to nearly 3d. per gallon of 90% alcohol.

According to different authorities, the cost of manufacturing 95% alcohol, without recovering potash and nitrogen, and excluding the cost of molasses itself, is stated as follows:—8 cents per gallon in the U.S.A., 5 cents in Demerara (exclusive of fuel), 10.2 cents in Hawaii, and 10 cents in Cuba. The actual working expenses therefore approximate to 5d. per gallon.

Transport by tank steamers would materially reduce the cost of alcohol imported from abroad, and tank transport from the distillery to the port of shipment would not present any great difficulty.

The transport of molasses for subsequent conversion into alcohol, does not seem to offer a more satisfactory solution of the problem, but, with this object in view, a process for producing solidified molasses for transport has been suggested by Prinsen-Geerligs.

There is little doubt that alcohol could be substituted for petrol and coal in most sugar producing countries, and Germany has shown what can be done in fostering the production of potato spirit. In 1903 potato spirit was there retailed at 7d. per gallon, and motors specially designed for alcohol fuel were put on the market. Brachvogel mentions that one firm in Berlin had contracts for supplying over a thousand of these motors which were to be used for the following purposes: Agricultural operations, 544; pumping plants, 88; creameries, 63; electric light plants, 52; woodworking machinery, 45; flour mills, 40; bakeries, 33; motor trucks, 30; boats, 30. The rest were required for general power purposes.

In 1904, the retail price rose to 1s. 3d. per gallon, owing to the failure of the potato crop, so that petrol then became the cheaper fuel in spite of the import tax.

As regards this country, the production of alcohol from beet molasses should contribute towards the success of our struggling beet sugar industry. Or, the beetroot might be cultivated solely for producing alcohol, as has been done so successfully in France.

Meeting held at Edinburgh on Tuesday, December 8th, 1914.

PROF. G. G. HENDERSON IN THE CHAIR.

DISCUSSION ON THE BEARING OF THE PRESENT WAR CRISIS ON THE CHEMICAL INDUSTRIES OF THE EAST OF SCOTLAND.

Professor HENDERSON said that the reasons for the German supremacy in the chemical industry were pretty obvious. As business men they had shown themselves remarkably acute, remarkably enterprising, and thoroughly unscrupulous; but, putting aside the business aspect altogether, on the purely scientific side they had shown the utmost enterprise in following closely the results of all scientific work, and in attracting to themselves the best possible scientific advice. They had shown great courage in spending enormous sums of money in acquiring knowledge by means of experiment, and there was no gainsaying that the great success which they had attained had been thoroughly well deserved. Endeavouring to explain the backwardness of our manufacturers in this matter, he said that one undoubted reason was the general attitude of indifference, even of opposition, which this country showed towards scientific work—an attitude, however, which he was glad to think was gradually changing. Then, again, there was no question but that manufacturers in this country were under a decided handicap from the point of view of fiscal matters. He emphasised the great need of systematic experimental work, and said

that if our manufacturers had not been so successful as their rivals it was because they had not to the same extent made use of the scientific resources in the shape of men and material which lay to their hands. He thought there was a great opportunity, not only to capture trade, but, what was more important, to retain it, and he was perfectly certain that if our manufacturers would only allow their powers of initiative, courage, and enterprise full scope they would see their industry develop rapidly, successfully, and profitably.

Principal A. P. LAURIE said that during last autumn the Board of Trade had appointed a Committee representative of manufacturers and men of science, with Lord Haldane as chairman. That Committee had separated into sub-committees to deal with different branches of the chemical trade, and Lord Moulton had undertaken the chairmanship of all the sub-committees. An immense amount of information had already been collected. One curious point that struck the members of the Committee was how seldom the manufacturers and the consumers were in touch. A manufacturer might send his samples to the broker, but did not get any business; but he did not know why he was not getting the business, and in many cases he was quite ignorant of the reason and therefore had never tried to improve his methods. One of the results of the inquiry had been to bring together the manufacturer and consumer, to their mutual advantage. The principal department he (the speaker) had looked into was that of the manufacture of paints and colours. There were very few cases among those he had inquired into of a chemical, a colour product, or a pigment, which was being made both in Germany and in England, in which the German product was not better than that made in this country. In many cases the English manufacturer was not aware of this until he had compared his own sample with the German product. Many English manufacturers had been content to have the second-class trade. There was also the question of improper packing; for instance, a manufacturer of a crystalline product does not dry the crystals, and then drives iron nails into them, with the consequence that the consignment is full of rust.

The Committee had also inquired into the question of the shortage of supplies; for example it had been found that there was a shortage of ultramarine and lithopone; manufacturers had then been approached, and had arranged to increase their output to meet the shortage. In other words, the inquiry had already done a great deal to meet the practical needs of the situation. He thought that in the past the manufacturer had been too narrow in his outlook; he had guarded jealously his little trade secrets, and had been afraid to ask for information for fear of giving something away, and thus had not developed his business as he ought to have done. Again, there were a great many barytes mines in England and Ireland. These mines were visited and their working conditions examined. There were in this country very large mineral resources which had never been submitted to proper scientific examination. There should be a proper survey of these districts where all old mines and existing mines were examined and a careful study of the deposits made. The mining valleys ought to be opened up by light railways. The big railways hesitated to do that because they had not the facts before them. Another and still bigger question was that of railway rates. For example, it was possible to carry barytes from Germany to the docks in London for 6s. a ton. As long as that condition of things existed we were at a great disadvantage. Again, it was admitted that German barytes was better ground than English. Yet an extensive literature on barytes and barytes mining had been published by Germans, showing exactly how German barytes

was ground. They had not found a barytes miner in England who owned a microscope. The Committee had collected numerous samples of barytes at different stages of grinding, and submitted them to rigid microscopical examination. From that they had been able to give manufacturers definite information by which they could improve their product. The English manufacturer did not believe in or use the man of science. The Germans had used the man of science in the proper way in the chemical industry. In this country it had not been done or only to a very limited extent.

There was a great opportunity during the war to improve existing products while German competition had ceased, to scrap old plant and fit out our heavy chemical works with modern plant, and to start the manufacture of new articles never manufactured in this country before, and which Germany had been making. With pluck and enterprise those changes could be carried out.

Mr. D. B. DOTT, speaking of the effect of the war on medicinal chemicals, said that stoppage of raw materials, limitation of markets, and Government interference, had so far resulted in less disturbance of trade than was anticipated. Taking chloroform, ether, caffeine, morphine, salicin, and strychnine as the principal products of the Scottish factories, the mean rise in price had not been great. The materials needed for making these products were not in any case obtained from Germany, although they had formerly supplied a good deal of the acetone used in preparing chloroform. The willow bark for salicin had come mainly from Belgium, but salicin was not indispensable. The rise in price of the rarer alkaloids or those which were used in smaller quantity had been quite marked. That was due to the fact that, with few exceptions, such alkaloids as atropine, cocaine, pilocarpine, and veratrine, had been mostly imported from Germany. There was no reason why they should not all be made in this country. In the case of atropine, however, the requisite belladonna was chiefly grown in Austria and Germany. Supplies of opium from Asia Minor had been interrupted, but supplies were obtainable from Persia. It would be a great advantage if India were available as a source of opium for preparing morphine. Most of the opium produced in that country was unsuitable for that purpose, and the area under poppy cultivation was being gradually reduced. With proper attention given to the cultivation of the poppy and the curing of the opium, there was no apparent reason why a drug equal to the Persian should not be procurable.

It was almost superfluous to say that the war had caused an increased demand for anaesthetics, antiseptics, antitoxins, and surgical dressings. It would be generally expected that some at least of the substances heretofore made exclusively in enemy countries would in future be produced in British factories, but many details might have to be worked out and special plant elaborated. Also a manufacturer would not readily take up a new line of business if there were a probability that at the end of the war he would not be in a favourable position to compete. This would be best met by an import duty adjusted from time to time to meet the requirements of the case.

Mr. RUTHERFORD HILL said that the cost of pure ethyl alcohol was so high, owing to the restrictions imposed for revenue purposes on its production and distribution, as to interfere with chemical research and prevent the development of chemical manufactures in this country. Many of the existing restrictions could safely be lessened or removed, and since pure methyl alcohol was really non-potable, it should be non-dutiable so that it could be freely used in the production of

formaldehyde and in many other chemical processes. He urged that Parliament should be approached with a view to these suggestions receiving legislative sanction. It had been pointed out that the security of the national revenue of this country depended on the population retaining their habit of using alcohol and tobacco. The annual revenue from alcohol being something like twenty-one millions a year, it would be very difficult to get any Government to give alcohol for commercial purposes duty free. Ethyl alcohol itself ought to be producible much cheaper than it is just now. One large maker recently stated that he could produce pure alcohol at 6d. per gallon if the restrictions of the Revenue authorities were reduced. Cheaper materials might also be used for the production of alcohol. Attempts had been made in this country to use beetroot and potatoes for the purpose, but they had not succeeded. If we could get a cheap enough supply of ethyl alcohol it would be possible to produce our own acetone by the oxidation process, which it was impossible now to do economically. It was to be hoped that the Government would be much more ready than hitherto to allow the use of more suitable denaturants adapted to particular products. The Government should be ready to subsidise any industry which could make out a good case.

Mr. J. F. BRIGGS said that the chief concern of the paper industry in the East of Scotland was to keep the esparto trade intact. The Germans thoroughly appreciated the fine qualities of esparto papers, without having, so far, been able to establish their successful manufacture on any appreciable scale. The high standing of English papers in Germany was illustrated by the widespread manufacture of papers in that country bearing fraudulent English water-marks. In attempting to capture German trade it appeared undesirable to devote attention to specialities which were protected by favourable German natural conditions, such as were assured them by the fact that they grew their own wood and were able to select and boil it in the best way to produce desired results. The manufacture of the very cheap "grease-proof" imitation parchment papers came under that category. He saw no reason why part of the trade in the chemically treated parchment papers should not be captured. As regarded filter papers, to some extent they depended on the use of very pure water, and their paper mills were rather badly off generally in that respect. They were very hard hit in the way of dyestuffs, and might have to revert to the old wood extracts and mineral pigments. He agreed that there was a want of frankness on the part of our industrial press. Too little space in our trade journals was devoted to the discussion of technical and scientific questions by genuinely "inside" contributors. Compared with the Germans our industrialists were too inarticulate. The difference between British and German industry was mainly one of "outlook." Our manufacturers, with a few exceptions, were apt to place themselves too much in the hands of the practical man with his past experience. The spirit required for the development of a large British industry in dyestuffs and fine chemicals was that which put the study of first principles before accumulated experience.

Mr. STEWART said that the linoleum and floor-cloth industry had been affected by the war, more especially in regard to pigments made from dyestuffs, some of which had hitherto come direct from Germany, while others had been made in this country from imported dyestuffs. They used especially a very strong red for making Turkey red carpet effects, and were searching now for substitutes. They also used large quantities of vegetable black, which some years ago they bought

entirely from Scotland, but it contained from 2½ to 13% of tarry matter, so that the black would not dry, and in certain goods remained soft, whereas the adjacent pigments were quite dry. A German firm had offered them vegetable black, calcined free from tarry matter, at exactly the same price. The local manufacturer said he could not produce such a product unless at a much higher price than formerly, so they had to get their supply from Germany. Since the war they had been able to get it from a source in England, but at an enhanced price. On the other hand, they found they could buy ultramarine just as cheaply and as good in this country as in Germany. The only other pigment with which they had had any trouble was Prussian blue, which was scarce owing to the want of potash salts. The question whether Prussian blue could be made with soda was a matter for manufacturers. One manufacturer said it would not be so strong.

Mr. TATLOCK, speaking from the laboratory glass apparatus makers' point of view, said that British manufacturers were finding it exceedingly difficult to replace German and Austrian products. The total amount of laboratory glass consumed was so small, compared with the other glass products required just now, that it was exceedingly difficult to induce manufacturers to take it up at all. It was hoped in a short time to have porcelain and glassware on the market which would compare not unfavourably with the German products. There was one great difficulty in competing with the German firms owing to their labour conditions which our people would find it impossible to touch. For instance, in one case recently they had found that the porcelain was made in the workers' houses in Germany. There were no such factory acts as our works had to labour under. With such conditions, of course, it was quite impossible to compete in this country. Professor Henderson had referred to the possibility of people buying more readily goods of British manufacture. They did not find that to be the case. The goods had to be cheaper or better; they would certainly never be bought purely because they were British, and he did not altogether think that they should be bought for that reason. Perhaps it was best to continue to buy the best and the cheapest article, no matter its source.

Principal LAURIE, in replying to the discussion, said that our scientific laboratories should be used to solve problems for our manufacturers. At the present time the whole time of our chemists was taken up with routine business, and they had no time for other problems. Until manufacturers realised the value of chemists we should not make much real progress against the competition we should have to face from Germany as soon as the war was over. He did not think the Government could be expected to assist every industry as it had done the aniline dye industry. We are the textile manufacturers of the world, and the stoppage of dyes meant a very great crisis, and in that case the Government were well justified in coming forward. Some pluck and enterprise on the part of our manufacturers was needed. We had the cheapest coal and many other facilities, and surely we could turn out an article, except in certain set cases, at the same price as the German manufacturer.

State Research Laboratories.

Speaking at the annual meeting of Messrs. Southall Brothers and Barclay, at Birmingham on March 29th, Sir Thomas Barclay referred to the position in the drug and chemical and allied trades

created by the war. He said that in his opinion there should be established a research laboratory separate from the laboratories in the country, which might be called a "Central State Research Laboratory." In the present universities there should be courses of three to four years, leading to an honours degree, with a post-graduate course of one year in the methods of research, and such students only should be eligible for nomination by their professors for scholarships in the Central State Research Laboratory. Such nominated and approved students would pass then with scholarships to the State Research Laboratory, where they would work under the control of a board, representing professors and business men, upon the problems of synthetic chemistry, including not only aniline dyes, but also the production of those chemicals which are either already used or would be likely to be of value in medicine. In correlation with this research laboratory would be the chemical works of the country employing the trained research workers and utilising the patented processes evolved in that laboratory under royalty payable to the Government. The scholarships might be of the value of £150 per annum, and any practical valuable discoveries made would not be remunerated to the worker by the Government, but by the enhanced value of such worker to manufacturers. It would, he thought, be necessary to have connected with the research laboratory a works laboratory which should be equipped for proving processes on a scale large enough for commercial tests. When that was done, and it was found that the process was right for commercial purposes, then it would be the business of the Board of Trade to patent the processes, and offer them to all manufacturers in the country who chose to work them by paying a royalty to the Government on each. The research students would be enthused with the idea of turning their attention to practical research, so as not only to obtain the kudos which such a discovery would give them, but to secure good appointments and the financial results which would fairly belong to them. Since war broke out the manufacturing chemists in the country had been endeavouring, with poor success so far, to manufacture many of the products previously obtained from Germany, but they had been handicapped by the lack of experienced technical research chemists who had had a university training in that direction.

Obituary.

C. J. EAMES.

Dr. Charles J. Eames died in New York on March 4th, at the age of 83. He was born in Fulham, and studied chemistry in England and Germany, afterwards crossing to New York, where he practised as an analytical and consulting chemist at a time when there were only three other chemists in that city. Later he became identified with the iron industry and invented the "petroleum process" for the reduction of iron, giving a product containing only 0.03% of impurity. During the last 15 years he practised as a consulting chemist in New York City.

D. A. LOUIS.

The Society has lost another of its original members by the death of Mr. David A. Louis

on March 25th. He studied mining at the Royal School of Mines between 1876 and 1881, acting during the latter part of that time as research assistant to Prof. Frankland. After a short time spent in dyeworks and silver plating works he was, from 1882 to 1886, engaged in work at Sir John Lawes' Experimental Station at Rothamsted. He spent some years subsequently in mining on the Continent and in America, and was also for a short time the manager of metallurgical works. Since 1891 he was in practice as a consulting mining engineer and metallurgist, and from 1893 onwards acted as Assistant Examiner in mining to the Science and Art Department. Louis contributed largely to the literature of mining, ore dressing, and metallurgical operations; he was for a long time a contributor to "The Engineer," and was joint-author of the article on "Miners' Safety Lamps" in Groves and Thorp's "Chemical Technology." He was for many years an abstractor for this

Journal, and served on its Publication Committee from 1912 until his death. His loss will be keenly felt by the Committee, of which he was one of the most active and useful members.

R. A. SEYMOUR-JONES.

Lieut. R. A. Seymour-Jones, of the 4th Battalion (Territorial) South Lancashire Regiment, was killed in action on March 27th. He was educated at Wellington College (Salop) and at Leeds University, and prior to the outbreak of war was a member of the chemical staff of Messrs. Joseph Crosfield and Sons, of Warrington. He was joint author with Prof. Procter of papers printed in this Journal on "Acids in tan liquors" and "The estimation of soluble mercuric salts at great dilutions" (see this J., 1910, 1354; 1911, 404). He was 25 years of age.

Journal and Patent Literature.

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I.—GENERAL PLANT; MACHINERY.

The evaporator and the power problem in electro-chemical plants. Mantius. See XI.

PATENTS.

Distilling liquids [e.g., oils and tar]; Apparatus for—. Sir K. I. Crossley and E. Wheeler, Manchester, and T. B. Smith, Silverdale, Staffs. Eng. Pat. 707, Jan. 10, 1914.

To diminish frothing during distillation of mixtures such as oil or tar and water, a horizontal pipe or superheater is placed in the upper part of the still. The pipe is heated by a flame or hot flue gases, considerably above 100° C.; part of the froth is evaporated, and the remainder falls back into the liquid.—W. F. F.

Sand, stone, grit, or other materials; Apparatus for drying and heating—. F. M. Andrews, New York, U.S.A. Eng. Pats. (A) 3761 and (B) 3762, Feb. 13, 1914.

(A) THE material is fed on to the centre of a horizontal corrugated rotary dish or disc mounted in a chamber, from the top of which fixed baffle plates or baffles of flexible chain mail project into the grooves. The material moves outwards against a current of hot gases. (B) The inlet pipe for the hot gases extends upwards from the bottom of the chamber, and its upper end is flared and terminates below a deflector fixed on the under side of the rotary member. The material falls from the deflector through the hot gases into a discharge hopper. Part of the hot gas may pass through perforations in the rotary member into the feed hopper containing the freshly supplied material.—W. F. F.

Dryers; Automatic charging and discharging device for vacuum—. E. Passburg. Ger. Pat. 280,035, July 28, 1912.

THE drying chamber is provided at each end with a closing device, e.g., a conical valve, which can be rapidly opened and again closed at relatively long intervals. The material enters and leaves the drying chamber through extensions provided with mechanical conveyors, the arrangement being such that there is always sufficient material in the extension to prevent ingress of air into the drying chamber during the short period for which the closing devices are opened. The apparatus is intended especially for fine materials such as starch.—A. S.

Kilns; Tunnel—. E. R. Sutcliffe, Leigh, Lancs. Eng. Pat. 4642, Feb. 23, 1914.

IN a tunnel kiln of the type described in Eng. Pat. 14,506 of 1910 (see this J., 1911, 878), fresh air is admitted through openings into the discharge end of the kiln, and a portion of this air is with drawn by a fan and mixed with the gas before it enters the combustion chamber proper.—W. H. C.

Clarifying liquids containing finely divided matter in suspension; Apparatus for—. W. McD. Mackey, Leeds. Eng. Pat. 7179, Mar. 21, 1914.

IN apparatus of the type described in Eng. Pats. 11,410 of 1905 and 1327 of 1911 (this J., 1906, 231; 1911, 1299), a circular tank, the bottom of which inclines towards a central sump or well, is divided into compartments by vertical partitions. The cover of the tank also inclines towards the centre and extends downwards to form a central tube, the lower end of which communicates with the different compartments. The liquid is

admitted down the central pipe, flows into the compartments, and escapes through outlets at the top. The sediment falls towards the sump or well and acts as a filter to the inflowing liquid; a sludge-cock is provided for drawing off the contents of the well.—W. P. S.

Liquids: Apparatus for impregnating— with carbonic acid or other gases. A. A. Pindstoffe, Frederiksberg, Copenhagen. Eng. Pat. 19,769, Sept. 14, 1914.

THE gas and liquid ascend together through a closed chamber provided with a series of inverted V-shaped partitions, each having one branch perforated, and arranged so that perforated and imperforate portions are superposed alternately. The liquid is discharged at the top, and the separated gas passes to the upper part of a reservoir situated above the impregnating chamber, from which it displaces liquid to supply the latter. When the liquid reservoir contains only gas, communication is opened to an upper supply reservoir from which the liquid passes down into the first reservoir, whilst the gas bubbles up through a perforated partition. Means are provided in the upper vessel for drawing off the air from the top, while the denser gas is led back to the impregnating chamber.—J. F. B.

Filter. C. G. Osgood, Assignor to The Montana-Tonopah Mines Co., Tonopah, Nev. U.S. Pat. 1,128,495, Feb. 16, 1915. Date of appl., Aug. 20, 1913.

RECTANGULAR, tapered, grooved filter-frames, covered with suitable filtering medium, are attached by flange joints to a tubular header, which is connected with a vacuum pump and with a source of compressed air.—W. H. C.

Liquids of different specific gravity: Apparatus for separating the specifically lighter liquid from a mixture of— B. Lorenzen. Ger. Pat. 280,086, March 17, 1914. Addition to Ger. Pat. 266,575.

THE apparatus described in the chief patent (this J., 1914, 14) is modified in that the overflow opening for the lighter liquid diminishes in section from the top downwards, or several openings are provided at different levels, each smaller than the next higher one. The separating vessel is fitted with one or more perforated partitions between the inlet and the overflow opening for the lighter liquid.—A. S.

Drying machine. The Sherwin-Williams Co. Fr. Pat. 471,616, Aug. 30, 1913.

SEE Eng. Pat. 19,409 of 1913; this J., 1914, 849.

Filling process and apparatus. C. Butters and Co., Ltd. Fr. Pat. 472,014, May 9, 1914. Under Int. Conv., June 11, 1913.

SEE U.S. Pat. 1,100,219 of 1914; this J., 1914, 781.

Filling process and apparatus. C. Butters and Co., Ltd. Fr. Pat. 472,016, May 9, 1914. Under Int. Conv., June 13, 1913.

SEE U.S. Pat. 1,078,794 of 1913; this J., 1914, 13.

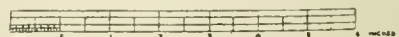
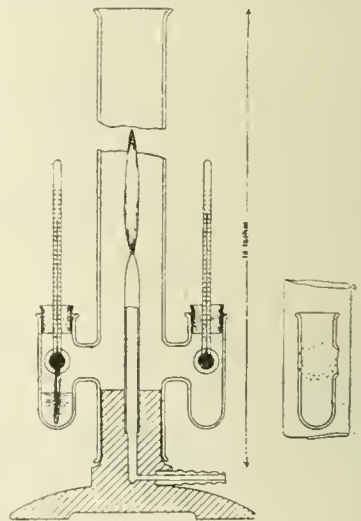
Apparatus for delivering powdered material into liquids. Eng. Pat. 3662. See XIXB.

Process and apparatus for addition of predetermined quantities of substances to a uniform or variable flow of liquid. Eng. Pat. 4435. See XIXB.

II.A.—FUEL; GAS; MINERAL OILS AND WAXES.

Metropolis gas [; Testing of—]. Notification of the Gas Referees for 1915.

THE new features—mainly concerned with the provisions of the Gas Light and Coke Company's Act, 1914—are as follow:—*Illuminating power.* The directions for testing with the Metropolitan Argand Burner No. 2, and with the standard flat flame burner are unaltered, but only those provisions relating to the use of the latter burner are applicable to gas supplied by the Gas Light and Coke Co. If sufficient gas cannot be passed through the flat flame burner to give a light of 8-candles (owing to the increase of density caused by the presence of a large proportion of enriched water-gas in the illuminant), the illuminating power is to be calculated on the basis of the maximum rate obtainable and reported as being less than the resulting figure. *Calorific power.* For gas supplied by the Gas Light and Coke Co., a standard calorific power of 540 B.Th.U., gross, per cub. ft. (at 60° F. and 30 in. of mercury) is required; but the Company is to be penalised only in respect of deficiencies exceeding 7½% of this amount. At each testing place, one test only is to be made daily, unless the calorific power is shown to be below 499.5 B.Th.U., when a second test is to be made, after an interval of not less than 1 hour, and the average of the two results taken as the calorific power of the gas on that day. In the testing places for the South Metropolitan and the Commercial Gas Companies, the calorific power of the gas is to be determined only on such days as the controlling authority shall direct. As heretofore, the Boys calorimeter is specified for use, but the metal vessel of the latter is now jacketed with felt protected by a sheet of metal, the outlet water box protected from loss of heat by a wooden shield made in two halves, and the thermometer for effluent gases supported in one of the five holes by means of a cork and an open spiral of wire, so



that the bulb is a short distance above the circulating coil. The result is corrected for the differences in temperature and humidity between the incoming and effluent gases. For this purpose the

ventilated wet and dry bulb hygrometer (see fig.) is employed, consisting of a single piece of glass, of the shape and dimensions shown, standing on a metal base which, by means of a glass tube, carries a single rat-tail burner adapted to make a flame about 1½ in. high. The air to supply the burner and chimney is drawn through two holes opposite the (Fahrenheit) thermometer bulbs, one of the latter being covered with cotton and connected by means of a wick with the water in the cup immediately below. The instrument is placed near the calorimeter and the ventilating gas flame lighted and adjusted not less than 10 mins. before the calorimeter readings are taken. The directions for ascertaining and applying this correction are:—

"The readings of the dry and wet bulbs shall be found in columns 1 and 2 of Glaisher's Hygrometrical Tables, pp. 1 to 28. On the same line in column 7, which is headed 'Vapour in a cubic foot of air,' will be found the number of grains of water contained as steam in a cubic foot of the air entering the calorimeter. Call this *a*. The reading of the meter thermometer shall then be found in both columns 1 and 2, and the corresponding number of grains of water in a cubic foot of the gas will be found in column 7. Call this *b*. The temperature of the effluent gases shall then be found in columns 1 and 2, and the number of grains of water in a cubic foot of these gases will be found in column 7. Call this *c*. On page xiv. of the same Tables, the weight in grains of a cubic foot of saturated air at the temperature of the effluent gases shall also be found to the nearest unit. Call this *d*. Subtract the reading of the dry bulb thermometer from that of the thermometer giving the temperature of the effluent gases, and call the difference *e*. If the effluent gas is cooler than the air entering the calorimeter this difference will be negative in sign. Find the value of $0.15(6.6c - 7a - b) + 0.00022de$. The figure so obtained is the number of B.Th.U. to be added [algebraically] to the result obtained directly from the calorimeter in order to obtain the gross calorific power or total heat value of a cubic foot of gas." This correction is based on the assumption that at the rate of burning employed (4—5 cub. ft. per hour) 1 vol. of gas requires 7 vols. of air for complete combustion, and that the products amount to 6.6 vols. The factor 0.15 represents the latent heat of steam in B.Th.U. per grain, and the value 0.00022 the specific heat of the effluent gases per grain per degree F. A copy of the official form with an example of the calculation is appended. The amount of condensed water resulting from the combustion of the gas in not less than 20 mins. is also to be measured, and in the event of the rate of condensation exceeding 150 c.c. per hour, the unions and coils of the calorimeter are to be examined for leakage and the test discarded if the latter is found.—W. E. F. P.

Coal gas for industrial purposes; Uses of—
H. M. Thornton. J. Roy. Soc. Arts, 1915, 63, 401—421.

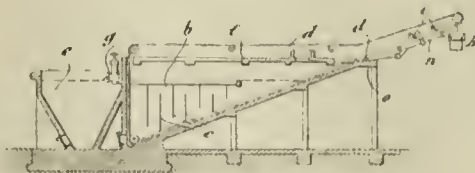
Mineral resources of German East Africa. See X.

PATENTS.

Coal washing and clarifying wash water; Process and apparatus for—C. Burnett, Bath. Eng. Pat. 4688, Feb. 23, 1914.

THE water carrying the fine coal in suspension is received in one of two settling tanks, *b*, provided with baffles or weirs, *c*; the tanks are used alternately. The coal settles on the bottom of the tank and is removed by a scraper-conveyor, *d*, whilst the clear water is run off into a well, *e*. The tanks must be of such a size and extend to such a

height above the overflow, *g*, that they can contain the whole of the water used for washing. As the coal leaves the upper edge of the tank it is drawn



over a fine grid and is simultaneously pressed by two rollers or wipers, *i*, the water which drains from it being passed through the trough, *n*, and pipe, *o*, back to the settling tank. The coal is discharged into a conveyor, *k*.—A. B. S.

Washing coal or other minerals; Apparatus for—
R. H. Reid, Hamilton, N.B. Eng. Pat. 12,990, May 27, 1914.

AN oblong tank with sloping ends is provided with a perforated plate a short distance above the bottom. A current of water flows through the tank, and the coal or the like is delivered on to the perforated plate below the level of the water. Compressed air is introduced below the perforated plate and bubbling up through the perforations assists in the separation of the light and heavy particles.—W. H. C.

Peat; Apparatus for the treatment of—T. E. Brown, London. Eng. Pat. 25,962, Nov. 12, 1913.

THE peat passes from a hopper provided with pressing blades and disintegrating knives, to a jacketed cylinder, containing a screw conveyor; in this it is further pulped and then delivered to a moulding box, from which the compressed peat issues as a rectangular mass, which is cut up into blocks.—W. H. C.

[Briquettes.] Composition of matter and process of producing the same. F. Meyer, Ouray, Colo. U.S. Pat. 1,129,109, Feb. 23, 1915. Date of appl., Jan. 21, 1914.

COAL or coke dust is mixed with a liquid extract of cactus plants and formed into briquettes.—W. H. C.

Fuel; Agglomerating small particles of—A. and M. Pidelaserra Brias, Fr. Pat. 472,101, May 11, 1914. Under Int. Conv., May 13, 1913.

CRUSHED or powdered coal, lignite, charcoal, or other fuel is mixed with powdered pitch or coal tar and water, and heated in a kiln until the pitch is coked. The agglomerated fuel is strong and uniformly porous, and its good quality is stated to be largely due to the use of water.—A. B. S.

Coking retorts, carbonizing chambers, or the like; Vertical—B. Cochrane, Darlington, and R. Peel, Durham. Eng. Pat. 3886, Feb. 14, 1914.

THE retort is provided with an inner concentric vertical cylinder, completely closed except for openings around the base leading from the annular fuel chamber to gas collecting tubes, which pass upwards through the cylinder and open into the gas space at the top of the retort; the gas is drawn off through a suction main. Firebrick may be packed around the tubes in the inner cylinder and may be heated separately. The retort is surrounded by a brick flue and heated by gas.—W. F. P.

Coke oven doors and like doors. H. Gourley, Wombwell, Yorks. Eng. Pat. 6020, March 10, 1914.

THE doors are made of firebrick, ganister, or other refractory material, reinforced with strong vertical bars of wrought iron or mild steel cast in the back portion and with an endless or loop-shaped bar of similar material.—A. B. S.

Furnace and gas-generator therefor; Combined —. J. A. Charter, Chicago, Ill. U.S. Pat. 1,128,584, Feb. 16, 1915. Date of appl., Nov. 11, 1912.

SOLID fuel is fed slowly from an external chamber through horizontal pipes with rotating feeding screws, which pass through the furnace. An injector forces the gaseous and solid products through a common opening into the furnace below the pipes.—W. F. F.

Gas; Apparatus for producing — [from wood]. W. R. Degenhardt, London. U.S. Pat. 1,128,585, Feb. 16, 1915. Date of appl., Oct. 5, 1914.

LARGE fuel in the form of logs is fed through an opening in the top of a stoking chamber mounted on the generating chamber, whilst small fuel, such as shavings, is delivered through a detachable shoot, constricted at its middle and suspended within the stoking chamber from the opening; the bottom half of the flared lower part of the shoot is perforated.—W. F. F.

Gas-producer. G. J. Weber, Kansas City, Mo. U.S. Pat. 1,129,258, Feb. 23, 1915. Date of appl., Oct. 16, 1913.

A CENTRAL core extending upwards into the combustion chamber of a gas-producer has a central air passage discharging into the latter, and means for discharging water into the chamber at a lower level. The core is provided with a cap by means of which a whirling motion is imparted to the air.—W. E. F. P.

Motor spirit from heavy hydrocarbons; Production of —. W. A. Hall, New York. Eng. Pat. 437, Jan. 7, 1914. Addition to Eng. Pat. 24,491, Oct. 28, 1913 (this J., 1915, 216).

A HEAVY hydrocarbon oil is cracked above 600° C. and the vapours evolved are condensed under pressure. The uncondensed gases are absorbed in benzol or toluol or a mixture of the two, and the liquid thus obtained is mixed with the condensed liquid to yield a product suitable for use as a motor-spirit.—E. R. A.

Motor spirit; Production of — from heavy hydrocarbons. W. A. Hall, New York. Eng. Pat. 7282, March 23, 1914.

To clarify motor spirit obtained by the process described in Eng. Pat. 24,491 of 1913 (this J., 1915, 216), the vapours of the hydrocarbons boiling below 200° C. are passed, immediately after dephlegmating but before condensing under pressure, through a scrubber containing dehydrated fuller's earth, dehydrated bauxite, infusorial earth, or the like.—W. F. F.

Petroleum distillation. E. M. Clark, Alton, Ill., Assignor to Standard Oil Co., Whiting, Ind. U.S. Pat. 1,129,034, Feb. 16, 1915. Date of appl., April 20, 1914.

THE distillate from a battery of stills passes to condensers, whence the condensed liquid passes to collecting drums and thence through pipes containing meters to a pair of headers, whilst the uncondensed gas passes from the condensers and

from the upper part of the collecting drums to valved headers where it is confined under pressure; the pressure produced at a later stage in the distillation is used to exert pressure on the material at an earlier stage.—W. F. F.

Fuels of low sulphur content; Process for obtaining —. A. Fingerland, A. Indra, and A. Lissner. Fr. Pat. 471,902, May 7, 1914. Under Int. Conv., June 5, 1913.

SEE Ger. Pat. 270,573 of 1913; this J., 1914, 411.

Coal; Process for the distillation of —. International Gas Development Co. Fr. Pat. 471,205, April 27, 1914.

SEE U.S. Pat. 1,097,513 of 1914; this J., 1914, 685.

Gas; Manufacture of illuminating —. Comp. Franç. du Centre et du Midi pour l'Eclairage au Gaz, Paris. Eng. Pat. 4829, Feb. 24, 1914. Under Int. Conv., Feb. 24, 1913.

SEE Fr. Pat. 466,197 of 1913; this J., 1914, 585.

Gas; Manufacture of lighting —. H. Burgi and C. H. Tenney. Fr. Pat. 471,770, May 4, 1914.

SEE U.S. Pat. 1,120,273 of 1914; this J., 1915, 71.

Gas; Process of making —. G. M. S. Tait, Montclair, N.J., Assignor to Hydrocarbon Converter Co., New York. U.S. Pat. 1,128,549, Feb. 16, 1915. Date of appl., Nov. 13, 1908.

SEE Eng. Pat. 24,109 of 1908; this J., 1910, 11.

Gas producers. H. F. Smith. Fr. Pat. 472,307, May 16, 1914.

SEE U.S. Pat. 1,098,059 of 1914; this J., 1914, 782.

Gas-purifying apparatus. II. Dicke, Assignor to Berlin-Anhaltische Maschinenbau-A.-G., Berlin. U.S. Pat. 1,129,558, Feb. 23, 1915. Date of appl., Dec. 6, 1913.

SEE Ger. Pat. 271,122 of 1912; this J., 1914, 472.

Paraffin and like substances and mixtures of such substances with oil; Process for the fractional separation of —. K. Opl, Assignor to Triester Mineral-Oel-Raffinerie, Trieste, Austria-Hungary. U.S. Pat. 1,128,494, Feb. 16, 1915. Date of appl., Feb. 7, 1912.

SEE Ger. Pat. 262,153 of 1912; this J., 1913, 902.

Apparatus for distilling liquids [oils]. Eng. Pat. 707. See I.

Process for destroying the malodorous gases and vapours produced in the distillation of ammoniacal liquor. Ger. Pat. 278,776. See VII.

Manufacture of ammonium sulphate. Ger. Pat. 279,953. See VII.

IIb.—DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Charcoal; Manufacture of —. J. Board Agric., 1915, 21, 1032—1037.

IN some recent charcoal burning operations in the Forest of Dean a yield of about 20% of charcoal was obtained from oak. The expenses of

burning vary between 18s. and 25s., and the cost of the wood is about 15s. per ton of charcoal obtained, in addition to which there is the cost of sacks and cartage. In normal circumstances the charcoal sells at 40s. to 50s. per ton in large consignments, though at the present time as much as 70s. to 80s. is being obtained.—J. P. O.

Sources and industrial uses of beryllium compounds. See VII.

Application of a variety of selenium particularly sensitive to light to the construction of selenium cells for photometry. Angel. See XXIII.

PATENTS.

Incandescence mantles and a process and apparatus for the manufacture thereof. E. L. Knoedler, Gloucester City, N.J., U.S.A. Eng. Pat. 4120, Feb. 17, 1914. Under Int. Conv., Feb. 20, 1913.

INCANDESCENCE mantles are shaped and hardened by directing a hardening flame into the mantle which is placed in a perforated muffle, the number, arrangement and size of the perforations being such that a thin film of hot gases is maintained between the inner surface of the muffle and the mantle. A second muffle may be placed outside the first, whereby a higher temperature and increased hardening effect is obtained.—E. R. A.

Electric conductors [for incandescence lamps, etc.]. British Thomson-Houston Co., Ltd., London. From General Electric Co., Schenectady, N.Y., U.S.A. Eng. Pat. 4235, Feb. 18, 1914.

A LEADING-IN conductor, composed for example of an alloy of iron and nickel with a copper sheath, may be sealed into glass by first coating it with a layer of a fused borate such as borax. The wire is passed from a reel through a strong solution of the borate and then through a tube heated to 800°–900° C., whereby the coating is dried and fused.—W. F. F.

Filament for incandescence (electric) lighting [; Metal —] and process of manufacture. E. Cervenká. Fr. Pat. 471,785, July 19, 1913.

THE filament is first covered with oxides of the rare earth metals, and afterwards submitted for a few minutes to a voltage higher than that normally employed for lighting, so as to fuse the oxides and form an adherent film.—B. N.

Photometers. Eng. Pat. 6319. See XXIII.

III.—TAR AND TAR PRODUCTS.

Peat tar; Composition of —. E. and F. Bornstein. J. Gas Lighting, 1915, 129, 731.

TAR obtained by destructive distillation of peat, contained 48.5% water; 1.8% boiling between 150° and 170° C.; 4.7% between 170° and 230° C.; 10.7% between 230° and 270° C., and 24.7% between 270° and 330° C. The residual coke amounted to 9.4%. The tar yielded 18% of phenols, 1% of bases, 34% of oils, and 47% of pitch. When the tar was extracted directly with alcohol-ether, 24% of paraffin, m. pt. 65° C., was obtained.

Use of nickel and its oxides in catalysis. Senderens and Aboulenc. See XX.

PATENTS.

Ureas of the naphthalene series; Production of —. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 471,933, May 7, 1914. Under Int. Conv., June 21, and Oct. 16, 1913, Jan. 22, Feb. 20, and April 11, 1914.

SEE Eng. Pat. 9172 of 1911; this J., 1914, 825. The aminobenzoyl group may be replaced by other aminoacyl groups, and the process may be applied to derivatives of naphthylaminesulphonic acids as well as of 1,8-aminonaphtholsulphonic acid.

Nitroaminoanthraquinones; Preparation of —. Badische Anilin und Soda Fabrik. Ger. Pat. 279,866, July 3, 1913.

THE formaldehyde compounds of α -aminoanthraquinones or the free α -aminoanthraquinones in presence of formaldehyde or substances capable of yielding it, are nitrated. The *o*- or *p*-nitroaminoanthraquinones are obtained either in the free state or in the form of their formaldehyde-compounds, which are readily hydrolysed by boiling with dilute alkali.—A. S.

1-Aminoanthraquinone-2-carboxylic acids and their derivatives; Preparation of —. Badische Anilin und Soda Fabrik. Ger. Pat. 279,867, Sept. 4, 1913. Addition to Ger. Pat. 247,411 (this J., 1912, 764; see also Addition of May 23, 1912, to Fr. Pat. 425,859, and Ger. Pat. 267,211; this J., 1912, 1174; 1913, 1151).

WHEN the method is applied to β -aminoanthraquinones, condensation is effected without the addition of copper or copper compounds.—A. S.

Anthracene-1,9-dicarboxylic acid and its substitution products; Preparation of —. Badische Anilin und Soda Fabrik. Ger. Pat. 280,092, July 11, 1913.

ACEANTHRENEQUINONE or one of its substitution products is treated with a mild oxidising agent, e.g., with manganese dioxide or potassium permanganate in neutral or alkaline aqueous suspension or solution, or with sodium bichromate and glacial acetic acid, avoiding excess of chromic acid. Anthracene-1,9-dicarboxylic acid and anthraquinone-1-carboxylic acid are produced from aceanthrenequinone and may be readily separated one from the other.—A. S.

Tar; Production of a liquid for heating and lighting from —. A. Markl. Fr. Pat. 471,506, April 29, 1914. Under Int. Conv., May 2, 1913.

SEE Ger. Pat. 277,502 of 1913; this J., 1915, 218.

Carbazole-sulphonic acids and process of making same. A. Schmidt, G. Krönlein, and E. Runne, Assignors to Farb. vorm. Meister, Lucius, and Brünig, Höchst-on-Maine, Germany. U.S. Pat. 1,128,369, Feb. 16, 1915. Date of appl., April 24, 1913.

SEE Eng. Pat. 9960 of 1913; this J., 1913, 972.

*Nitrosulphochlorides of *o*-hydroxycarboxylic acids and their derivatives.* Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 472,213, May 14, 1914. Under Int. Conv., May 29, 1913.

SEE Eng. Pat. 12,061 of 1914; this J., 1914, 855.

Anthraquinone; Preparation of —. Chem. Fabr. Griesheim-Elektron. Fr. Pat. 472,216, May 14, 1914. Under Int. Conv., June 6, 1913, Feb. 14 and Mar. 18, 1914.

SEE U.S. Pat. 1,103,383 and 1,119,546 of 1914; this J., 1914, 826; 1915, 22.

Apparatus for distilling liquids [tar]. Eng. Pat. 707.
See I.

IV.—COLOURING MATTERS AND DYES.

Indigo; Government purchase of—Board of Trade Announcement, Mar. 12, 1915.

HIS Majesty's Government have acquired the greater part of the crop of natural indigo, now coming forward. British dye-using firms desirous of participating in this supply should make early application to the Government brokers, Messrs. Lewis and Peat, 6, Mincing Lane, E.C., who will furnish further particulars, and who are instructed to allocate the amount available among *bona fide* users of dyes as nearly as may be in accordance with their requirements, at prices just sufficient to cover the cost of acquisition by the Government and the expenses of distribution. Priority will be given to Government contractors, and no application will be entertained from dealers, other than commission buyers acting on behalf of dye-users.

PATENTS.

[*Azo*] *dycstuffs; Production of fast shades and therefor.* H. Levinstein, J. Baddiley, and Levinstein, Ltd., Manchester. Eng. Pat. 28,569, Dec. 11, 1913.

NEW disazo dyestuffs are produced by combining two mols. of resorcinol, *m*-aminophenol, or *m*-phenylenediamine or a substitution product of these substances, or one mol. of any one of them and one mol. of another suitable azo component, with the tetrazo compound derived from an aminoarylacidyldiamine of the benzene or naphthalene series of the general formula $\text{NH}_2\text{ArCO.NH.Ar'.NH}_2$. Extremely fast shades are obtained by after-treatment with formaldehyde.—F. W. A.

Anthraquinone series; Preparation of nitrogenous condensation products [dycstuffs] of the—Farbw. vorm. Meister, Lucius, und Brüning. Ger. Pat. 280,190, March 19, 1913. Addition to Ger. Pat. 270,789 (this J., 1914, 474).

ESTERS of the α -anthraquinonylarylglycines obtained as described in Ger. Pat. 270,790 (this J., 1914, 475) are heated with caustic alkalis or alkaline-earths in presence of inert solvents at atmospheric or increased pressure: water is split off and α -anthra-N-arylpyrrolecarboxylic acids are formed. They are yellow to brown substances which dye wool yellow to blue shades in an acetic acid-acetate bath.—A. S.

Vat dyestuffs and process of making same. A. Schmidt, K. Thiess, and E. Bryk, Assignors to Farbw. vorm. Meister, Lucius, und Brüning, Höchst-on-Maine, Germany. U.S. Pat. 1,128,358, Feb. 16, 1915. Date of appl., Mar. 3, 1913.

SEE Ger. Pats. 265,195 and 265,196 of 1912; this J., 1913, 1101.

Indophenolsulphonic acids and process of making same. A. Schmidt and G. Krönlein, Assignors to Farbw. vorm. Meister, Lucius, und Brüning, Höchst-on-Maine, Germany. U.S. Pat. 1,128,370, Feb. 16, 1915. Date of appl., April 24, 1913.

SEE Eng. Pat. 10,875 of 1913; this J., 1913, 974.

Sulphur dyestuffs and process of making same. A. Schmidt and G. Krönlein, Assignors to Farbw. vorm. Meister, Lucius, und Brüning, Höchst-on-Maine, Germany. U.S. Pat. 1,128,371, Feb. 16, 1915. Date of appl., April 24, 1913.

SEE Fr. Pat. 457,535 of 1913; this J., 1913, 1005.

Azo colouring matters. Azo dyes. W. Neelmeier and A. Sigwart, Leverkusen, Germany, Assignors to Synthetic Patents Co., New York. U.S. Pats. 1,128,813 and 1,128,814, Feb. 16, 1915. Date of appl., Feb. 25, 1914.

SEE Ger. Pat. 274,082 of 1913; this J., 1914, 784.

Vat dyes. O. Bally, Mannheim, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen, Germany. U.S. Pat. 1,128,836, Feb. 16, 1915. Date of appl., Aug. 14, 1913.

SEE Eng. Pat. 26,551 of 1912; this J., 1913, 1004.

Vat dyes and process of making same. G. Kalischer and D. Nissen, Frankfurt, Germany, Assignors to Cassella Color Co., New York. U.S. Pats. 1,129,574 and 1,129,575, Feb. 23, 1915. Date of appl., June 18, 1914.

SEE Eng. Pat. 1443 of 1914; this J., 1914, 743.

[*Azo*] *dycstuffs; Production of blue diazotisable*—L. Cassella und Co. Fr. Pat. 471,779, July 18, 1913.

SEE Eng. Pat. 17,030 of 1913; this J., 1914, 743.

Azo dyestuffs derived from the arylamides of 2,3-hydroxynaphthoic acid; Production of—Chem. Fabr. Griesheim-Elektron. Fr. Pat. 471,799, May 4, 1914. Under Int. Conv., Sept. 19, 1913.

SEE Eng. Pat. 10,085 of 1914; this J., 1914, 915.

Azo dyestuffs; Production of new diazotisable—Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 471,881, May 6, 1914. Under Int. Conv., May 16, 1913.

SEE Ger. Pat. 273,934 of 1913; this J., 1914, 783.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

PATENTS.

Paper; Apparatus for boiling and washing rags for use in the manufacture of—T. H. Nash, St. Paul's Cray, Kent. Eng. Pat. 6874, Mar. 18, 1914.

THE boiler consists of a water-tight casing in which revolves a cylindrical holder having perforated walls formed with angular or V-shaped corrugations, or with sinuous or semi-circular corrugations, and with imperforate ends. Means are provided for driving the holder by gear-wheels at each end and for supplying steam and rinsing water to the interior of the casing.—J. F. B.

Paper pulp and feeding stuff from the root-stalks of Brassica species, such as cabbage stumps, etc. W. Fornoff. Ger. Pat. 279,516, Jan. 17, 1914.

THE material is treated with an alkali and digested with steam or water, preferably under pressure, and the fibrous residue is then separated from the soft pulp by pressing. The pulp is used as a feeding stuff, and the fibrous matter, after further digestion with caustic soda or with water under

pressure, is disintegrated in a beating engine and used alone or mixed with other materials as paper pulp.—A. S.

Fibrous materials; Apparatus for treating—. E. D. Jefferson, Boston, Mass. U.S. Pat. 1,128,451, Feb. 16, 1915. Date of appl., Jan. 15, 1912.

THE material is treated in a perforated drum rotating in a closed tank partially filled with liquid which is boiled by steam under pressure. The material is prevented from turning in the drum as it rotates, so that it is alternately subjected to the action of the boiling liquid and of the steam above it. Perforated pipes, open at the ends, are arranged across the drum to assist the penetration of the liquid.—J. F. B.

Acetyl-cellulose plastics; Process of making—. W. G. Lindsay, Caldwell, N.J., Assignor to The Celluloid Co., New York. U.S. Pat. 1,128,468, Feb. 16, 1915. Date of appl., Nov. 27, 1911.

ACETYLCELLULOSE soluble in acetone is incorporated with a triarylphosphate having not more than seven carbon atoms in the aryl group, e.g., triphenylphosphate, in the presence of a small proportion of methyl alcohol, and the mixture is heated.—J. F. B.

Retting of plants, especially textile plants; Chemical process for the—. V. N. F. Lombard and G. A. F. Lasègue. Fr. Pat. 471,781, July 19, 1913. SEE Eng. Pat. 23,355 of 1913; this J., 1914, 248.

Cellulose; Purified hydrated—and method of manufacture. A. Pellerin, Neuilly, France. U.S. Pat. 1,128,624, Feb. 16, 1915. Date of appl., July 8, 1910.

SEE Fr. Pat. 410,776 of 1909; this J., 1910, 811.

Cellulose esters, cellulose compounds, india-rubber, and other ingredients; Manufacture of substances from—. L. Collardon, West Bromwich. U.S. Pat. 1,128,851, Feb. 16, 1915. Date of appl., Jan. 20, 1913.

SEE Eng. Pat. 1598 of 1912; this J., 1913, 498.

Cellulose or cellulosic substances; Preparation of solutions of—in concentrated hydrochloric acid. R. Willstätter. Fr. Pat. 471,479, April 29, 1914. Under Int. Conv., May 24, 1913.

SEE Eng. Pat. 10,605 of 1914; this J., 1914, 859.

Methyl alcohol or other volatile substances from wood or other material containing cellulose; Method of producing—. H. O. V. Bergström, Stockholm, Sweden. U.S. Pat. 1,129,542, Feb. 23, 1915. Date of appl., April 30, 1912.

SEE Fr. Pat. 433,168 of 1911; this J., 1912, 123.

New substituted ureas [and their use for stabilising nitro-products, e.g., celluloid]. Eng. Pat. 17,501. See XX.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Peroxide bleaching baths; Prevention of decomposition of—. V. Wintsch. Rev. Mens. Blanchissage, 1914, 7, 102.

To prevent the rapid decomposition of alkaline solutions of hydrogen peroxide and other bleaching agents containing active oxygen, the addition of

boron compounds as well as pyrophosphate is suggested. A litre of solution containing 34 grms. of hydrogen peroxide, 1.7 grms. of caustic soda, 30 grms. of sodium pyrophosphate, and 5 grms. of sodium metaborate, had not diminished in available oxygen content after heating to 60° C. for one hour. After keeping at this temperature for 3½ hours, a diminution of 84% was noted in the case of a sample which did not contain the metaborate, whereas the above sample had only lost 11.2% of its available oxygen. These additions are also useful for the preservation of neutral or acid baths.—F. W. A.

Weighting of silk; Determination of—. P. Heermann and Frederking. Chem.-Zeit., 1915, 39, 149—150.

IN the usual method of determining tin phosphate and silicate weighting the silk is heated with dilute hydrofluoric acid at 50°—60° C. (compare this J., 1903, 622, 825, 968): the method is somewhat tedious and special precautions have to be taken to prevent the thermometer being attacked by the acid. The authors have found that silk fibroin may be digested with boiling 2% hydrofluoric acid for 1 hour without appreciable loss of weight and propose the following modified method. The sample is heated with 2% hydrofluoric acid in a platinum dish on the water-bath for 15—20 mins., with occasional agitation, then treated as usual with 5% hydrochloric acid, washed, dried, and weighed.—F. W. A.

Acid dye bath; Mechanism of the—. II. M. Fort and D. Swares. J. Soc. Dyers and Col., 1915, 31, 80—83.

IN a previous communication (this J., 1913, 907), one of the authors stated a provisional theory of the acid dye bath. It has been shown that if wool is dyed with colour acids or salts of acid dyestuffs in a bath containing sulphuric acid, more sulphuric acid remains in the bath than when wool is treated, under similar conditions, in a bath containing sulphuric acid alone. This is assumed to be similar to the replacement of sulphuric acid from acid-prepared wool on dyeing with an acid dyestuff. In the acid dye-bath the acid first prepares the wool, combination occurring to a considerable extent at the same time, and then an interchange of acid and dyestuff takes place, the wool combining with the dyestuff and liberating sulphuric acid (free or combined). The view that the absorption of acids by wool is due to additive salt formation has received much support (see this J., 1914, 133). Sisley has compared dyeing phenomena to the formation of substances such as anthracene picrate, a suggestion similar to the theory advanced. It has further been shown that suppressed amidation of wool results in decreased affinity, and increased amidation in increased affinity for acid dyestuffs (see this J., 1914, 306). The present results confirm the view that the dyestuff and the acid interfere with the exhaustion of each other when used together in the ordinary acid dye bath; this interference is related to their combination with wool, and takes place to such an extent that it may reasonably be assumed to be one of the factors influencing dyeing. The common assumption that sulphuric acid liberates the free colour acid from an acid dyestuff in the ordinary acid dye bath, does not explain the excess SO₄ remaining in the acid dye bath, since this excess is found when picric acid is used. Moreover, when salts of acid dyestuffs are used, the excess SO₄ does not correspond to the amount of sodium sulphate which would be formed if such an interaction occurred. Knecht has shown that the magnesium salt of Crystal Scarlet recrystallises unchanged after heating in strongly acid solution.

Misleading results are obtained from a short laboratory test to estimate the bleeding which would occur under a prolonged treatment. On immersion in cold water, changed twice a day, wool dyed from an acid bath scarcely bled until three days had elapsed, when considerable bleeding occurred, increasing to a maximum in several days, and continuing to bleed after six weeks' immersion. Wool dyed from a neutral bath bled considerably at first; the bleeding gradually diminished after several days, but continued to the end of six weeks. This seems to show that the excess of combined sulphuric acid is first removed from the wool, and as its protective action disappears the dye commences to bleed more rapidly, until eventually bleeding may be more pronounced than in the case of wool dyed from a neutral bath. Further experiments are described in support of the reaction: wool-basic hydrate- $\text{H}_2\text{SO}_4 + \text{Na}$ colour salt \rightleftharpoons wool-basic hydrate-colour salt $+ \text{Na}_2\text{SO}_4$.—F. W. A.

PATENTS.

Vegetable textile fibres for bleaching; Preparation of — J. L. Jardine, Penicuik, and T. A. Nelson, Edinburgh. Eng. Pat. 802, Jan. 12, 1914.

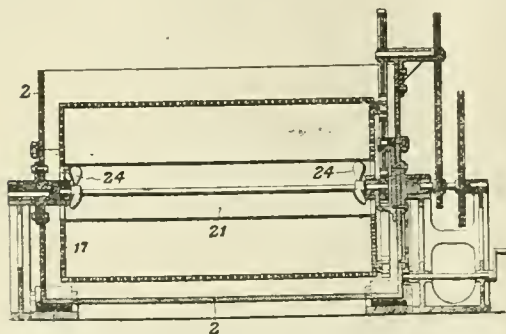
THE material is digested under pressure with a solution of magnesium or sodium bisulphite containing an excess of available sulphurous acid, the gases liberated during the treatment being completely removed to prevent deterioration of the fibre by the liberated sulphur dioxide. This single treatment may be substituted for the alternate alkaline (bowking) and acid (souring) treatments, the lignified incrustations as well as pectose and gummy ingredients being removed without any tendency towards mercerisation, or appreciable alteration of the structural character or strength of the fibres.—F. W. A.

Bleaching action of hydrogen peroxide or other peroxides, or per-salts; Process for accelerating the — L. Golodetz and B. Benedix. Ger. Pat. 279,863, Aug. 1, 1912.

THE material to be bleached is treated first with an oxydase preparation, e.g., with an aqueous alcoholic extract of horse-radish, or with yeast or a yeast extract, and then with the bleaching solution. —A. S.

Dyeing machine. W. H. Shainline, Norristown, Pa. U.S. Pat. 1,129,128, Feb. 23, 1915. Date of appl., April 10, 1914.

A ROTARY perforated cage, 17, mounted in a tank, 2, for the dye liquor, contains an inner perforated chamber, 21, communicating with the tank by



openings in the ends of the cage. The inner chamber is fitted at each end with a propeller, 24, which can be rotated in either direction. Perforated radial partitions connect the inner and

outer perforated chambers, and divide the cage into separate compartments.—F. W. A.

Printing of fabrics and other material; Machinery for the intermittent — E. W. Buckley, and Mather and Platt, Ltd., Manchester. Eng. Pat. 3408, Feb. 10, 1914.

A MACHINE for printing various lengths of fabric, paper, or other material, with means for changing rapidly to deal with varying lengths. A constantly-rotating disc is provided with openings parallel to its axis in which are movable pins. By means of a selective chain device, certain of the pins may be moved so as to project from one side of the disc, whereupon they engage with pawl and ratchet wheel devices which raise and lower the printing rollers.—F. W. A.

Discharges; Production of coloured — on tannin-mordanted goods with vat dyestuffs. Kalle und Co. A.-G. Ger. Pat. 280,367, March 7, 1914.

THE tannin-mordanted goods are treated with aluminium acetate solution before being printed with the coloured discharge paste.—A. S.

Aniline Black; Dyeing — on tissues and fibres by oxidation with air. A. E. Vergé. Fr. Pat. 471,320, July 7, 1913, and Addition thereto, dated July 18, 1913.

SEE Eng. Pats. 15,668 and 18,246 of 1913; this J., 1914, 418, 747.

Discharging vat or sulphide colours with reducing agents; Process for — L. Cassella und Co., G. m. b. H. Fr. Pat. 471,655, July 16, 1913.

SEE Eng. Pat. 17,031 of 1913; this J., 1914, 418.

Production of fast shades and dyestuffs therefor. Eng. Pat. 28,569. See IV.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Sulphuric acid; Fused silica dishes for the concentration of — A. E. Marshall. Met. and Chem. Eng., 1915, 13, 136—137. (See also this J., 1915, 135.)

FUSED silica dishes for use in continuous cascade concentrating plant were introduced in 1907. This resulted in great fuel economy, as the silica dishes may be exposed directly to the fire gases. The breakage in 15 factories is stated always to be under 5% per annum from all causes, and the fuel consumption 17% of the weight of finished acid. A unit producing 20,000 lb. of acid of 66° B. (sp. gr. 1.842) per 24 hours from acid of 50° B. (sp. gr. 1.53) consists of 100 dishes (12½ in.) and 60 pre-heating pans (24×12 in.) in direct contact with the fire gases, except the last three dishes in each row; these are supported in closed seatings to minimise risk of breakage.—W. R. S.

Steamer carrying sulphuric acid; Loss of a — Oil, Paint, and Drug Rep., Mar. 15, 1915.

THE steamship "De Sola," which sailed from New York for Great Britain in January with a cargo of concentrated sulphuric acid, carried about 7400 steel drums, each weighing approximately 800 lb., representing about 2800 tons. After the steamer had been eleven days from port, with rough weather, and nearly half-way across, with water in the hold, which had broken through the hatches, it was discovered that the

acid was leaking from the drums, and two men were overcome with gas. It was then deemed advisable to return to the nearest port. Upon reaching St. John's, N.F., the cargo was taken out, and the sound drums carefully re-stowed, but when the steamer was only 24 hours out other steel drums were found to be leaking, and once more the steamer returned to port. While waiting at St. John's for instructions the steamship took fire, as a result of the escape of inflammable gases, and this, together with the damage done to the hull of the ship by the action of the acid, caused the ship to sink. While under water, the drums of sulphuric acid exploded, and the steamer and the cargo are now said to be a total loss.

Hydrocyanic acid : Determination of small quantities of —. A. Viehoever and C. O. Johns. J. Amer. Chem. Soc., 1915, 37, 601—607.

THE Prussian-blue method is recommended, the authors having determined the conditions necessary to obtain a constant shade as well as density of colour from a given quantity of hydrocyanic acid. The distillate containing the hydrocyanic acid is rendered slightly alkaline with sodium hydroxide and evaporated under reduced pressure and below 70° C. to a volume of 1 c.c.; 0.2 c.c. of 3% ferrous sulphate solution and 0.05 gm. of potassium fluoride are then added, and the air is exhausted from the flask. After 10 minutes, the mixture is acidified with 30% nitric acid, and the blue coloration obtained compared with a suspension of Prussian-blue made from a known weight of potassium cyanide. The use of nitric acid or sulphuric acid is preferable to that of hydrochloric acid for acidifying the mixture, and the presence of potassium fluoride has a remarkably favourable effect on the formation and colour of the Prussian-blue. It is not necessary to add a ferric salt, and any considerable formation of ferric salts should be avoided.—W. P. S.

Calcium cyanamide ; Crude — as a raw material of the chemical industry. O. B. Carlson. Baltischer Ing.-Kongress, July, 1914. Z. angew. Chem., 1914, 27, Wirtschaftl. Teil, 724—725.

CRUDE calcium cyanamide has acquired rapidly increasing importance as a raw material of chemical industry. Ammonia is prepared from it by heating with water, and cyanides by fusing with alkali salts; both processes are worked on the industrial scale. By heating with water at moderate temperatures under definite conditions, cyanamide is converted almost quantitatively into dicyanodiamide, $\text{NH}:\text{C}(\text{NH}_2)_2$, and this yields dicyanodiamidine, $\text{NH}:\text{C}(\text{NH}_2)_2\text{NH}:\text{CO}:\text{NH}_2$, from which guanidine is prepared technically by heating with acids in an autoclave. Cyanamide when heated with acid yields urea or dicyanodiamide according to the conditions, as is shown in the following table:

Acid.	Temp., °C.	Maximum yield.	
		Urea %	Dicyano- diamide %
10% H_2SO_4	20	100	0
	50	99	1
	70	48	52
	90	31.5	68.5
20% H_2SO_4	25	99	1
	50	50	50
	60	7	93
	100	2	98

Thiourea is obtained by the hydrolysis of calcium cyanamide in presence of hydrogen sulphide.

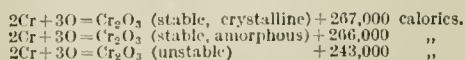
As an example of the use of calcium cyanamide as a raw material for the manufacture of pharmaceutical chemicals, the preparation of veronal (diethylbarbituric acid) is represented schematically. In this process 2-cyanimino-4-imino-5-diethyl-6-oxypyrimidine is produced by the interaction of dicyanodiamide and the ethyl ester of diethylcyanoacetic acid, and is converted into veronal by replacing the cyanimino and imino groups by oxygen. The chief disadvantage attaching to the use of calcium cyanamide as a raw material is its great reactivity, which makes it difficult to obtain high yields and pure products on account of the ease with which secondary reactions take place.—A. S.

Ferric salts ; Apparent slowness of hydrolysis of —. A. Quartaroli. Gaz. Chim. Ital., 1915, 45, 1, 139—152.

THE hydrolysis of ferric chloride in solutions of various concentrations was studied by making determinations of the magnetic susceptibility (due to iron in the ionised condition), electrical conductivity, and concentration of hydrogen ions. It is concluded from the results that the hydrolysed portion of the ferric chloride consists partly of FeOH ions (and possibly FeO_2H_2 ions) and partly of amicroscopic colloidal particles of ferric hydroxide or highly basic chlorides: the colloidal particles adsorb a considerable quantity of hydrochloric acid. The proportion of colloidal ferric hydroxide remains unaltered on keeping, but its degree of dispersion diminishes and the resulting decrease of surface causes the liberation of part of the adsorbed hydrochloric acid and hence an increase in the electrical conductivity. With increasing dilution the ionised portion of the products of hydrolysis increases at the expense of the colloidal portion. The magnetic susceptibility measurements are opposed to the view that ferric chloride is completely hydrolysed and converted into the colloidal hydroxide at a dilution of 0.000054 gm.-mol. per litre.—A. S.

Chromium sesquioxide ; Unstable —, and corrections of previous work on the heat effect of chromium and aluminium sesquioxides in fusions with sodium peroxide. W. G. Mixter. Amer. J. Sci., 1915, 39, 295—299.

EITHER the crystalline or the supposedly amorphous modification of chromium sesquioxide when fused with sodium peroxide gave an average exothermal effect of 720 calories per gram: these two stable forms are therefore regarded as the same polymer of the unstable form, the average heat of reaction of which with sodium peroxide was 865 calories per gram. A dark olive-green specimen of the unstable form containing 5.9% $\text{H}_2\text{O} + \text{CO}_2$ was obtained by dehydrating chromic hydroxide in hydrogen for 24 hrs. at 420° C., but complete dehydration required higher temperatures at which the unstable sesquioxide "glowed" and changed to the stable green oxide. Prolonged heating of the unstable sesquioxide below the temperature of glowing resulted in a similar but slower change, while in a brisk stream of oxygen the change was very rapid at such temperatures. The following derived thermal data are given:



Alumina containing 1.7% H_2O was obtained by maintaining the hydroxide at 500° C. for 24 hrs.; thermal determinations similar to the foregoing indicated that this form polymerises at higher temperatures.—J. R.

German Potash Syndicate. Engineering, Mar. 19, 1915.

THE Kali Syndicat has recently forwarded a petition to the authorities asking that permission might be given to raise the maximum prices for the home market fixed in the Kali Law of May 25, 1910. The present condition of the potash industry may be illustrated by the fact that the Anhalt Crown Works have made a loss of 500,000 marks from August to the end of December, whilst the corresponding period of 1913 yielded profits of 200,000 marks. The increase asked for amounts to an allowable limit of 25% during the duration of the war, and six months beyond. In the meantime the board has fixed the production of potash goods for the current year as follows. The figures represent 100 kilos. pure potash:—

	1915.		1914.	
	Home.	Abroad.	Home.	Abroad.
Carnallite with not less than 9% and not more than 12% K ₂ O	48,000	3,000	71,000	1 000
Raw products with 12 to 15% K ₂ O	2,666,000	822,000	3,390,000	1,411,000
Manure with 20 to 22% K ₂ O	20,000	334,000	23,000	483,000
Manure with 30 to 32% K ₂ O	36,000	115,000	40,000	164 000
Manure with 40 to 42% K ₂ O, including potash manure with 38% K ₂ O	2,292,000	687 000	2,113,000	671,000
Chloride of potash	545,000	1,383,000	697,000	1,875,000
Sulphate of potash with more than 42% K ₂ O	12,000	376,000	17,000	550 900
Potassium - magnesium sulphate	2,000	147,000	2,000	158,000
Total	5,621,000	3,867,000	6,353,000	5,313,000

The quantity to be disposed of for home and abroad for the present year thus amounts to an aggregate of 948,600,000 kilos., against 1,166,600,000 kilos. for the preceding year.

Beryllium compounds; Sources and industrial uses of —. Bull. Imp. Inst., 1914, 12, 613—615.

THE most important beryllium mineral is beryl, a typical analysis of which is: BeO, 12.64; Al₂O₃, 17.05; Fe₂O₃, 2.20; CaO, 0.57; Na₂O, 0.68; SiO₂, 65.21; H₂O, 2.70%. It is widely distributed and has been found in various parts of the United Kingdom. The treatment of the mineral consists in fusing it with two parts of potassium carbonate for three hours, adding a slight excess of sulphuric acid, evaporating, and diluting with water. The silica is filtered off, the solution concentrated to induce crystallisation of most of the aluminium as potash alum, and the mother liquor poured into a saturated solution of ammonium carbonate, allowed to stand for several days, and then filtered. Basic beryllium carbonate is precipitated from the solution by means of superheated steam and is purified by dissolving in ammonium carbonate and precipitating with steam several times. In an alternative method the beryl is fused with six parts of ammonium fluoride for ten to twelve hours, then extracted with water, the solution evaporated with sulphuric acid, diluted, and treated with ammonium carbonate as above. The only important commercial application of beryllium compounds is the addition of 0.5% of beryllium nitrate to the impregnating solution used in the manufacture of incandescence gas mantles to give

increased strength to the ash skeleton. Prior to the war the manufacture of beryllium nitrate was carried on entirely in Germany, but British manufacturers are now prepared to put beryllium salts on the market.—A. S.

Hydrazine; Electrolysis of a solution of sodium hydrazide in anhydrous —. T. W. B. Welsh. J. Amer. Chem. Soc., 1915, 37, 497—508.

SODIUM amide or metallic sodium reacted with anhydrous hydrazine, yielding sodium derivatives of hydrazine which could not be characterised on account of their violently explosive nature. Their solutions in anhydrous hydrazine conducted the current, yielding both nitrogen and hydrogen at each electrode. In tests with a copper coulometer the ratio Cu:N varied from 1:1.1 for dilute solutions to 1:2.6 for stronger solutions.—J. R.

Silicidised carbon. Silfrax. F. J. Tone. Trans. Amer. Electrochem. Soc., 1914, 26, 181—198.

SILFRAX is obtained by the action of the vapour of silica or silicon on carbon; the product retains the original shape of the carbon, which is penetrated to a maximum depth of about $\frac{1}{8}$ in. The appearance and character of the product vary with the temperature of production, but non-crystalline (yellow) and crystalline (steel black) varieties, obtained by heating carbon in the amorphous and crystalline zones of a carborundum furnace (i.e., at 1150°—1820° C. and 1820°—2220° C., respectively) were both found to consist essentially of the same silicon carbide as carborundum, viz., SiC. By the combined action of silicon vapour and molten silicon, carbon is silicidised in the same manner as when placed in a carborundum furnace; but the resulting product is carborundum containing varying proportions of pure silicon, these two components being mutually soluble in all proportions. In considering the difference between silfrax and ordinary carborundum, the reactions of the carborundum furnace are discussed, the author being of opinion that the equation, $\text{SiO}_2 + 3\text{C} = \text{SiC} + 2\text{CO}$, explains only the conversion of carbon particles into carborundum *in situ*, but not the formation or growth of crystals larger than the original carbon particles, since at the temperature and vapour pressure of the carborundum furnace, carbon is generally regarded as having no appreciable vapour tension. The equation, $3\text{Si} + 2\text{CO} \rightleftharpoons 2\text{SiC} + \text{SiO}_2$, is suggested to account for all the phenomena of the furnace, the forward or low temperature reaction (which is exothermic and occurs throughout the crystalline zone) explaining the building up of the large from the small crystals formed by the first equation, and the reverse reaction (occurring in the hottest part of the furnace and next to the core) explaining the phenomena of the local disappearance and recrystallisation of carborundum. On these grounds, silfrax is regarded as differing fundamentally from carborundum in its mode of production, being formed mainly by the action of silicon vapour on carbon *in situ* and not from gaseous carbon compounds. In the production of silfrax, the density of the original carbon article is such that when the initial coating is formed the pores are almost completely filled with silicon carbide, so that further circulation of gases is made very slow and difficult. Hence the vapour reaction indicated in the second equation cannot occur to any extent, and the crystals remain small and closely compacted so that the product acquires toughness and mechanical strength superior to those of carborundum. Silfrax is used commercially as a refractory material for the manufacture of pyrometer tubes, electrical heating elements, and chemical ware.—W. E. F. P.

Nitrogen monopoly in Germany. Chem. and Drug., Mar. 27, 1915.

A GERMAN Reichstag Bill authorises the Federal Council to introduce a commercial monopoly in nitrogen for the period down to March 31, 1922, and to frame the necessary regulations. The monopoly is to apply to (1) inorganic nitrogenous minerals; (2) nitrogenous compounds obtainable from natural products, as well as nitrogen combinations primarily produceable artificially from nitrogen; and (3) nitrogenous fertilisers produced under Nos. (1) and (2) or from other materials. The monopoly would only be extended beyond March, 1922, on the basis of the adoption of a special imperial law. The preamble to the Bill states that German agriculture and industry, particularly the explosives industry, have hitherto been dependent in a great degree upon foreign countries for supplies of nitrogenous compounds, although large quantities were obtained in the country as by-products of coal-combustion. German chemists learned how to make nitrogenous compounds from the air, and after great trouble and financial sacrifices by the Empire and by Prussia, substitutes have been found during the war for the deficiency caused by stoppage of imports of Chile nitrate and other nitrogenous fertilisers, and a nitrogen-industry has been created which can meet the requirements of agriculture and industry in the future. The remunerativeness of the industry after the war must, however, be guaranteed, and this can only be assured by the establishment of a monopoly immediately.

German Bromine Convention. Brit. and Col. Drug., Mar. 27, 1915.

It is announced that the mutual agreement hitherto existing between the German Bromine Convention and the Chloride of Magnesium Convention was recently dissolved. The members of the former are consequently now at liberty to produce and dispose of magnesium chloride, whilst it is assumed that some of the members of the Magnesium Chloride Convention who possess bromine plant will also commence to manufacture and sell bromine in the near future. It is considered that the termination of the agreement may cause the prices of both products to fall to the cost of production, with the final result of further prejudicing the position of the potash works concerned, which are already suffering from the unfavourable working and sale conditions prevailing at the present time.

Export of lin chloride. Board of Trade Announcement. See X.

Arsenic trioxide from flue dust. Elton. See X.

Physico-chemical studies on the electrometallurgy of aluminium. [Melting point and density of mixtures of cryolite, alumina, and calcium fluoride]. Pascal and Jouniaux. See X.

The evaporator and the power problem in electro-chemical plants. Mantius. See XI.

Catalysis in the oxidation of alkali sulphites. Saillard. See XVII.

Molecular structure of isotropic and anisotropic binary mixtures [silico-boric oxide glasses]. Tammann. See XXIV.

PATENTS.

Nitrogen: Process of fixation of—. Soc. Générale des Nitrures, Paris. Eng. Pat. 22,586, Nov. 16, 1914. Under Int. Conv., Nov. 21, 1913.

THE impure ferro-aluminium obtained by heating a mixture of bauxite (or other aluminous material), carbon, and metallic iron in an electric furnace, is finely pulverised, mixed with sawdust to render the mass porous, moistened with water, and exposed to the air; the mass becomes gradually and spontaneously heated, combustible gases being evolved, and quickly attains a high temperature, the resulting product being impure aluminium nitride. When once initiated, the reaction may be continued in an atmosphere of pure or impure nitrogen and hastened by blowing air or nitrogen over or through the mass.—W. E. F. P.

Polishing compositions [mixture of magnesium oxide and a rare earth oxide]; Process of making — and the product thereof. J. P. Carmichael, Milwaukee, Wis. U.S. Pat. 1,128,287, Feb. 16, 1915. Date of appl., July 17, 1912.

SUITABLE fibre, impregnated with about its own weight of a solution of alkaline-earth or magnesium nitrate (which may also contain a nitrate of a rare earth metal) is dried and calcined, and the ash strongly ignited. The dry product is used for polishing the enamel of teeth, etc.—W. E. F. P.

Hydrogen peroxide solution. J. A. Trimble, Brooklyn, N.Y. U.S. Pat. 1,128,637, Feb. 16, 1915. Date of appl., Sept. 4, 1914.

A SOLUTION of hydrogen peroxide containing einchonidine; for example, one part of einchonidine to twenty thousand of 3% peroxide solution.—F. SODN.

Silicates containing potassium and aluminium; Process of decomposing natural—. Process of producing salts of potassium and aluminium and fixed nitrogen compounds. S. Peacock, Chicago, Ill., Assignor to Internat. Agricultural Corporation, New York. U.S. Pats. (A) 1,129,221, and (B) 1,129,721, Feb. 23, 1915. Dates of appl., July 8, 1912, and Aug. 14, 1913.

(A) THE silicate rock, mixed with carbon, is heated to above 1600° C. in the presence of nitrogen (substantially free from oxygen), and the carbonitrides of potassium and aluminium thus formed are removed by a current of nitrogen. (B) A mixture of carbon and a silicate containing potassium and aluminium is heated in an atmosphere of nitrogen to below 1600° C., and the products are collected and heated in the presence of steam.—F. SODN.

Potassium and aluminium; Process for separating — from their silicate combinations. S. Peacock, Chicago, Assignor to International Agricultural Corporation, New York. U.S. Pat. 1,129,505, Feb. 23, 1915. Date of appl., July 8, 1912.

SILICATES containing potassium and aluminium are heated with carbon in the presence of nitrogen at 1200° to 1400° C., and the reaction products are distilled off under diminished pressure. (See also following abstract.)—W. H. H. N.

Silicon compounds and by-products; Process for making—. S. Peacock, Chicago, Assignor to International Agricultural Corporation, New York. U.S. Pat. 1,129,506, Feb. 23, 1915. Date of appl., July 17, 1912.

A MIXTURE of finely divided felspar and carbon is heated in the presence of nitrogen to 2500° C.

Potassium and aluminium are removed in the form of gaseous carbonitrides, and the residue is further heated to form a compound containing silicon and carbon. The separated potassium and aluminium carbonitrides are treated with superheated steam.—W. H. H. N.

Phosphorus; Process of separating— from its phosphale combinations. S. Peacock, Chicago, Assignor to International Agricultural Corporation, New York. U.S. Pat. 1,129,504, Feb. 23, 1915. Date of appl., July 8, 1912.

PHOSPHATES are heated with carbon in an atmosphere of nitrogen at 900° — 1300° C. and the reaction products are distilled off under diminished pressure. Carbide of phosphorus is first formed, and is subsequently converted into nitrides.

—W. H. H. N.

Volatile compounds [phosphorus and carbonitrides]; Mixed—and process of producing same. S. Peacock, Chicago, Assignor to International Agricultural Corporation, New York. U.S. Pat. 1,129,514, Feb. 23, 1915. Date of appl., April 18, 1914.

PHOSPHATE rock and carbon are mixed in suitable proportions and heated in nitrogen to 1500° C. The resulting phosphorus and carbonitride vapours are removed under diminished pressure and are separated by oxidising the former and passing into water. The carbonitride is decomposed to ammonia by heating the solution to 200° C.

—W. H. H. N.

Oxides of phosphorus and nitrogen compounds; Process of producing— S. Peacock, Chicago, Ill., Assignor to International Agricultural Corporation, New York. U.S. Pat. 1,129,722, Feb. 23, 1915. Date of appl., Aug. 14, 1913.

A MIXTURE of natural phosphate and carbon is heated in an atmosphere free from oxygen, and the gases produced are burnt with an excess of air.—F. SODX.

Boron carbonitride; Process for producing— S. Peacock, Chicago, Assignor to International Agricultural Corporation, New York. U.S. Pat. 1,129,508, Feb. 23, 1915. Date of appl., Sept. 7, 1912.

BORON oxide and carbon are mixed, briquetted, and heated in nitrogen to form $B_2N_2C_3N_4$, which is cooled in the presence of nitrogen.—W. H. H. N.

Alkali carbonitride; Process for producing— S. Peacock, Chicago, Assignor to International Agricultural Corporation, New York. U.S. Pat. 1,129,510, Feb. 23, 1915. Date of appl., Sept. 7, 1912.

ALKALI oxide and carbon are mixed, briquetted, and heated in nitrogen to the temperature of formation of the carbonitride, e.g., $K_2N_2C_3N_4$, and the product is cooled in nitrogen.—W. H. H. N.

Alkaline silicates [sodium silicate]; Solution of—and process of preparing the same. J. G. Vail, Chester, and J. D. Carter, Lansdowne, Pa. U.S. Pat. 1,129,320, Feb. 23, 1915. Date of appl., Oct. 22, 1913.

A SOLUTION, forming an almost insoluble product on drying, composed of a neutralised solution of a silicate (e.g., sodium silicate) to which has been added a concentrated alkaline solution of a silicate.

—F. SODX.

Ammonia; Apparatus for condensing—from a gaseous to a liquid state. H. C. Gardner, Chicago, Ill. U.S. Pat. 1,129,477, Feb. 23, 1915. Date of appl., Nov. 13, 1913.

A COOLING liquid is discharged on to a coil fixed in a vertical plane and provided with an outlet for the condensed liquid at the bottom, an outlet for uncondensed gases at the top, and an inlet for the gas to be condensed at an intermediate point. The lower portion of the coil is connected by a pipe with the portion above the gas inlet, so that partially condensed gases in the lower portion are separated from the liquid and conducted to the upper portion of the coil, where they are further cooled and partly liquefied, and intermingle with the incoming gases.—F. SODX.

Ammoniacal liquor; Process for destroying the malodorous gases and vapours produced in the distillation of— J. Becker. Ger. Pat. 278,776, June 21, 1913.

THE gases are burnt in the known manner to yield sulphur dioxide, which is brought into contact with the condensed water from the ammonia still in a trickling tower. The sulphur dioxide reacts with the hydrogen sulphide in the condensed water to form sulphur.—A. S.

Ammonium sulphate; Manufacture of— Bambach und Co. Ger. Pat. 279,953, April 23, 1914.

AMMONIUM sulphate is produced by the interaction of an alkaline-earth sulphate and ammonium sulphite or bisulphite or substances capable of yielding the same. The reaction is preferably carried out in a saturated solution of ammonium sulphate, and the alkaline-earth sulphite which is formed is subsequently decomposed with an acid or a solution of an acid salt. When the process is used to recover ammonium sulphate from gases containing ammonia and sulphur dioxide, e.g., in coking installations, gas-works, and the like, the counter-current method of working is adopted.—A. S.

Alkali halides; Process for obtaining—from natural double silicates. R. van der Leeden. Ger. Pat. 278,259, March 21, 1914. Addition to Ger. Pat. 267,867 (this J., 1914, 865).

NATURAL double silicates (e.g., leucite) with or without addition of reducing agents, are treated with a quantity of a halogen sufficient only to combine with the alkali metals, and the whole is heated under pressure. Substances such as silica, alumina, etc., capable of acting as halogen-carriers, may be added.—A. S.

Crystallising apparatus for potassium chloride solution and other solutions of the potash industry. W. Häberlein. Ger. Pat. 279,311, Aug. 15, 1913.

THE long crystallising chamber is provided with narrow, vertical cooling boxes and with a trough at the bottom connected with a tubular extension outside the chamber. A mechanical conveyor passes through the trough and the extension. The latter is in two parts, of which one is perforated. The crystals are removed from the trough by the conveyor and are compressed in the first non-perforated portion of the extension, thus preventing outflow of the solution. In the second, perforated portion of the extension most of the solution carried along by the crystals escapes through the perforations, so that comparatively dry crystals are delivered by the conveyor into an elevator adjacent to the end of the extension.—A. S.

Potassium salts; Process for cooling hot solutions of — to obtain large crystals. W. Häberlein. Ger. Pats. (A) 280,089, July 19, 1913, and (B) 280,090, Jan. 21, 1914.

(A) THE solution is cooled in troughs provided with narrow cooling boxes supplied at first with water at a temperature only slightly lower than that of the solution to be cooled. The temperature of the cooling water is then lowered progressively by introducing gradually increasing quantities of cooler water. (B) After emptying a trough, the cold water in the cooling boxes is displaced by warmer water, a quantity of hot water is added, and the hot solution of potassium salts is introduced gradually into the trough; the temperature of the water in the cooling boxes is then reduced progressively by introducing increasing quantities of cooler water.—A. S.

Alkali chloride solutions; Electrolysis of —, using a mercury cathode and a porous diaphragm. Hoesch und Co. Ger. Pat. 279,998, April 25, 1913.

THE electrolyte is circulated from the cathode chamber through the diaphragm into the anode chamber, whence it is withdrawn and passed to the saturating apparatus and then back to the cathode chamber; or a portion only of the liquid in the cathode chamber may be circulated in this way.—A. S.

Seaweeds; Treatment of —. C. Christiansen. Ger. Pat. 279,312, March 28, 1912.

THE seaweed is fermented with a culture of organisms (chiefly *Oidium lactis* and *Aspergillus glaucus*, with smaller quantities of lactic bacteria) obtained from decomposing seaweed, the cellulose-containing residue is separated and washed with an alkaline solution and with water, and the solution is treated in the known manner for the recovery of alkali salts, pectin substances, etc. Fermentation is preferably conducted under diminished pressure, and the seaweed may be submitted to a preliminary treatment with acid or alkaline solutions.—A. S.

Hydrosulphites; Preparation of anhydrous —. Chem. Fabr. Griesheim-Elektron. Ger. Pat. 279,389, Sept. 28, 1913. Addition to Ger. Pat. 267,872.

A MODIFICATION of the process described in the chief patent (see Fr. Pat. 460,610 of 1913; this J., 1914, 76), the last portions of the water being expelled by heating the hydrosulphite at 60°–65° C., in presence of aniline or an equivalent organic base.—A. S.

Sodium hydrosulphite; Preparation of anhydrous —. Kinzlberger und Co. Ger. Pat. 280,181, Nov. 10, 1912.

ANHYDROUS sodium hydrosulphite is obtained as an insoluble precipitate by the interaction of zinc hydrosulphite or zinc-sodium hydrosulphite and sodium acetate in alcohol.—A. S.

Oxides or hydroxides of heavy metals practically free from basic salts; Process for obtaining —. F. Cochlovius. Ger. Pat. 279,426, May 14, 1913. Addition to Ger. Pat. 272,182 (this J., 1914, 550).

PRECIPITATES of basic salts obtained by treating a solution of a salt of a heavy metal with a quantity of a basic substance at least equivalent to the metal content of the solution, are heated at a moderate temperature, below the boiling point of the salt, e.g., at 500° C., and then lixiviated with water. To effect a separation in the case of solutions of mixed salts, a quantity of basic substance equivalent only to the metal to be separated, is used.—A. S.

Hydrogen; Production of — from mixtures of carbon monoxide and steam with the aid of a catalyst. Badische Anilin und Soda Fabrik. Ger. Pat. 279,582, June 24, 1913.

CONTACT masses are used containing activating substances, especially oxygen compounds of chromium, thorium, uranium, beryllium, antimony, and the like, or mixtures of these, in addition to the usual catalysts: with such contact masses the reaction is practically quantitative at a relatively low temperature; the contact mass during preparation or use should not be heated above 600° C. Small quantities of carbon monoxide may be readily removed from gaseous mixtures with the aid of the contact masses described.—A. S.

Hydrogen; Production of — by the action of steam on heated metals. W. Näher and M. Nöding. Ger. Pat. 279,726, Aug. 7, 1913.

STEAM free from air is superheated to about 1000° C. and passed successively over copper and iron, in the order given, in a retort heated to about 800° C. To regenerate the metals from the oxides produced, the undecomposed steam from the retort is converted into water-gas, which is passed first over the iron oxide and then over the copper oxide. The gases from the retort are led again into the water-gas generator to reduce carbon dioxide to monoxide, and this circulation is continued until the reduction of the metal oxides is complete and carbon dioxide is no longer formed, whereupon steam is again led through the retort to produce hydrogen. Since 1 vol. of carbon dioxide yields 2 vols. of monoxide, the water-gas generator is provided with a valve by means of which a certain proportion of the gas can be withdrawn to be used as fuel.—A. S.

Radioactive preparation suitable for yielding a solution of thorium-X; Production of a —. Kunheim und Co. Ger. Pat. 279,956, Nov. 30, 1913.

A PURIFIED neutral solution of radiothorium, containing small quantities of rare earths, is treated with hydrogen peroxide, whereby the radiothorium is precipitated as hydrated peroxide. The precipitate can be readily separated by filtration after standing a short time, and the thorium-X generated by disintegration of the radiothorium can be removed by extraction with a dilute solution of sodium chloride.—A. S.

Sodium sulphate or the like; Process and furnace for the manufacture of —. Chem. Fabr. Rhenania, C. Thelen, and F. Wolf. Ger. Pat. 279,997, June 4, 1913.

THE charge is heated in a pear-shaped "pan" mounted horizontally and provided with a screw agitator, and then, by rotating the screw in the opposite direction, is forced rapidly through an opening in the narrow end of the pan into the roaster. The material is delivered on to the circular muffle-hearth of the roaster at the centre and is moved across the hearth to a discharge opening at the periphery by mechanical scrapers.—A. S.

Magnesium carbonate; Process for obtaining — from minerals containing magnesium and calcium. A. Hambloch. Ger. Pat. 280,084, Sept. 27, 1913.

MINERALS such as magnesite, dolomite, or magnesium silicates are ignited, with or without addition of lime or limestone, the product is treated with ammonium carbonate solution at the ordinary temperature to dissolve magnesia, and the resulting solution is heated to precipitate magnesium carbonate.—A. S.

Sulphuric acid; Apparatus for the manufacture of —. E. Packard and Co., Ltd. Fr. Pat. 472,366, May 19, 1914. Under Int. Conv., May 23, 1913.

SEE Eng. Pat. 12,067 of 1913; this J., 1914, 692.

Acetic acid from acetylene; Process for producing —. C. Hansen and A. Weindel, Leverkusen, Germany, Assignors to Synthetic Patents Co., New York. U.S. Pat. 1,128,780, Feb. 16, 1915. Date of appl., Jan. 16, 1914.

SEE Fr. Pat. 467,515 of 1914; this J., 1914, 830.

Titanium oxygen compounds; Manufacture of — from ilmenite, titaniferous iron ores, and other titaniferous materials. P. Farup, Trondhjem, Norway. Eng. Pat. 15,680, June 30, 1914. Under Int. Conv., July 1, 1913.

SEE Ger. Pat. 276,025 of 1913; this J., 1914, 920.

Hydrogen; Process of producing —. A. Mittasch and C. Schneider, Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen, Germany. U.S. Pat. 1,128,804, Feb. 16, 1915. Date of appl., Oct. 20, 1913.

SEE Fr. Pat. 463,114 of 1913; this J., 1914, 313.

Hydrogen from iron ore and steam; Reducing and oxidising apparatus for generating —. H. Dicke, Assignor to Berlin-Anhaltische Maschinenbau-A.-G., Berlin. U.S. Pat. 1,129,559, Feb. 23, 1915. Date of appl., Dec. 6, 1913.

SEE Eng. Pat. 28,390 of 1913; this J., 1914, 256.

Ammonia; Production of —. C. Bosch and A. Mittasch, Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen, Germany. U.S. Pat. 1,128,843, Feb. 16, 1915. Date of appl., Nov. 11, 1912.

SEE Eng. Pat. 3345 of 1912; this J., 1912, 1031.

Peroxide of hydrogen; Process of making —. F. Fischer, Charlottenburg, Assignor to Henkel und Co., Dusseldorf, Germany. U.S. Pat. 1,128,966, Feb. 16, 1915. Date of appl., May 7, 1913.

SEE Eng. Pat. 8582 of 1913; this J., 1913, 791.

Silicon carbonitride, aluminium carbonitride, and calcium carbonitride; Process of producing —. S. Peacock, Chicago, Assignor to International Agricultural Corporation, New York. U.S. Pats. 1,129,507, 1,129,509 and 1,129,511, Feb. 23, 1915. Dates of appl., Sept. 7 and 19, 1912.

SEE Eng. Pat. 11,390 of 1912 and Fr. Pat. 458,168 of 1913; this J., 1913, 699, 1067.

Nitrogen compounds; Manufacture of —. T. Fujiyama. Fr. Pat. 471,377, April 27, 1914.

SEE U.S. Pat. 1,126,000 of 1915; this J., 1915, 283.

Fluoric acids; Preparation of salts of complex —. Gebr. Siemens und Co. Fr. Pat. 471,482, April 29, 1914. Under Int. Conv., April 30, 1913.

SEE Ger. Pat. 279,011 of 1913; this J., 1915, 230.

Electric furnace. Process of making [nitrogen] compounds in electric furnaces. U.S. Pats. 1,129,512 and 1,129,513. See XI.

VIII.—GLASS; CERAMICS.

Silicidised carbon. Silfrax. Tone. See VII.

Molecular structure of isotropic and anisotropic binary mixtures [silica-boric oxide glasses]. Tammann. See XXIV.

PATENTS.

Tunnel kiln for glazing and enamelling tiles and for like purposes. G. Andia, Turin, and J. W. Bottomley, Leeds. Eng. Pat. 6818, March 18, 1914.

THE kiln contains several tiers of muffles arranged longitudinally, separated by flues, and surrounded at their middle portions by a series of transverse heating-chambers through which the gases from an adjacent furnace are led in zig-zag fashion around the tiers towards the charging end of the kiln. The supply of air to the various flues is so controlled that the charge in each muffle attains a maximum temperature at the middle of the kiln and is gradually cooled towards the discharge end.
—W. E. F. P.

Refractory materials with a basis of molten bauxite. N. Leccesne. Fr. Pat. 471,513, April 29, 1914.

ANTHRACITE is mixed with three times its weight of bauxite and heated in a furnace by an air blast at a pressure of 50 grms. (1 m. water column) to start and gradually rising to 200 grms. or even to 500 grms. The temperature rises rapidly, the charge decrepitating strongly until the combined water has been removed, and with the formation of aluminium carbide the mass becomes incandescent, the silica is volatilised, and the iron is reduced and thrown off as sparks. The heat of reaction is sufficient to raise the temperature of the charge to about 3000° C. and to melt the bauxite completely. Blowing is continued until nearly all the anthracite has been burned off and to cool the charge, which is afterwards removed and crushed, and freed from iron by means of magnets. The product is very porous and of low density (1500 to 1700 grms. per litre). To make impervious refractory articles, it is mixed with water, ground quartz, and a little quicklime; the two last combine and form a bond. For porous refractory goods, finely ground, pure, raw bauxite is used as bond, e.g., 3 to 9 vols. of fused bauxite to 1 vol. of raw bauxite. The mixture is shaped by means of powerful presses, then dried and burned; the finished goods may be used for making abrasive wheels.—A. B. S.

Porcelain insulators; Method of manufacturing —. W. Boehm, Charlottenburg, Germany. U.S. Pat. 1,128,747, Feb. 16, 1915. Date of appl., Feb. 24, 1913.

SEE Fr. Pat. 462,857 of 1913; this J., 1914, 321.

Enamel, glass, and the like; Manufacture of white —. I. Kreidl, Vienna. U.S. Pat. 1,128,691, Feb. 16, 1915. Date of appl., March 15, 1913.

SEE Addition of Jan. 18, 1913, to Fr. Pat. 438,908 of 1912; this J., 1913, 753.

Enamel; White —. I. Kreidl, Vienna. U.S. Pat. 1,129,300, Feb. 23, 1915. Date of appl., Sept. 20, 1912.

SEE Fr. Pat. 438,908 of 1912; this J., 1912, 643.

Coke oven doors and like doors. Eng. Pat. 6020. See IIA.

IX.—BUILDING MATERIALS.

Gypsum; The products of dehydration of —. R. Grengg. Z. anorg. Chem., 1914, 90, 327—360.

THE different products obtained by the dehydration of gypsum may be identified by placing a small quantity of the powder in paraffin oil on a microscope object glass, covering with a cover-glass, and heating. In the case of stucco plaster, steam is evolved and soluble anhydrite, recognisable by its ill-defined contour, is formed. With dead-burnt plaster the same structure of the grains is observed as with stucco plaster, but there is no evolution of steam and no change of optical properties (increase of double refraction, considerable diminution in refraction) such as is associated with the formation of soluble anhydrite. Flooring plaster burnt to the point of sintering has a basic reaction and when it is triturated with water hard grains can be observed, which mostly exhibit strong double refraction, though some may show only slight double refraction or even single refraction; the structural elements of stucco plaster are no longer visible, or, if the flooring plaster has been burned at a relatively low temperature, are present only in a partially sintered form and mostly permeated by isotropic droplets; no steam is evolved on heating. Standard preparations should be made for comparison: the pure hemihydrate is prepared by digesting precipitated calcium sulphate with concentrated nitric acid; this yields first soluble and then insoluble anhydrite when heated in paraffin oil on the microscope object glass. Dead-burnt plaster is obtained by heating the hemihydrate in a crucible at a dull red heat, and flooring plaster by heating to incandescence. The author's conclusions in regard to the dehydration of gypsum agree in the main with those of von Glasenapp (this J., 1908, 538).—A. S.

Plaster of Paris; Hygroscopic and total water in —. E. Canals. J. Pharm. Chim., 1915, 11, 118—122.

THE uncombined water in plaster of Paris can be determined by drying 5 grms. spread out on a Petri dish, for two hours at 50° C., taking precautions to prevent free access of air to the dried powder before and during weighing. Free and combined water is determined by heating the plaster for a short time at 150° and then for an hour at 300° C. in an Erlenmeyer flask on a sand bath, the sand being piled up to the top of the flask, which must be closed with a cork as soon as the heat is withdrawn and only opened momentarily afterwards in a desiccator to equalise the pressure when cold. Surgical and other fairly pure plasters were found to contain about 1% of hygroscopic water and 6.7—8.1% total water. Samples of lower quality contained less water, generally about 3%.—G. F. M.

Cement trade of Brazil. J. Roy. Soc. Arts, Mar. 26, 1915.

THE imports of cement into Brazil have increased from 92,575 tons in 1904 to 260,010 tons in 1910, 364,251 tons in 1912, and 457,986 tons in 1913. The average annual imports from various countries are as follows:—Germany, 129,853 tons; Great Britain, 85,808 tons; Belgium, 54,856 tons; France, 8148 tons; United States, 7160 tons; Denmark 5079 tons; Austria Hungary, 2526 tons. The American brands known as the "Lehigh" and the "Atlas," in barrels of 150 kilos. (about 3 cwt.) are in good demand, at a price of about \$s. 5d. per barrel in Rio de Janeiro. Cement imported from the United States enjoys a reduction of 20% off the Customs duty.

PATENTS.

Concrete; Waterproofing and strengthening compound for —. L. E. Levi, Milwaukee, Wis., Assignor to C. H. Propach, Chicago, Ill. U.S. Pat. 1,128,696, Feb. 16, 1915. Date of appl., Apr. 29, 1912.

CALCIUM chloride is added to a solution containing 30 parts of resin dissolved in sodium carbonate, 70 of soap, and 5 of carnauba wax; the precipitate is filtered off, dried, and pulverised for use.

—W. E. F. P.

Slag; Process for preparing — for the manufacture of mortar, etc. A. Deckers. Fr. Pat. 471,662, March 31, 1914.

GRANULATED slag is mixed with quicklime and the mixture is ground until a portion of the slag is converted into cement and can thus serve as a binder for the remainder, or the grinding may be continued until the whole mass is of the same degree of fineness as cement.—A. B. S.

Wood; Process of preserving —. R. I. Smith, Washington, Assignor to M. H. Smith and W. H. Knight, Takoma Park. U.S. Pat. 1,129,430, Feb. 23, 1915. Date of appl., Nov. 7, 1913.

THE wood is soaked in a solution of iron sulphate and then treated with a solution of copper sulphate.

—W. E. F. P.

Wood and other materials; Process for preserving — and rendering them non-inflammable. G. Clédat. Fr. Pat. 472,172, May 13, 1914.

THE articles are treated with a solution, saturated at 80° C., of equal parts of magnesium silicate, sodium phosphate, and borax, and then coated with water-glass.—A. B. S.

Cement. J. H. Amies, Philadelphia, U.S.A. Eng. Pat. 5242, Feb. 28, 1914.

SEE U.S. Pats. 1,087,914 and 1,088,646 of 1914; this J., 1914, 356.

Stone; Artificial —. J. Billwiller, Goldach, Switzerland. U.S. Pat. 1,129,060, Feb. 23, 1915. Date of appl., May 18, 1912.

SEE Fr. Pat. 443,991 of 1912; this J., 1912, 1130

Refractory products. Comp. Franç. pour l'Exploit. des Proc. Thomson-Houston. Fr. Pat. 471,514, April 30, 1914. Under Int. Conv., May 2, 1913.

SEE U.S. Pat. 1,094,352 of 1914; this J., 1914, 594.

Apparatus for granulating liquid blast-furnace slag. U.S. Pat. 1,128,829. Sec X.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Ferrovandium; Determination of manganese in —. W. W. Clark. Met. and Chem. Eng., 1915, 13, 155—156.

0.2 GRM. of finely powdered alloy is dissolved in 5 c.c. of nitric acid (1:1) and 5 c.c. of sulphuric acid (1:1), with the addition of a little hydrofluoric acid if necessary. The solution is boiled vigorously, treated with 10 c.c. of silver nitrate solution (1.25 gm. per litre) and an excess of solid ammonium persulphate, again heated to boiling, and cooled at once in cold water; after adding a

few drops of saturated solution of salt, the permanganic acid is titrated with sodium arsenite solution. If the manganese content be above 5%, the solution is diluted and an aliquot portion treated with silver nitrate and ammonium persulphate. A determination may be made in about 15 minutes.—W. R. S.

[Cyanide treatment of low-grade Cobalt silver ores.] *Mill and metallurgical practice of the Nipissing Mining Co., Ltd., Cobolt, Ontario.* J. Johnston. Trans. Canadian Min. Inst., 1914, 17, 64—92.

CYANIDE treatment of the low-grade ores was adopted in preference to concentration because the higher cost of construction of the plant was more than balanced by the increased extraction; certain arsenic-antimony-silver combinations and decomposed silver minerals found in some veins give poor results by concentration but yield over 90% of their silver to cyanide. The ore is crushed in a 0.25% caustic soda solution with the addition of 5 lb. of lime per ton of ore to facilitate subsequent settling of the slimes. The pulp is ground to slime in tube mills working in conjunction with Dorr classifiers and is then subjected to a wet desulphurising process by passing it first through a tube mill containing ingots of aluminium and then through an aluminium-lined tank in which it is slowly agitated. By this treatment the refractory silver minerals are broken down and the silver left in a spongy metallic state, so that the subsequent extraction by cyanide is accelerated and improved. The slime from the desulphurising apparatus is dewatered in a Butters vacuum filter to remove as much as possible of the caustic soda solution, and is then subjected to cyanide treatment in tanks fitted with mechanical stirrers and with an air-lift device: the cyanide solution contains 0.25% KCN and 0.20% NaOH, 2 tons being used per ton of dry slime, and agitation is continued for 48—60 hours. After settling and withdrawing the clear solution, the residual slime is transferred to a cyanide stock pulp tank and then to a Butters vacuum filter. Silver is precipitated from the cyanide solution by means of aluminium dust (see Hamilton, this J., 1913, 660) and the precipitate is smelted and refined in a reverberatory furnace, yielding bullion 997—999 fine (see Watson, Eng. and Min. J., Dec. 7, 1912). The cost of construction of the plant, which has a capacity of 244 tons of ore per day, was 254,840 dollars (about £53,090), and the working costs are less than 3 dollars (12s. 6d.) per ton, whilst the extraction on ore containing 26 oz. Ag per ton is 92—93%.—A. S.

Lead; Desilverisation of—F. C. Newton. Amer. Inst. Min. Eng., Feb., 1915. Met. and Chem. Eng., 1915, 13, 181.

ATTEMPTS were made to effect a higher concentration of the silver and reduce the amount of zinc used in the Parkes process by working at a higher temperature with a view to obtain the compound, Zn_3Ag_2 (solidif. pt., 665°C.) in the crust. The tests proved, however, that a higher temperature was prejudicial to the process: the silver content of the crust was lower, dross and blue powder more abundant, the fuel consumption higher, and the life of the kettle shorter, than in current practice.—W. R. S.

Copper anodes; Formation of a badly conducting film on— in copper cyanide solutions. W. L. Miller. Trans. Amer. Electrochem. Soc., 1914, 26, 63—66.

In thirteen different copper cyanide electrolytes, under similar conditions as regards circulation, films of insoluble copper salts were formed on the anodes as the result of local concentration of copper in the solutions; the current densities at

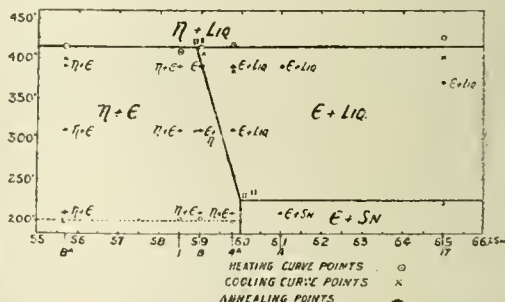
which the films appeared varied in the same manner as the relative amounts of a normal copper salt required to effect a slight precipitation in the electrolytes, and the upper limit of anodic current density economically possible with any similar electrolyte could be ascertained by determining the volume of cupric chloride solution required to produce a precipitate in 5 c.c. of the liquid. The use of a higher current density is rendered possible by addition not only of cyanide but also of ammonia or any other substance capable of keeping the copper in solution.—W. E. F. P.

Corrosion [of brass]; The micro-chemistry of—. Part III. *The $\alpha\beta$ alloys of copper and zinc.* S. Whyte. Inst. of Metals, March, 1915. [Advance proof.] (See also this J., 1914, 358; 1915, 258.)

FOUR alloys of copper and zinc containing about 60% Cu were subjected to electrolytic corrosion by an applied electromotive force in sodium chloride solution. One alloy containing only copper and zinc was tested in the unannealed state and also after annealing at 575°C. The other three alloys contained about 1% respectively of Fe, Pb, and Sn, and were all annealed at 575°C. for 1½ hours. The total corrosion of these $\alpha\beta$ alloys was found to be much less than that of simple β alloys, but more than that of simple α alloys. Corrosion first proceeded through the β areas and then spread to the α areas; it still penetrated the β areas in advance after the surface action had ceased. The unannealed alloy was more corroded than the same alloy annealed; iron and lead both accelerated corrosion; tin gave an increase in a five-minute test, and a decrease in a sixty-minute test, due to the retarding action of a tough compact layer of basic salts. In the case of two $\alpha\beta$ alloys corroded in service, the nature of the corrosion was similar to that induced by an applied electromotive force. "Pitting" is considered to be the result of rapid dezincification, loose porous copper being left behind which is easily removed mechanically.—T. St.

Copper with tin; Constitution of the alloys of—. Parts I. and II. J. L. Haughton. Inst. Metals, March, 1915. [Advance proof.] 23 pages.

THE equilibrium diagrams of Cu-Sn alloys suggested by previous workers, although agreeing in broad outline, differ considerably in several parts of the



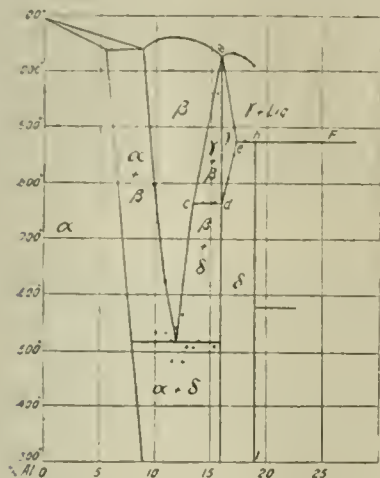
field, notably as regards the range and position of the ϵ region, designated H by Heycock and Neville (this J., 1901, 814). The results of the author's study of this region are shown in the accompanying diagram. It is pointed out that neither Shepherd and Blough nor Hoyt (J. Phys. Chem., 1906, 515; this J., 1913, 1112) published any micrographs, so that the evidence for their diagrams cannot be weighed; and that the alloys investigated by Giolitti and Tavanti (this J., 1908, 1155) were evidently not in equilibrium. According to the present diagram ϵ is first formed at

415° C. and Sn 59%, and the point H'' occurs at Sn 60%; whereas according to Heycock and Neville ϵ is formed at 400° C. and Sn 61.1% and the line H'H'' meets the eutectic line at Sn 65%. The methods employed by Heycock and Neville are criticised and their conclusions regarded as based on scanty and unsatisfactory evidence.

—W. E. F. P.

Copper-aluminium alloys: Some experiments upon
— J. H. Andrews. Inst. of Metals, March,
1915. [Advance proof.] 14 pages.

The accompanying diagram is suggested for alloys containing up to 20% Al. The existence of the line de found by Carpenter and Edwards (this J., 1907,



153, 206) but ignored by Curry (this J., 1907, 1241) is confirmed; it separates the γ from the δ phase, whereas the line dc separates the $\beta + \gamma$ from the $\beta + \delta$ phases, δ being the γ^1 constituent of Carpenter and Edwards. In the author's view, the β constituent (which according to Curry breaks down into $\alpha + \gamma$ at about 570° C, but according to Carpenter and Edwards exists down to normal temperatures) breaks down into $\alpha + \gamma$, and γ afterwards changes into δ . The low point at 480° C. and 12.5% Al is due entirely to supercooling caused by retardation of the decomposition of β into $\alpha + \delta$; at 13.5% Al, δ is formed directly from the γ constituent previously deposited at 766° C., so that, in alloys containing more than 13.5% Al, free δ is already present when the decomposition of β sets in and there is little tendency towards supercooling. The evolution of heat noted by Carpenter and Edwards as occurring at 290° C. in alloys containing 9—16% Al, is confirmed by the author and also regarded as due to supercooling.—W. E. F. P.

Copper-nickel-cobalt alloys. M. Waehlert. Oesterr. Zeits. Berg- u. Hüttenw., 1914, 62, 341—346, 357—361, 374—378, 392—395, 406—410. Z. angew. Chem., 1914, 27, Ref., 707—708.

MONEL metal, an alloy of about Cu 1 and Ni 3 parts, made direct from the Sudbury copper-nickel ores, has found extensive application in the United States, and as the separation of cobalt from the ores makes the cost of production of such alloys excessive, the author examined the influence of cobalt on copper-nickel alloys. It was found that the hardest ternary alloys were those containing nickel and cobalt in equal proportions. The alloys were tolerably resistant to sulphuric acid but were all attacked by nitric acid.—A. S.

Nickel-aluminium and copper-nickel-aluminium alloys; Properties of some [light]—. A. A. Read and R. H. Greaves. Inst. Metals, March, 1915. [Advance proof.] 52 pages.

A DETAILED investigation of the alloys of aluminium with nickel (1·4—4·3%) alone, and with copper (1—1%) and nickel (1—6%) together. All the alloys were easily machinable, but were harder and less ductile the higher the content of copper and nickel; malleability was reduced more by copper than by nickel. By the addition of nickel to aluminium, the maximum stress was increased at the expense of elongation and reduction of area, this being also the case with the alloys containing 1 and 2% Cu; in the 4% Cu series a general deterioration in properties was caused by the addition of up to 3·2% Ni, after which the maximum stress either remained constant or increased. The relative effects of copper and nickel, and the effects of variations in casting temperature and heat treatment of the alloys were also investigated; the conclusion that the properties were unaffected by quenching was confirmed by determinations of the hardness of annealed and quenched specimens. The elastic limit increased with the nickel content in the Ni-Al alloys and in the 2% Cu series, but not in those containing 4% Cu; a diminished resistance to alternating stress generally accompanied an increase in the total nickel and copper content. The specific gravities of the (chill cast) alloys varied from 2·725 to 2·870 (grms. per c.c.); the melting points from 619° to 652° C.; and the electrical conductivities from 46·5 to 55·6 (Cu=100) or from 77·8—93·2 (Al=100). The results of corrosion tests in fresh and sea water, and of microscopic examination of the alloys are also given: the nickel alloys were in all cases more resistant than those containing both copper and nickel.

—W. E. F. P.

Aluminium; Physico-chemical studies on the electrometallurgy of—. [Melting point and density of mixtures of cryolite, alumina, and calcium fluoride.] P. Pascal and M. Jouniaux. *Rev. Mét.*, 1914, 11, 1069–1093.

THE binary system cryolite-alumina forms a eutectic with Al_2O_3 24%, m. pt. 904°C ., composed of solid solutions containing Al_2O_3 20% and 29% respectively. The system cryolite-calcium fluoride forms a eutectic with CaF_2 24.4%, m. pt. 905°C ., composed of solid solutions containing CaF_2 20.5% and 50% respectively. The system CaF_2 - Al_2O_3 forms a eutectic with Al_2O_3 26.5%, m. pt. 1270°C ., composed of solid solutions containing Al_2O_3 20% and about 28.5% respectively. The ternary system forms a eutectic of the composition cryolite 59.3, CaF_2 23.0, and Al_2O_3 17.7%, the melting point being 868°C . The 950°C . isothermal on the derived liquidus roughly forms the boundary of all the mixtures used industrially as electrolytes for the manufacture of aluminium. Density determinations of the systems in the molten state were also made. The density of metallic aluminium at 950°C . is 2.365. Molten cryolite has a maximum density of 2.216 at 995°C ., i.e., a little above the melting point. Cryolite with 3% SiO_2 has a maximum density of 2.150 at 990°C .; with 12% CaF_2 2.310 at 985°C ., and with 25.4% CaF_2 a maximum of 2.474 at 1000°C . About 15% CaF_2 suffices to render the melt denser than the molten metal. The effect of added alumina is to lower progressively the temperature at which the maximum occurs. Cryolite with 24% Al_2O_3 has a maximum density of 2.260 at 935°C . Of the maxima given by different proportions of alumina, that with 13% Al_2O_3 has the lowest value, viz., 2.110, the temperature being about 960°C . With 28% Al_2O_3 the value of the

maximum density has risen to that of the metal. The ternary system was also studied, the results serving for the construction of the density surfaces for temperatures between 900° C. and 1100° C. The results show that at 950° C. all the mixtures actually employed have a density not exceeding 2.4. Owing to the inevitable presence of a little silica this figure is never actually reached, the consequence being that the density of the bath never exceeds that of the metal, which therefore collects at the bottom.—T. Sr.

Aluminium wire; Electrolytic insulation of—. C. E. Skinner and L. W. Chubb. Trans. Amer. Electrochem. Soc., 1914, 26, 137—147.

A NON-CONDUCTING film of alumina is produced on aluminium wire used as anode in an aqueous solution of borax, ammonium borate, or sodium silicate, the last giving the best results. The wire is passed continuously at a rate of from 40 to 150 ft. per min. according to its diameter, through a series of five tanks, the first and last of which contain hot water for washing. The consumption of energy varies from 0.15 to 0.80 watt-hour per sq. in. of surface treated; the energy required per unit of surface to bring the wire up to the required voltage (400—425) is less with a high than with a low current density. The non-conducting film, which varies in thickness from 0.0001 to 0.0004 in., is quite flexible and not appreciably weakened by bending, kinking, or stretching the wire; the dielectric strength of the film is high, since two wires, electrolytically treated and then twisted tightly together without abrasion, will stand from 200 to 500 volts without short circuiting. The coating is also fireproof and has sufficient mechanical strength to support the wire in small coils when the metal is above the melting point, the treated wire being thus particularly suited to cases where temperature requirements are severe and insulation requirements not excessive. (See Fr. Pats. 403,234, 419,961, 420,269, and 454,292; this J., 1909, 1317; 1911, 221, 372; 1913, 874.)—W. E. F. P.

Zinc-lime ore; Leaching a— with acids. O. C. Ralston and A. E. Gartside. Met. and Chem. Eng., 1915, 13, 151—154.

CERTAIN low-grade zinc ore deposits in Utah are replacements of zinc carbonate in limestone. An ore containing Zn 15.7, CaO 12.96, Fe 4.19, Pb 0.55, and Ag 0.30%, with Au 0.24 oz. per ton, was crushed to 150-mesh and leached cold with hydrochloric acid and with sulphuric acid in an agitator. The extraction of zinc was about the same by the two acids: 80% of the zinc was extracted with an acid efficiency of 50%, the latter being independent of the concentration. When less acid was used than was required to dissolve all the zinc, zinc and lime went into solution in amounts proportional to the percentages in which they were present in the ore. Tests indicated that it may be possible simultaneously to extract the gold by adding chlorine to the liquor.—W. R. S.

Tin from tin salts of mineral acids; Electrodeposition of—. F. C. Mathers and B. W. Cockrum. Trans. Amer. Electrochem. Soc., 1914, 26, 133—135.

NUMEROUS experiments were made with electrolytes containing 4% Sn as chloride, fluoride, perchlorate, or fluoborate with about 1% of the corresponding acid (and in some cases the corresponding ammonium salt also) and 0.05 to 0.5% of one or more of twenty-five different addition agents; a current density of 0.4 amp. per sq. dm. was employed. None of the deposits was entirely satisfactory: the best were obtained at the

ordinary temperature from stannous fluoborate baths saturated with clove oil or containing 0.1% of digitalin. and from stannous perchlorate baths containing 0.1% of phloridizin; these deposits were firm and free from loose projections, but very crystalline.—W. E. F. P.

Tin, tin ore, and tin chloride; Export of—. Board of Trade Announcement, March 18, 1915.

THE export of tin, chloride of tin, and tin ore to foreign destinations has been prohibited by Order of Council issued on March 18th. Applications for licences to export these commodities should be addressed on the proper form to the War Trade Department, at 4, Central Buildings, Westminster, London, S.W. Such applications will in general only be entertained if the goods are consigned (a) in the case of export to the Netherlands, to the Netherlands Oversea Trust; (b) in the case of export to the United States of America, to His Majesty's Consul General at New York. Exports to neutral European countries other than the Netherlands will only be sanctioned where the country to which the exports are consigned has prohibited the export of tin, chloride of tin, and tin ore.

Metals; The wet oxidation of—. Part III. Corrosion of lead. B. Lambert and H. E. Cullis. Part IV. Passivity. B. Lambert. Chem. Soc. Trans., 1915, 107, 210—218; 218—222.

PURE lead, which has been distilled in a vacuum, corrodes very rapidly when subjected to the action of pure water and pure oxygen within a short time of the distillation of the metal. Tests fail to show the presence of lead in solution before the addition of oxygen, and the rate of corrosion is enormously decreased if such lead is kept for long periods in water in a vacuum before adding the oxygen. The pure distilled lead resembles silver or mercury in appearance and colour, and, if kept for some months, can be exposed to air for many days without appreciable diminution of its brilliant metallic lustre, but more prolonged exposure causes the gradual formation of a dark-coloured oxide on the surface. The solution of the metal, which precedes corrosion, is due to electrolytic action between the electrically different parts of the mass of lead. With the chemically pure metal, the physical heterogeneity (due to the presence of different allotropic modifications) causes part of the mass to be electrically different from other parts, and these differences persist for a long time after its preparation. Hydrogen peroxide, produced in the wet oxidation, is the product of a subsidiary action, and has no direct bearing on the corrosion, though it plays a part in oxidising the monoxide to higher oxides.

Passivity is defined as the production, by some chemical or electrochemical process, of a physically homogeneous layer on the surface of the metal, of which the surface was originally physically heterogeneous. Experiments have shown that it is very difficult to explain the inactivity of the author's pure iron (this J., 1910, 1456), except on the assumption that it has a physically homogeneous, and therefore electrically equable, surface of metallic iron, and consequently possesses no tendency to pass into solution in an electrolyte. In a "bad" batch of iron prepared by the author's method, a very large proportion of the pieces can be made to lose their active character and become non-corrodible by keeping for several months either in dry air or in a vacuum, or by reheating for a long time at about 1000° C. in a current of pure dry hydrogen or in a high vacuum; in the last operation hydrogen is given off in considerable quantities.—B. N.

Mineral resources of German East Africa. Bull. Imp. Inst., 1914, 12, 585—599.

THE chief economic minerals of German East Africa are mica, gold, garnet, coal, iron ore, uranium minerals, trona, and salt. The most important deposits of mica are in the Uluguru Mountains, where the biotite gneiss, which is the predominant rock, is cut by numerous veins of pegmatite carrying mica associated with pitchblende, rutherfordine, samarskite, galena, blende, bismuthinite, copper and iron pyrites, arsenopyrite, garnet, and tourmaline. The greenish or greenish-brown mica is of the muscovite variety. It is equal to Indian muscovite and Canadian amber mica as an electrical insulator, but inferior to the best Indian ruby mica. The exports were 153,806 kilos. in 1912, nearly all of which went to Germany.

Alluvial gold deposits have been found in various parts and also gold-bearing quartz veins, but the latter, though fairly rich at and near the surface, are much impoverished even at shallow depths. The total output of gold was 450 kilos. in 1911 and 234 kilos. in 1912.

Garnets of value as gem-stones occur in the south-eastern part of the colony: the exports were 154 kilos. valued at about £576 in 1911, and 8 kilos. valued at £29 in 1912, all of which went to Germany.

Coal occurs in various parts, the most important deposits being in the Karoo beds to the north-west of Lake Nyasa, where in one section a seam 4.9 m. thick was found with two thin shale partings, 6 cm. thick together. The coal of this seam contains: C, 60.60; H, 3.00; O, 13.00; S, 0.25; H_2O , 4.33; and ash, 18.50%, and yields 78.7% of coke; the calorific value is 5657 calories. The coal from other seams contains up to 70% of carbon and in some cases as little as 5% of ash.

Iron ore also occurs in various parts. Samples of hæmatite and spathic iron ores contained 75.75% Fe_2O_3 and 47.95% FeO respectively. A sample of magnetite contained 65.52% Fe_3O_4 and 1.85% TiO_2 . Titaniferous iron ore containing up to 25% TiO_2 has also been found.

Specimens of radioactive uranium minerals which have been found had the following composition:—Uraninite (pitchblende): U_3O_8 , 89.47; PbO, 6.87; CaO, 0.82; SiO_2 , 0.52; FeO, 0.48; ThO₂, 0.20; H_2O , 2.03%. Rutherfordine: U_3O_8 , 83.8; CO₂, 12.1; PbO, 1.0; FeO, 0.8; CaO, 1.1; H_2O , 0.7; insol. residue, 0.8%. Samarskite (plumbonibite): Nb_2O_5 , 46.03; Ta₂O₅, 1.20; UO₂, 13.60; TiO₂, 0.90; Y₂O₃, 14.12; Fe₂O₃, 5.72; Al₂O₃, 0.17; PbO, 7.55; CuO, 1.21%.

Trona occurs abundantly as a white crystalline crust in Lake Natron, a large soda lake near the northern boundary of the colony: a sample gave on analysis 68.5% Na_2CO_3 and 29.5% H_2O . In 1912, 2000 tons of salt was obtained from salt springs in the Ujiji district: the spring water has the sp. gr. 1.1 and contains 11.6% NaCl; it has a strong odour of hydrogen sulphide.—A. S.

Zinc lead smelting; The commercial aspect of electric —. W. McA. Johnson. Trans. Canadian Min. Inst., 1914, 17, 107—129.

A DESCRIPTION of the smelting of complex zinciferous copper-lead ores, containing also silver and gold, in the Johnson electric furnace, and a comparison with the retort furnace method. The ores are roasted till they contain 4—6% S and then blended to give a mixture containing Zn, 15—40; Pb, 5—30; Cu, 1—5; Fe, 10—20; S, 3—7; SiO_2 , 10—30; Al_2O_3 , 3—5; and CaO, 3—7%. This is mixed with about 15% of soft coal and deoxidised and preheated in a muffle

furnace of the Hasenclever type, a final temperature of 850°—1040° C. being attained. From the preheater the charge is fed continuously into the electric furnace, which is of the buried arc type with the electrodes submerged in the slag and charge, and in which a temperature of 1225°—1250° C. is maintained in the fusion zone. In the preheater calcium and barium sulphates are converted into sulphides, and zinc sulphate into oxide, whilst ferric and copper oxides are reduced; 90—99% of the ferric oxide is reduced to metal. In the electric furnace the products are copper matte containing some of the silver and gold, lead bullion, and slag, whilst the reduced zinc passes as vapour through a brick-lined flue to a condenser. The metallic iron and copper act as deoxidising and desulphurising agents on the gases in the fusion zone of the furnace, and under these conditions up to 90% of the zinc vapour is deposited in the condenser in the molten metallic form. A highly fluid slag is produced which readily separates from the matte and base bullion. The average results of the analysis of about 6000 lb. of the slag were Zn, 0.65 and Cu, 0.12%; Ag, 0.15 oz. per ton; Pb and Au, nil. The electric furnace process possesses the advantages over the retort distillation method that ores containing iron, lime, and silica can be treated successfully; in the treatment of ores containing copper, lead, silver, and gold, these metals are recovered directly in marketable form; the labour cost per ton of material treated is less; the preliminary roasting need be carried on only till the sulphur content is reduced to 4—6%; the cost per ton of treating low-grade ores is less than in the case of high-grade ores, whereas the reverse is true in the retort distillation method. The electric furnace process should be specially serviceable for the treatment of copper-lead ores containing such a large percentage of zinc as to prevent their profitable treatment in the lead blast-furnace, and it may become even a more important factor in lead smelting than in zinc smelting. Some results obtained in practice with the electric furnace are tabulated in the form of a balance sheet, showing the amounts of zinc, lead, copper, silver, and gold charged into the furnace, and the quantities accounted for in the various products.—A. S.

Metals; The effects of heat and of work on the mechanical properties of —. A. K. Huntington. Inst. of Metals, March, 1915. [Advance proof.]

ALTERNATING-STRESS tests were made at temperatures up to 343° C. on rods of copper and on an alloy (Cu 95%) in which the added metals (Fe and Ni) were in solid solution; the revolutions for cracking and breaking were plotted against temperature. There appear to be five maxima and five minima in the curves, the curves for breaking and cracking being in every case almost exactly parallel. The lines leading to the maxima and minima respectively are also parallel to each other. The maxima and minima are greatly reduced by annealing, indicating the important part played by "work" in emphasising the transformation points. When plotted together on the same system, there is complete agreement between the alternating bending stress curves and the yield point and reduction of area in simple tension for the same metal. Several of the author's maxima and minima agree with the data obtained by other workers in other ways for various metals and alloys. The author considers that except in the case of phase changes in alloys, mechanical tests are to be preferred to heating and cooling curves as a means of studying changes of state with temperature.—T. St.

Etching reagents and their applications. O. F. Hudson. Inst. of Metals, March, 1915. [Advance proof.]

THE principal reagents which have been found specially suitable for different metals and alloys are the following:—*Copper.* Ammonia, ammonium persulphate, bromine (with ammonia), copper-ammonium chloride. *Brasses.* Ammonia, ammonium persulphate, copper-ammonium chloride, electrolytic etching, ferric chloride, chromic acid, nitric acid. *Bronzes.* Ammonia, ammonium persulphate, ferric chloride. *Copper-aluminium alloys (aluminium bronzes).* Ammonium persulphate, ferric chloride, copper-ammonium chloride, nitric acid. *German silver.* Ammonium persulphate, ferric chloride. *Nickel-copper alloys, monel metal, etc.* Electrolytic etching. *Gold and rich gold alloys, platinum and its alloys. Aqua regia (dilute).* Aluminium and light aluminium alloys. Sodium hydroxide, hydrochloric acid, hydrofluoric acid. *Lead, tin, and their alloys (white metal, etc.).* Chromic acid in nitric acid, ferric chloride, hydrochloric acid, nitric acid, silver nitrate. *Zinc and alloys rich in zinc.* Sodium hydroxide, iodine, Timoféef's reagent (94 grms. $\text{HNO}_3 + 6$ grms. CrO_3), a few drops in 50 c.c. of water. *Iron and steel.* Copper-ammonium chloride, copper chloride, hydrochloric acid in alcohol, iodine, nitric acid in alcohol, picric acid in alcohol.—T. St.

Alloys [and other metallurgical products] in the molten condition; Electrical conductivity of—. E. Bornemann and K. Wagenmann. *Ferrum*, 1914, 11, 276–282, 289–314, 330–343. *Z. angew. Chem.*, 1914, 27, Ref., 707.

FERROUS sulphide has a much higher electrical conductivity than cuprous sulphide. $2\text{Cu}_2\text{S} \cdot \text{FeS}$ is appreciably dissociated in the fused state even at relatively low temperatures, and the degree of dissociation increases rapidly with rise of temperature. The results obtained with Cu-Sn, Cu-Cd, and Cu-Zn alloys were analogous to those obtained previously by Bornemann and von Rauschenplat (this J., 1910, 884; 1912, 991) with Cu-Sb alloys. The existence of Cu_3Sn , Cu_3Cd , and Cu_2Zn was shown on the conductivity and temperature-coefficient curves. In the case of Cu-Al alloys indications were obtained of the existence of Cu_2Al and CuAl_2 but not of Cu_3Al . The temperature-coefficients of iron and aluminium in the molten condition are very small; that of silver is of the same order as the temperature-coefficients of solid metals.—A. S.

Mercury, copper, lead, molybdenum, tantalum, tungsten, and silver bromide; Compressibilities of—. T. W. Richards and E. P. Bartlett. *J. Amer. Chem. Soc.*, 1915, 37, 470–481.

THE compressibilities were determined at 20°C . in a steel piezometer at pressures ranging from 100 to 500 megabars with the following results: Cu 0.76, Pb 2.35, Hg 3.96, Mo 0.47, Ta 0.54, W 0.28, AgBr 2.70. These values, expressed in the megabar standard, multiplied by a million, are referred to the absolute value 0.61 for iron.

—J. R.

Gases; Determination of— in smelter flues; and notes on the determination of dust losses at the Washoe Reduction Works, Anaconda, Mont. E. M. Dunn. *Trans. Amer. Inst. Min. Eng.*, 1914, 46, 648–689.

Oxygen, carbon monoxide, and nitrogen. Twelve 16-oz. bottles, filled with mercury and supported in a strong, specially designed, two-deck rack, are used for taking samples, the last ten being analysed

in the usual way in a Hempel burette. *Water vapour* is determined by aspirating the gases through a filter of hot glass wool and then through weighed bulbs containing sulphuric acid. *Sulphur dioxide and trioxide and carbon dioxide.* The filtered gas is aspirated through four flasks in series, the first two containing iodine solution (about N/10) and the others a solution of barium hydroxide. The sulphuric acid in the first two flasks is precipitated by barium chloride, and the carbon dioxide is determined by titrating the barium hydroxide solution with standard oxalic acid. *Sulphur trioxide.* The Lunge-Reich and Hempel methods have been discarded in favour of the following method combined with the preceding test. The filtered gases are aspirated through four flasks in series containing weak barium chloride solution and 10–15% of hydrochloric acid. Dissolved sulphur dioxide is entirely removed by boiling, being wholly unoxidised to the trioxide if the solutions are protected from direct sunlight and the light of a free flame. The content of sulphur dioxide is obtained by difference. A specially designed box for carrying the absorption flasks and aspirator is described, and the precautions to be observed are discussed. *Arsenic trioxide* is absorbed in water, two absorption flasks in series being sufficient. Large carboys are used as aspirating bottles to deal with large volumes of gas, and a speed of 25 litres per hour may be used. The tube connecting the first flask with the flue must be washed out with warm sodium hydroxide solution to remove condensed arsenic trioxide. The "sulphate method" is used for the estimation of the arsenic. The following shows the order of the amounts determined:— SO_2 0.123–2.845, SO_3 0.0044–0.275, CO_2 0.1136–6.493, water vapour 1.061–3.869, As_2O_3 0.00073–0.0156, O_2 10.18–14.02, N_2 78.13–83.64%. *Dust losses.* The total volume of gas passing to the stack was determined from the velocity of the gas stream and the cross-sectional area of the free space in the flue. The velocity was measured by Pitot tubes with an Ellison differential draught gauge, and the area of the free space by soundings from holes made in the top of the flue. Dust determinations were made by drawing samples of the flue gas through a finely woven asbestos bag filter by means of an electrically driven rotary blower fan. Runs of 100–120 minutes were made, during which time about 10,000 cb. ft. of gas (standard conditions) passed through the filter, yielding from 400 to 500 grms. of dust. The precautions taken to ensure accuracy, and the methods of calculation are described at length.—T. St.

Arsenic trioxide from flue dust. J. O. Elton. *Trans. Amer. Inst. Min. Eng.*, 1914, 46, 690–702.

ARSENIC trioxide is recovered from flue dust or fume by volatilisation, the product obtained by a single roasting or distillation being classed as "crude arsenic." A second distillation gives a refined product often containing 99.97% As_2O_3 . Muffle tests in which time and temperature were varied showed that below 1200°F . (649°C .) the proportion of arsenic trioxide recovered is practically constant. Above this temperature lower yields are obtained owing to the formation of arsenates. Roasting with pyrites and powdered coke showed that when arsenic is once "burned in" (i.e., converted into arsenates), it is not liberated again below about 1600°F . (870°C .) The best results are obtained at 950°F . (510°C .) at which temperature arsenic pentoxide and pentasulphide break down and the trioxide is volatilised; only a small amount of sulphur trioxide is liberated, and the metallic oxides have a very low vapour pressure. The gas must be

cooled to 250° F. (121° C.) to obtain complete condensation of the arsenic trioxide. The furnace should have a large capacity; large hearth area, with means for constantly shifting the surface of the dust; intimate contact of the hot gas with the dust, preferably a constant falling of the hot dust through a slow-moving current of the hot gas; continuous operation, with sealed feed and residue-discharge openings; gradually increasing temperature of the dust towards the residue-discharge end. The length of time the dust should remain in the furnace depends on the thickness of the bed of dust and the rabbling it receives; under favourable conditions, the arsenic trioxide is eliminated completely in 30—45 minutes. Rotating cylinder furnaces are suitable, preferably with a dust chamber at the end from which the dust will slide back into the furnace. Multiple hearth furnaces make good first-refining furnaces. Cast-iron hearths give good transference of heat, and at 950° F. (510° C.) the rabble arms and castings do not need cooling.—T. St.

Mineral production of Canada. J. McLeish. Eng. and Min. J., March 13, 1915.

THE preliminary report on the mineral production of Canada in 1914 shows a total value of \$128,475,499, which is a decrease of 11.8% from 1913. This is the first decrease shown in a number of years, and is the smallest total reported since 1911. The subjoined table shows the details of this production.

	1913.		1914.	
	Quantity.	Value.	Quantity.	Value.
		\$		\$
Copper, lb. . .	76,976,925	11,753,606	75,738,386	10,301,935
Gold oz. . . .	802,973	16,598,923	770,374	15,925,044
Pig iron, tons	1,128,967	16,540,012	783,164	10,002,856
Lead, lb. . . .	37,662,703	1,754,705	36,337,765	1,627,568
Nickel, lb. . .	49,676,772	14,903,032	45,517,937	13,655,381
Silver, oz. . .	31,845,803	19,010,924	27,544,231	15,097,269
Other metallic products. . .		1,313,732		1,123,919
Total. . . .		\$81,904,934		\$67,733,972
Less pig iron credited to imported ores, tons . .	1,055,459	15,543,583	687,420	8,363,944
Total metallic		\$66,361,351		\$58,370,028
		\$		\$
Asbestos and asbestos, tons	161,086	3,349,025	117,573	2,909,806
Coal, tons . .	15,012,178	37,334,910	13,594,984	33,433,108
Gypsum, tons	636,370	1,447,739	510,663	1,137,157
Natural gas, m. ft. . . .	20,177,838	3,309,331	21,047,028	3,511,302
Petroleum, bbl.	228,080	406,439	214,805	343,124
Pyrites, tons .	158,566	521,181	224,958	735,514
Salt, tons. . .	100,791	491,280	107,038	493,648
Cement, bbls. .	8,658,805	11,019,418	7,172,430	9,187,924
Clay products		9,504,314		7,090,898
Lime, bu. . . .	7,558,484	1,609,398	6,245,180	1,247,517
Stone		5,501,630		5,593,485
Miscellaneous non-metallic		4,274,807		3,921,988
Total non-metallic .		79,273,461		69,695,471
Grand total		\$ 145,634,812		\$ 128,475,499

The quantity of ores treated by smelters and refiners in Canada in 1914 was: Nickel-copper, 947,053; silver-cobalt, 5661; lead, 71,064; copper-gold, 1,612,197; total, 2,619,935 short tons, a decrease of 387,456 tons from 1913. The first products were 12,238 tons blister copper, 6291 tons copper matte, 46,396 tons nickel-copper

matte, and 101 tons cobalt material. The metallic contents are given in the table below:—

	Refined.	In matte, etc.	Total.
Gold, oz.	11,088	170,818	181,906
Silver, oz.	11,006,861	873,400	11,970,261
Lead, lb.	36,413,706		36,443,706
Copper, lb.		59,237,016	59,237,016
Copper sulphate, lb. . .	152,060		152,060
Nickel, lb.		45,517,937	45,517,937
Nickel oxide, lb.	391,312		391,312
Cobalt oxide, lb.	895,789		895,789
White arsenic, lb.	3,474,322		3,474,322

The reproducibility of the copper electrode. Getman. See XI.

Flue dust [from iron works] as a manure. See XVI.

Constancy of base metal thermocouples as related to the microstructure. Kowalke. See XXIII.

Molecular structure of isotropic and anisotropic binary mixtures [gold-silver and gold-copper alloys]. Tammann. See XXIV.

PATENTS.

*Cast iron, rod iron or cast steel: Fluxing composition for use in brazing—*to cast iron. J. Abt, Sydney, N.S.W. Eng. Pat. 902, Jan. 13, 1914. Under Int. Conv., Jan. 21, 1913.

A MIXTURE of clean, finely powdered steel or iron, 60; borax, 20; coconut oil, paraffin oil, or vaseline, 10; and methylated spirit, 10 parts.—W. E. F. P.

*Iron or steel: Treatment of—*for the prevention of oxidation or rust. Rudge-Whitworth, Ltd., and H. L. Heathcote, Coventry. Eng. Pat. 9926, April 22, 1914.

AN iron or steel article which has already been given a phosphatic coating, is treated with linseed oil, either boiled or raw, preferably by spraying, and then stoved at 300°—400° F. (149°—205° C.). A collodion or celluloid varnish or lacquer may similarly be sprayed on the article; when this is done, the coating may be conveniently, though not necessarily, stiffened by a stoving operation, best carried out in the case of celluloid at not above 110° F. (43° C.).—T. St.

*Steel: Process for imparting acid properties to motten—*in a basic electric furnace. Elektro-stahl G. m. b. H. Ger. Pat. 279,989, May 12, 1910.

MIXTURES of silica or aluminium silicate with carbon and iron, with or without addition of silicon carbide, are added to the bath in the form of briquettes of sufficient density to sink through the layer of slag. The constituents of the mixture react gradually with one another and with the molten iron, forming ferrosilicon, silicon carbide, and carbon monoxide. The ferrosilicon and silicon carbide dissolve in the molten steel and the carbide reacts with carbon monoxide to form that variety of carbon to which the characteristic properties of steel made in an acid furnace are due.—A. S.

*Steel of good quality and high-grade phosphate slag; Manufacture of—*from pig iron of high silicon content. Deutsch-Luxemburgische Bergwerks- und Hütten-A.-G. Ger. Pat. 280,044, Nov. 30, 1913.

THE pig iron is smelted in a basic open-hearth furnace with a sufficient quantity of ore to oxidise

the silicon, but with a minimum quantity of lime, whereby an acid slag, containing most of the silicon but only traces of phosphoric acid, is formed almost immediately; this is removed as quickly as possible and the smelting completed as usual so as to obtain a slag rich in citrate-soluble phosphoric acid. (See also Fr. Pat. 466,016 of 1913; this J., 1914, 600.)—A. S.

Furnace for annealing metals. Gibbons Bros., Ltd., and R. Masters, Lower Gornal, Staffs. Eng. Pat. 2866, Feb. 4, 1914.

THE inlets and outlets of the retorts or heating chambers in a close annealing furnace heated by producer gas, are trapped by water seals and are surrounded by a system of flues through which heating gases are passed. The heating gases are led direct to the flues from a combustion chamber (underneath the retorts) to which producer gas and heated secondary air are supplied, and then pass to a stack through a waste heat flue disposed longitudinally between the retorts.—W. E. F. P.

Muffles or tubes for containing articles to be annealed, or to receive heat treatment. C. Glossop, Sheffield. Eng. Pat. 9783, April 21, 1914.

CAST-IRON or earthenware muffles are formed with a cylindrical or polygonal interior and longitudinal horizontal flutings on the exterior. At intervals along the exterior are collars or flanges so that the muffle may be turned on its periphery, whilst leaving a space between the fluted portion and the bed upon which the collars rest. Bolt holes formed in the collars allow of any number of units being coupled together lengthwise.—T. Str.

Furnaces; Rabble arms of roasting —. H. H. Stout, New York. Eng. Pat. 4221, Feb. 18, 1914. Under Int. Conv., Oct. 30, 1913.

THE teeth along each arm are shaped to give both forward and backward movements to the ore, the active forward area becoming progressively less towards the extremity of the arm, so that an equal volume of ore is moved forward by each tooth. The bed of ore is thus kept at a substantially even depth over the entire surface, and every particle of ore remains under treatment for about the same period of time. Slight mechanical differences prevent the teeth from being wrongly assembled.—T. Str.

Separators; Electrostatic — for sorting out the constituent parts of commodities according to their electric capacity. A. Bibolini, Belluno, and P. Riboni, Naples, Italy. Eng. Pat. 7274, March 23, 1914.

A POLE piece or field plate is arranged above a conveyor of low inductivity, with its faces inclined upwards towards both sides transversely to the direction of travel of the conveyor, its length corresponding approximately to the distance between the feeding and discharging devices. The plate may be made of flexible material, curved, and carried at its longitudinal edges by arms capable of adjustment transversely to the longitudinal axis of the apparatus, so that the curvature of the plate may be varied. The pole piece may also be raised or lowered, parallel to or at an angle with the conveyor band.—B. N.

Copper from nickel and matte and other products; Separating —. N. V. Hybinette, Christiansand, Norway, Assignor to National Trust Co., Ltd., Toronto, Canada. U.S. Pat. 1,128,313, Feb. 16, 1915. Date of appl., June 5, 1912.

A SLAB containing copper, nickel, and sulphur, is subjected as an anode to electrolytic action to prepare its surface, and copper is deposited on it,

by cementation, from a solution containing copper and nickel sulphates, the solution becoming simultaneously enriched in nickel.—B. N.

Copper-nickel anodes; Producing —. *Process of circulating solution for electrolysis. Anode for electrolysis.* N. V. Hybinette, Christiania, Norway, Assignor to Pacific Securities Co., Ltd., Toronto, Canada. U.S. Pats. (A) 1,128,314, (B) 1,128,315, and (C) 1,128,316, Feb. 16, 1915. Date of appl., June 26, 1913.

(A.) COPPER-NICKEL anodes, comparatively poor in copper, are produced from matte and other products comparatively rich in copper. The matte is roasted, and the resulting oxides are leached with dilute sulphuric acid, the solution being then electrolysed to recover copper. The acid solution is crystallised, and the acid mother liquor again used for leaching, whilst the impure crystals of nickel sulphate are mixed with the residue from the leaching process, and the mixture smelted for the production of metal, which is cast into anodes. (B.) In the separation of copper from nickel by electrolysis, the electrolyte is passed alternately into the bottom and top of the cathode compartment, and then circulated through a filter from the cathode to the anode. (C.) A charge of copper-nickel matte containing sulphur is reduced by a blast in a suitable furnace, the charge being proportioned so as to obtain a product containing from 4 to 8% S. The product is cast into slabs, and the surface treated by electrolysis.—B. N.

[Radium, vanadium, etc., from carnotite.] Metallurgical process. L. F. Vogt, Washington, Assignor to Standard Chemical Co., Pittsburgh, Pa. U.S. Pat. 1,129,029, Feb. 16, 1915. Date of appl., July 21, 1913.

CARNOTITE ore is roasted with sodium chloride and an oxidising agent, the product treated with water, the solution of sodium vanadate separated, and the residue treated with dilute sulphuric acid to obtain a solution of uranyl and vanadyl salts and a residue containing radium and barium sulphates. The latter is fused with sodium carbonate, the melt extracted with water, the insoluble carbonates dissolved in acid, and the solution precipitated with sulphuric acid and filtered. The precipitate (radium and barium sulphates) is roasted with carbonaceous matter and a chloride, and the product treated with water to obtain a solution of radium and barium chlorides, which are subsequently separated by fractional crystallisation.—W. E. F. P.

Vanadium ore; Treatment of —. L. F. Vogt, Washington, Pa. U.S. Pat. 1,129,253, Feb. 23, 1915. Date of appl., Nov. 26, 1913.

THE ore is heated with excess of sulphuric acid or acid sulphate, and the mixture is roasted to expel most of the uncombined acid and then treated with water; the resulting acid solution, containing vanadium and other sulphates, is treated with iron to remove copper and arsenic, and then with alkali to neutralise the remaining acid and precipitate ferrous vanadate. When the latter contains much phosphorus it is fused with sodium chloride to produce sodium vanadate and phosphate, and the mass extracted with hot water, the solution being first treated with an aluminium salt to remove the phosphorus and then with ferrous sulphate to precipitate the vanadium.—W. E. F. P.

Blast furnaces; Preparing ore for —. G. L. Collard, Sharon, Pa. U.S. Pat. 1,129,645, Feb. 23, 1915. Date of appl., April 22, 1914.

FINELY divided dry ore is prepared for use in a blast furnace by mixing it with another finely

divided cementitious ore in its natural moist condition and injecting steam into the mixture.—T. St.

Blast-furnace slag; Apparatus for granulating liquid—. E. Werzner, Troisdorf, Germany. U.S. Pat. 1,128,829, Feb. 16, 1915. Date of appl., March 28, 1914.

WITHIN a casing are two discs operating independently, one of which carries two concentric rows of beater rods, and the other a single row between the first two rows. Slag and cooling fluid are delivered within the rows of beaters, the inlet pipe for the cooling fluid being beneath the inlet shoot for the slag.—T. St.

Iron alloy. W. Rübel, Charlottenburg, Germany. U.S. Pat. 1,128,726, Feb. 16, 1915. Date of appl., Oct. 22, 1913.

SEE Eng. Pat. 3445 of 1913; this J., 1914, 318.

Ores; Chloridising roasting of—. A. Ramén and K. J. Beskow, Helsingborg, Sweden. U.S. Pat. 1,129,123, Feb. 23, 1915. Date of appl., Aug. 18, 1910.

SEE Eng. Pat. 23,108 of 1909; this J., 1910, 1459.

Metals, etc., soluble in alkalis; Process of obtaining—. G. Spitz, Brünn, Austria-Hungary, Assignor to Goldschmidt Detinning Co., New York. U.S. Pat. 1,129,431, Feb. 23, 1915. Date of appl., April 21, 1908.

SEE Fr. Pat. 370,986 of 1906; this J., 1907, 257.

Magnetic separator. G. Ullrich, Assignor to F. Krupp A.-G., Grusonwerk, Magdeburg-Buckau, Germany. U.S. Pat. 1,129,822, Feb. 23, 1915. Date of appl., July 3, 1913; renewed Jan. 21, 1915.

SEE Eng. Pat. 14,427 of 1913; this J., 1914, 425.

Electrostatic [ore] separator. A. Bibolini and P. Riboni. Fr. Pat. 471,657, March 30, 1914. Under Int. Conv., April 28, 1913.

SEE Eng. Pat. 7274 of 1914; preceding.

Nickel; Recovery of—*from its ores*. The Madagascar Minerals Syndicate, Ltd. Third Addition, dated July 4, 1913, to Fr. Pat. 463,615, Dec. 21, 1912.

SEE Eng. Pats. 27,626 of 1912 and 3814 and 6703 of 1913; this J., 1914, 30.

Tin-plate scrap; Process for detinning—. Chem. Fabr. von der Linde m. b. H., and G. von der Linde. Fr. Pat. 471,738, May 1, 1914. Under Int. Conv., May 5, 1913.

SEE U.S. Pat. 1,116,176 of 1914; this J., 1914, 1214.

Zinc; Extraction of—*from its ores or other products containing zinc*. The Metals Extraction Corporation, Ltd. Fr. Pat. 472,346, May 18, 1914. Under Int. Conv., Sept. 24 and Oct. 8, 1913.

SEE Eng. Pats. 21,581 and 27,761 of 1913; this J., 1914, 1058.

XI.—ELECTRO-CHEMISTRY.

Electro-chemical plants; The evaporator and the power problem in—. O. Mantius. Trans. Amer. Electrochem. Soc., 1914, 26, 215—226.

THE general conditions governing the efficiency of evaporating equipment are considered in

relation to the production of caustic alkali by electrolytic processes employing steam or water power. The use of a high-pressure straight triple-effect for the evaporation of caustic liquors to a strength of 50° B. (sp. gr. 1.515) is attended with economic and practical disadvantages, and better results can be obtained by the use of a compound or triplex condensing engine working in connection with a double-effect, or a combination of a low-pressure triple-effect and a single-effect evaporator with a cast-iron heating surface. Figures are given to show that for a yearly production of 3600 tons of sodium hydroxide the cost of fuel alone is about £400 more with a high pressure triple-effect than with the alternative systems mentioned. For small plants producing up to 5 tons of sodium hydroxide per day, a single or double-effect evaporator should generally be used on account of low first cost and simplicity of operation.—W. E. F. P.

Copper electrode; The reproducibility of the—. F. H. Gelman. Trans. Amer. Electrochem. Soc., 1914, 26, 67—78.

THE electrodes used in the investigation were:—electrolytic copper wires, 3 mm. and 1 mm. in diameter; platinum plates covered with a uniform and adherent electrolytic deposit of copper; electrolytic copper wires, 1 mm. in diameter, embedded in copper powder (Kahlbaum's "reduziert"); and fine platinum loops covered with a deposit of spongy copper obtained by electrolysis of a neutral solution of copper sulphate at high current density. The last was found to be the only constant and reproducible form, the values obtained with it being in close agreement with the theoretical requirements. The irregularities observed with the remaining forms are ascribed to a metastable condition of copper, the spongy variety being regarded as the stable modification under ordinary laboratory conditions.—W. E. F. P.

Sitidised carbon. Silfrax. Tone. See VII.

Electrolytic insulation of aluminium wire. Skinner and Chubb. See X.

Electrometric titrations. Ziegel. See XXIII.

PATENTS.

Electric [resistance] furnace. Process of making [nitrogen] compounds in electric furnaces. S. Peacock, Chicago, Assignor to International Agricultural Corporation, New York. U.S. Pats. (A) 1,129,512 and (B) 1,129,513, Feb. 23, 1915. Dates of appl., Sept. 20 and 22, 1913.

(A.) THE furnace consists of a vertical rectangular shaft with two horizontal electrodes placed opposite one another, the cross-section of each being the same as that of the shaft. The whole is enclosed in a gas-tight metal casing. The charge is supplied from above by hand or from a valved hopper and the solid product is removed below by a conveyor. Nitrogen is introduced by two opposite valved pipes below the electrodes and the gaseous products are removed by similar pipes above. (B.) The reacting materials are heated in nitrogen in an electrical resistance furnace (see above). The supply of material and of nitrogen and the removal of the gaseous products and solid residue are continuous. The temperature of the reaction zone between the electrodes is regulated by the proportion of carbon in the mixture, the rate of passage through the zone, and the amperage of the current supplied. The voltage used is too low to allow of substantial arcing.—W. H. H. N.

Electrode : Negative —, and process of making the same. W. Tassin, Washington, D.C. U.S. Pat. 1,129,818, Feb. 23, 1915. Date of appl., June 6, 1914.

COPPER oxide is maintained at about its fusing point, until an intimate mechanically-inseparable mixture of cuprous and cupric oxides is obtained, in about the molecular ratio 2 : 1. This is moulded into any desired form.—B. N.

Nickel oxide plates [for secondary batteries]; Preparation of —. P. Hoyer. Ger. Pat. 277,743, July 17, 1913.

A GRANULAR mass of nickel, obtained, for example, by igniting nickel carbonate in a reducing atmosphere, is moistened and applied to a support of perforated sheet nickel or nickel wire gauze. After drying, the plate is heated to redness in a reducing atmosphere, then used as anode in the electrolysis of a solution of sodium or potassium carbonate, and the nickel subsequently oxidised electrolytically in a concentrated solution of potassium or sodium hydroxide.—A. S.

Electrodes ; Manufacture of —. Schott und Gen. Ger. Pat. 279,253, July 22, 1913. Addition to Ger. Pat. 268,061 (see Eng. Pat. 17,759 of 1913 ; this J., 1913, 950).

THE metallic conductor passes through the carbon electrodes, and the parts near the electrode are thickened and enclosed in hot plastic glass, so that on cooling, the two glass portions press against opposite ends of the electrode.—A. S.

Electric arcs ; Process for obtaining rotating — by means of rotating gas currents. A. Foss. Ger. Pat. 279,461, Sept. 16, 1913.

AN arc, struck, for instance, between annular electrodes, is caused to rotate in the known manner by introducing a current of gas tangentially into the furnace, and at the same time a current of gas is blown, preferably through an annular inlet, into the space enclosed by the arc and in the direction of the axis around which it is rotating. This current of gas tends to force the arc radially outwards, causing it to take the form of a rotating tube.—A. S.

Electrodes in arc furnaces ; Method and apparatus for protecting the —. J. I. Bronn and W. Schenmann, Assignors to Rombacher Hüttenwerke, Rombach, Germany. U.S. Pat. 1,129,377, Feb. 23, 1915. Date of appl., Dec. 16, 1913.

SEE Eng. Pat. 29,259 of 1913 ; this J., 1914, 555.

Electrolyte for alkaline dry cells. E. Achenbach. Fr. Pat. 472,359, May 19, 1914. Under Int. Conv., May 21, 1913.

SEE Eng. Pat. 10,616 of 1914 ; this J., 1914, 871.

Electrolysis of alkali chloride solutions, using a mercury cathode and a porous diaphragm. Ger. Pat. 279,998. See VII.

Process of introducing iron into foods, drugs, and beverages. Process of forming compounds of iron and carbohydrates. U.S. Pats. 1,129,306 and 1,129,307. See XIXA.

XII.—FATS; OILS; WAXES.

Copra, coconut oil, and coconut cake ; The industrial position of —. Bull. Imp. Inst., 1914, 12, 557—577.

LARGE quantities of copra hitherto exported to Germany and Austria-Hungary are now available

for use elsewhere. Prior to the war a large proportion of the exports of copra from British possessions went to Germany, e.g., three-quarters of the total from Ceylon in 1913, and four-fifths of the total from India in 1912-13. The imports of copra from all sources to Hamburg (representing probably nearly the total German imports) were 230,395 metric tons in 1913, of which 124,434 metric tons came from British possessions. The Austro-Hungarian imports of copra in 1913 were 33,604 metric tons from all sources, including 29,177 metric tons from British possessions. A new market has thus to be found for nearly 154,000 metric tons of copra from British territories. Considerably more than half of this might be taken by the United Kingdom for home use, since in 1913, the British imports of coconut oil from foreign sources amounted to about 49,000 metric tons, corresponding to about 82,000 tons of copra. English firms engaged in crushing copra are extending their plant and there is a good prospect of the British market for copra being greatly enlarged. In addition the export trade in copra and coconut oil to Denmark, Scandinavia, and Russia is capable of development, and British Colonies and India should secure a share of the French import trade in copra ; in 1913 France imported 72,964 metric tons from the Philippines and 43,422 metric tons from the Dutch East Indies. Coconut cake forms an excellent feeding stuff for milch cows and for fattening cattle, and the meal may be used to replace oats in the ration for horses. Coconut cake is nearly equal in food value to deoiled cottonseed cake, and somewhat superior to linseed cake, the low proportion of protein being compensated by high contents of carbohydrates and crude fibre. It is cheaper than linseed or cottonseed cake at the prices prevailing recently, when comparison is made on a basis of net cost per food unit, with allowance for the manurial value of the residues. Coconut cake produced in the United Kingdom is superior to that produced in Germany owing chiefly to the lower content of fibre and higher content of carbohydrates. (See also this J., 1914, 1096.)—A. S.

Fat of Pentadesma Kerstingii. H. Wagner, J. Muesmann, and J. B. Lampart. Z. Unters. Nahr. Genussm., 1914, 28, 244—249. Z. angew. Chem., 1914, 27, Ref., 700.

THE seeds of *Pentadesma Kerstingii*, when extracted with ether, yield 41.5% of a fat similar in appearance to butter fat but somewhat harder. The characters of the fat are : m. pt. 38°—39° C. ; solidif. pt., 29.2° C. ; refractometer reading, 45—46 at 40° C. ; acid value, 12.4 ; Reichert-Meissl value, 0.22 ; Polenske value, 0.4 ; saponif. value, 192 ; iodine value, 45.9 ; unsaponifiable matter soluble in ether, 0.6%. The fat gives no reaction with the reagents of Baudouin, Soltsien, and Halphen ; with Bellier's reagent it gives a blue-violet coloration changing soon to wine-red.—A. S.

Lipase of soya beans. Studies on enzyme action. XIII. K. G. Falk. J. Amer. Chem. Soc., 1915, 37, 649—653.

A COMPARISON of the lipolytic properties of soya beans, castor beans, and duodenal contents, showed that the hydrolytic enzymes present had the following relations :—Soya beans contain a lipase active towards triacetin (and therefore presumably towards fats), slightly soluble in water, and with a maximum solubility in 1.5N sodium chloride solution. Castor beans contain an esterase soluble in water, and a lipase insoluble in water and soluble in sodium chloride solution. Duodenal contents contain an esterase and a lipase, the former predominating in the intestinal juice and

the latter in the pancreatic juice and bile. Marked similarities are shown by the lipases from different sources in their behaviour towards neutral salts and alcohols. When dried over calcium chloride or phosphorus pentoxide, soya bean lipase does not decrease in activity, but when dried at 100° C., the activity is reduced 50%; castor bean lipase and esterase are affected similarly by drying and heating. (See also this J., 1912, 593; 1913, 381.)

—W. P. S.

Palm-kernel cake and meal. See XIXA.

Use of nickel and its oxides in catalysis. Senderens and Aboulenc. See XX.

PATENTS.

Oleaginous substances; Means and apparatus for treating— and for melting and extracting fat and other products therefrom. W. T. Powling, jun., and B. B. Powling, Prittlewell. Eng. Pat. 3664, Feb. 12, 1914.

HOT vapours escaping from material being reduced by dry heat (see Eng. Pat. 8397 of 1912; this J., 1913, 543) are utilised in the preliminary heating of fresh quantities of material, the vapours being thereby cooled and steam condensed.—C. A. M.

Oils; Method of and apparatus for deodorising—. J. T. Bateman, London. Eng. Pat. 24,605, Jan. 6, 1914.

THE exhaust superheated steam from the deodorising apparatus is used for the preliminary heating of a fresh quantity of oil, the aldehydes in the steam being subsequently condensed and separated. In a form of apparatus claimed, the steam heats the tubes of two heaters through which the oil passes.—C. A. M.

Catalytic processes. [Hydrogenation of oils.] O. C. Hagemann and C. Baskerville. New York. Eng. Pat. 3344, Feb. 9, 1914. Under Int. Conv., Feb. 8, 1913.

SEE U.S. Pat. 1,083,930 and Fr. Pat. 469,172 of 1914; this J., 1914, 207; 1915, 39.

Catalysts [for hydrogenating oils]: Preparation of—. W. Fuchs. Fr. Pat. 472,377, Aug. 1, 1913.

SEE Eng. Pat. 11,542 of 1913; this J., 1914, 702.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

PATENTS.

Elastic masses; Production of solid—. W. Meusel. Ger. Pat. 276,363, June 25, 1913.

THE colloidal solid product obtained from linseed oil according to Ger. Pat. 201,966 or 258,900 (this J., 1913, 616) is mixed in suitable proportions with the product obtained from castor oil (*loc. cit.*), and the mixture, with or without other additions, is dried.—A. S.

Lead paste from red or orange lead; Manufacture of—. W. Eckford. Rhyl, Wales. U.S. Pat. 1,128,901, Feb. 16, 1915. Date of appl., April 9, 1910.

SEE Eng. Pat. 8017 of 1910; this J., 1910, 1398.

White lead; Manufacture of—. E. Euston. Fr. Pat. 471,348, April 25, 1914. Under Int. Conv., April 28, 1913.

SEE U.S. Pat. 1,075,143 of 1913; this J., 1913, 1077.

Varnishes; Manufacture of submarine—. G. Paterno and C. Mannelli, Milan, Italy. Eng. Pat. 29,524, Dec. 22, 1913.

SEE Fr. Pat. 466,368 of 1913; this J., 1914, 604. Reference is directed, in pursuance of Sect. 8, Sub-sect. 2, of the Patents and Designs Act, 1907, to Eng. Pat. 5432 of 1914.

Chlorinating [oleaginous material to obtain artificial resins]; Process of—. M. Buchner, Assignor to C. F. Boehringer und Soehne, Mannheim-Waldhof, Germany. U.S. Pat. 1,129,165, Feb. 23, 1915. Date of appl., Nov. 13, 1911.

SEE Ger. Pats. 256,856 of 1910 and 258,156 of 1911; this J., 1913, 499, 613.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Caoutchouc-benzene-alcohol and caoutchouc-benzene-acetone; The systems—. The behaviour of colloids towards pure and mixed liquids. Part I. W. A. Caspari. Chem. Soc. Trans., 1915, 107, 162—171.

THE caoutchouc employed in the experiments was a de-resinified pale plantation crêpe. The solvents were carefully dried. Caoutchouc changes from the gel to the sol condition reversibly, and it is therefore possible to represent the system, caoutchouc-solvent-precipitant, by isothermals which express all possible equilibria between the three substances concerned. The physical stability of the solutions employed was sufficient not to have any important influence upon the results. (1) Fresh solutions of caoutchouc in benzene, of known concentration, were titrated with alcohol until separation into two phases just set in. The limiting triads thus obtained were plotted on a binodal curve. Volume percentages were calculated by taking 0.91 as the sp. gr. of the caoutchouc, and neglecting volume changes. (2) Excess of alcohol was added to benzene solutions of caoutchouc. Two fluid layers were formed in equilibrium and the composition of each represented a point on the binodal. Tie-lines representing distribution of benzene between caoutchouc and alcohol were also obtained by this method. Caoutchouc was determined in the upper layer by evaporation, and the ratio of benzene to alcohol by determination of refractivity and comparison with an experimental curve. The volume of the lower layer was measured, and its composition calculated from these data. (2A) When the precipitated clot contained too much caoutchouc to form a homogeneous layer, it was removed, pressed between filter-paper, and its volume measured in a volumometer charged with a benzene-alcohol mixture. Under these circumstances the upper layer was free from caoutchouc. It was found that in presence of water far less precipitant was required to produce precipitation. In the case of the system including acetone, method (2) could not be employed, owing to flocculation in the lower layer. The following conclusions are drawn from a discussion of the results. Caoutchouc is practically insoluble (at 20° C.) in mixtures containing 43 vols. or more of absolute alcohol or 80 vols. or more of anhydrous acetone to 100 of benzene. Presence of water in the precipitant results in economy of the latter. A very small excess of precipitant serves in general to precipitate the whole of the dissolved caoutchouc; hence the latter cannot be separated into components by fractional precipitation. For caoutchouc concentrations greater than 2% in the

original benzene solution, quantitative relations are given roughly by the equation for the bimodal of caoutchouc-benzene-alcohol at 20° C.:

$$\left(\frac{100\text{ C}}{\text{B}}\right)^{0.24} \times \left(\frac{100\text{ A}}{\text{B}}\right) = 60$$

A, B, C, being volumes of alcohol, benzene, and caoutchouc respectively. There are indications from the experimental results that discontinuity between caoutchouc-benzene sol and caoutchouc-benzene gel exists in the neighbourhood of 1 vol. caoutchouc: 6 vols. benzene. It is significant that the caoutchouc employed absorbed about 6 vols. of benzene before passing into solution. —E. W. L.

PATENTS.

Rubber latex; Coagulation of —. N. W. Barritt, Shrewsbury. Eng. Pat. 3632, Feb. 12, 1914.

RUBBER latex is concentrated to a definite degree by evaporation under reduced pressure at ordinary temperatures—say not exceeding 50° C.—and is then coagulated by exposing it, in a thin film, to acetic acid vapour or to smoke.—E. W. L.

India-rubber, caoutchouc, and other similar material; Apparatus for washing and cleaning —. W. G. Gass, Bolton. Eng. Pat. 1200, Jan. 16, 1914.

THE apparatus, which is designed primarily for the treatment of scrap or bark, etc., comprises a casing containing a main inclined roller grooved longitudinally, and one or more plain rollers frictionally driven from the main roller through the material being treated; or one of the plain rollers may be positively driven. The lower part of the casing is provided with longitudinal pressure surfaces, or ridges, alternating with longitudinal grooves or pockets, the ridges being almost in contact with the tops of the teeth on the grooved roller. The casing is provided with inclined guides to carry the material from the lower, feed end of the rollers to the upper, discharge end, where knives attached to the main roller cut it into short lengths. The material is fed into the machine from a hopper provided with a revolving barrel having blades co-acting with a stationary blade or other arrangement for the purpose of cutting up the material into small pieces before it enters the machine. Water enters the casing of the machine near the upper discharge end of the inclined rollers, and passes out through an overflow at the other end, carrying with it the sand and dirt, which fall away at the lowest point of the feed end. The machine may be heated, and the casing and cover may be easily removed for purposes of cleaning, inspection, and the removal of the washed product, where, as in the case of very soft rubbers, it is not desirable to work the machine automatically.—E. W. L.

Rubber; Machines for preparing —. J. E. Pointon, Peterborough. Eng. Pat. 4105, Feb. 17, 1914.

THE machines contain screw-like or spiral rotating blades having their forward surfaces of convex or like form so as to knead the material by pressure against the walls of the chamber. The blades may have radial or concave tips and be of equal or unequal radial length.—C. A. M.

Caoutchouc or caoutchouc-like substances; Process for accelerating the vulcanisation of natural or artificial —. S. J. Peachey, Stockport. Eng. Pat. 4263, Feb. 19, 1914.

VULCANISATION is accelerated by the addition to the mixing of small quantities of *p*-nitrosodimethylaniline or of its homologues such as *p*-nitrosomethylaniline or *p*-nitrosoethylaniline. For example, a mixing composed of plantation rubber, 100; sulphur, 10; and accelerator 0.5 parts

can be vulcanised in 20 minutes at 135°–145° C., as against one hour without the accelerator. A hard and durable ebonite is obtained by heating for 2 hours at 145° C. a mixing composed of plantation rubber, 100; sulphur, 40; accelerator, 0.75 to 1.0 parts; without accelerator the time of vulcanisation is about 6 hours.—E. W. L.

XV.—LEATHER; BONE; HORN; GLUE.

Tanning materials; Analysis of — intended especially for tanning fishing nets. G. C. A. van Dorp. Collegium (London), 1915, 71–72.

MATERIALS showing a higher tannin value than cutch when tested by the hide powder method, are not always so suitable for tanning fishing nets. The author proposes a method of analysis giving better results, which depends on the adsorption of the material by cotton. As a standard, the adsorption of cutch under definite conditions is first determined by shaking a solution of known strength with cotton and subsequently evaporating the residual solution. An adsorption curve for cutch solutions of different concentrations is constructed, and the strength of a solution of any other material giving a certain adsorption compared with the strength of a cutch solution giving the same adsorption, shows the value of the material. —F. C. T.

Bates; Artificial —. J. T. Wood. Collegium (London), 1915, 82–85.

Two new proprietary articles are discussed, which the manufacturers describe as bates. The vendors of one ("Pilos") state that it destroys fats and greases in the skin, but investigation showed it to contain about 80% of ammonium chloride and failed to show either lipolytic or tryptic enzymes. A practical test did not substantiate the claims made for it. The other article, "Enzo," described as a substitute for natural bate or puer, contained 68.7% ammonium chloride, 8.4% gelatin and proteins, and 15% starch; diastase was present but not tryptic enzymes. It is thus a deliming material combined with a drenching material, and capable of useful service, though not as a bate. An artificial bate should be composed of an ammonium compound and a tryptic enzyme combined with some inert carrier such as kaolin or wood dust. No artificial bate can have all the properties of puer, owing to the presence in the latter of certain compounds in very minute quantities which have some specific effect on the bating action.—F. C. T.

Neradol D; Experiments with —. (1) A. Rogers, and (2) G. J. Laemmle, H. J. Newman, and N. W. Shepard. Tanners' Inst., Brooklyn. Reports of Third Year, 25–30, 38–42. J. Amer. Leather Chem. Assoc., 1915, 10, 105–106.

THE influence of Neradol D in hastening vegetable tannage and on the final yield of leather was investigated. In the case of hide and sheep skin a preliminary treatment with Neradol D rendered subsequent vegetable tannage more rapid at first, but did not influence the final yield of leather. Calf skin, pickled as for chrome tannage, gave a similar yield with a combination of Neradol D and quebracho as with quebracho alone; Neradol D alone did not give so good a yield of leather. —F. C. T.

Tannage; [Determination of] degree of —. W. James. Collegium (London) 1915, 76–77.

THE organic insoluble matter of leather, apart from hide substance, may contain matter such as

"bloom" which is fairly easily washed out and cannot be regarded as combined tannin. The author proposes, in the determination of water-soluble matter, to evaporate the unfiltered aqueous extract and thus include "bloom," etc., in the water-soluble matter and not in the combined tannin.—F. C. T.

PATENTS.

Leather-board; Method of making——. A. L. Clapp, Braintree, Mass., Assignor to Hide-lte Leather Co., Boston, Mass. U.S. Pat. 1,128,290, Feb. 16, 1915. Date of appl., Jan. 11, 1913.

LEATHER scrap or fibre is washed and mixed with a waterproofing material capable of depositing an insoluble precipitate on the fibres by a reaction with tannic acid, and the wash water which contains tannic acid is then added to the mixture. The wash water may be treated with alum and heated before addition to the mixture.—E. W. L.

Gelatin masses; Production of transparent objects from——. L. Trommer. Ger. Pat. 278,667, April 27, 1913.

AN aqueous solution of 100 parts of gelatin, 1—3 of potassium bichromate, 2—4 of magnesium sulphate, 2—4 of potassium sulphate, 3—4 of borax, and 3—4 parts of sodium chloride, with or without addition of colouring matters, is concentrated on the water-bath and poured into moulds. The moulded objects, after cooling, are treated with hardening agents or coated with a lacquer.—A. S.

Leather, artificial; Process for colouring——. E. Girzik. Fr. Pat. 472,023, May 9, 1914. Under Int. Conv., Dec. 18, 1913.

SEE Eng. Pat. 4668 of 1911; this J., 1914, 559.

XVI.—SOILS; FERTILISERS.

Flue dust [from iron works] as manure. J. Board Agric., 1915, 21, 1043—1046.

A SAMPLE of flue dust from an iron works in the Midlands was found by the Government Laboratory to contain nearly 6% K_2O , about one-third of which was directly soluble in water, together with about 7% CaO as gypsum. No substance directly harmful to plant life was present, and the proportion of water-soluble magnesia was only 0.29%. It is doubtful whether the potash could be extracted profitably, but the material could be used locally as a manure.—J. P. O.

PATENTS.

Phosphate rock; Process of treating natural——. F. K. Hoover and A. J. Mason, Chicago, Ill. U.S. Pat. 1,128,874, Feb. 16, 1915. Date of appl., June 9, 1911.

THE crude phosphate rock is triturated with water to form a plastic mass, a further quantity of water is added, and the mixture is subjected to currents of water, so as to separate the clean phosphate mineral by gravity.—F. SODN.

Phosphate rock; Process of treating pebble——. W. F. Lay, Boston, Mass. U.S. Pat. 1,129,407, Feb. 23, 1915. Date of appl., May 1, 1914.

THE pebbles, previously separated from the matrix, are immersed in an acidulated bath, which is preferably heated and agitated, so as to separate and neutralise adherent alkaline matter, and the

liquor is then drawn off and fortified with additional acid for treating a further supply of pebbles, whilst the treated pebbles are washed with water.—F. SODN.

Guano or the like; Process for simultaneously colouring—and treating it with acid. Chem. Fabr. vorm. Weiler-ter-Meer. Ger. Pat. 280,227, July 25, 1913.

THE guano is treated with sulphuric acid in which a soluble organic dyestuff has been dissolved. Suitable dyestuffs are Auronal Orange, Brown, and Yellow, Bismarck Brown, and Toluylene Orange.—A. S.

Production of mixtures for destroying plant pests. Ger. Pat. 279,563. See XIXb.

XVII.—SUGARS; STARCHES; GUMS.

Cane stalk; Varying concentration of the juice in the cells of the——. R. S. Norris. Intern. Sugar J., 1915, 17, 127—128.

CANES of the Lahaina and Yellow Caledonia varieties were cut into sections, and the nodes and internodes, and in some cases also the pith and rind, submitted separately to successive pressings. In each instance the juice was found to increase considerably in density with each successive pressing; in one case, using very heavy pressure, the juice extracted by the last operation had a density more than twice that of the first expressed juice. It is concluded that in different parts of the cane there are a few cells containing juice of high density and having walls more resistant to crushing than those containing weaker juice. In another experiment the cane was passed through a Jeffry pulveriser, and the parenchyma and fibrovascular cells were then separated by shaking with the hand. In this case successive pressings produced no increase in the density of the several juices obtained, the explanation advanced being that the cells containing juice of high density were ruptured with the others during the process of shredding. The results indicate that there is an advantage in the practical milling of cane in reducing it to a fine state of division, either by shredding or by the grinding action of the rollers in the early part of the process, so that none of the juice of high density is retained in the final bagasse.—J. P. O.

Beets; Determination of sucrose in frozen and thawed——[by the double polarisation method, using acid and invertase as hydrolysts.] E. Saillard. Circ. hebdom. Synd. Fabr. Sucre de France, 1915, 27, Nos. 1350, 1351, and 1352.

IN the determination of sucrose in roots which had been frozen and thawed, there was an appreciable discrepancy between the figure given by the ordinary double polarisation (Clerget) method and that deduced from the determination of the reducing sugars before and after inversion by hydrochloric acid. This result pointed to the presence of non-sugar substances in the deteriorated roots, the optical activity or cupric-reducing power of which was modified by the action of the hydrochloric acid used for hydrolysis so as to vitiate the sucrose value. When invertase was used as hydrolyst in place of hydrochloric acid, the solution being clarified as described by Ogilvie (this J., 1911, 62), the two methods of determining the sucrose gave concordant results.—J. P. O.

Sugar: Norit process of manufacturing white —. A. Wijnberg. Intern. Sugar J., 1915, 17, 70—74 and 129—131. (See Eng. Pats. 21,204 of 1911 and 11,860 of 1912; this J., 1912, 1047; 1913, 376.)

"NORIT" is a special decolorising carbon for use in the sugar industry as a substitute for animal charcoal. The quantity of colour that can be removed by the carbon from a solution of cane molasses depends principally upon the concentration of the colouring matter; the point at which the carbon cannot adsorb any more colouring matter varies very considerably according to the kind of carbon and the nature of the colouring matter. Though in some cases relatively little carbon may be required to remove most of the colour from a solution, a large amount is necessary to eliminate the last traces; in one experiment, for example, twice as much carbon was required to remove the last 10% of colour as was needed to remove the first 90%. In tests in which the colour was only partly removed, the decolorising power of "Norit" carbon was about 25 times greater than that of animal charcoal. Since the presence of sugar and salts has a marked inhibiting effect on the action of the carbon, the thin-juice and not the thick-juice must be operated upon in practice, in order to obtain the most profitable decolorisation. In alkaline and neutral media little or no adsorption of the colouring matter may take place, whereas decolorisation is readily effected in a solution having an acidity corresponding to about N/100. By boiling the spent carbon with a 3% solution of sodium hydroxide or carbonate for about 15 minutes and washing, the material is revived to a large extent (see Eng. Pats. 19,357 of 1912 and 17,432 of 1913; this J., 1913, 85; 1914, 853); e.g., if originally its decolorising power was 92%, after the regenerating treatment it may be 87%, becoming constant at 65% after being regenerated about 10 times. The carbon adsorbs gums and pectins in addition to colouring matter; a solution of cane molasses after treatment passed readily through filter-paper, whereas previously it percolated with difficulty.

Experiments on the large scale. In a factory in Natal the mill juice was sulphited, limed to a slightly acid reaction, boiled, treated with about 0.5% of the decolorising carbon, and passed through filter-presses; the clear liquid was almost colourless. After evaporation, the resulting syrup was filtered through Perrin filters without the difficulty that is often experienced owing to the presence of gummy matters, and this favourable effect was further noticed during the operations of vacuum pan boiling and centrifuging. The sugar finally obtained was sold at prices corresponding to those obtained by the refined sugar made at refineries. The spent carbon was regenerated by boiling with a 5% solution of sodium carbonate and washing; its decolorising action was not diminished considerably thereby. Trials were also made in a Greenock refinery, where it is stated that the entire usual Taylor filter installation was discarded, though the existing charcoal installation was still retained. After affining the raw sugar in centrifugals in the ordinary way, it was dissolved to a liquor of 60° to 65° Brix, slightly acidified, treated with 1% of the carbon, and passed directly through a filter-press. Filtration proceeded very rapidly, notwithstanding the comparatively high concentration of the liquor, and the cakes were easily washed and well exhausted. Even after regenerating the carbon 30 times, its value decreased only to 70% of what it was originally. It is claimed that the use of the decolorising carbon opens up the possibility of making refined sugar directly from juice, and of carrying on refining operations in some factories all the year round.—J. P. O.

Reducing sugars; Studies on the decomposition of — with reference to white sugar manufacture. A. Schweizer and G. Loos. Archief Suikerind. Nederl.-Indië, 1914, 22, 1855—1859. Intern. Sugar J., 1915, 17, 141.

FRAMM (Pflüger's Arch. Physiol., 64, 575) has shown that the presence of air has a considerable influence upon the decomposition of reducing sugars by alkalis. To determine the effect of air in the carbonatation process of making high-grade sugars, a sucrose solution containing reducing sugars was treated with 3% of milk of lime at 20° B. (sp. gr. 1.157), and maintained at 28° C. for 3 hours, whilst a second solution was treated similarly, except that a slow current of air was passed through it for 3 hours. Both liquids were carbonatated to a slight alkalinity, heated to 55° C., and filtered. It was found that decomposition of reducing sugars had taken place in both cases, but in that in which air had been used the colour was distinctly less.—J. P. O.

Scums [produced during beet sugar manufacture]; Sucrose content of —. H. Pellet. Intern. Sugar J., 1915, 17, 132—133.

THE scums formed during carbonatation may contain at the same time insoluble sucrose in the form of saccharate and insoluble sucrose which has been carried down by the bulky precipitate produced on the addition of lime to the dense diffusion juice. Carbon dioxide acts more or less on both forms, making the quantity of insoluble sucrose found in the press-cake very variable, depending upon the conditions of working. When the insoluble sucrose is mostly present in the form of saccharate, greater difficulty is experienced during the process of washing than when it has been carried down mechanically.

—J. P. O.

Alkali sulphites [in the sugar industry]: Catalysis in the oxidation of —. E. Saillard. Compt. rend., 1915, 160, 318—320.

IN the treatment of syrups and sugar juices with the gases of a special sulphur-burner, containing 10—14% SO₂, the following were found to act as catalysts in the oxidation of alkali sulphite to sulphate: *Retarding agents:* sucrose, invert sugar, non-sugars, ammonium oxalate, glycerin, free and carbonated alkalis, asparagine, glutamic acid, and potassium lactate. *Accelerating agents:* (in the form of fine powder) nickel, zinc, aluminium, ferric oxide, manganous oxide, calcium carbonate, marble, magnesium carbonate, fire-brick, calcium sulphate, calcium phosphate, calcium oxalate, alumina, and calcium sulphite. The rate of oxidation increases regularly with rise of temperature between 15° and 90° C., and decreases rapidly with the sugar concentration up to a content of about 60% of sugar. *Practical conclusions:* Oxidation of alkali sulphite is very difficult in molasses, which contains about 50% of sugar and 33% of non-sugar, and is retarded by the maintenance of low temperatures and the absence of precipitable lime, which might give rise to the formation of calcium carbonate or sulphite.—O. R.

Notes on [use of] caramel [in brewing]. Handcock. See XVIII.

PATENTS.

Sweetmeats and the like; Manufacture of —. E. Shaw, London. Eng. Pat. 3824, Feb. 13, 1914.

A SOLUTION of sugar which has been inverted by means of an acid and then neutralised, is mixed with sugar containing sodium bisulphite and the mixture quickly boiled.—J. F. B.

Sugar; Recovery of— from molasses, especially cane molasses. F. Tiemann. Ger. Pats. (A) 279,719 and (B) 279,720, Dec. 21, 1912, and July 5, 1913.

THE methods are based on the known fact that invert sugar is capable of displacing sucrose from impure solutions. (A) Desaccharification is effected by adding to the molasses invert sugar separated by known methods from a separate portion of the same molasses. (B) The molasses is treated with strong acids or acid salts added in such quantities that a portion of the dissolved sucrose is inverted and the treated juice contains sucrose, invert sugar, and salts in the relative proportions most favourable to the recovery of the sucrose by crystallisation.—A. S.

Sugar in fine crystals; Manufacture of—. J. F. P. Kestner. Fr. Pat. 471,912, July 22, 1913.

SEE Eng. Pat. 17,010 of 1914; this J., 1915, 241.

Automatic charging and discharging device for vacuum dryers. Ger. Pat. 280,035. See I.

Process of introducing iron into foods, drugs, and beverages. Process of forming compounds of iron and carbohydrates. U.S. Pats. 1,129,306 and 1,129,307. See XIXA.

XVIII.—FERMENTATION INDUSTRIES.

Diastase; Determination of the activity of—. O. Wolff. Chem.-Zeit., 1915, 39, 105—107.

For the study of enzyme reactions, *e.g.*, the determination of diastatic activity, the Zeiss interferometer (this J., 1911, 770; 1912, 559) is far more sensitive than the refractometer. In the 2 cm. cell a 0.2% solution of soluble starch shows a reading of 142 as compared with water, while a similar solution of dextrose shows 200, the subjective error of the instrument being only 2 scale divisions. The interferometer may be calibrated by means of 1% solutions of soluble starch and dextrose, one cell being kept filled with the starch solution and compared with mixtures of starch and dextrose in complementary proportions in the other cell. The differential readings are plotted with scale divisions as abscissæ and grms. of dextrose as ordinates, and a straight line is thus obtained from which subsequent results can be integrated, provided identical quantities of water or solid matters be added to each solution. For the estimation of diastatic activity, a known quantity of diastase is added to each of two 50 c.c. portions of 1% starch solution in two flasks; one portion is immediately boiled to destroy the enzyme and the other is digested at 38° C. for 2 hours. Both solutions are filtered through dry paper filters of the same size and the clear filtrates compared together in the cells of the interferometer. Some little difficulty may arise in obtaining perfectly clear filtrates and hence it is seldom possible to employ the 4 cm. cells, but if very small proportions of enzyme are present, the delicacy of the method may be increased by adopting a longer time of digestion. Determinations have shown that the readings obtained are proportional to the quantity of diastase within certain limits.—J. F. B.

Malt amylase; Purification of—. H. C. Sherman and M. D. Schlesinger. J. Amer. Chem. Soc., 1915, 37, 643—648.

MALT amylase loses activity during its separation by dialysis, apparently owing to hydrolytic destruction of the enzyme. When the dialysis is

carried out at a low temperature, the loss is greatly diminished, and the following method is recommended. Concentrated malt extract is placed in a collodion sack which is suspended in a large volume of water at 5° to 10° C. for 24 hours, the water being changed two or three times during this period. The clear solution is then decanted from the sack and ammonium sulphate is added in the proportion of 15 grms. for every 100 c.c. of solution. The mixture is kept below 10° C. until the salt has dissolved, the clear liquid portion is then decanted and rejected, and the precipitate dissolved in cold water. This solution is again dialysed as before for 24 hours, and the solution mixed with an equal volume of cold 99.8% alcohol. The precipitate is separated, the solution mixed with a quantity of alcohol sufficient to make the alcohol content 65% (by vol.), and the precipitate is collected and dried over sulphuric acid under reduced pressure in the dark and at a temperature not above 15° C. In this way the authors have obtained preparations having a diastatic power of 1200 to 2350 on Lintner's scale.—W. P. S.

Malt amylase; Influence of certain acids and salts upon the activity of—. H. C. Sherman and A. W. Thomas. J. Amer. Chem. Soc., 1915, 37, 623—643.

THE activity of pure malt amylase was increased by acetic, propionic, phosphoric, hydrochloric, nitric, and sulphuric acids, and by the chlorides, nitrates, sulphates, and primary phosphates of sodium and potassium (see this J., 1913, 986). The activities observed at the optimum concentrations of these different electrolytes varied from less than double to more than thirty times the corresponding activities in the absence of the electrolyte. Acids had a greater effect than neutral salts, but the acid phosphates of sodium and potassium were as effective as any of the free acids. The weak and strong acids and the acid phosphates all showed optimum activation at those concentrations which had essentially the same acidity; this optimum hydrogen ion concentration, as expressed by Sørensen's exponent, in each case lay between the limits $p_{\text{H}}^+ 4.2$ and 4.6. When the concentration of the acid exceeded the optimum, the activity of the enzyme was diminished; it was almost entirely destroyed in the presence of from five to eight times the optimum quantity of a strong acid. Whether the activating agent was an acid or a salt, the amylolytic action, as measured by the Wohlgemuth method (Biochem. Zeits., 1908, 9, 1), reached an optimum at a concentration of the activating agent much below that which gave an optimum saccharogenic action.—W. P. S.

Malt and beer. F. P. Siebel. Master Brewers' Assoc., U.S.A. Brewers' J., 1915, 51, 169—172.

DEALING more especially with the brewing of all-malt beers under American conditions, the author prescribes an evenly graded barley with plump corns, retained by a 2.5 mm. sieve, in order to avoid an undue proportion of husks. In malting, the strength of the peptic enzyme must be well developed, not so much from the point of view of its activity in the finished malt as from that of the modification it effects during germination. Slow growth is therefore necessary, at 15°—19° C. (59°—66° F.) for 6 or, preferably, 8 days. Under-germinated malts cannot be rectified in mashing, but if poor modification is the result of too rapid growth it can be remedied by the action of the peptic enzyme in the mashing. The acripsire should be three-quarters developed rather than full grown. The green malt should not be withered but dried on the upper kiln at 41°—43.5° C. (105°—110° F.) with full draught, treated on the lower kiln

at 54° C. (130° F.) until the moisture is reduced to 10%, and finished off at 82°—88° C. (180°—190° F.) for 4—5 hours. In mashing the first important stage is the "lactic acid rest" at 35° C. (95° F.). This stage has been studied over a period of 20 hours; the formation of lactic acid increases gradually in the first 4 hours, then more rapidly, and becomes very rapid after 8 hours, especially with high-grade well modified malts. At this temperature the coagulable protein remains constant, but the extraction of non-coagulable nitrogenous matters increases steadily with the increase of lactic acid during the first 8 hours. In practice the duration of the lactic acid rest may vary from 1 to 4 hours according to the degree of undermodification of the malt. The next stage, the "protein rest," takes place at 43°—45° C. (109°—113° F.) in the presence of a slight acidity developed in the first stage, and the duration will depend almost entirely on the time required in the first stage. The last stage, the "sugar rest," at 56.5°—60° C. (133°—140° F.) depends on the type of beer required, and since palate-fulness is necessary in the case of American all-malt beers, it is desirable to omit this rest completely. In view of the high percentage of non-coagulable proteins and the palate-fulness, the original gravity of all-malt beers should be lower than with ordinary beers and should lie between 11.5—11.8%. In boiling the wort a thorough "first-break" must be effected before the first addition of hops, one-fifth of which is added first and then two portions of two-fifths each. The proportion of hops must be not less than 1 lb. per barrel. Aeration is effected in the hop-back by blowing filtered air through coils for 15—20 minutes. Fermentation should be made to proceed slowly by adopting a low pitching temperature of 6° C. (45° F.) and not letting it rise above 10°—11° C. (50°—52° F.); the quantity of pitching yeast should not exceed 1 lb. per barrel. The usual method of storing the beer is not recommended. The completely fermented beer, cooled to 4° C. (39° F.), is treated with chips and finings and then with 5% of ordinary beer "Kräusen." After the latter has worked itself out the beer is chilled to 0° C. (32° F.) very gradually and stored at that temperature for 6—8 weeks before racking.—J. F. B.

Caramel [in brewing]; Notes on [use of] — W. A. Hancock. *Brewers' J.*, 1915, 51, 167—169.

CERTAIN caramels which appear perfectly satisfactory under the usual tests and with fairly strong worts, will form an amorphous deposit when mixed with weaker worts. Analysis of a sample of such a deposit showed 5.1% N, suggesting a combination of caramel and protein matter. In practice when boiling a two-copper parti-gyle, the caramel was all added to the wort in the first copper and the deposit produced by diluting this with the second wort persisted in the beer after racking. The trouble was cured by dividing the caramel between the two coppers, the precipitate being then thrown out before reaching the collecting vessel. Experiments with invert sugars also showed that many specimens will produce a bad "haze" when mixed with second wort, so that sugars also should be divided between the various coppers. Some samples of caramel give a precipitate with waters containing calcium bicarbonate; such caramels are too unstable to be satisfactory for brewing purposes.—J. F. B.

Whisky; Standards for — in *Western Australia, under "The Health Act, 1911-12."* Government Papers, pp. 39, Jan. 5, 1915.

THE following standards have been ratified by the Governor in Council:—Scotch whisky shall be

spirit distilled from barley, malt, or other grains (which as regards pure pot still whisky shall be distilled at a strength not exceeding 35% over proof), matured by storage in wood for not less than two years, and shall be sold under one of the following designations and conform to the corresponding standards:—(a) Standard pot still whisky shall contain not less than 45 grms. of compound ethers, 3.5 grms. of furfural, and 180 grms. of higher alcohols, per 100 litres of absolute alcohol, these ingredients to be determined by the methods laid down in Schedule A of the Regulations (not included in the present papers). (b) Blended whisky containing at least 75% of standard pot still whisky, shall contain not less than 40 grms. of compound ethers, 2.6 grms. of furfural and 140 grms. of higher alcohols. (c) Blended whisky containing at least 50% of standard pot still whisky, shall contain not less than 35 grms. of compound ethers (esters), 1.75 gm. of furfural, and 110 grms. of higher alcohols. (d) Blended whisky containing less than 50% of standard pot still whisky shall be that which fails to comply with any of the above standards.

Irish whisky shall be spirit distilled from barley, malt, or other grains, matured by storage in wood for not less than two years, and shall be sold under one or other of four designations identical with those for Scotch whisky but with different standards as follows (no standards at present as regards furfural):—(a) Not less than 35 grms. of compound ethers and 200 grms. of higher alcohols. (b) Not less than 30 grms. of compound ethers and 160 grms. of higher alcohols. (c) Not less than 25 grms. of compound ethers and 130 grms. of higher alcohols. (d) Less than 25 grms. of compound ethers or 130 grms. of higher alcohols. All other kinds of whisky shall conform to the standards for Scotch whisky. The four classes of whisky, (a), (b), (c), (d), must bear distinctive labels of prescribed colouring. These regulations are based on a Report made by the Government Analyst for Western Australia, E. A. Mann, after visits to, and analysis of the products of, more than fifty distilleries in Scotland and Ireland. The standards prescribed for "standard pot still whisky" (Scotch) are only slightly lower than the averages of the values obtained in the analysis of all the investigated Scottish whiskies (117 samples) produced with pot stills, so that about one-half of the number of samples analysed would not conform to the standards, whilst nearly all the products obtained with more or less modified types of still, and all those obtained with patent stills would be excluded. It is pointed out in the report, however, that as the whiskies imported into Australia are usually blends of a large number of products, their composition would tend to approximate to the standards laid down. The papers include, besides the report mentioned, a Memorial of protest from the Scottish Whisky Exporters' Association, supported by reports by P. Schidrowitz and R. R. Tatlock, in which it is submitted that the setting up of any chemical standard for whisky would be injurious both to distillers and consumers, and that whisky, whether made from malt alone or with cereals, should be known and sold as "whisky" without any distinction being drawn between the products of the two classes of still.—J. H. L.

Vinegar [from malted maize]. J. S. Jamieson. *Analyst*, 1915, 40, 106—107.

THE accompanying table shows the composition of a sample of vinegar made from malted maize, both before (col. 2) and after (col. 1) being pasteurised, compared with that of a barley malt vinegar (col. 3). Although the maize vinegar was manufactured on the same principle as the barley malt

vinegar, the figures for nitrogen and phosphoric acid in the former are much below those generally accepted for a genuine vinegar from barley malt, whereas the figures for extract and original solids are considerably higher.

	1	2	3
Sp. gr.	1.019	1.020	1.013
Total solids, %	3.66	3.23	1.64
Ash, %	0.36	0.34	0.36
Nitrogen, %	0.009	0.014	0.06
Phosphoric acid, % ..	0.02	0.02	0.05
Acetic acid, %	4.20	4.50	4.59
Original solids, % ...	9.96	10.03	8.52

—J. H. L.

PATENTS.

Malt for mashing purposes; Apparatus for treating — G. Porteus, Leeds. Eng. Pat. 20,716, Oct. 8, 1914.

The apparatus consists of two pairs of shredding rolls with an interposed stationary cylindrical sieve fitted with revolving beaters or detachers. The reduced malt from the first pair of rolls falls into the sieve, where the beaters separate the husks from the meal. The latter passes through the meshes of the sieve, while the husks are thrown out by the beaters and fall between the second pair of rolls, the product from the latter being subsequently mixed with the separated meal.—J. F. B.

Brewing processes. E. W. Kuhn, Brussels. Eng. Pat. 849, Jan. 12, 1914. Addition to Eng. Pat. 9170 of 1913 (this J., 1914, 608).

THE malt, previously extracted with water at 10° C., is added to water at 80° C., agitated at that temperature for one hour or more and then boiled, in order that the coagulation of the albumin may take place after the gelatinisation of the starch granules. The conversion of the starch paste into a wort rich in dextrins may take place between 70° C. and 80° C., the lower temperature being adopted for malts of low diastatic power. Alternatively the original aqueous extract of the malt may be heated to 70°—80° C. for two minutes and then cooled before use.—J. F. B.

Yeast and the like; Dryer for — J. H. A. Wiesener, Hamburg, Germany. U.S. Pat. 1,129,031, Feb. 16, 1915. Date of appl., Feb. 7, 1914.

SEE Eng. Pat. 25,302 of 1913; this J., 1914, 802

Diastase; Manufacture of — S. Fränkel, Vienna. U.S. Pat. 1,129,387, Feb. 23, 1915. Date of appl., Aug. 7, 1913.

SEE Eng. Pat. 18,427 of 1913; this J., 1913, 1166.

Apparatus for impregnating liquids with carbonic acid or other gases. Eng. Pat. 19,769. See I.

XIXA.—FOODS.

Bread; Microscopical detection of potato starch in — G. Schutz and L. Wein. Chem.-Zeit., 1915, 39, 143.

THE microscopical identification of potato flour in bread is much facilitated by staining with suitable dyestuffs, e.g., neutral red, methylene blue, or, best of all, thionine. Wheat and rye starches are relatively resistant and remain unstained under conditions sufficient to stain distinctly the granules of potato starch, even

when the latter are considerably gelatinised. A few crumbs of bread are moistened with water and a small sample is pressed between two cover slips which are then pulled apart. The material remaining on the slips is dried in the air and fixed by passing through a flame. The preparation is treated with a drop of thionine stain diluted with 2 vols. of water for 2½—3 minutes, the dyestuff washed out, and the slip mounted in water and examined under a low power. The cereal starch granules are colourless and the potato starch lilac-coloured; the large cells of the potato parenchyma tissue are stained deep reddish-violet, also the endosperm tissue of the cereals. The tissues of the fruit- and seed-husks of the cereals and the cortical tissue, reticulated vessels, and sclerenchyma of the potato rind are all stained deep blue, but since potato rind may be assumed to be absent, it is sufficient for practical purposes to regard all blue elements as derived from the cereals. When boiled potatoes have been used in the bread, the gelatinised granules may be destroyed by the above method of preparation and overlooked. In such cases the moistened crumbs should be broken down on a slide by pressing with a scalpel without any rubbing action, drained by blotting paper, treated with the thionine solution, again drained by blotting paper, and washed with water in the same manner, the cover slip being then put on with very gentle pressure. The sacs filled with starch paste, of very large size, will then be mostly well preserved and easily differentiated by a red stain.—J. F. B.

Milk; Bacillus abortus in market — A. C. Evans. J. Washington Acad. Sci., 1915, 5, 122—125.

THE following method is described for the separation and identification of *B. abortus*, an organism occurring in milk and capable of causing contagious abortion in cattle; its effect on human health is not known. The milk is plated on ordinary lactose agar, to which 10% of sterile blood serum is added just before pouring into the plate at 50° C. After incubation for four days at 37° C., a certain area of the plate, large enough to include several colonies of *B. abortus*, should they be present, is transferred to a nutrient broth containing 1% of glycerol; similar portions of the colonies are transferred to tubes containing whole milk mixed with litmus. The growth in the glycerol broth is characteristic; there is a medium amount of growth in small compact spherical masses which settle to the bottom of the tube and do not cloud the liquid. In the litmus-milk there is an abundant growth in the cream layer, with a gradual development of acid. On plain infusion agar slopes the growth is in very small separate colonies; these are scattered over the whole surface of the slope if it happened to be moist at the time of inoculation, or are confined to a ribbon-like growth if the agar was comparatively dry. The organism is a small rod-shaped bacterium about 0.5μ in width and sometimes about 3μ in length, but is often so short as to appear coccoid in form. It does not attack carbohydrates, and glycerol is one of the very few food substances it can utilise; since it grows more abundantly in cream than in skim milk, it is probable that the organism is capable of breaking down glycerides in order to obtain the glycerol for its support. Of 46 samples of dairy milk examined, 14 were found to contain *B. abortus*, the number of organisms present varying from 110 to 4300 per c.c.—W. P. S.

Bacillus coli; Ability of — to survive pasteurisation. S. H. Ayres and W. T. Johnson. J. Agric. Research, 1915, 3, 401—410.

THE thermal death point of 174 cultures of *B. coli* isolated from cow faeces, milk and cream, human

feces, flies, and cheese, showed considerable variation when the cultures were heated in milk for 30 minutes under conditions similar to pasteurisation. At 60° C., 95 cultures survived; at 62·8° C., the usual temperature for pasteurising, 12 survived. One culture was not destroyed by heating to 65·6° C., until the heating was repeated. The survival of the few cultures at the higher temperature was due to the resistance of a few cells, and it is evident that 62·8° C. maintained for 30 minutes is a critical temperature for *B. coli*. The colon test as an index of the efficiency of the process of pasteurisation of milk, is complicated by the ability of certain strains to survive a temperature of 62·8° C. for 30 minutes and to develop rapidly when the pasteurised milk is kept under the conditions of temperature met with during storage and delivery. If, however, milk is pasteurised at 65·6° C. or above for 30 minutes, few *B. coli* would survive, and the colon test might be of value.

—W. P. S.

Rice: The organic phosphorus of —. A. R. Thompson. *J. Agric. Research*; 1915, 3, 425—430.

RICE bran was found to contain 8·22% of phytin, whilst polished rice was free from this substance. Analyses of barium phytate, prepared according to Anderson's method (this *J.* 1914, 371) from unpolished rice and rice bran, respectively, contained:—C, 6·51 to 6·97; H, 1·75 to 1·87; P, 16·05 to 16·43; Ba, 36·84 to 37·84%. Inositol was prepared from the barium phytate by hydrolysis with 30% sulphuric acid at 150° C. for 5 hours.—W. P. S.

Palm kernel cake and meal: a new feeding stuff for live-stock. Bull. Imp. Inst., 1914, 12, 577—579.

THE first consignment of palm kernels (1600 tons) from British West Africa to Hull was recently landed, and a very large proportion of W. African palm kernels will probably be crushed in Great Britain in future. There will be no difficulty in disposing of the oil, but palm-kernel cake, though a popular feeding stuff in Germany, Holland, Denmark, and Scandinavia, is comparatively unknown in Great Britain. British-made palm-kernel cake and meal are superior in quality to the German products, as is shown in the following table:—

	Palm-kernel cake (expressed).			Palm kernel meal (extracted).		
	English.			German	English	German
	1	2	3			
	%	%	%	%	%	%
Moisture.....	12·0	12·0	10·85	9·7	15·0	10·9
Crude protein ..	16·75	18·5	16·12	17·7	19·0	18·7
Fat	7·07	5·5	6·17	8·6	2·0	1·6
Carbohydrates ..	46·83	50·0	48·51	36·2	51·0	39·1
Crude fibre ...	13·55	10·0	14·80	23·8	9·0	25·4
Ash	3·8	4·0	3·55	4·0	4·0	4·3
Food units ...	106	110	104	102	104	90

(See also this *J.* 1914, 1060, 1218.)—A. S.

The industrial position of copra, coconut oil, and coconut cake. See XII.

PATENTS.

Flour; Manufacture of an improved form of — and apparatus for use therein. T. T. Vernon, Chester. Eng. Pat. 558, Jan. 8, 1914.

THE flour is delivered from a hopper in a fine stream on to an inclined plane where it receives drops of water at 130° F. (54° C.) delivered from points projecting through perforations in a trough. The drops of water are immediately surrounded with flour, and these aggregates passing on to a sieve are separated from the fine flour which is returned to the hopper. The aggregates pass on to a series of endless travelling bands in a casing through which a current of warm air (at 100°—140° F., 38°—60° C.) is drawn, then on to a second sieve and into a second casing, the lower portion of which acts as a cooler. From this, the aggregates drop on to a third sieve and thence into a sack. Suitable substances may be dissolved in the water used.—J. H. J.

Flour or bread, or other foods made therefrom; Manufacture of —. J. E. Shackleton, Pleasington, Lanes. Eng. Pat. 7383, March 24, 1914.

WHEAT from which flour is to be prepared is steeped in a liquid obtained by washing or steeping unwashed wheat in water, or the flour itself is sprayed with the liquid. The liquid, before use, is allowed to stand until it becomes acid, then concentrated and filtered.—W. P. S.

Grain or the like; Appliances for heating, drying, and cooling —. E. Samuelson, Banbury, and J. Backhouse, Bootle. Eng. Pat. 4589, Feb. 23, 1914.

A GRAIN heating chamber is enclosed within a casing, the air in which is heated by radiation or convection from the sides of the chamber or from hot water pipes. This heated air is drawn downwards through louvred columns, through which also the grain falls from the heating chamber above. Valves are provided for regulating the admission of fresh air to the casing and the columns. From the bottom of the columns the grain passes down over baffle-plates, between which a current of air at 60°—70° F. (16°—21° C.) is drawn, and finally between tubes containing a cooling fluid.—J. H. J.

Kola preparation; Process for making a —. G. C. Zimmermann, Stuttgart, Germany. Eng. Pat. 15,725, July 1, 1914. Under Int. Conv., July 2, 1913.

A KOLA preparation free from bitter flavour is obtained by disintegrating fresh kola nuts, allowing them with the juice to lie in vats until an odour of violets is produced, indicating that fermentation has commenced, and then roasting the mass. The product may be extracted with hot water and the extract mixed with sugar, or the extract may be used directly as a beverage.—W. P. S.

Foods, drugs, and beverages; Process of introducing iron into —. Process of forming compounds of iron and carbohydrates. H. L. Marsh, Philadelphia, Pa. U.S. Pats. (A) 1,129,306 and (B) 1,129,307, Feb. 23, 1915. Dates of appl., Dec. 5 and 26, 1914.

(A) A SOLUTION of a carbohydrate (sucrose) is heated under pressure to about 300° F. (149° C.) and subjected to electrolysis, an iron anode being used. (B) A current of electricity is passed through a solution of a carbohydrate, e.g., sucrose, contained in a cell divided into two communicating compartments; an iron anode is employed and both the anode and the cathode are suspended in their respective compartments at some distance from the dividing wall.—W. P. S.

[Extracts] having a vegetable base : *Manufacture of products* —. H. Schmidt, Meudon, France. U.S. Pat. 1,128,628, Feb. 16, 1915. Date of appl., Dec. 26, 1911.

SEE Eng. Pat. 25,151 of 1911; this J., 1912, 947.

Apparatus for impregnating liquids with carbonic acid or other gases. Eng. Pat. 19,769. See I.

XIXB.—WATER PURIFICATION; SANITATION.

Soil-contaminated wounds; Elementary principles involved in the treatment of —. A. G. R. Foulerton. Lancet, 1915, 188, 484—490.

THE principal object in the treatment of soil-contaminated wounds is the avoidance of dangers arising from the entry of anaerobic soil bacteria or their spores, e.g. *B. oedematis maligni*, *B. welchii*, *B. perfringens*, etc. These organisms may be dealt with by disinfecting the wound by the use of germicides, or by inhibiting the activity of the organisms by continuous oxygenation, or by a combination of these two methods. The second method, used alone or following the first, prevents any danger arising from an anaerobic state of the tissues. Suitable oxidising agents are calcium and barium peroxides and sodium perborate. To ascertain the relative rapidity of the evolution of oxygen by these substances, equal weights were added to water, pus, and blood corpuscles in fermentation tubes and incubated at 37° C. The volume of oxygen given off was observed after 1 and 2 hours and 1 and 2 days. In all the experiments, the evolution of oxygen from the perborate was the most rapid and gave the largest volume of gas after 2 days. The rate was not constant, being very rapid during the first few hours and slowing down afterwards. The residues after decomposition were slightly alkaline; the perborate dissolved completely in pus and blood, but the peroxides left an insoluble residue. To show that the nascent oxygen evolved from these compounds was an active germicide, experiments were carried out with these substances added to bacterial emulsions, pus, and putrid meat. Pyogenic cocci were killed after 2 hrs. by 2.5% barium peroxide solution and after 1 hr. by 5% perborate; *B. coli* was killed in 15 mins. by 5% perborate, and anthrax spores in 1 and 2 days. The time required to sterilise the pus and the meat varied from 1 to 2 days. In practice, if the wound is fresh, application of perborate after cleaning the wound will maintain aerobic conditions, the nascent oxygen also acting as a germicide to aerobic organisms. If the wound is not so recent and there has been time for spores to germinate under the anaerobic conditions set up, then the wound should be cleaned and swabbed with pure phenol, before applying the perborate.—J. H. J.

Sulphur in peptone [e.g. in culture media]; Comparative study of methods for the determination of —. H. W. Redfield and C. Huckle. J. Amer. Chem. Soc., 1915, 37, 607—611.

OF various methods investigated, the Liebig-Koch process, in which the substance is treated with nitric acid and then fused with a mixture of potassium hydroxide and nitrate, was found to be the most trustworthy for the determination of total sulphur in peptone. The treatment with nitric acid need not be prolonged for more than 2 hours and there is no loss of volatile sulphur compounds during this part of the process. As regards methods for determining a part only of

the sulphur, the Schultz method for loosely-combined sulphur (see this J., 1902, 505) and the digestion process with nitric acid and potassium chlorate for readily oxidised sulphur, gave the most accurate results.—W. P. S.

Sulphur in the culture medium for the detection of bacteria producing hydrogen sulphide; Determination of —. H. W. Redfield and C. Huckle. J. Amer. Chem. Soc., 1915, 37, 612—623 (see also preceding abstract).

THE authors have made an investigation as regards the total amount of sulphur broken down by the so-called putrefactive bacteria, the forms of sulphur most readily used by the bacteria, and the forms in which the sulphur existed after their action. More material is broken down and more hydrogen sulphide is produced the larger the surface of medium exposed. When sterile air is passed over the cultures, about 50% more total sulphur is converted into hydrogen sulphide than when they are exposed to quiescent air, and about 100% more than when carbon dioxide is passed over them. From 25 to 30% of the total sulphur is converted into hydrogen sulphide when the cultures are incubated for 48 hours in a current of sterile air, and 50 to 60% when incubated for 72 hours. In media made from the portion of peptone soluble in alcohol, much less sulphur-containing substance is broken down and much less hydrogen sulphide produced than in the case of media made from the portion of peptone insoluble in alcohol. A larger percentage of sulphur-containing substance than of total peptone is broken down by the bacteria, the ratio being 3 : 1, and slightly more readily-oxidised sulphur than total sulphur is converted into hydrogen sulphide (4 : 3). Further, the loosely-combined sulphur is converted into hydrogen sulphide to a greater extent than is the total sulphur (3 : 2) but only slightly more so than the readily oxidised sulphur (10 : 9). The volumetric iodine method is not available for the determination of the hydrogen sulphide evolved owing to the presence of volatile unsaturated organic compounds; potassium hydroxide solution is to be preferred for absorbing the hydrogen sulphide.—W. P. S.

PATENTS.

Delivering powdered material into liquids; Apparatus for —. [Water softening.] C. R. B. Brown, London. Eng. Pat. 3662, Feb. 12, 1914.

THE powder rests on a piston which forms the bottom of a cylindrical vessel, open at the top and supported over a mixing tank. The spindle of the piston is raised by a ratchet wheel. The liquid to be treated is fed into a tipper, the movement of which actuates the ratchet wheel and lifts the piston a short distance, thus exposing a layer of the powder above the top of the cylinder. The tipper pivot has an arm reaching to the top of the powder cylinder and carrying a skimmer which sweeps the exposed layer of powder into a shoot leading to the mixing vessel, where it meets the liquid discharged from the tipper.—J. H. J.

Addition of predetermined quantities of substances to a uniform or variable flow of liquid; Process of and apparatus for —. [Water softening.] B. C. Hinman, London, and E. W. Robey, South Woodford, Essex. Eng. Pat. 4435, Feb. 20, 1914.

A FIXED proportion of the main flow of water is led to a proportioning box where it flows over a horizontal weir. A fixed proportion of the flow over the weir is led to a float tank, the float in which actuates a drum regulating the proportions

of the flow over the weir taken into the chemical tank and into the main flow. In the chemical tank the reagents required for the treatment of a definite volume of the water are kept in suspension and mixed with the incoming water by agitators driven by a water wheel actuated by the main flow. The water leaving the chemical tank carries its proportional amount of reagents and passes into the main flow, which is then passed into sedimenting and filtering tanks. The amount of water entering the float tank is fixed as desired, and may be 1/500 to 1/5000 of the total volume. By calibrating the float tank, the level of the water will be an index of the volume treated.—J. H. J.

Filtration [of water] under pressure; Apparatus for —. J. H. Missong. Ger. Pat. 280,087, Aug. 20, 1913. Addition to Ger. Pat. 260,096.

THE water may be forced through a filter on its way to the high-level reservoir mentioned in the chief patent (this J., 1913, 708). The filters may be in the form of open chambers provided with barometric fall tubes; the water from the first filter flows through the fall tube into a reservoir, which may also serve as a settling tank, and is then pumped up into the next filter.—A. S.

Lime, or like, mixing machines [used in sewage purification]. J. B. Broadhead and D. Barker, Brighouse, Yorks. Eng. Pat. 5081, Feb. 27, 1914.

THE lime is fed to the interior of the mixing pan by means of a shoot extending through one side of the pan. A pump delivers the desired amount of water to the milk of lime flowing from the mixer, and the mixture passes into a channel extending across the sewage conduit. This channel has a sloping bottom with V-shaped slots at intervals along the bottom of the deeper side, through which the milk of lime falls into the sewage. The mixing pan is provided with a bottom outlet pipe for discharging any undissolved solids into the sewage conduit when necessary. This pipe is closed at its interior end by a valve worked by a spindle and hand wheel from above, and furnished with radial lugs with knife edges for cutting into any deposit when the valve is raised.—J. H. J.

Plant pests; Production of mixtures for destroying —. A. Lang. Ger. Pat. 279,563, Feb. 13, 1914. Addition to Ger. Pat. 265,656 (this J., 1913, 1169; see also Eng. Pat. 20,395 of 1913; this J., 1914, 663).

A METALLOID such as carbon is intimately mixed with an equivalent quantity of sulphur and with a mixture of a metal powder and a sulphur- or oxygen-carrier, capable of developing an exothermic reaction without access of air; the mass is moulded and when required for use is ignited, whereupon the sulphur compound of the metalloid is formed.—A. S.

Apparatus for clarifying liquids containing finely divided matter in suspension. Eng. Pat. 7179. See I.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Cinchonine; The hydrogenation of —. M. Freund and J. A. W. Bredenberg. Chem. Ges. zu Frankfurt, Nov. 24, 1914. Chem.-Zeit., 1915, 39, 109.

ON electrolytic reduction with lead cathodes prepared by Tafel's method (see this J., 1900, 909; 1901, 48), cinchonine combines with 2 mols. of hydrogen, with loss of water, yielding two bases, one of which, dihydrodesoxycinchonine, $C_{19}H_{24}N_2$,

is crystalline, m. pt. 135° – 136° C.; it contains an imino group and is formed by the conversion of the $CH(OH)$ group of cinchonine into CH_2 , while two atoms of hydrogen enter the pyridine ring. It yields desoxycinchonine on treatment with iodine and is further hydrogenated in the pyridine ring by sodium and amyl alcohol, giving the tetrahydro-compound. When shaken with palladium in hydrogen it also takes up two atoms of hydrogen, the vinyl group of the side chain being converted into an ethyl group. This last product, dihydrodesoxycinchotone, can be obtained also from cinchotone by electrolytic reduction. Dihydrodesoxycinchotone, on reduction with sodium and amyl alcohol, and tetrahydrodesoxycinchonine, on reduction with hydrogen and palladium, both give the same product, which may be termed either tetrahydrodesoxycinchotone or hexahydrodesoxycinchonine.—J. F. B.

Strychnine; Substances which mask the colour reactions of —. E. Mameli. Boll. Chim. Farm., May–Sept., 1914. J. Pharm. Chim., 1915, 11, 125–126.

THE usual scheme for the isolation of the alkaloids does not separate them from a number of common medicaments or their decomposition products such as phenacetin, *p*-phenetidine, *p*-aminophenol, phenocoll, guaiacol, heroin, sulphophenoxides, glycerol, etc., and many of these substances prevent or otherwise mask the alkaloidal colour reactions. In the case of strychnine, both the sulphuric acid and bichromate, and the sulphovanadic acid reactions are vitiated by the presence of the above substances, and the precipitation reactions with ferrocyanide and picric acid, when not actually prevented, may be rendered extremely uncertain in the presence of these and other substances owing to the precipitates which they may themselves produce. The only method of avoiding these undesirable results is to obtain the alkaloid in a sufficient state of purity by the judicious employment of suitable solvents.—G. F. M.

Aconitine; Oxidation of —. G. Barger and E. Field. Chem. Soc. Trans., 1915, 107, 231–233.

WHEN aconitine is oxidised in acetone solution with potassium permanganate in presence of glacial acetic acid, 90% of the theoretical yield of oxonitin is obtained. Five grms. of aconitine is dissolved in 250 c.c. of acetone and 11 grms. of finely powdered potassium permanganate and 12.5 c.c. of glacial acetic acid are added in the course of five to seven days, the separated oxonitin and manganese dioxide being then filtered off and suspended in water, and the manganese dioxide removed by sulphur dioxide. Oxonitin crystallises best from boiling glacial acetic acid after addition of acetone, forming stout prisms, m. pt. 276° – 277° C. When heated with hydriodic acid and phosphorus, it is converted into a substance, crystallising from alcohol in prisms, m. pt. 121° – 122° C., b. pt. about 200° C. at 15 mm. The mean results of a number of analyses of recrystallised oxonitin gave C, 60.51, H, 6.66, CH_3O , 18.5%. (See also this J., 1912, 1145, 1199).—T. C.

Pavine; Constitution of —. Constitution of the reduction products of papaverine. F. L. Pyman. Chem. Soc. Trans., 1915, 107, 176–187.

PAVINE (dihydropapaverine) on methylation yields N-methylpavine, the methohydroxide of which is converted by boiling concentrated, aqueous potassium hydroxide into the methine, $C_{22}H_{27}O_4N$, which on oxidation with cold aqueous potassium permanganate gives a dicarboxylic acid,

ethyl acetate by *N*/10 hydrochloric acid at 0° C., 25° C., and 40° C., indicates that the ratio of the catalytic activities of the undissociated molecule and the hydrogen ion does not possess a considerable temperature coefficient as suggested by MacBain and Coleman (Chem. Soc. Trans., 1914, 105, 1520), but that, on the contrary, it is independent of temperature. The importance of a consideration of the activity of the undissociated molecule in calculations of reaction constants in acid catalyses is emphasized.—W. P. S.

Crude calcium cyanamide as a raw material of the chemical industry. Carlson. See VII.

PATENTS.

Substituted urcas; Manufacture of new — [and their use for stabilising nitro-products]. Fabr. de Prod. Chim. Org. de Laire, Issy, France. Eng. Pat. 17,501, July 23, 1914. Under Int. Conv., July 29, 1913.

CLAIMS are made for new tetra-substituted ureas, of the type $RR^1N.CO.NR^2R^3$, where R and R² represent alkyl and R¹ and R³ aryl radicles, and their use for stabilising nitro-derivatives (explosives, celluloid, etc.). The new products are viscous liquids or melt below 50° C., and are very soluble in organic solvents. Methylphenylethyl-*o*-tolylurea, ethylphenylmethyl-*o*-tolylurea, methyl-ethyl-di-*o*-tolylurea, and diethyl-di-*o*-tolylurea are claimed specially.—F. W. A.

Hydroxyisopropyl derivatives of hydrocarbons and their derivatives; Preparation of —. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 280,026, Sept. 9, 1913.

ACETONE-SODIUM, when obtained by the action of sodium amide on acetone in presence of ether at low temperatures, is a crystalline substance readily soluble in ether and petroleum spirit, and, unlike the known insoluble acetone-sodium, is very reactive. By its action on hydrocarbons or their derivatives, one or more atoms of hydrogen are replaced by the $(CH_3)_2C(OH)$ group; the products are obtained in the form of their sodium compounds, from which the hydroxyisopropyl compounds are prepared by treatment with acids.—A. S.

Panama bark; Process for the suppression of dust during the working up of —. R. Mandelbaum, Asperg, Germany. U.S. Pat. 1,128,472, Feb. 16, 1915. Date of appl., Aug. 19, 1913.

SEE Ger. Pat. 264,163 of 1912; this J., 1913, 1031.

Medicinal preparation for human use. H. Belart, Huddersfield. U.S. Pat. 1,129,270, Feb. 23, 1915. Date of appl., Oct. 8, 1913.

SEE Eng. Pat. 23,097 of 1912; this J., 1913, 989.

Carbohydrate phosphoric acid esters; Manufacture of —. H. K. A. S. von Euler-Chelpin, Assignor to Aktiebolaget Astra, Apotekarnas Kemiska Fabriken, Stockhorn. U.S. Pat. 1,129,321, Feb. 23, 1915. Date of appl., May 20, 1913.

SEE Fr. Pat. 458,096 of 1913; this J., 1913, 1031.

2-Phenylquinoline-4-carboxylic acid; Preparation of —. Chem. Fabr. auf Actien, vorm. E. Schering. First Addition, dated April 27, 1914, to Fr. Pat. 445,529, June 27, 1912. Under Int. Conv., Aug. 1, 1913.

SEE Eng. Pat. 11,836 of 1914; this J., 1914, 889.

Alcohol; Process and apparatus for the manufacture of —. W. K. Freeman. Fr. Pat. 471,621, Dec. 18, 1913.

SEE Eng. Pat. 28,923 of 1913; this J., 1915, 248.

Urcas [; Substituted —.] and their application. Fabr. de Prod. Chim. Org. de Laire. Fr. Pat. 472,211, July 29, 1913.

SEE Eng. Pat. 17,501 of 1914; preceding.

Process of introducing iron into foods, drugs, and beverages. Process of forming compounds of iron and carbohydrates. U.S. Pats. 1,129,306 and 1,129,307. See XIXA.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Application of a variety of selenium particularly sensitive to light to the construction of selenium cells for photometry. Angel. See XXIII.

PATENT.

Photographic prints in natural colours from Lumière autochromic and other colour-sensitive lined plates; Process for obtaining —. M. F. Ungerer, Offenbach, Germany. U.S. Pat. 1,128,389, Feb. 16, 1915. Date of appl., Aug. 15, 1913.

SEE Eng. Pat. 17,979 of 1913; this J., 1914, 222.

XXII.—EXPLOSIVES; MATCHES.

Electrolysis of a solution of sodium hydrazide in anhydrous hydrazine. Welsh. See VII.

PATENTS.

Explosive. F. Sparre, Assignor to E. I. du Pont de Nemours Powder Co., Wilmington, Del. U.S. Pat. 1,128,380, Feb. 16, 1915. Date of appl., Jan. 25, 1913.

THE explosive consists of an oxidisable carbon-containing material, a nitrate, and an alkaline-earth polysulphide.—T. St.

Explosive. F. R. and J. G. Burrows. Fr. Pat. 472,371, May 19, 1914.

A MIXTURE of 6 parts of ammonium perchlorate, 56 of potassium nitrate, 18 of aluminium (in coarse particles which will pass through a 30-mesh sieve, and produced by cooling the metal in water), 18 of *a*-trinitrotoluene, and 2 parts of pure paraffin wax.—B. N.

Detonator-easings; Charge for —. L. Wöhler, Darmstadt, Germany, Assignor to E. I. du Pont de Nemours Powder Co., Wilmington, Del. U.S. Pat. 1,128,394, Feb. 16, 1915. Date of appl., May 10, 1911.

SEE Addition of June 27, 1911, to Fr. Pat. 387,640 of 1908; this J., 1912, 153.

Explosive; Gelatin —. J. Maire, Argenteuil, Assignor to A. E. Vergé, Vincennes, France. U.S. Pat. 1,128,471, Feb. 16, 1915. Date of appl., July 22, 1913.

SEE Eng. Pat. 17,205 of 1913; this J., 1914, 943.

New substituted urcas [and their use for stabilising nitro-products, e.g. nitrocellulose]. Eng. Pat. 17,501. See XX.

XXIII.—ANALYTICAL PROCESSES.

Base metal thermocouples; The constancy of — as related to the microstructure. O. L. Kowalke. Trans. Amer. Electrochem. Soc., 1914, 26, 199—214.

THE couples tested (Ni-Cr and Ni-Fe-Si, Cr-Fe-Ni and Al-Ni, Fe and Al-Ni, Fe and Cu-Ni, Cr-Ni and Fe-Ni) showed departures of 20°—125° C. from their original calibrations. Examination of the microstructures of the separate wires before and after heat treatments for 2 hours at 400°, 600°, 800°, and 1000° C., showed that in those cases where there was considerable deviation from the original calibration, segregation occurred on heating, and it was concluded that, provided the thermo-electric force is satisfactory and the m. pt. high, those metals which form solid solutions with one another give the best results, and that silicon is not a desirable constituent in a nickel alloy for thermocouple material.—W. E. F. P.

Selenium cells for photometry; Application of a variety of selenium particularly sensitive to light to the construction of —. L. Angel. Bull. Soc. Chim., 1915, 17, 10—14.

VITREOUS selenium, melted at 220° C. and then cooled rapidly under pressure, changes into a new, very unstable, crystalline variety of greyish violet appearance which is very sensitive to light. By choosing suitable conditions of heat and pressure it is possible to obtain a kind of solid solution of this variety in vitreous selenium which is much more stable, and is suitable for the construction of photo-electric cells. Two parallel naked copper wires wound on an insulating bobbin at a distance of not more than 0.04 mm. apart form the electrodes, and the selenium is spread over to bridge the gap. The minute quantity of metallic selenide formed acts as a sensitiser, and greatly enhances the sensitiveness of the selenium. With this construction the conductivity of the selenium varies almost as rapidly as the illumination, and its inertia is practically negligible. The cells have been successfully used for the photometric study of heat radiations, X-rays, cathode rays, and the solar eclipse. —G. F. M.

Freezing-point depression of dilute solutions; The measurement of —. L. H. Adams. J. Amer. Chem. Soc., 1915, 37, 481—496.

THE method provides a means of measuring the freezing-point depressions of solutions of the order $N/10$ to $N/200$ with an accuracy sufficient to enable comparison to be made with results derived from conductivity measurements; this involves the determination of the depression to 0.0001° C. and of the equilibrium concentration with commensurate accuracy. Two similar vacuum-jacketed vessels are completely surrounded by ice in a large closed pot insulated by a layer of felt; the vessels contain pure water and the solution, respectively, and in each case stationary equilibrium with a large quantity of ice is achieved by using a small circulating pump. The depression is determined directly by means of a 50-junction copper-constantan differential thermo-element (giving 2000 microvolts per 1° C.). The E.M.F. is read to 0.1 microvolt. The concentration of the equilibrium solution is determined (to about 2 parts of solute per million of water) by means of a Zeiss interferometer. The observed and calculated freezing-point depressions for five solutions of mannitol were, respectively, 0.0075, 0.0075; 0.0157, 0.0156; 0.0260, 0.0261; 0.0525, 0.0525; 0.1162, 0.1162. Results are also quoted for aqueous solutions of potassium nitrate and potassium chloride at concentrations ranging from $N/250$ to $N/10$.—J. R.

Electrometric titrations. H. Ziegel. Trans. Amer. Electrochem. Soc., 1914, 26, 91—97.

DETAILS are given of a device by means of which the change in potential occurring in a solution at the end-point of a titration is utilised for automatically closing the stopcock of the burette when the end-point is reached. The apparatus is similar to that of Forbes and Bartlett (J. Amer. Chem. Soc., 1913, 35, 1527), a Weston No. 30 relay replacing the ordinary galvanometer. A telegraph sounder with a narrowed arm, 7 in. long, is attached to each extremity of the stopcock, which is thus indirectly opened or closed by the movement of the needle of the Weston instrument. The solution is stirred rapidly by the elongated shaft of a battery motor; this shaft is heavily plated with platinum and tipped with a deeply nicked disc of platinum, the latter forming the oxygen electrode with which a calomel electrode of ordinary form is used. In the titration of a sulphuric acid solution of potassium bichromate with ferrous sulphate, the burette readings obtained automatically were concordant and in close agreement with those obtained manually by the use of a spot plate. It is proposed to apply the apparatus to the titration of iron (as indicated) and zinc (by ferrocyanide). —W. E. F. P.

[Testing of] metropolis gas. See IIA.

Determination of weighing of silk. Heermann and Frederking. See VI.

Determination of small quantities of hydrocyanic acid. Viehoveer and Johns. See VII.

Hygroscopic and total water in plaster of Paris. Canals. See IX.

Determination of manganese in ferrovandium. Clark. See X.

Determination of gases in smelter flues and of dust losses. Dunn. See X.

Analysis of tanning materials intended especially for the tanning of fishing nets. Van Dorp. See XV.

[Determination of] degree of tannage. James. See XV.

Determination of sucrose in frozen and thawed beets [by the double polarisation method, using acid and invertase as hydrolysts]. Saillard. See XVII.

New method for determining the activity of diastase. Wolff. See XVIII.

Microscopical detection of potato starch in bread. Schütz and Wein. See XIXa.

Determination of sulphur in peptone [e.g., in culture media]. Determination of sulphur in the culture medium for the detection of the bacteria producing hydrogen sulphide. Redfield and Huckle. See XIXb.

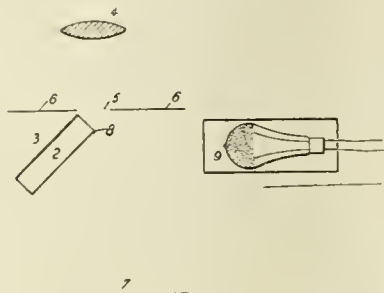
Substances which mask the colour reactions of strychnine. Mameli. See XX.

Velocity of saponification of linalyl, terpenyl, and geranyl acetates. [Detection of terpenyl acetate in bergamot oil.] Barillet and Berthelé. See XX.

PATENTS.

Photometers. J. M. G. Trezise, Croydon. Eng. Pat. 6319, March 12, 1914.

LIGHT from a standard lamp, 9, falls on a glass slab, 2, with opal backing, 3, the reflected light from the end of the slab being viewed through the



hole, 5, in the screen, 6. Direct light from the luminous surface, 7, the brilliancy of which is to be measured, passes through the hole, 5, for comparison. The edge, 8, forms a sharp dividing line between the luminous areas to be compared, and may be magnified by the lens, 4. To compare two light sources, two slabs such as 2, but oppositely inclined, are used, the visible edges slightly overlapping.—W. F. F.

Thermometer; Electrical resistance—. The Cambridge Scientific Instrument Co., Ltd., and W. H. Apthorpe, Cambridge. Eng. Pat. 20,248, Sept. 25, 1914.

A DOUBLE metal wire is wound in a double helical thread, cut on the surface of a tube or rod of porcelain, steatite, glass, or the like, the surface is then coated with a suitable fusible material, and the whole is heated until the material is fused on to the surface.—B. N.

Gaseous mixtures with known constituents; Quantitative analysis of—. Siemens und Halske A.-G. Ger. Pat. 278,676, July 3, 1913. Addition to Ger. Pat. 275,084.

IN carrying out the process described in the chief patent (see Fr. Pat. 458,916 of 1913; this J., 1913, 1171), the gas used as a standard for comparison and the gas under examination are kept under the same conditions of temperature and pressure, and the speed of the centrifugal device is controlled by the manometer for the standard gas. In this way the indications are

rendered independent of fluctuations of temperature and pressure.—A. S.

XXIV.—MISCELLANEOUS ABSTRACTS.

Gases; The analysis of—after passage of electric discharge. A. C. G. Egerton. Proc. Roy. Soc. 1915, A., 91, 180—189.

ELECTRIC discharges were passed, using three coils of different sizes with different types of interrupters, through tubes of various shapes and sizes with palladium, platinum, and aluminium electrodes, and the residual gases were analysed with the aid of phosphorus and charcoal in various ways. No production of helium or neon was observed. From theoretical considerations it is also held that, if such a production has an origin other than from atmospheric contamination, the source must be in some action on the electrodes or the glass composing the discharge tube. (See also this J., 1913, 231; 1914, 1087.)—B. N.

Binary mixtures; Molecular structure of isotropic and anisotropic—. [Silica-boric oxide glasses, and gold-silver and gold-copper alloys.] G. Tammann. Z. anorg. Chem., 1914, 90, 297—326.

THE paper deals with the action on a binary mixture of a solvent in which one component is soluble and the other insoluble. For isotropic mixtures, in which there is no regular arrangement of the molecules of the components, the probability of a molecule of the soluble component being protected against the action of the solvent by a definite number of molecules of the second component may be calculated with the aid of the laws of chance. In the case of glasses composed of fused mixtures of silica and boric oxide, submitted to the action of water and of a solution of hydrochloric acid in methyl alcohol (cf. this J., 1896, 220) respectively, the proportion of boric oxide left undissolved in the glasses containing 1 mol. B_2O_3 to 1 mol. SiO_2 or 1 mol. B_2O_3 to 2 mols. SiO_2 agreed fairly well with the values calculated on the assumption that 1 mol. B_2O_3 is protected by 5 mols. SiO_2 ; in the glasses richer in boric oxide the proportion of the latter left undissolved was considerably greater than the calculated values, a result attributed to adsorption by the insoluble residue.

In the case of binary mixed crystals, the molecules of the components may be distributed without any regular arrangement in the space-lattice forming the framework of the crystal structure, or they may be distributed symmetrically. With the first arrangement the composition of the residue left undissolved by a selective solvent should agree with

% Ag in alloy.	Time of extraction, hours.	Percentage loss of weight of gold-silver alloys.			% Cu in alloy.	Percentage loss of weight of gold-copper alloys.	
		“Hard,” after rolling.	Annealed at 820° C. for :			“Hard,” after rolling. 10 hours' extraction.	Annealed for 49 hours at 700° C. 13 hours' extraction.
			41 hours.	111 hours.			
50-00	9-5	49-01	49-43	49-70*	60-12	60-01	60-23
44-92	9-5	9-80	3-39	—	55-04	54-82	55-33
44-92	15-5	34-37	22-55	44-17*	50-12	49-85	49-65
39-88	9-5	1-63	0-58	—	45-14	44-85	44-80
39-88	15-5	9-71	1-86	—	39-96	39-67	35-14
39-88	27-5	15-89	6-57	17-67*	35-24	33-15	22-58
39-88	40-5	23-84	12-40	—	30-00	13-46	1-65
34-94	27-5	1-43	0-32	0-24*	21-00	0-45	0-27
34-94	40-5	2-13	1-04	—	10-14	0-15	0-27

* Time of extraction, 28 hours.

that calculated from the laws of probability. It is shown that with the second arrangement in the case of crystals having a cubical space-lattice, the whole of the soluble component should be removed by a selective solvent from mixtures containing more than 62.5 mols. % of the soluble component and practically none from mixtures containing less than 50 mols. %; also that a certain proportion of the soluble component should be dissolved much more rapidly than subsequent portions. Experiments with gold-silver and gold-copper alloys were in good agreement with the view that the molecules of the components are arranged symmetrically in the space-lattice. Small plates of the alloys ($2 \times 1 \times 0.01$ cm.) were heated with nitric acid of sp. gr. 1.3 under a reflux condenser and the loss of weight determined. Some of the results are collected in the preceding table. A. S.

Trade Report.

Prohibited exports. Additions to List.

A ROYAL Proclamation, dated March 18th, amends and adds to the Proclamation of Feb. 3rd, 1915 (see this J., 1915, 154) as follows:—

The heading "Thorium nitrate" in the list of goods the exportation of which is prohibited to all destinations is deleted, and there is substituted the heading "Thorium oxide, thorium nitrate, and other salts of thorium."

The heading "Salicylic acid and salicylate of soda" in the list of goods the exportation of which is prohibited to all destinations is deleted, and there is substituted the heading "Salicylic acid, salicylate of soda and methyl salicylate."

The heading "All vegetable oils (other than linseed oil, boiled and unboiled, unmixed with other oil, and not including essential oils)" in the list of goods the exportation of which is prohibited to all destinations abroad other than British Possessions and Protectorates is deleted, and there is substituted the heading "Oils, all vegetable, and fats (other than linseed oil, boiled and unboiled, unmixed with other oil and not including essential oils)."

The heading "Oleo oil, Premier jus, and animal tallow" in the list of goods the exportation of which is prohibited to all destinations abroad other than British Possessions and Protectorates is deleted, and replaced by the heading "All animal oils and fats."

The heading "Rubber (including raw, waste and reclaimed rubber) and goods made wholly of rubber, including tyres for motor vehicles and for cycles, together with articles or materials especially adapted for use in the manufacture or repair of tyres" in the list of goods the exportation of which is prohibited to all destinations abroad other than British Possessions and Protectorates is deleted, and there is substituted therefor the heading "Rubber (including raw, waste and reclaimed rubber, solutions containing rubber, jellies containing rubber, or any other preparations containing rubber) and goods made wholly of rubber; including tyres for motor vehicles and for cycles, together with articles or materials especially adapted for use in the manufacture or repair of tyres."

The following articles are added to the list of goods the exportation of which is prohibited to all destinations abroad other than British Possessions and Protectorates:—Ammonia and its salts,

whether simple or compound, other than ammonium nitrate, perchlorate and sulphocyanide (the exportation of which is already prohibited to all destinations). Ammonia liquor. The compounds of aniline, except aniline salt (the exportation of which is already prohibited to all destinations). Chloride of tin. Copper iodide. Tanning substances of all kinds (including extracts for use in tanning) except chestnut extract, oak-wood extract, and valonia (the exportation of which is already prohibited to all destinations). Urea and its compounds. Tin and tin ore. Neat's foot oil.

Contraband of War.

A ROYAL Proclamation, dated March 11th, declares the following articles to be "absolute contraband": Tin, tin ore, tin chloride; castor oil; paraffin wax; copper iodide; lubricants; ammonia and its salts; ammonia liquor; urea, aniline, and their compounds. It is further declared that tanning substances of all kinds (including extracts for use in tanning) will be treated as "conditional contraband," and that the terms "foodstuffs" and "feeding stuffs for animals" in the earlier Proclamations shall include oleaginous seeds, nuts, and kernels; animal and vegetable oils and fats (other than linseed oil) suitable for use in the manufacture of margarine; and cakes and meals made from oleaginous seeds, nuts, and kernels.

These items are in addition to those enumerated in the Royal Proclamation of Dec. 23rd last (see this Journal, 1914, 1230).

Russian Customs Tariff; Proposed revision of the —, Board of Trade, Commercial Dept., March, 1915.

THE Board of Trade have received, through the Foreign Office, a translation of an article, giving particulars of certain projected modifications of the Russian Customs Tariff, which, it is understood, have been under the consideration of the Russian Government. The proposals for tariff modification are, in their latest and revised form, as follows:—

(1) The "conventional" rates of duty resulting from the Russian Commercial Treaties with Germany and Austria-Hungary are to be abrogated, and the goods covered by those rates are to be cleared at the "General" tariff rates of duty, increased by 10% (except as regards certain goods mentioned under (3) below, in respect of which specially increased rates are to be imposed).

(2) No change is to be made as regards goods the duties on which are fixed by the Russian Commercial Treaties with France, Italy, and Portugal.

(3) Certain goods, including spirits and beer, certain glass wares, rubber (crude), certain colours, cotton, jute, wool, cotton yarns, and certain cotton tissues, are to be subject to special augmented rates of duty.

(4) The existing rates on a small number of articles are to be maintained in force. These articles include: cocoa in the bean and cocoa husks; cooking salt of all kinds; manures; bones, prepared or not; sulphate of ammonia; cast iron in pigs, scrap, and shavings, except manganese (ferro-manganese), ferro-silicon, and ferro-chrome; paper pulp (mechanical)—wood pulp; paper clippings and waste; paper pulp (chemical)—cellulose pulp made from rags.

(5) All other goods are to pay the existing "General" Tariff rates of duty, increased by 10%. A comparative statement showing the present and proposed rates in detail, has been prepared. No information is at present available as to the date from which the temporary tariff is to come into operation.

Chemical industry [in the United States]; The war and the —. W. H. Nichols Amer. Assoc. for the Advancement of Science. Dec. 30, 1914. J. Ind. Eng. Chem., 1915, 7, 131—136.

THE effect of the war upon the chemical industry in the United States has been mainly indirect, certain industries directly affected having reduced their consumption of chemicals. In the case of certain heavy chemicals for which the supply of raw materials has been curtailed or entirely cut off, there has been a sharp advance in prices, but there has been no general rise in prices as a result of the war. The United States imports a considerable proportion of its sulphur in the form of pyrites, nearly all of its potash, and all of its nickel, tin, and sodium nitrate, but in consequence of the command of the sea by the Allies only the importation of potash has been greatly affected by the war. It is suggested that less potash could be used on the soil than hitherto without any great disadvantage. The coal tar colour industry is dealt with at some length, and it is noted, incidentally, in regard to fuming sulphuric acid which is largely used in this industry, that the United States produces more sulphuric acid by the contact process than any other country in the world, and possibly more than all other countries combined. An attempt to manufacture aniline oil in the United States some years ago failed owing to the foreign product being offered at less than cost price; and it is stated that at the present time, when there is no longer any prospect of procuring additional protection of new industries through the tariff, it will be rash to hope that American capital and enterprise should further embark in any of those industries firmly entrenched abroad, and where, as soon as the war is over, foreigners can attack or destroy the local industry by dumping their products at unfairly low prices. It is urged that the anti-trust sections of the Wilson Tariff Act should be amended so as to include therein the prohibition against monopolising of the Sherman Act, even when practised by one person alone, and that the restraint of trade by dumping of goods at unfairly low prices be expressly defined as an act of monopolising.—A. S.

Book Received.

BULLETIN OF THE IMPERIAL INSTITUTE. Vol. XII. No. 4. Oct.-Dec., 1914. Price 2s. 6d.

THIS issue contains the results of investigations in connection with soils from the East Africa Protectorate, tea from new sources, nuts of *Canarium* species, beans from British West Africa, and barley from Cyprus; also special articles on the new developments in the work of the Imperial Institute, the industrial position of copra, coconut oil, and coconut cake, and an article on the economic resources of German East Africa.

* New Books.

[The Roman numerals in thick type refer to the similar classification of abstracts under "Journal and Patent Literature" and in the "List of Patent Applications."]

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Official Notice.

ANNUAL GENERAL MEETING, 1915.

In accordance with the provisions of By-law 64, notice is hereby given that the Annual General Meeting will be held at the Municipal School of Technology, Manchester, at 10.30 a.m. on Wednesday, July 14th, 1915. A programme of the proceedings will be issued later.

In accordance with the provisions of By-law 24, those members whose names are printed in *italics* in the List of Council will retire from their respective offices at the forthcoming Annual Meeting.

Dr. C. C. Carpenter has been nominated to the office of President under By-law 20; Prof. G. G. Henderson has been nominated a Vice-President under By-law 20; Prof. E. C. C. Baly, F.R.S., Mr. R. H. Clayton, and Mr. Julius Hübner have been nominated Vice-Presidents under By-law 21, and Mr. Thos. Tyrer and Dr. R. Messel, F.R.S., have been reappointed Hon. Treasurer and Hon. Foreign Secretary respectively.

Members are requested to nominate, on or before May 22nd next, fit and proper persons to fill four vacancies among the Ordinary Members of Council. Forms for this purpose can be obtained from the Secretary of the Society.

By-law 23:—An Ordinary Member of Council shall be nominated by ten or more members upon Form B in the Schedule, a copy of which form shall be furnished by the Secretary upon the written or verbal request of any member, but a member shall not be eligible to sign more than one such nomination form, and the member nominated shall sign the declaration set forth on the form. A nomination shall be declared invalid by the Council if:

a. The member thereon nominated is disqualified for election, or ineligible to be elected, as provided by the By-laws.

b. The nomination is not made on the authorised printed form or substantially not in the manner directed thereon.

c. The nomination form is signed by less than ten members not disqualified or not ineligible to nominate as provided by the By-laws.

d. The nomination form is not received before or upon the day appointed therefor.

e. The member nominated has not signed the declaration printed upon the form.

A member whose nomination aforesaid is declared to be invalid, shall receive notice thereof from the Secretary, and shall not be submitted for election.

CHARLES G. CRESSWELL,
Secretary.

Birmingham Section.

Meeting held at Birmingham University, on Thursday, April 15th, 1915.

MR. H. T. PINNOCK IN THE CHAIR.

POSSIBLE SOURCES OF POTASH.

BY CHARLES G. CRESSWELL.

Although sodium salts will replace potassium salts in many cases, for some important processes potassium salts are still essential or present practical advantages. Potash is wanted in the manufacture of soft soap and crystal and hard glass, as a frit or glaze for pottery, as a fertiliser, for

pyrotechny, explosives, and matches, and for preserving food; and in a less degree in tanning (as chrome alum), printing (as chlorate and ferro-arsenate), photography, and medicine. In medicine the chief advantage of potassium salts lies in their superior rapidity of absorption and excretion, but in nearly every case the corresponding sodium salts can replace them. The uses of potash in the laboratory are well known.

Stassfurt salts are not separately distinguished in the "Annual Statement of Trade of the United Kingdom," nor were they specifically enumerated in the German official Trade Returns prior to 1890. The first allusions to them occur in British patent records in the year 1863 (Klemm, Eng. Pat. 1776 of 1863). The exports from Germany to the United Kingdom since 1890 have been as follows:—

Year.	Tons.	Value £.
1890	38,731	48,400
1895	31,648	39,550
1900	28,191	34,550
1905	82,461	84,500
1910	52,705	65,900

The German Potash Syndicate was founded in 1879 after 22 years of competition and limited consumption. In 1879 the output of crude salts was 768,971 metric tons, while in 1902 it had increased to 3,250,835 tons. Simultaneously prices improved, due to a systematic propaganda among agriculturists.

In 1911 the Syndicate extracted 9,706,507 tons of crude salts, of which the United States took 1,002,326 tons for agriculture and 22,828 tons for industrial purposes. The German Government allow only one half of the output to be exported, so that Germany has nearly 5,000,000 tons of crude salts for home consumption. There are at present 115 mines; 510 executive officers and 37,000 foremen and labourers are employed.

In reply to a question as to how far a reduction in the price of crude salts would affect their consumption in the chemical industry, Grüneberg (this J., 1882, 25) stated that it was doubtful if the price of crude salts—within limits—could affect the industrial consumption of potash; such industries could well afford to pay for it. Stassfurt, he said, ruled the world. Cheap potash salts were good for the German chemical industry, and any attempt to raise the price by monopoly would involve loss of business. As a fact, competition among the mines kept down prices.

In 1902 the United States obtained control of certain mines, and already in 1906 there were signs of over-production, seeing that of the 36 mines belonging to the Syndicate, 31 were sinking new shafts. In 1909 the Syndicate was provisionally renewed for another year. The acquisition of two groups of mines by the International Agricultural Corporation of America created some difficulty. Negotiations were opened for taking over their contracts under a threat that, if the Syndicate were not renewed, Germany would levy an export duty on potash equal to about £4 per ton on concentrated salts. This threat failed, and the Syndicate started to undersell the Americans. In May, 1910, Germany passed a law making all potash mines members of a pool under Government control, with a strictly limited right of output. Maximum prices for domestic distribution were fixed, and export prices were not to exceed them. The United States protested vigorously but to no purpose. By this time the number of mines had risen to 80, and profits were much attenuated. The United States resented the limitations placed by Germany on the output of mines belonging to American Corporations, and started to search for

new sources of supply. This is the reason why there is so much recent literature on new sources of potash.

On August 31st last the offices of the Syndicate were closed, and it was stated that the mines were not in a condition to be worked, the shafts being filled with water. About the same date, in London, kainit, which sold last spring for £2 per ton, was quoted at £4, caustic potash went up to £4 per cwt., and potassium carbonate was quoted at about £65 per ton. Little more, if any, Stassfurt salts are likely to be available till the end of the war. To medicine this is not very serious, but to agriculture it comes somewhat as a shock. British agriculture, however, did without these salts for many years. For a time it must do without them now, and chemists must cudgel their brains to find other sources of supply. The potash situation has been further complicated by the recent embargo placed by the German Government on the export of potash. At the present time (March), the Federal Council has under consideration a proposal to increase the home prices for potash to what they were before the Potash Act of 1910. The Potash Syndicate calculates a production of 949,000 tons of pure potash for 1915: 563,000 tons for home consumption and 386,000 tons for export. In 1914 the production was 1,167,000 tons; the exports are said to have been 531,000 tons, and the home consumption 636,000 tons.

In the course of this paper, the rise and fall of certain potash industries will be recorded. These changes must not hastily be attributed to apathy on the part of the British manufacturer. The kelp industry was carried on for years at a loss, because its cessation meant starvation in the

crystallises out abundantly, and the density falls to 32°–33° B. The next day, when the water warms up again, the salts deposited at night do not redissolve, and the layer of Epsom salts is covered by a fresh deposit of mixed salts. After a period of these alternations, the mixed salts, containing about 40–45% of Epsom salts and 50–55% of common salt, are collected, while the mother liquors are gathered in large cement tanks and refrigerated.

This separates the potassium salts as carnallite ($\text{KCl} \cdot \text{MgCl}_2 + 6\text{H}_2\text{O}$); this is treated with half its weight of cold water, which dissolves the magnesium chloride with a little potassium chloride, leaving 75% of potassium chloride. The solution is returned to the lagoons, and the crystals of the potassium chloride are centrifuged. One cubic metre of sea water at 28° B., corresponding to 75 cubic metres of ordinary sea water, gives by this process 10 kilos. of potassium chloride. The climate has much influence on the success of this process. The Dead Sea in Palestine and lakes in the tropics without outlets, such as Lake Chad in Nigeria, contain considerable stores of potash salts. The Caspian Sea and Sea of Aral in Russia, and the Rann of Cutch in India are worth examination. Near Yarmouth in the Isle of Wight are remains of such lagoons, though the collection of common salt was their main object.

Hera path (J. Chem. Soc., Vol. 2, 336) states that the waters of the Dead Sea contain in parts per million: sodium 47,908; potassium 6385; and bromine 2167.7.

The following table gives the contents of sodium and potassium salts in normal seas in parts per million:—

Locality.	Venice Lagoons.	Bay of Leghorn.	Mediterranean (Cette)	Pacific I.	Pacific II.	Atlantic I.	Atlantic II.	North Sea.	Red Sea.	Dead Sea.
Sp. gr. ...	1.0184	1.0231	1.0258	1.0264	1.0260	1.0244	1.0287	—	1.03060	—
NaCl	22,346	26,191	29,424	25,885	25,887	26,442	29,554	25,513	30,300	108,630
KCl	833	1111	505	—	—	—	—	—	2880	13,468
K ₂ SO ₄ ...	—	—	—	1359	1327	1499	1810	1529	2950	—

Western Highlands and Islands. Given constant over-production of Stassfurt salts, an imperative need for outlet, untiring Government assistance in every form, and a legion of commercial travellers ever thrusting them before consumers, what chance of existence had the private competitor with his potash in driplets from kelp, molasses, wool scouring, felspar, and sea-water?

Potash from sea water.

All the potash washed off the land eventually finds its way into the sea. From sea water it may be obtained direct or through the agency of sea-weed. Comparatively little attention has been paid to its direct extraction, but it is worth trying, especially where the sun's rays are sufficiently abundant. Sir James Dewar in his presidential address at Glasgow (this J., 1888, p. 479) referred to Balard's process of extraction as being used by M. Pechiney at that date. It appears, however (International Exhibition of 1862, Reports of the Juries, Class II., 48–50) that after 1860 a process came into use which was a combination of Balard's process with that of M. Merle, partner of M. Pechiney. In this process, sea water is concentrated in lagoons by sun action to 28° B. At the Salin Giraud there are 123 acres of earthen lagoons and 40 acres of cemented areas. During the day the sea water deposits salt mixed with a little magnesium sulphate and gradually concentrates to 35° B. On clear nights, radiation cools the liquor to such an extent that magnesium sulphate with 7 equivalents of water

Potash from sea-weed (kelp).

Sea-weed contains on an average 80.44% of water, 9.25% of organic matter (0.45% N) and 10.31% of ash ($\text{K}=1.95$, $\text{P}_2\text{O}_5=0.47$) (Macadam, this J., 1888, 79). When air-dried the giant kelps of the Pacific lose 85% of their weight and then contain 10–15% of potash (as KCl) as well as 1% of nitrogen and 0.5% of phosphoric acid. Experiments made by the United States Bureau of Soils with wheat (Circ. No. 76) showed an increased growth of 31% on one soil and 23% on another, about equal to that produced by potassium chloride but slightly less than by potassium sulphate. Green kelp is too bulky to be transported any distance for fertilising. Cameron (this J., 1912, 227) estimates the possible supply from Pacific kelps as 1,000,000 tons per annum. Balch (this J., 1910, 150) states that one ton of air dried kelp yields 500 lb. of potassium carbonate and 3 lb. of iodine. He suggests collection by properly fitted ships, drying on shore until efflorescence appears (by which time the weed is dry enough without being too hard to press into bales), carbonisation to a point where the carbon is rendered insoluble, and lixiviation.

The algae *Nereocystis* and *Macrocystis* absorb far more potash than soda from the sea, and the efflorescence consists of nearly pure potassium chloride. Their stems contain the most potash. (Merz, this J., 1914, 134) but they are low in iodine. Lindemuth (this J., 1914, 1086) states that freshly cut kelp does not lose potassium chloride when immersed in sea water for a period up to 13

hours. The ash of the rock weed "sea lettuce" contains 45% of KCl. Its presence in kelp is desirable but it would not pay to collect it separately. Up to 1885, Japan imported potash and iodine; since then she has learnt to extract them from kelp, and now sends potash to Europe, and iodine valued at £192,000 annually to the United States.

The kelp industry of Scotland is of very ancient date and is intimately connected with that of glass. The Celtic vitrified forts, which have puzzled archaeologists, arose in this way. Ramparts of sand were covered with dry sea-weed and the sea-weed set on fire. On the vitrified layer thus formed more sand was piled and the operation repeated until a vitreous rampart of considerable height and hardness was obtained. One of these forts may be seen not far from Connell Ferry in Argyllshire.

In olden times the sea-weed, dried as much as the climate would permit, was burnt in the open and the charcoal leached; considerable loss of salts resulted. As early as 1767, Delaval (Eng. Pat. 870) proposed burning the wet weed in reverberatory kilns by the aid of coal or wood. There were one or two patents faintly modelled on Le Blanc's soda process, but until Stanford's time men's minds were devoted to soda. In 1861 (Eng. Pat. 1411), in place of burning sea-weed in the open, Stanford dried it and pressed it into cakes, and destructively distilled it. The charcoal was withdrawn into closely-covered iron boxes to cool, leached and treated as usual for potash and iodides. The distillate gave gas and a tar water which yielded ammonia and other useful bodies.

Gignon and Gagnage (Eng. Pat. 2741 of 1865) proposed to crush and press *Fucus giganteus* and *Zostera maritima*, preferably while wet, so as to extract the salts and nitrogenous organic matter. They steeped the residual pulp in a solution of sodium carbonate, and again pressed it to deprive it of the greater part of the lye, which they used again. The solid residue was to be used for the manufacture of paper.

After this potash became of secondary importance and iodides only were sought. In 1881 (Eng. Pat. 142) Stanford leached the kelp with hot or cold water, boiled down the liquor, and carbonised the extract for potash and iodine. The residual pulp boiled with alkali gave algin, which had only a moderate success. Soon afterwards even the iodine ceased to be profitable and the works were at last closed down.

The action of the German Government in regard to Stassfurt salts stimulated the United States to fresh energy, and recent journals contain much literature on the extraction of potash from kelp. A recent report to the Board of Agriculture for Scotland (Cd. 7564; this J., 1914, 919) describes the American methods of collection and treatment, and the article on "Iodine" in Thorpe's Dictionary, written by Stanford and revised by Prof. Henderson, affords much valuable information. The Columbia Chemical Co., of Los Angeles, Cal., U.S.A., invites correspondence from those interested.

The Board of Agriculture for Scotland, 29, St. Andrew Square, Edinburgh, has been taking steps to increase the output of kelp this season. At present, kelp is purchased by two Scottish firms, and names of other purchasers are asked for. Sea transport from the Islands and Highlands, where it is collected, is available.

Boberg and Testrup (Eng. Pat. 1766 of 1914, this J., 1915, 227) mince and pulp kelp, freed from occluded air, and heat in closed vessels to 170° C. for 20 minutes. The mass now yields a firm press cake. The liquor contains 70% of the original alkali salts, 90% of the iodine, 33% of the nitrogen, and 10% of the organic matter.

The U.S. Bureau of Soils considers that £10,000 would be sufficient to instal plant for producing potash from kelp on a small commercial scale, and Mr. H. S. Gale expresses the opinion that the kelp beds afford the only really promising sources of potash in commercial quantities (Oil, Paint, and Drug Rep., Feb. 8, 1915).

Plant and wood ashes.

This was the earliest source of potash, and in the sixteenth and seventeenth centuries "Muscovy ashes" were highly esteemed by soap boilers; they contained lime. The Board of Trade states that two cargoes (200—300 tons) a month had been coming from South Russia for some time past, but at present shipment is stopped. Potash is still made from wood ashes in the north-west of the United States and in Canada. In 1894 Canada produced 1936 barrels (this J., 1899, 190). In 1898 this had fallen to 1080 barrels, due to the adulteration with soda salts and the abolition of compulsory inspection. There is always some demand for it for soft soap making.

As early as 1802 Hudson (Eng. Pat. 2586) drew attention to "soapers' waste ashes," tanners' bark, bean and other straw, fern, furze, and broom, as well as kelp, as sources of potash. J. C. Umney (this J., 1914, 1046) suggests co-operation for the collection and incineration of many waste sea and land plants, such as furze, bracken and hedge-clippings. He gives the potassium contents of various ashes: bracken 60%, *Boletus edulis* 50—57%, *Agaricus velutipes* 78%, *Hypnum Schroberi* 28—30%, groundsel 43.5%, broom 33%, and *Euphorbia amygdaloides* 39%. A conference has recently been held in Edinburgh under the auspices of the Board of Agriculture on this subject and a Committee appointed to take up the matter. The annual consumption in Scotland is given as about 25,000 tons of 10—15% potash and 500 tons of high grade salts 40—50% (Ch. Tr. Jnl., Dec. 12th, 1914). Quaintenne (this J., 1905, 1302) states that mangrove trees growing in fresh water marshes are rich in potash salts. There are many noxious weeds and inconvenient growths all over the world, the ash of which might be examined for potash, such as the prickly pear in Australia, the sudd of the Nile, the reeds and rushes, bracken, and brushwood.

In the Caucasus there are 24 factories producing potash from the stems of sunflowers. In 1907, 14,500 tons was produced.

Saltpetre.

In the Agricultural Ledger for 1905 (pp. 17—48, this J., 1905, 1170) Dr. D. Hooper discusses nitrification with special reference to conditions obtaining in India. He also gives an account of the districts where nitrous earths occur and where the salt is manufactured, describes process of manufacture, and gives analysis of crude and pure salts and by-products. J. W. Leather has also reported to the Government of India on this subject. The supply of saltpetre from India is increasing (March, 1915), and the production may assume much larger proportions. There are numerous caves in India and other countries where it has accumulated, and the formation of nitrates in the soil is continuous. A process has been perfected recently in India for avoiding waste. The plant for a daily production of 2400 lb. costs only £200, and a product of 94% purity is secured.

Potassium nitrate invariably accompanies the sodium compound in the deposits of Chile, 3—5% of the former to about 25—50% of the latter. At Tacunga in Peru, and at Cochabamba in Bolivia, deposits of saltpetre of some importance have been met with (T. H. Norton, U.S. Dept. of Comm. and Labour. Special Agent's Series, No. 52).

Potash lakes and deposits.

The Board of Trade Journal of Dec. 12th, 1907 (this J., 1907, 1278), stated that large tracts of ground between Torrelavega and Cabezon de la Sal (near Santander in Spain) had been taken up by a Belgian firm of alkali manufacturers. Borings proved the presence of sodium and potassium salts in quantity, which were to be treated locally.

A salt field in the bed of a Miocene lake has recently been found at Cardona, on the borders of Barcelona and Lerida. The Stassfurt Syndicate, which had already bought up all the European and other deposits on which it could lay its hands, tried to acquire this field, and the American Agricultural Chemical Co. also made offers for it. The Spanish Government, realising the importance of the question, nominated a commission of the Geological Institute of Spain to examine the deposit, and armed with their favourable report, has submitted to Parliament a measure to regulate the exploitation of these deposits (Bull. Instit. Agriculture, Rome, Jan. 1915). At a meeting of the German Geological Society of Berlin (Zent. f. d. Kunst- und Industrie, XIX. 338) Prof. Schmidt stated that the deposits occurred in the tertiary deposits of the Ebro basin. They were 260 ft. thick, and contained 70 ft. of carnallite with 20% of KCl and 33 ft. of sylvine with 95% KCl. In origin they resembled those of Alsace, being secondary formations derived from more ancient saline deposits of the Triassic age. Concessions have been applied for in regard to several thousand acres in extent, not only in the province of Barcelona, but in those of Gerona, Lerida, and Huesca.

Searles Lake is the most promising potash bed yet discovered in the United States. It is in the north of San Bernardino Co., Cal., and for some twelve miles the lake bottom, as shown by borings, consists of a mass of salts about 70 ft. thick. These salts consist of sodium chloride, sulphate, carbonate, bicarbonate, and borate, with some potassium chloride, and are coarsely crystalline and honeycombed, the spaces being filled with brine. For the first 23 ft. the deposit is mainly common salt, analysis of the brine below this showing about 4% of potassium chloride. The plan is to extract this salt from the brine which moves freely through the salts, and an output of 5 tons a day was expected within three months (this J., 1914, 919).

The Oil, Paint, and Drug Reporter (Feb. 8, 1915) states that over £300,000 has been spent in developing the Searles Lake deposits, but that a considerable addition will have to be made to the plant if potash is to be produced in commercial quantities.

It should not be forgotten that the Stassfurt deposits extend well into Upper Alsace at Cernay, near Mulhouse, and that the French are now close to that place.

A good account of the Stassfurt deposits by B. Leslie Emslie, was read before the Canadian Section in 1909 (this J., 1909, 393).

Felspar, mica, and leucite.

The large quantity of potash in these minerals is responsible for the number of attempts to extract it, but it must be remembered that for every 100 parts of mineral, the maximum extraction is not more than 15%, leaving some 85% of by-product, increased possibly to over 100% if lime is used to expel the potash. Orthoclase felspar has always been most in favour, though mica (muscovite), due to its being a waste product of the china clay industry in a fine state of division, has certain advantages. Leucite is comparatively scarce.

Lyell in his "Elements of Geology" gives the following content of potash in this type of mineral on the authority of Delesse, Klaproth and Rose:—

	1.	2.	
Felspar	12%	11%	Leucite
Mica	10%	5.6% (black) 6% (green)	{ 21% (reddish 9% (white pegmatite)

The following are some analyses of felspar by Abich and Rose:—

	Theory.	a.	b.	c.
K ₂ O	16.59	13.99	14.02	14.73
Na ₂ O	—	1.01	1.25	trace
CaO	—	1.34	0.34	0.60
Al ₂ O ₃	18.06	17.97	18.57	19.15
SiO ₂	65.35	65.67	65.72	65.52

Felspar is found in the Mourne Mountains and Wicklow in Ireland, and in Aberdeenshire in Scotland. It is plentiful in Sweden, in the United States, and in Canada.

Spiller (this J., 1882, 128) states that the granite from the Duke of Argyll's quarries in Mull consist mainly of rose-coloured felspar. That from the Mourne Mountains is mostly white, and large white crystals occur in the white granite from Lanlivery (Cornwall), St. Barule (Isle of Man), Castlean (Penzance) and Lundy Island. Rubislaw and Cove (Aberdeen) produce almost pure felspar containing 13% potash.

Muscovite (mica) contains 11.8%, and Haughtonite from Cove (Aberdeen) 8.81%. As above mentioned, mica is a waste, requires no crushing, and needs outlets.

Felspar in a state of minute division makes water alkaline at 220° C. Potassium tetrasilicate is probably dissolved out leaving aluminium disilicate. (Forchhammer, Pogg., 35, 353.)

Berthier states (Gmelin, III., 442) that equal weights of felspar and white marble fused in a charcoal crucible in a blast furnace yield transparent glass which is readily dissolved by acids and contains 5.9 parts of potash to 64.1 of silica.

Fuchs (*ib.*) states that if powdered felspar is gently ignited with lime and digested with water, or if ignited powdered felspar is boiled with milk of lime, it gives up potash to the water, the lime taking its place.

Felspar is used both as a glaze and glass-forming ingredient in porcelain. "Cornish Stone" is a granite in which felspar has been partially decomposed, but which retains enough alkali silicate to render the mass fusible. It is quarried at St. Stephen's in Cornwall.

In Sweden felspar occurs in masses of salmon-red colour, becoming white when calcined. Pegmatite is of the same class but in a more advanced state of decomposition; it retains no mica and a very little quartz. All these are very hard and are ground in mills of special construction.

In view of the many processes of potash extraction which involve the use of lime, it is well to glance at the composition of some pottery materials. The average proportion of fusible and infusible materials is shown in the following table:—

	English China (Worcester).	Porcelain (glaze).	Sèvres (body).
SiO ₂	38.88	67.5	58.00
Al ₂ O ₃	21.48	14.5	34.00
Fe ₂ O ₃	—	2.5	—
CaO	10.06	10.0	4.5
MgO	—	1.0	0.5
Na ₂ O	2.14	0.5	0.5
K ₂ O	2.14	4.0	3.0
Ca ₃ (PO ₄) ₂	26.44	—	—

Lucea della Robbia's terra cotta contained 22.4% of lime. Clays rarely contain more than 0.5% of lime, but they contain from 2% to 3.5% of alkalis. Clay is a hydrous body and when once deprived of its water can never again become plastic. Its fusibility is greater or less as its composition approaches or recedes from that of felspar. Clay containing lime is unsuitable for the manufacture of battery cells.

The best monograph on this subject is "Potash from the Natural Silicates," a paper read before the 8th International Congress of Applied Chemistry by Messrs. A. S. Cushman and G. W. Coggeshall, and published in the "Journal of Industrial and Engineering Chemistry," 1912, 4, 821. This is a summary of all the work the authors could discover, and is divided into: (1) Adaptation of natural agencies, (2) wet processes of a chemical nature, (3) dry processes in which potash salts are volatilised, (4) dry processes in which potash is separated as such or as carbonate, (5) dry processes producing the chloride, (6) dry processes producing sulphates, (7) resumé of their own large scale experiments, (8) conclusions.

The main part of their paper deals with the authors' process for treating felspar for agricultural purposes (Cushman, U.S. Pat. 987,436; this J., 1911, 488) and Coggeshall (U.S. Pat. 987,544). Cushman's process consists in powdering 100 parts of felspar with 20 parts of lime and 10—20 parts of salt. The powdered mixture is fed on to the top of a revolving drum of about 3 feet diameter in a layer about $1\frac{1}{2}$ inches deep. Strong calcium chloride solution is sprinkled on this and forms calcium oxychloride, producing "clumps" in the powder. These are separated and the residue treated with calcium chloride again. The "clumps" are fed into a rotary kiln of the cement type and treated by a blast of air and powdered coal to a temperature short of that which would volatilise the potassium chloride. The product is ground and used as a fertiliser. It contains 6% of potash. It will be observed that this process evades the extraction of the potash and the utilisation of the residual clay.

In a paper read before a recent meeting of the American Institute of Chemical Engineers (see this J., 1915, p. 79) Messrs. Cushman and Coggeshall give further particulars of their process and claim that the salts obtained therefrom are at least as good as crude Stassfurt salts. They also furnish an estimate of working costs, which shows a profit without taking into account the residue. This, owing to the volatilisation of ferric chloride, is free from iron and pure white in colour, and ought to find an outlet in the manufacture of pottery, glazes, and high-class cement.

Rhodin (this J., 1901, 439) mixes 40 parts of slaked lime, 40 parts of salt, and 100 parts of powdered felspar and submits it to a temperature of 900° C., when 80—90% of the potash is converted into potassium chloride. At this temperature, little change is made in the appearance of the felspar: the lime scarcely acts on it and the salt is hardly evaporated at all. The residue is used for glass making, requiring addition of soda and silica. Given a careful control of the furnaces, the above proportions give the best results.

Herstein (J. Ind. Eng. Chem., 1911, 3, 426) proposes to heat finely powdered felspar with calcium chloride and some limestone, forming potassium chloride, and a residue available for the manufacture of cement.

A recent German Patent (Chem. Fabr. Rhenania, this J., 1912, 1170) proposes to treat phonolite with basic calcium nitrate and boil in alkaline solution under pressure (4—10 atmospheres) during 10—20 hours. It is stated that 1 ton gives 180 kilos of saltpetre. There are many other lime processes, but the above will suffice as examples.

As an example of processes in which fluorine takes part may be cited Ward and Wynant's process (Eng. Pat. 3185 of 1857, this J., 1914, 1007). Finely ground felspar is mixed with finely-ground fluorspar equivalent to the alkali in the felspar. Chalk and lime are mixed with this so that 2 parts of lime are present for one of silica, and $1\frac{1}{2}$ parts to 1 of alumina and 10% excess. The mixture is heated to a yellowish-red heat for a few hours, and the porous frit so obtained is leached with boiling water. This is said to extract 90% of the potash originally present. Cushman and Hubbard in criticising Cushman's and Swayze's processes (this J., 1907, 608, 1008, and 1908, 560) state that this class of process cannot be a commercial success since the fluorine cannot be recovered owing to the excess of the lime necessary.

Another type of process extracted alum from felspar, but these were all early processes, when potash alum held the field.

In many of the fusion processes, so high a temperature was employed that potash was volatilised. Cameron (this J., 1913, 976) states that when felspar is used as a cement material, potash is found in the flue-dust.

In discussion on another paper, C. L. Parsons states (this J., 1912, 332) that cement kiln dust contains 35% of alkalis of which one-half is potash. This is worth examining. A sample of flue dust from an iron works in the Midlands was found by the Government Laboratory to contain nearly 6% of K_2O , about one-third of which was directly soluble in water. Such a dust might be used locally as a manure. (J. Bd. of Agric., 1915, 1043.)

A. H. Cowles (J. Ind. Eng. Chem., 1913, 331) grinds rock phosphate with felspar in the proportion of two molecules of lime to each molecule of silica, and heats to a sintering temperature of about 1000° C. He leaches the resulting product with sulphuric acid or hydrochloric acid, obtaining either potash alum or the double chloride, phosphoric acid, and diacalcium silicate.

The Spar Chemical Co., Baltimore, Md., has done some experimental work on silicate rocks at Curtis Bay, using Thompson's process (U.S. Pat. 995,105 of 1911; this J., 1911, 955). The yield of potash is said to be 80% or 90%. For the best results the temperature must be controlled in rather narrow limits. (W. C. Phalen, Min. Res. of U.S.A., 1913, Part II., pp. 85—107).

Another process which is worth investigation is to mix enough Redonda phosphate with felspar to replace the potash by alumina, and fuse with a large excess of salt at a temperature just below that at which salt volatilises and with just enough lime to flocculate the clay formed. The melted salt would probably contain the potash as phosphate. The residue should be available for porcelain making. The bulk of the melted salt could be poured off and used again until enough potassium phosphate accumulated in it. Fine division of the materials is essential.

A possible process (Newton, Eng. Pats. 1211 and 2421 of 1854) is to mix ground felspar with lime and soda, heap it on a hard floor, and keep it wetted and exposed to the air for a month. The drainage will be rich in potash.

Richardson (J. Ind. Eng. Chem., 1911, 3, 880) says that all the processes to deal with felspar such as fusion with salt or lime, or electrolysis, give no promise of profitable working. The only hope lies in the soluble sources of supply.

In regard to direct use in agriculture, although felspar disintegrates better on weathering, mica gives better results in pot cultures and yields up potash (this J., 1912, 1088). Plants can avail themselves of about 17% of the potash in mica, 25% of that in nepheline, but less than 5% from orthoclase (this J., 1909, 722).

Phonolite meal (a mixture of "sanidine" and nepheline) has been suggested (this J., 1910, 581) as a fertiliser. It contains 9% of potash of which 3% is soluble in hydrochloric acid. Varying opinions as to its value are expressed.

Bulletin 53 (1913), U.S. Bureau of Mines, contains an exhaustive report on the mining and treatment of feldspar and kaolin by A. S. Watts.

Alum.

Potash-alum is found in the Silurian alumschists of Sweden, Norway, and Scotland, the coal formations (Hurler and Campsie) in Scotland, and the lias near Whitby. All the available deposits are worked out.

Alunite.

Alunite, a hydrated basic aluminium potassium sulphate, $KAl_3(SO_4)_2(OH)_6$, is found in Europe in the Lipari Islands, Auvergne, and the Island of Milo. When pure it contains 11% of potash. On powdering and ignition most of the potassium sulphate leaches out, leaving alumina behind. Seven miles S.W. of Mary's Vale, Utah, it occurs in a large banded vein, cutting the volcanic rock at steep inclination. The solid alunite is from 6 to 20 feet thick, and contains from 9.7% to 10.5% of potash. Assuming an average width of 10 feet in the principal vein for a length of 3,500 feet, this gives a surface area of proved outcrop of 35,000 sq. ft.

Calculating this alunite at 175 lb. per cub. ft., there would be approximately 300,000 short tons of the rock, or 30,000 tons of potash for each 100 feet in depth. (U.S. Geol. Survey, Bull. 511.)

A deposit of it, called locally "Galafatite," has been discovered near Benahabux, 6 miles from Almeria, Spain (this J., 1911, 282). Concessions have been granted over 2470 acres, and it was reported that the mineral would be placed on the market at once. Ignited alunite makes a good fertiliser.

Leucite.

Leucite occurs imbedded in volcanic rocks. No deposits in Great Britain are recorded. It is abundant in the lavas of Vesuvius, the tufas near Rome, and the "peperino" of Albano. The Leucite Hill, Wyoming, contains more potash than any other igneous rock. Eight analyses of "Wyomingite" and "Orentite" from this region show an average potash content of 11%. An available supply of 197,000,000 tons of potash from this source is estimated. (U.S. Geol. Survey, Bull. 521.) Its composition is $Al_2O_3 \cdot 3SiO_2 + K_2O \cdot SiO_2$. It is soluble in hydrochloric acid without gelatinising.

Waste liquors of cellulose pulp mills.

Seidel (this J., 1898, 178) thus describes the constitution of waste liquors from the sulphite pulp process: liquor of Silesian Mill working the Ritter-Kellner process: sp. gr. 1.050; total solid residue (dry at 100° C.) 12.013 grms. per 100 c.c., i.e., 11.44% containing 9.54% total sulphur, 93% of which exists as organic compound. Potash amounted to 1 gm. in 52 litres.

J. F. Briggs states that the soda lyes used in the boiling of esparto are all evaporated and incinerated for the recovery of 85–90% of the original soda. These lyes contain only traces of potash as the ash constituents of the plant are practically resistant to the comparatively mild digestion. The potash accumulated after indefinite re-utilisation of the soda never exceeds 1–2% of the total alkali. If this lye were fused with feldspar, there would still be the problem of separating the potassium silicate from the large excess of sodium silicate. Thus no potash is to be expected from cellulose liquors.

Sugar residues.

A great deal of potash has been recovered from beetroot residues, but this cannot be regarded as a source of potash for general use, as no continuous crops of beetroot can be grown unless the potash goes back to the soil. In a review of the results of 1890 (this J., 1891, 282) a serious reduction in the French production is mentioned, and 24,000,000 kilos. of potash are said to have been refined during the year.

Potash was recovered at one time from syrups by the Duncan and Newlands process (this J., 1883, 319). When as much sugar as possible had been crystallised out, aluminium sulphate and sulphuric acid were added and the alum so produced crystallised out. Mr. W. B. Clark of Greenock states that, so far as he knows, that process is no longer worked in any refinery. No potash is being recovered in any of the Greenock refineries. The molasses containing the raw sugars are worked away in the form of yellow sugars and golden syrups. Unless the molasses were separated and afterwards fermented and the residues ignited no potash could be expected from this source. Moreover, says Mr. Robt. R. Lyle, an exhausted residual molasses, which is periodically turned out, goes out of the town to the distillers or for cattle feeding and its quantity is small. At the present time the refineries are obtaining their raw products from cane sources and it is generally accepted that the potash content of the residual molasses therefrom is lower than in a molasses from beet. Practically there is now no potash available from this source.

Potash from wool scouring.

At Field Head Mills, Bradford, the greasy raw wool, containing 40–50% of grease and dirt and about 4% of potash, is washed in two series of bowls, consisting of four bowls each. It is then carded and goes through two bowls of soap solution to remove oil and dirt. The suds from the wash-bowls are treated by the Smith-Leach process, in which pure wool-grease is extracted centrifugally, the water evaporated, condensed and used again. The potash is also recovered and used again for scouring (this J., 1903, 851–852).

Bott (this J., 1883, 123) states that 1000 lb. of wool yields 90 lb. of potassium carbonate and 5–6 lb. of other potassium salts. The quantity of wool washed in a certain district in France amounted at one time to 30,000,000 kilos. a year. This would give 1,200,000 kilos. of potassium carbonate worth £85,000. In 1890 the French production had dropped to 4,000,000 kilos.

Prof. Gardner, of the Technical College, Bradford, writes that as nearly as he can ascertain, the annual production of wool grease in Bradford is about 5500 tons. On the average 100 lb. of raw wool yields 18–20 lb. of grease and the amount of potash naturally accompanying this is 5–6 lb. Successful potash recovery plants were in operation until about ten years ago. Owing to trade conditions, however, the process is no longer profitable. The wool now scoured in Bradford is practically all blends of sheared, skin and slip wool, and it is found impossible, even by a reverse flow process, to obtain the potassium salts in more than 4% solution. In France, says Prof. Gardner, the wool treated is nearly all greasy "B.A." wool which gives about 13% solution, and the difference in cost of evaporation of the two solutions is sufficient to make the process practicable in one case and not in the other.

In conclusion, the "Reports of the Juries," International Exhibition of 1862, contain under Class II., Section A., pp. 41–57, a most interesting monograph on "Potassium Compounds," by the late A. W. von Hofmann, F.R.S., who acted as Reporter to the Section.

DISCUSSION.

MR. ALEX. E. TUCKER said that, notwithstanding the wide distribution of granite, on the weathering of which the formation of china clay depended, china clay was of less frequent occurrence than might be expected. He had found that finely divided felspar obtained from such weathered granite gave a distinctly alkaline reaction on simply agitating it with water, and that when carbon dioxide was passed into the water, the extraction of potash was much increased, and potassium carbonate seemed to be continuously formed over a considerable period. The same result was obtained with powdered mica and other alkali-bearing minerals found in such weathered granite. On repeating these tests with powdered orthoclase, containing some 12% of potash but which did not appear to have been weathered at all, a total extraction of only some 0.4% of alkali could be obtained with water and even with strong acids with or without digestion under pressure, etc. It therefore seemed to follow that although some wet processes might be successfully adopted for the extraction of potash contained in such minerals, regard must be had to their physical condition, and it would appear that the fritting processes described by Mr. Cresswell would be likely to give the best results.

DR. R. S. MORRELL said that farmers were not utilising the potash obtained from wood ashes, and that valuable source of supply was unfortunately not fully appreciated by them. It seemed probable that as kainit was dear its use this year might be foregone. It had been stated (University Coll. of N. Wales, Bangor, Dept. of Agric.) that the application of common salt to the soil would increase the proportion of potash available by acting on unavailable supplies.

MR. F. R. O'SHAUGHNESSY, in reply to a question, said that no potash could be expected from sewage. The percentage was very small and the dilution very great.

MR. CRESSWELL, in reply to a question from the Chairman, said that Rhodin and Cushman and Coggeshall had given some estimate of cost. Most of the sources mentioned would be dearer than Stassfurt salts; how much dearer would depend on local circumstances.

asserting the presence of nitrate on the evidence of the "black-ring" test alone, and tests of the order of delicacy of the diphenylamine reaction are, for many purposes, too sensitive. An over-sensitive reaction may mislead the analyst; when such an one is used it becomes impossible to distinguish between a slight contamination and a deliberate admixture.

Tests involving the reduction of nitrates to ammonia are necessarily slow, and are not easy of qualitative application when ammonium salts are present.

The author required a test for nitrates which should be of the same order of delicacy as the "black-ring" test, easy and quick in manipulation, and of very general applicability. Such a test was suggested by the well-known action of sulphonated salicylic acid on nitrates, used in the quantitative determination of total nitrogen in fertilisers containing nitrates. Nitrosalicylic acids are produced when salicylic acid is dissolved in sulphuric acid and the mixture is heated with a nitrate. These, like the nitrophenols, are pale-coloured, but give intensely yellow (or red-yellow) salts on the addition of an alkali. It is on the foregoing reactions that the present test is based.

Method of manipulation.—Two grms. of salicylic acid is dissolved in 30 c.c. of sulphuric acid (sp. gr. 1.84). The test is applied as follows:—If the substance to be tested is a solid, it is cautiously heated in a test tube with a slight excess of the reagent. A drop of the resulting liquid is withdrawn on to a cold white porcelain slab and two or more drops of concentrated potassium hydroxide solution are added—enough to make the drop alkaline. The development of a yellow or orange colour indicates the presence of nitrate.

If the substance to be tested is in solution, two or three drops are placed in an evaporating dish, casserole, or porcelain crucible, two or three drops of the reagent are added and the mixture is warmed cautiously over a Bunsen flame till acid fumes are evolved. When cool, a slight excess of potassium hydroxide is added, as directed above. A distinct yellow colour is given by one drop of a 0.1% solution of potassium nitrate.

Strong aqueous ammonia may be substituted for potassium hydroxide solution, but the yellow colour produced is more fugitive.

The presence of halides does not interfere with this test.

The author wishes to express his indebtedness to Professor J. Bishop Tingle for kindly submitting this reaction to the test of use by students. Report of the result of these trials is so favourable as to make it seem worth while to publish this note.

Canadian Section.

Meeting held at Toronto, on Friday, 26th February, 1915.

PROF. J. WATSON BAIN IN THE CHAIR.

A QUALITATIVE REACTION FOR THE DETECTION OF NITRATES.

BY ALFRED TINGLE.

The author has frequently felt the need of a readily applied reaction for nitrates which would serve as a substitute for, or check upon, the well-known "black-ring" and "red fume" tests. It sometimes happens that one or both of these is inapplicable to the substance under examination.

For instance, a meat preservative containing much sodium hydrogen sulphite and a small amount of potassium nitrate might well fail to give "red fumes" with sulphuric acid and copper; yet a cautious analyst would hesitate before

Liverpool Section.

Meeting held at The University, on Wednesday, February 17th, 1915.

MR. FRANK TATE IN THE CHAIR.

THE CONSTITUTION OF ORGANIC COMPOUNDS IN RELATION TO THEIR ABSORPTION OF LIGHT.

BY PROF. E. C. C. BALY, F.R.S.

There have been published during the last few years a number of papers which deal with the

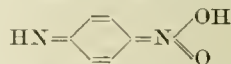
absorption spectra of organic compounds and which attempt to determine the constitution of these compounds from the shape of the absorption curve. All such attempts are based on the primary assumption that there exists a definite correlation between the constitution of a compound and the power which it exerts of absorbing light. All these light observations have dealt with the ultra-violet and visible regions of the spectrum, no reference whatever having been made to the absorption of light in the infra-red region. This is somewhat surprising, for many compounds have been investigated as to their power of absorbing infra-red light, and it also must be remembered that this spectral region is very extensive, being about 500 times as long as the ultra-violet and visible regions combined. It would seem obvious that there must be an intimate connection between all the absorption bands exerted by a compound, in whatever region of the spectrum they may occur, and yet, in spite of this, all the attempts that have been made to correlate light absorption and structure have been based on observations made in the ultra-violet and visible regions.

One of the oldest theories which attempts to correlate absorption and structure is that known as the quinonoid theory. From a general and casual survey of coloured compounds, especially of the dyestuffs, it certainly appears as if the quinonoid theory were justified by the facts. When, however, the problem is investigated more closely, the issue is not so clear as might at first be thought. As long as the physiological sensation of colour is adopted as the criterion, the difficulties connected with the theory are not very prominent. It is true that highly coloured compounds, such as diacetyl, $\text{CH}_3\text{COCOCH}_3$, do exist for which a quinonoid structure seems to be inadmissible, yet the main fact remains that by far the greater majority of coloured compounds belong to the aromatic series, where the quinonoid configuration can be made use of. It is when the coloured compounds themselves are scientifically investigated that the real difficulty of the problem is encountered. Two substances may well appear of identical colour to the eye and yet be entirely different in their powers of absorbing light, and hence it is impossible to accept ocular evidence in this respect. Therefore a scientific basis must be found to which the light absorption can be referred, and the most obvious one is the measure of the amount of light of different wave-lengths which is absorbed by a definite molecular concentration of the compound in question. It is most satisfactory to express all such observations in terms of a normal solution, and in Fig. 1 is shown a typical absorption curve, which represents the amount of light absorbed by a normal solution of phenol in alcohol. On the ordinate is placed the molecular absorptive power in terms of the

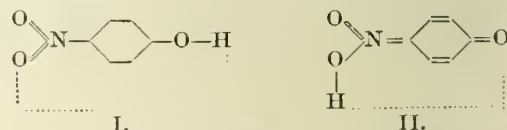
molecular extinctions, that is to say $\log \frac{I_0}{I} \times \frac{1}{Cd}$,

where I_0 is the intensity of the light incident on the solution, I is the intensity of the light after it has passed through the solution, C is the concentration expressed in terms of the number of gram-molecules per litre, and d the thickness of the solution in cms. The curve therefore shows the absorptive power exerted by 1 cm. of a normal solution for light of various wave-lengths. As may be seen, phenol shows an absorption band with its centre at about $\lambda = 2720$ Angströms. Now when the absorption curves of many substances are examined, it is very often found, as foreshadowed above, that two compounds apparently identical in colour show entirely different absorption curves. Clearly, therefore, colour alone cannot be accepted as a criterion, and it becomes necessary to attribute

each absorption curve to a definite molecular structure if it still be desired to uphold the doctrine of colour-structure correlation. When, however, the absorption curves of compounds are systematically investigated, it very soon becomes apparent that the quinonoid theory is by no means as secure on its foundations as was supposed. Two difficulties at once make themselves apparent. In the first place it is found that by far the greater number of compounds exhibit absorption bands. Some of these absorption bands lie in the ultra-violet and some in the visible region. These bands may, indeed, appear in any position in the ultra-violet or visible. It may well be asked at what position in the spectrum must an absorption band lie in order for it to be accepted as evidence of a quinonoid structure. In the second place there are several highly coloured compounds for which quinonoid structures seem to be impossible. Thus nitronaphthalene is bright yellow, acenaphthylene is red, and in neither case is a quinonoid formula obvious. Then again, although *o*- and *p*-nitro-aniline may be given a quinonoid structure, e.g.,

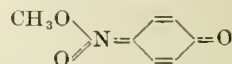


the corresponding nitrodimethylanilines cannot have an exactly analogous quinonoid constitution. The absorption curves of the parent compounds and their dimethyl derivatives are, however, practically identical, as may be seen from curves I. and II. on Fig. 3. These and similar difficulties have fully been recognised by Hantzsch, to whom we owe much for his exhaustive spectroscopic examination of numerous organic compounds. Fully recognising the difficulties in the way of the quinonoid theory as generally formulated, Hantzsch has extended the theory and has introduced the conception of "valency isomerism." The essential novelty about this idea lies in the use of the secondary valencies rather more definitely than was done previously. For instance Hantzsch puts forward two different formulae for *p*-nitrophenol:—

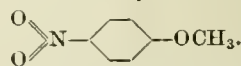


the dotted lines showing the play of forces due to the secondary valencies. Of these he says I. is colourless and II. is coloured, and on this view the coloured alkali salts would be derived from form II.

The quinonoid theory receives some support from the discovery by Hantzsch and Gorke of the existence of highly coloured ethers of certain nitrophenols. These substances are very reactive and very unstable, and they pass over with great ease into the ordinary and well-known colourless ethers. Hantzsch and Gorke proved that these highly coloured substances are isomeric with the ordinary forms of the ethers, and they considered it to be in the highest degree probable that they possess a quinonoid structure. They assumed that, in the case of *p*-nitrophenol, the highly coloured ether would have the formula,



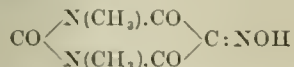
and that this compound passes over with great readiness into the ordinary form,



It would seem, at first sight, that this work afforded a direct support to the quinonoid theory, and indeed it is mainly on these results that Hantzsch has based the whole of his theories of the structure of compounds in relation to their absorption.

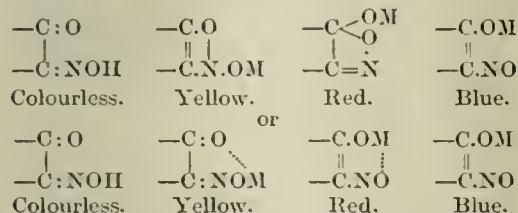
The problem became somewhat more complex when Hantzsch discovered that more than one coloured salt can be obtained from a single colourless acid. Such examples are especially noteworthy in the case of violuric acid and its dimethyl and diphenyl derivatives. From these acids colourless, yellow, green, orange, red, violet, and blue salts may be obtained, all of them isomeric and monomolecular.*†

From the point of view of the quinonoid theory these differently coloured salts are peculiarly interesting, because it does not seem to be an easy matter to write a quinonoid formula for dimethylvioluric acid



and yet the acid is colourless and its salts coloured.

Now Hantzsch in all his work has started from the categorical statement that every appearance of colour or change of colour on salt formation is due to intramolecular isomerisation. Further he says that each isomer is characterised by a definite type of absorption curve. According to these tenets it is necessary to devise a different structural formula for each of the differently coloured isomers. As regards the violurates Hantzsch begins by saying that there are only four definite isomeric modifications, colourless, yellow, red, and blue respectively. The orange, green, and violet salts he says are mixtures. He points out that the isomerisation in all probability is only concerned with the oximido group and the neighbouring carbonyl group. Hantzsch gives two alternative sets of formulae, in which M stands for a colourless monovalent metallic atom.



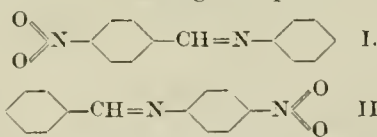
Apart from any other question, it is somewhat difficult of acceptance that two differently coloured modifications of the same molecule should exist, in one of which the secondary valencies are active and in the other they are latent. If secondary valencies are playing a part, then surely they must be considered to be of essential importance in every salt.

Hantzsch has made use of structural formulae very similar to the above in explaining the differently coloured derivatives from several colourless parent compounds. There is no need specifically to mention other instances beyond those given above, which are sufficient to illustrate the position taken up by Hantzsch. There is, however, one other phenomenon which Hantzsch has dealt with, and that is the existence of more than one modification of the same coloured isomer. This introduces a new complexity into the problem. A good example of this new phenomenon is afforded by *o*-tolyl-2,4-dinitroaniline, which can exist in four modifications, two of which are orange and two yellow. Hantzsch calls the two types of isomers chromoisomers, namely those which differ

in colour, and homochromoisomers, namely those which have the same colour. He attributes the latter entirely to stereochemical differences, but in spite of all endeavour he finds that the total number of isomers in several cases is greater than the structural theory can explain.

It will be seen from the above that Hantzsch has made considerable advances beyond the older quinonoid theory. He views the quinonoid conception as one special case of his theory. It may, however, be pointed out that there is no real basis for any one of his conclusions. There is not one single particle of scientific evidence to show why any one of his structural formulae should exhibit a colour different from any other. The mere fact that different molecular structures can be drawn is no explanation of the fact that differently coloured forms exist. Then, again, there is the added difficulty arising from the fact that there are more coloured modifications than possible structural formulae in many cases, for it must not be forgotten that in the violurates three differently coloured modifications were dismissed as being mixtures of other forms.

In these laboratories there have been made a number of investigations into the absorption spectra of organic compounds, and the general result of these is that the Hantzsch theory is entirely untenable. In fact the evidence is very strongly against there being any direct correlation between absorption and primary structure. Inasmuch as such correlation is the fundamental principle of the quinonoid theory, so the results must also be considered as antagonistic to this theory. Apart from there being no scientific basis for such correlation, that is to say there is no physical reason why a quinonoid structure should selectively absorb visible light more than invisible light, many facts have been noted which are in direct opposition to it. Three compounds have already been quoted which are coloured and yet without a quinonoid structure, diacetyl, α - and β -nitronaphthalenes, and acenaphthylene. To these may be added azobenzene and dimethylaminoazobenzene, both of which are highly coloured and yet no quinonoid structure is possible for either of them. Then again the two sets of isomers, the nitrobenzylidene-anilines and the benzylidene-nitroanilines form a striking example



When the nitro group is substituted in the benzene residue (I.) a simple quinonoid formula is possible, but in the isomeric compound (II.) this is not the case. The absorption spectra of all these compounds are strikingly similar, there being, however, more marked absorption bands in the case of the compounds (II.), that is to say those compounds which can exist in the quinonoid form show less marked absorption than those which cannot do so.* It is clear, therefore, that the quinonoid theory entirely fails to explain the colour and absorption of these compounds. Many other instances might be quoted of cases which are at variance with the quinonoid theory, but sufficient has been said to justify the statement that this theory not only entirely fails to give a scientific explanation of the selective absorption of light, but it also is quite inapplicable in numbers of cases where marked colour is exhibited and no quinonoid structure is feasible. Similarly Hantzsch's theory offers and can offer no explanation of the differences in absorptive power shown by isomeric compounds.

* Hantzsch. Ber., 1909, 42, 966.

† Hantzsch and Robison. Ber., 1910, 43, 45.

* Baly, Tuck and Miss Marsden. Chem. Soc. Trans., 1910, 97, 571.

It is obvious that neither theory can be accepted and that the explanation is yet to be found of the origin of selective absorption in the first place and in the second of the existence of many differently coloured forms of the same compound. Any explanation, in order to be accepted, must be capable of satisfying all the chemical facts and all the variations in the absorptive power of compounds. It must also correlate the absorption throughout the whole spectrum and at the same time give a physical theory of the mechanism of selective absorption.

It is a well accepted fact that chemical atoms possess electromagnetic fields of their own, and one important proof of the existence of these fields is to be found in the Zeeman effect, which is the resolution of spectrum lines into doublets and triplets when the luminescent atoms are brought into an external magnetic field. These fields must possess a polar factor, and consequently when two atoms of different elements exist in a molecule there must ensue a condensing together of the force lines of the respective fields, with the escape of energy and the establishment of a molecular force field. It may readily be shown how the existence of these closed molecular fields is capable of explaining all the phenomena of chemical reaction and reactivity. It is not proposed in this paper to deal with this aspect of the theory, but rather to show how the theory gives a reasonable explanation of the selective absorption such as is shown by chemical compounds and also of the existence of series of differently coloured salts from colourless acids or bases. The chemical side of the theory, however, must very briefly be referred to, in order that the application to absorption phenomena may be understood.

The essential feature of the theory is that chemical reactivity may be attributed entirely to the force fields which surround all molecules. When two molecules, the force fields of which differ in type, are brought together, there will at once be formed an addition complex of the two owing to the condensing together of the force lines of the two fields. Within this complex there will naturally exist potential gradients, and if these gradients be sufficiently steep, one or more electrons will tend to pass over from one atom to the other within the molecules. If such electronic transference takes place new chemical individuals will be produced and a specific chemical reaction will have occurred. If, however, the potential gradients are not sufficiently steep, the addition complex first formed will remain as such. Although whenever two substances are mixed there will always be formed an addition complex between the molecules, no chemical reaction will take place unless the potential gradients within the complex are sufficiently steep to cause the electrons to move from one atom to another. There must obviously be a complete gradation from the condition when, owing to the force fields of the two molecules being exactly the same, no mutual influence is evidenced, to the condition when a chemical reaction occurs.

On these lines the reactivity of a molecule must depend upon its external force field. In the formation of this force field much will depend upon the force fields of the atoms composing the molecule. If these atomic fields happen to be equal and opposite the resulting molecular field will be entirely closed and such a molecule will possess no measurable reactivity when in the pure state. No doubt such cases as the want of reaction between hydrogen chloride and ammonia, when these compounds are pure and dry, are due to the fact that their force fields are entirely closed. On the other hand, it may happen that, after the maximum possible condensing together

of the atomic force lines has taken place, there is left over an uncompensated residuum. In such cases as these the molecule will possess residual affinity.

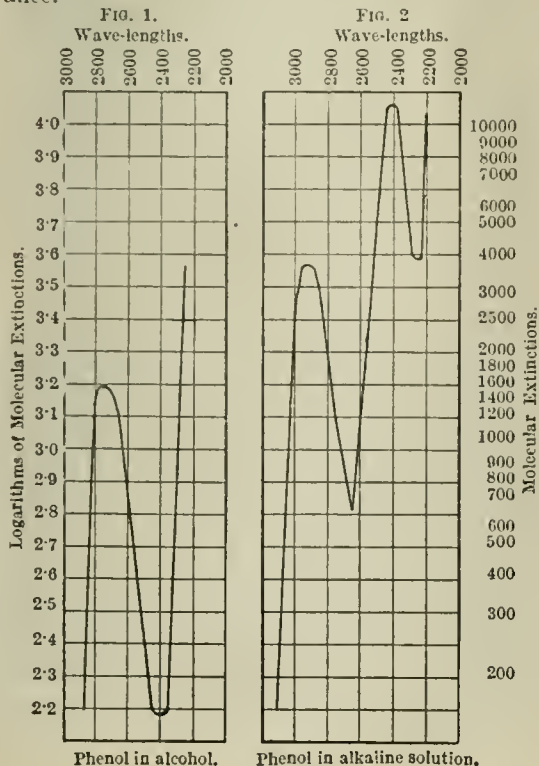
It follows from this that the reactivity of any molecule must be enhanced when its closed or partially closed field is opened or unlocked. This opening up may be produced by means either of a solvent or of light. If a substance, the molecules of which possess closed force fields, be dissolved in a solvent, the molecules of which possess residual affinity, the free force lines of the solvent molecules will interpenetrate the closed fields of the solute so that the latter are opened up and capable of reacting with any other suitable substance dissolved in the same solvent. There will be formed addition complexes between solute and solvent, usually known as solvates, and in these complexes the originally closed fields of the solute molecules will be opened up, in that some of the originally condensed force lines have been broken to reform with those of the solvent. It must clearly be understood that the condition here described is a perfectly general one and always exists when such molecular types are brought together, whether an actual solution is formed or not. Again, when such a condition obtains as described, it does not by any means follow that all the molecules of the solute have their force fields opened up. A type of equilibrium is established between the opened up molecules and the non-opened up molecules of the solute, and the reactivity of the mixture will depend upon this equilibrium.

The second method of opening up the force fields is by the action of light. Due, as they are, primarily to the rotation of the electrons, it follows that these force fields will respond to and absorb definite light vibrations. The light energy, in being absorbed, does work upon the systems and shifts the equilibrium towards the reactive side, or, in other words, it increases the relative number of opened up molecules which are present in the equilibrium. A new photodynamic equilibrium is thus established. In this way the selective absorption of light by substances is explained, for every single system in which an equilibrium exists between opened up or non-opened up force fields must be able selectively to absorb light of a definite vibration frequency.

The mechanism of the opening up of a closed field may be dealt with more fully. The opening up of any given force field no doubt consists in the attacking by the solvent of one or more potential gradients. In the case of a complex molecule, the force field itself will also be complex and will contain many potential gradients. As these in turn are attacked, so it is to be expected that the action of solvents on such a complex field would be progressive. It follows, therefore, that the opening up takes place in definite stages, each stage marking the resolution of one particular gradient. Now each stage must necessarily possess a power of selectively absorbing light rays, and the various stages in the opening up of a given complex field will be capable of recognition by the vibration frequencies of the light which they selectively absorb. These stages may be called into play by the use of suitable solvents, and thus it follows that from one given complex primary structure it is possible, by the use of suitable solvents, to call into play different stages in the opening up of the molecular force field. Each of these will exert different absorptive powers, each will show its own absorption band, and the higher the stage in the opening up the longer the wave-length of the light absorbed. If these absorption bands happen to be in the visible region the different stages will have different colours. There is, therefore, absolutely no necessity to postulate any change in primary structure to account for variation in absorption,

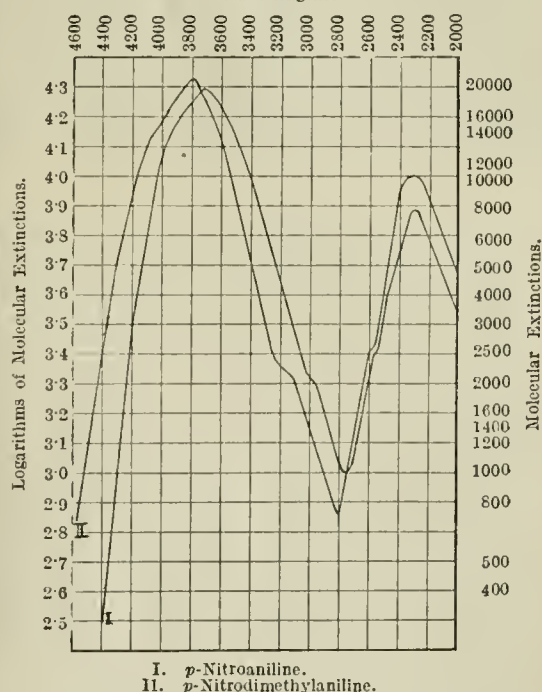
for the whole is due to changes in the condition of the force field which is an attribute of one single unaltered primary structure.

In general, the more complex the force field the greater the number of possible stages and therefore the greater the number of absorption bands to be shown. Such cases frequently occur in organic chemistry where all the molecules are relatively complex. Before applying the theory to specific cases two points may be dealt with. In the first place, it is obvious that the most appropriate solvent to open up a force field will be one the residual affinity of which is opposite in type. For example, the force field of an acid will most readily be opened by a basic solvent and *vice versa*. Then, again, the force field may be of such a nature that it is opened both by a basic and an acid solvent; in such a case the mechanism of opening up will be different and the solute force field will be amphoteric. Further, in the case of a complex force field, the stage in the opening up called into play will depend upon the difference between that field and the residual affinity of the solvent. Thus, with a complex acid, the more basic the solvent the higher the stage in the opening up that will be called into play and the longer the wave-length of the light that is selectively absorbed. In the second place, the condition existing in the addition complex must be considered. When the force field of an acid, for example, is opened up by an alkaline solvent, an addition complex of the two will be formed. The condition of the force field of the acid in this addition complex will entirely depend upon the potential gradients set up. The force field may remain opened or it may give a new closed field, according to the steepness of the gradients. The essential conclusion follows that, in the event of a coloured salt being formed from a colourless acid and colourless metal, the colour and absorption band of the salt are due to the acid force field and to this alone, and the fact that a salt may be formed is of secondary importance.



The theory may now be applied to certain specific cases in order to show how far simpler is the interpretation of colour and absorption compared with that based on the old colour-absorption correlation theory. As first examples the nitrophenols and the nitroanilines may be taken. In Fig. 1 is shown the absorption curve of phenol in alcoholic solution and it shows an absorption band, that is to say the force field of phenol is opened up by the residual affinity of the alcohol to one stage which is characterised by its power of selective absorption of light of a wave-length of about 2720. If now sodium ethoxide be added to the solution the absorption is changed considerably. Phenol is an acid substance and consequently its force field will most easily be opened up by a basic solvent. In the presence of alkali the force field is opened to a higher stage than in neutral solution, for the solution now selectively absorbs light of wave-length of about 2900. There is also present some of a stage lower than that present in neutral solution. The absorption curve of the alkaline solution is shown in Fig. 2, and the existence of the two absorption bands, proving the presence of two stages, is well shown. Altogether, therefore, three stages in the opening up of the force field of phenol have been realised with powers of absorbing light of approximate wave-lengths 2900, 2720, and 2400 Angströms respectively. Of these the first and third are called into play in alkaline alcoholic solution and the second in neutral solution.

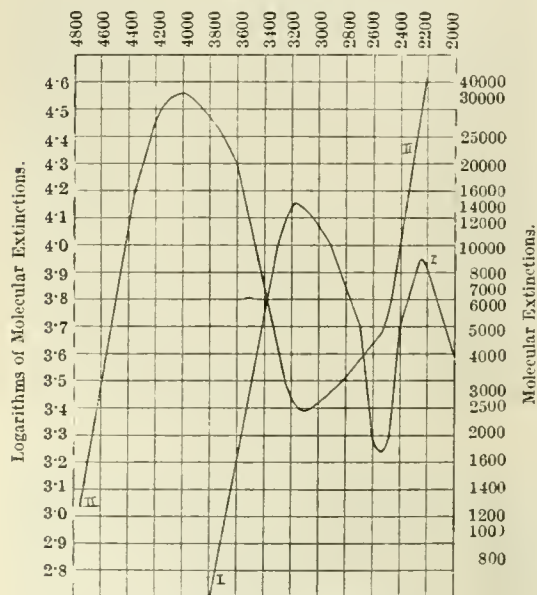
FIG. 3.
Wave-lengths.



Exactly analogous results are obtained with all the three nitrophenols, for all three isomers exhibit absorption bands in neutral alcoholic solution which evidence the existence of definite stages in the opening up of their force fields. In the presence of alkali higher stages in the opening up are called into play, proved by the presence of absorption bands of lower frequencies. These new bands happen to be in the visible region of the spectrum and therefore the alkaline solutions are visibly coloured. Now the absorption curves of the alkaline solutions are similar

in one respect to those of the corresponding nitro-anilines and nitrodimethylanilines. In the latter compounds alcohol alone is capable of calling into play analogous stages in the opening up of the force fields, so that the frequencies of their absorption bands are not far removed from those of the absorption bands shown by the alkaline solutions of the nitrophenols. The essential deduction from the present theory is that each absorption band is to be interpreted as evidence of one stage in the opening up of the force field of one single primary structure. Each nitrophenol in alkaline solution is very similar to the corresponding nitroaniline and nitrodimethylaniline in neutral solution. Analogous stages are called into play, and each stage is a function of one single primary structure in each case. This explanation at once removes the difficulty connected with the nitrodimethylanilines on the quinonoid theory, for these compounds, although they closely resemble their parent bases in absorption, cannot possess a quinonoid structure. A further difficulty also vanishes, for it is somewhat of a strain on chemical formulae to picture a quinonoid structure for sodium *m*-nitrophenoxide, *m*-nitroaniline, and *m*-nitrodimethylaniline. The absorption curves of these compounds, however, bear exactly the same relation to one another as do the curves given by the ortho and by the para isomers. It is, indeed, impossible to believe that any change of structure takes place when the three nitrophenols are converted into their salts, and the present theory fully explains the variation in the absorption which takes place as being due to changes in the molecular force fields. There is no doubt that the constitution of each compound is that determined by chemical means, namely $C_6H_4(NO_2)(OX)$, $C_6H_4(NO_2)(NH_2)$, and $C_6H_4(NO_2)(NCH_3)_2$ respectively, where X stands for hydrogen or a colourless metallic atom. The absorption curves of *p*-nitrophenol, *p*-nitroaniline, and *p*-nitrodimethylaniline are shown in Figs. 3 and 4.

FIG. 4.
Wave-lengths.



- I. *p*-Nitrophenol in neutral solution.
II. *p*-Nitrophenol in alkaline solution.

Perhaps the most striking case is that of the various coloured salts of diphenylvioluric acid.

prepared by Hantzsch and Robison.* Now the force field of this and analogous acids will naturally be opened by alkalis, and owing to the complexity of the molecule many stages will exist. The particular stage called into play will depend upon the strength or electropositivity of the alkali used; the stronger this is the higher the stage that will become active. The series of alkali metals, Li, Na, K, Rb, and Cs, increase in electropositivity with increase in atomic weight, and thus it is not surprising that the stages induced by these metals differ. It must be remembered that the molecular structures, and hence the force fields of these acids, are much more complex than those of the nitrophenols. Up to the present it has not proved possible to obtain different stages of the latter compounds with different metals. It is not possible to reproduce on one diagram the absorption curves of all the salts, but on Fig. 5 are shown those of diphenylvioluric acid (I.) and its lithium (II.) and caesium (III.) salts as given by Hantzsch and Robison. In this diagram the old method of plotting is employed. The curves mark the limits of total absorption at the various concentrations. The free acid shows an absorption band at a frequency of 3830 and therefore one stage in the opening up is present in this case. A higher stage is called into play in the case of the salts, characterised by the absorption band with frequency of 3220. Higher stages are also called into play in the latter case, for the lithium salt shows a band at 1890, while the caesium salt shows a higher stage still at 1680. The greater electropositivity of caesium is responsible for this stage, which is higher than that induced by the less electropositive metal lithium.

Very strong confirmatory evidence of this theory is obtained in the following way. It has been shown in a previous paper† that, on the energy quantum theory, if all the absorption bands evidenced by one compound are functions of one single unaltered primary structure, there must exist a constant difference between their frequencies and further that this difference must equal the frequency of an absorption band in the infra-red region of the spectrum. This at once places the theory upon a quantitative basis, and at the same time affords a very rigid method of proof as to whether the various absorption bands shown by a compound are functions of one single primary structure and not due to any isomerisation. There is no doubt that the infra-red absorption band is a function of the primary structure as determined by chemical analysis, and therefore, if all the visible and ultra-violet absorption bands are directly connected with this band in the manner described, it is clear that they also are functions of the primary structure.

The existence of the constant frequency differences is very evident in all the compounds dealt with above, and in those cases in which the infra-red spectrum is known, there is always found an absorption band with a frequency equal to that constant difference. It is not possible here to enter into proofs of this relation, and the statement that it exists must suffice. It is evident that this relation supports in the strongest manner the present explanation of the absorption and colour of the salts from one colourless base or acid, and that the variation in absorption is due to the condition of the force field of a given molecule with a fixed primary structure.

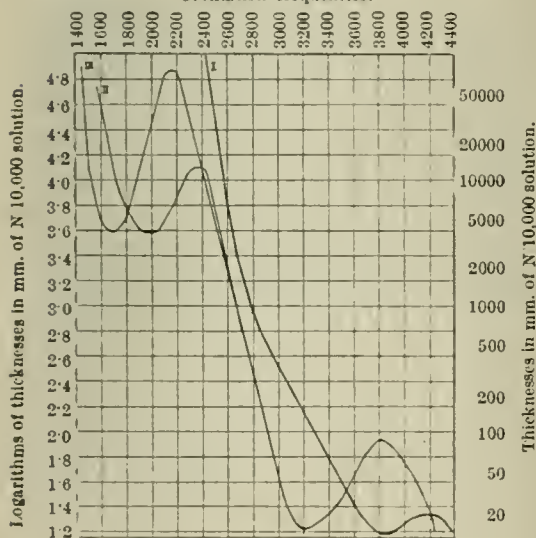
Many other instances might be given of the application of this theory, as for example the azo compounds, which form so large a branch of the dyestuffs. It seems, however, hardly necessary to do so, for every argument advanced above holds

* Ber., 1910, 43, 45.

† Baly. Phil. Mag., 1914, 27, 632.

good in each case. The only difference between the various types of compounds lies in the type of residual affinity best designed to open the closed fields and to form the addition complexes with their characteristic absorption bands. In the case of the aminoazo compounds, for example, an acid is required since the substance is basic in type. In the case of trinitrobenzene, trinitroanisol, and picric acid, the force fields are opened to various stages by alkaline solvents, such as alcoholic sodium ethoxide, piperidine, and dimethylaniline.* Three stages are induced in each case and the absorption curves simply differ in that the three corresponding absorption bands vary in their intensities. Another solvent which opens the fields of the trinitro compounds is a benzene solution of anthracene. In each of these solvents the opening up is due to the formation of addition complexes between solute and solvent. In certain cases these addition complexes separate in the solid phase from their solution. For example, the picrates of anthracene and other hydrocarbons are well known, as also are the addition compounds of sodium ethoxide and the trinitro compounds. The formation of these addition compounds and their colour are perfectly well explained on the present theory.

FIG. 5.
Oscillation frequencies.



I. Diphenylvioluric acid.
II. Lithium diphenylviolurate.
III. Caesium diphenylviolurate.

There remains one set of observations to be discussed, namely the highly coloured nitrophenol ethers of Hantzsch and Gorke, and many similar compounds. The existence of such compounds can readily be explained by the present theory. Since a closed field is opened in stages, so the condensation of an opened up field must also take place in stages. When a nitrophenol ether, for example, is prepared from one of its salts, it must exist at the moment of formation in an opened up condition. There is no obvious necessity that, provided suitable precautions are taken, the ether should not be maintained in the opened up condition. Such a condition would be metastable and would at once in presence of a suitable solvent undergo condensation of its force lines to give the normal stable modification. Owing to the fact that the force fields are open, such metastable substances would possess abnormal reactivity

and they would, in short, exhibit all the properties attributed to them by Hantzsch and Gorke. There indeed seems every reason to believe that all such unstable isomers in reality consist of the partially opened up and hence metastable modifications of the stable forms. There is no necessity to postulate any difference in primary structure for any one of these compounds, for all the properties, both chemical and physical, are far better explained by the fact that their force fields are partially opened than by any alteration in their primary structure.

In conclusion, the evidence against change of primary structure being the cause of change in absorption is overwhelmingly strong. All the absorption bands are undoubtedly due to one atomic grouping in the molecule, as is clearly proved by the relation between these bands and the band in the infra-red region, which latter is known to be a property of that atomic grouping. One advantage of the theory may perhaps be touched upon, namely, it does away with the somewhat alarming complexity which the Hantzsch doctrine of one absorption curve one structure introduces into organic chemistry.

New York Section.

Meeting held at Rumford Hall, Chemists' Building,
on Friday, March 19th 1915.

MR. G. W. THOMPSON IN THE CHAIR.

THE USE OF BARIUM COMPOUNDS IN GLASS.

BY ALEXANDER SILVERMAN.

Historical.—In 1829 Dobereiner suggested the use of barium compounds in glass, and though his experiments were not fruitful, records show that in 1833 fairly good glasses were obtained by Baudrimont and Pelouze.* At Valenciennes, two factories produced a glass said to have been denser, more uniform, and more easily melted than lime glass. It is likely that barium compounds entered the batch, though the manufacturers were not aware of the fact. At a factory in St. Juste sur Loire, sand, felspar, witherite, and lime were used as raw materials; at Regout's factory in Maastricht, litharge, witherite, and lime.

Window and bottle glass were made from sand, barytes, salt cake, and a little lime by Jeanne in Paris. Benrath describes an attempt in 1871 to produce alkali-barium glass of the formula $\text{Na}_2\text{O} \cdot \text{BaO} \cdot 6\text{SiO}_2$. The ideas were unfruitful at the time but were later found to possess value. Harcourt also realised their possible value and Schott made valuable applications.

In more recent times barium compounds have been used in the manufacture of pressed glassware in the United States. From the reticent manner in which chemists in cut glass factories discuss the matter, the writer is inclined to concede these materials considerable value.

Compared with the action of lime, barium compounds produce glass of higher specific gravity. Barium glasses have a higher index of refraction and greater brilliancy than lime glasses and closely

* Baly and Rice. Chem. Soc. Trans., 1913, 103, 2085.

* The writer is indebted to Dr. Ludwig Springer, from whose article in *Sprechsaal*, 1913, much historical material was obtained. Also to the various American chemists and manufacturers, through whose generous co-operation interesting practical data are included.

resemble the lead glasses in these respects. The specific heat of barium glasses is lower than that of lime glasses. Elasticity and toughness are also increased by barium compounds. In hardness and coefficient of expansion barium glasses are practically identical with lead glasses.

The barium silicates are more soluble in water than corresponding calcium silicates. While more heat is required to dissociate BaCO_3 than CaCO_3 , BaSiO_3 has a lower melting point than CaSiO_3 . According to some glass makers barium should displace calcium; others think it should take the place of alkali, and still others suggest a partial substitution for each. There are glasses on the market to-day which tend to confirm all three views, a recently published analysis of one of the Jena glasses showing no alkali, but a large quantity of barium.

To replace 1 part of CaCO_3 molecularly, 1.97 parts BaCO_3 or 2.34 parts BaSO_4 must be used. With the latter it is necessary to use a reducing agent, theoretically 2.7% carbon, in practice 4 to 7%. It is, of course, evident that the sulphate cannot be employed as a partial substitute for litharge owing to the blackening of glasses through sulphide formation. Where barium carbonate is substituted molecularly for PbO , 0.87 part is equivalent. Taking a molecular equivalent for CaCO_3 , the glass would be softer than the corresponding lime glass, so it is possible to reduce sodium carbonate or to use less barium carbonate than a molecular equivalent. The normal formula, $\text{R}_2\text{O} \cdot \text{R}'\text{O} \cdot 0.6\text{SiO}_2$, is said to work, but increased silica to present melting difficulties and cause devitrification.

American experience (Sprehsaal, 1911, 566) is that an imperfect glass is obtained in tank furnaces. The glass is said to be cordy and there is a tendency toward stone formation by the action of gases producing barium sulphate. A higher temperature or the addition of zinc oxide is said to overcome this difficulty.

Zsigmondy's patent for ruby glass specifies the use of 100 kilos. sand, 16 of BaCO_3 , 43 kilos. of soda ash, and 12 grms. gold. The colour is said to appear in the working of the glass.

The Jena glass previously referred to contains 12% BaO . Phosphate crown S40 from the same factory 28% BaO and 60% P_2O_5 . Other Jena crowns contain smaller percentages of BaO .

Sprehsaal (1909, 264) deprecates the use of more than 10 or 12 kilos. of barium compound per 100 kilos. of sand.

R. Hohlbaum ("Die Hohlglasfabrikation," p. 14) states that barium glasses are rarely produced in factories for fine ware, because barium carbonate is more costly than calcium carbonate, and glasses made from the former do not stand the fire as well. They cannot, therefore, be utilised for decorating with hard, resistant colours.

R. Dralle ("Die Glasfabrikation," I., p. 173) says that the coefficients of expansion of barium and lead glasses are identical. Barium serves mainly as a lead substitute. Its silicates have the advantage of remaining unaffected by products of combustion, whether reducing or oxidizing. Barium glasses can be melted in open pots and tanks. For cut glass barium glasses closely approximate lead glasses though they are naturally not quite equal.

Sprehsaal (1912, p. 127) gives a formula for pure barium crystal for soft cut glass. Most opinions there given hold that lead should not be displaced beyond a certain point. Additional batches are found in Sprehsaal, 1913, p. 268.

Chimney glass formulæ, showing partial displacement of lead compounds by barium compounds, are given in Sprehsaal (1906, p. 1082 and 1909, p. 389). Muspratt's *Chemie* III., p. 1431,

credits Benrath with the preparation of a very useful glass according to the formula $4\text{Na}_2\text{O} \cdot 4\text{BaO} \cdot 4\text{CaO} \cdot 36\text{SiO}_2$, which might serve as a substitute for the lighter lead glasses.

Tschueschbner ("Handbuch der Glasfabrikation," p. 103) recommends the use of barium sulphate and carbon in plate glass, displacing both calcium and sodium in part. Sprehsaal, 1909, p. 739, calls attention to the high cost of barium carbonate, the greater specific gravity of barium glass and the consequent increase in freight charges on plate. The brilliancy is considered desirable, but mention is made of the greater fluidity of the glass and fear is expressed as to its weathering qualities.

For pressed ware barium glasses should prove desirable because of their easy flow (Sprehsaal, 1908, p. 28; 1909, p. 39; 1912, p. 283).

The use of barium compounds in glass subsequently treated for the production of iridescence is mentioned in a number of works on decoration and treatment.

The following are a few quotations from replies to letters of inquiry sent to American chemists and manufacturers:—

"We have used the barium carbonate in a limited way for the past ten years and have substituted it for lime in ordinary soda lime silicate with considerable increase in the brilliancy of the product. In opal glass we have used it instead of lead. It makes the glass harder and stands fire in the decorating kiln better, but we have noticed a tendency to devitrify more than in the lead glass. We have noticed but little more, if any, difficulty in planing a soda-lime barium silicate than an ordinary lime glass. (I mention the above in view of the difficulty certain optical glasses are known to give the lens manufacturer.)"—An eastern manufacturer who requests that his name be withheld.

"I have found that barium carbonate will displace lead oxide in the manufacture of lead glass, but owing to the fact that all lead glass blanks are used for cutting purposes in this country and are polished with hydrofluoric acid, it is impossible to use this material in place of the lead owing to the fact that a fine brilliant polish cannot be obtained as with the lead oxide. If it were not for this peculiarity, there is not the least doubt but that the precipitated barium carbonate would be used very freely. Its use in making coloured glass is sometimes of importance, particularly in the case of pale greens obtained from uranium and copper, giving a colour that cannot be obtained with either zinc or lead."—Frederick Carder, Corning, N.Y.

"Barium carbonate can be used to replace lead oxide in giving density and high refractive index to glass, although, of course, in a lesser degree. The presence of barium oxide produces a glass more easily fusible than that with a corresponding percentage of lime but less fusible than glass with the same percentage of lead oxide. Viewed as an oxide used in connection with alkali to lessen the solubility of the glass, barium oxide is inferior to lime or lead because of its greater solubility. Commercial barium carbonate, the only compound suitable for introducing oxide into glass, usually contains about 1% barium sulphide. This is a marked disadvantage, and it is probable that the extended use of barium oxide will not be successful until improvements are made in the purification of the carbonate."—Dr. S. R. Scholes, Pittsburgh, Pa.

"I append herewith two analyses of window glass made in 1906 from a 'batch' containing barium carbonate. (A) $\text{SiO}_2 = 72.29$, $\text{BaO} = 5.31$, $\text{Al}_2\text{O}_3 = 0.88$, $\text{CaO} = 8.60$, $\text{Na}_2\text{O} = 12.14$, $\text{MgO} = 0.78\%$; (B) $\text{SiO}_2 = 72.39$, $\text{BaO} = 5.22$, $\text{Al}_2\text{O}_3 = 0.84$, $\text{CaO} = 8.55$, $\text{Na}_2\text{O} = 12.25$, $\text{MgO} = 0.75\%$."—William A. Hamor, Pittsburgh.

"The experiments here referred to were made for the purpose of determining if barium could be used advantageously in the making of window glass, our principal object being to overcome the production of lines or stresses, sometimes called 'reams,' when lading this glass into pots as used in the mechanical process of making cylinders for window glass. Also, to determine if any benefit would be derived in the way of increased tensile strength, or a reduction in strains and breakage, or the improving of other physical conditions so as to increase production. Therefore, a plant was selected, for the purpose of conducting these experiments, which operated a tank having a melting capacity of substantially 50 tons per 24 hours and holding approximately 500 tons. The barium was added in the form of carbonate and was gradually added to the batch in such proportions as to replace lime substantially molecule for molecule. Physical tests were made, and the chemical analyses are shown in the tables enclosed herewith. The physical test in the last column is the modulus of rupture in grams, and the column marked 'mm. deflection' is the distance through which the specimen travelled, or the deflection constant, before breaking. 'A' contained from 1% to 1½% of barium oxide, 'B' 1½% to 2½%, 'C' 2½% to 3½%, 'D' 3½% to 4½%, 'D-d,' 4½% to 5.35%, or the maximum quantity which we introduced. 'D-B' was a flat 5% of barium oxide with the silica content summing as in 'B,' and, as will be noticed, there is considerable discrepancy in regard to the modulus of rupture between 'B' and 'D-B,' showing conclusively that doubling the amount of barium oxide more than doubled the modulus of rupture, but our deflection constant is substantially the same; this was a great surprise. The soda-silica ratio is the same. In Table I. I have taken a practically constant SiO₂ value with varying ratios of Na₂O, and with varying or rather incremental increase in BaO. In Table II. the BaO is substantially constant (except in D-8, D-9) with an increasing SiO₂ ratio, the Na₂O being constant or practically so.

TABLE I.

	SiO ₂ Na ₂ O	Al ₂ O ₃ and Fe ₂ O ₃ %	BaO %	CaO %	Na ₂ O %	mm. De- flection.	Modulus in grms.
A	4.81	1.37	0 to 1.5 to	11.54 10.78	13.59	0.38	18,170
B	5.12	1.21	2.5 to 9.9	10.5 9.9	13.18	0.38	21,530
C	5.40	1.19	3.5 to	9.71	12.09	0.55	29,500
D	5.07	1.07	4.5 to	9.37	12.90	0.46	44,720
D-B ..	5.12	1.07	5.0 to	9.1	12.79	0.33	45,470
D-d ..	5.02	1.09	5.35	8.30	12.85	0.58	52,780

TABLE II.

	SiO ₂ Na ₂ O	Al ₂ O ₃ and Fe ₂ O ₃ %	BaO %	CaO %	Na ₂ O %	mm. De- flection.	Modulus in grms.
D-1 ..	5.02	1.09	5.35	8.30	12.85	0.58	52,780
D-1 ..	4.81					0.21	37,100
2 ..	4.96	1.13	5.27	8.38		0.45	36,890
4 ..	5.19					0.38	35,350
D-5 ..	5.03				12.90	0.50	52,370
6 ..	5.38	1.11	5.28	8.35	12.41	0.41	42,990
7 ..	5.4				12.73	0.43	39,150
D-8 ..	5.70		3.17		12.02	0.58	34,890
9 ..	5.70	1.17	4.25	8.31	12.71	0.45	35,250
10	5.71		5.29		12.80	0.48	21,850

"The results were surprising, for these figures represent the mean of from three to five tests of each specimen. Glass conforming to 'D,' 'D-B,' 'D-d' or 'D-5' was made with from 40 to 80% less breakage from tank to box, according to the melting conditions, also the quality was greatly improved."—Robert L. Frink, Lancaster, Ohio.

"I have used barium carbonate in place of lead oxide with success, it being possible to replace all of the lead in a formula. Barium has been used largely in enamels using antimony salts in place of tin oxide. Enamels containing antimony oxide and lead oxide are usually very yellow. Replacing a certain portion of the lead with barium removes this objection. Barium used in molecular proportion to replace lead gives an enamel requiring a higher heat to form, but when formed the melting point is about the same as that of the lead enamel. Barium enamels are somewhat stiffer, and show no tendency to flow on the ware. Variation in barium content does not give same expansion and contraction as when content is changed and thus can not be used as a control. Lead enamels show a bright fine surface. Barium enamels are apt to show a slightly greasy surface, with many very slight pits. In enamels I consider it of advantage to carry 6% of BaO, using BaCO₃ as origin. Barium fluoride acts like fluorspar, and I have found it of advantage to replace ½ of the fluorspar in my formulae with BaF₂. My experience would indicate that BaCO₃ could replace PbO in lead glasses to some extent."—H. L. Bowers, Oshawa, Ont., Canada.

"Barium oxide is used a great deal in ceramic glazes. It has been found that up to 0.2 equivalent it imparts brilliancy and hardness to the glaze, and at the same time tends to lower the maturing temperature as compared with the action of lime. It seems to be used a good deal, especially in borosilicates. The only objection to barium compounds is their readiness to absorb sulphuric acid during the early stages of the burning. The resulting sulphate may give rise to surface scumming. For this reason in many glazes it is introduced as part of the frit. Some European porcelain glazes carry as much as 0.2 equivalent of barium oxide. In glazes which tend to craze barium aggravates this difficulty."—Dr. A. V. Bleining, Pittsburgh.

The writer's personal experience with barium compounds has been confined to their use in opal and alabaster glasses. Here they can displace both lime and litharge, wholly or in part, depending on the nature of the batch. The advantage is in the increased whiteness which results and in reducing the tendency to strike, so common in lead glasses. Further, the glasses flow well for pressed ware and with proper correction a good metal is obtained for blowing. The advantage over lead glasses in fire-polishing has already been made apparent.

Supply and cost.—According to good authority,* domestic crude barytes averaged \$3.45 per ton in 1913 and the refined product was valued at \$14.18. Very little carbonate or witherite is mined in the United States and there are apparently but two plants equipped to manufacture it from barytes. Barium carbonate can be bought in quantity at \$3.75 per 100 lb. There is then, obviously, a limited supply and the price would prove a material factor in certain branches of the glass industry. The demand for barium compounds in the paper, leather, rubber, textile, and paint industries and for the manufacture of the peroxide is not indicative of a reduction in price.

Conclusion.—Facts already established show the value of barium compounds in the manufacture of certain glasses. The price of the compounds prevents their economical use in other branches of

* The production, manufacture and uses of compounds of barium, W. E. Emley and S. E. Young, Proc. Amer. Ceram. Soc., 1915

the industry, when the cost of cheaper glasses is considered. Further investigation may prove that improved quality will more than offset cost. Further development of natural resources may sufficiently reduce the price of these compounds to make their use more general. Both are worth while if one can judge from results already obtained.

THE CAUSES OF THE OPALESCENCE OF GLASS.

BY JUDSON G. SMULL.

The manufacture of opal glass has come to be an immense industry in recent years, to say nothing of the increasing manufacture of enamels and enamel ware. The theory and processes of opalisation have been the subject of many investigations, with the result that many conflicting theories have been proposed to explain them. It is the purpose of this paper to give a general review of these investigations, together with some experiments performed by the author, in an attempt to ascertain, if possible, the true causes of opalescence.

Opal glass is used to a great extent in the manufacture of gas and electric globes, because its use has been found to be very effective in the distribution of light in space.* It is known under the names, "alabaster," "bone glass," "Carrara"; the term "hot cast porcelain" was a trade name used as early as 1860, when it was manufactured extensively in Philadelphia and Pittsburgh. The substances used to produce opacity include the oxides of tin, zinc, aluminium, titanium, zirconium, antimony, and arsenic, calcium phosphate, barium carbonate, asbestos, kaolin, felspar, cryolite, fluorspar, and fluosilicates. The "hot cast porcelain" was made from sand, cryolite, and zinc oxide. There is apparently a wide range of substances which may be used to produce opacity; several, however, may be eliminated on account of their cost and difficulty experienced in working. The substances used most and which have been the subject of nearly all of the investigations are the aluminium compounds, such as felspar, cryolite, in combination with fluorspar, fluosilicates, and alkali fluorides. Some typical formulæ† are as follows:—

Sand	100	100	100	100	100
Potash	16		20	20	20
Soda		20			6
Arsenic	1.0	1.0		1.0	
Red lead		40.0	20		
Lime	8.0				8
Zinc oxide	6.0				
Cryolite	15.0			8.0	12
Fluorspar		22.0	20	10.0	
Felspar		19.0	20	12.0	
Saltpetre					3

Upon examination of these and many other formulæ, it is found in the majority of cases, that a fluoride is used with a compound of alumina, such as aluminium silicate, or again as fluo-aluminate, as in cryolite, and very seldom do we find alumina used in the uncombined form.

Opal, the mineral and precious stone found in nature, is an amorphous form of silica, transparent to opaque. It contains a varying amount of water, but the water is sometimes regarded as being non-essential. The hardness and specific gravity are lower than in quartz. The opal is formed, according to Dana's "Mineralogy," from the silicious waters of some hot springs, and often from the silicious shells of infusoria, etc., which consist essentially of opal silica. The opal is now

considered to be a solid silicic acid gel. (Zsigmondy and Siedentopf, *Ann. Physik*, 1913, 4, [10] 2.)

The first reference in literature goes back to 1860,* when in Philadelphia, Pa., cryolite was used to make opal glass by the American Hot Cast Porcelain Co. In 1869, Benrath† analysed some pressed glassware of "hot cast porcelain" of sp. gr. 2.471, and found it to contain: SiO_2 , 67.07%; Al_2O_3 , 10.99; Fe_2O_3 , 1.09; CaO , trace; Na_2O (calc.), 19.83%. A glass of this composition was made from 1 part cryolite and 2 to 4 parts quartz sand; the high iron content was said to come from the sand. To make a glass of similar composition, Benrath melted cryolite with sand, and found that the melt, while still molten, was perfectly transparent, and remained so until the glass cooled somewhat, when a turbidity appeared and finally, upon cooling, a dense white glass of sp. gr. 2.373 remained; the analysis compared closely with the American product. Benrath found no fluorine in this glass, and he advanced the theory that opalisation was due to the separation of crystalline alumina, and concluded that the fluorine was completely expelled from the glass as volatile SiF_4 . He gives the following reaction as taking place:—



In the same year, Williams‡ examined an opal glass made up as "hot cast porcelain," containing 8% F, and calculated that the approximate composition of the glass batch was: sand, 67.19; cryolite, 23.84; zinc oxide, 8.97%. He concluded that opacity was due to sodium fluosilicate, which dissolves in the molten glass at a bright heat, and passes on cooling into a porcelain-like mass, and states that the action on the pots in making this glass was no greater than in other glasses.

In 1877, Ebell§ made some investigations on opal glass, to determine the role of fluorine; on melting Benrath's mixture of 1 part cryolite and 2 parts sand for two hours at a yellowish-red heat, a great evolution and loss of SiF_4 was observed. A test portion taken from the melt and suddenly cooled was colourless, but on warming to the softening point the whole mass suddenly became intensely opaque. The glass which remained in the crucible cooled slowly and showed a more definite structure; it was not so dense as the former, and a thin section under the microscope showed an opaque ground mass, with a crystalline substance of wave-like appearance. An analysis of the glass showed 1.74% fluorine, and upon reheating with fine sand, a perfectly clear glass was obtained containing no fluorine. Ebell concludes that fluorine is essential in producing opacity, and that sodium silicofluoride cannot effect it without alumina.

In 1884, Johnson and Zeodesco¶ (Eng. Patent 6899) made opal glass by substituting cryolite, felspar, or fluorspar for calcium phosphate, and state that the usual ingredients for an opal glass are an alkali fluoride, either with or without the conjoint use of a substance containing alumina.

In 1885, C. Weinreib** made a series of glasses from mixtures containing alumina and a fluoride, separately and in conjunction, from which he concluded that aluminium fluoride is formed and produces the opacity.

Schwarz*** in 1888, experimented with a glass of the molecular formula, $6\text{SiO}_2 \cdot \frac{1}{2}\text{PbO} \cdot \frac{1}{2}\text{CaO} \cdot \frac{1}{2}\text{K}_2\text{O} \cdot \frac{1}{2}\text{Na}_2\text{O}$, using a mixture of three-fourths of this glass and one-fourth cryolite. He

* This Journal, 1885, 502.

† Benrath, *Dingl. Polyt. J.*, 192, 239.

‡ Williams, *J. Franklin Inst.*, 57, 252.

§ Ebell, *Dingl. Polyt. J.*, 225, 70.

¶ Johnson and Zeodesco, *this J.*, 1885, 349.

** Weinreib, *Dingl. Polyt. Jour.*, 256, 361.

*** Schwarz *Dingl. Polyt. Jour.*, 267, 223.

* Schott u. Herschkowitz, *J. Gasbeleucht.*, 1901, No. 26.

† Die Glashütte, 37, 210, 226, 237.

contends that no fluorine is volatilised and that he experienced no bad effects from cryolite or other fluorides on the pots, provided the proper proportions of ingredients are used. Fluorine compounds in the batch up to 10% gave satisfactory results. He agrees with Williams* that sodium fluosilicate is the cause of opacity, and that alumina plays no part in the opalisation, since fluorspar and potassium fluoride gave equally good results.

In 1888, R. Zsigmondy† made experiments from which he concluded that AlF_3 is the essential constituent in producing opacity. He contended further that zinc and lead fluorides act in a similar manner, that is, they remain suspended in the glass, just as aluminium fluoride does. He also gives an example of a French opal glass, free from fluorine but high in alumina and lead, the opacity of which he attributes to lead, since in lead glass, which fuses at a low temperature, the alumina is less soluble than in those glasses not containing lead.

J. A. Reich,‡ in 1898, showed that the sodium fluoride content of cryolite was the cause of opacity, but considered that the fluorine escaped completely in the form of silicon fluoride.

K. Reidell,§ in 1909 found that, if cryolite be replaced by an equivalent amount of aluminium hydroxide, a perfectly clear glass was obtained, from which he concluded that the alumina content of cryolite alone is not the cause of opacity. Replacing cryolite by an equivalent amount of sodium fluoride and working at moderate temperatures, opalescence was produced, but not as dense as with cryolite. He also found that opalescence may be produced by using fluorspar in sufficient quantity, in the absence of all other substances used for the same purpose. Reidell refers also to an article by Tschenschner,|| who doubted that the fluorine content of cryolite and fluorspar was essential in producing opacity.

Schaller¶ in 1909 stated that, contrary to the general opinion, fluorine does not escape completely as SiF_4 , but frequently remains in the glass in considerable quantities, causing a notable change in the physical properties and at the same time producing opacity. It is further stated, however, that it should not be taken that SiF_4 alone produces opacity in glass, for some observers assert that silica separates in a very finely divided condition, and is the opalizing substance. Soda-lime glasses of high silica content become opaque on cooling even without the addition of phosphate or fluoride, but the opacity may be increased by the addition of fluoride or phosphate, according to the effect desired.

Again, in 1909, Enequist** concluded that opacity is caused by SiF_4 in a gaseous form, as shown by the fact that "if an opal glass, particularly one containing lead, is heated to fusion it becomes clear; but, if cooled it becomes opaque. If the same or a similar piece of glass or enamel is heated as above and a part of the molten drop squeezed suddenly with a pair of tongs, the opacity will practically vanish from the pressed part."

Frink†† doubts the ability of SiF_4 , in gaseous form, to produce opacity; he agrees that opacity is produced by SiF_4 , but considers that it remains in the glass in a crystalline form, and that it is these crystals of SiF_4 that produces opacity; furthermore, the heating of such a glass

in a reducing atmosphere will break up these crystals, changing the opal glass into a clear glass.

The most recent addition to the literature of opal glass is the patent of George Macbeth, of the Macbeth Evans Glass Co. (U.S. Pat., Reissue No. 13,766, reissued July 7th, 1914). Macbeth uses the following combination as the "foundation" mixture: Sand, 100 lb.; lead oxide, $15\frac{1}{2}$ lb.; soda, $21\frac{1}{2}$ lb.; nitre, $5\frac{1}{2}$ lb.; salt, $5\frac{1}{2}$ lb.; borax, $1\frac{1}{2}$ — $2\frac{1}{2}$ lb.; to which he adds 18-12 lb. aluminium hydroxide (containing 11-84 lb. aluminium oxide) and 6 lb. of fluorspar. The working temperature is approximately 2700°F . (1500°C). The use of aluminium oxide and a fluoride, such as fluorspar, Macbeth claims "apparently produces specks, the larger of which are ordinarily visible to the naked eye, and which have the effect of diffusing or scattering the light and giving the glass its white luminous appearance." The specks in the finished ware are elongated in shape, and I believe them to be bubbles of silicon fluoride gas held in suspension in the material and elongated during pressing or blowing into moulds."

The theories of the different investigators, as to the cause of opacity, may be summarised briefly as follows: That it is produced by

- (a) Crystalline alumina, no fluorine remaining in the glass.
- (b) Sodium fluosilicate, presence of Al_2O_3 necessary.
- (c) Sodium fluosilicate, presence of Al_2O_3 immaterial.
- (d) Aluminium fluoride, also by zinc and lead fluorides.
- (e) Silicon fluoride in gaseous form.
- (f) Silicon fluoride in crystalline form.
- (g) Silica in finely divided form.

Experimental.

The experiments to be described were carried out in a gas-fired crucible furnace; French clay crucibles were used for the fusions. A clay crucible permits of a much larger charge than a platinum crucible; the charge in each case was approximately 125 grms. Then again the influence of rapid cooling would be greatly diminished in a clay crucible charge of 100 grms. or more as compared to a platinum crucible charge of 5 or 10 grms. In fact, a clay crucible charge when compared with a charge of large scale operation presents great differences in the phenomena of glass, especially since these phenomena depend upon the production and manipulation of the glass while it is still hot. The action of fluorides on the clay crucible was not enough to produce an opal effect in any case, so that it was possible to use chemically pure substances in order to study the reactions and in all experiments where there was any doubt about the effect produced, "chemically pure" substances were used. It may be noted that no mention is made in the literature referred to concerning the use of such chemicals in any of the experimental work.

The heating in most cases lasted for two hours after complete fusion; prolonged heating was found to render an opal batch perfectly clear; the temperature of the furnace was not measured, but was estimated to be between 1300° and 1500°C . In every case the melts were allowed to cool slowly in the furnace, before breaking the crucible for examination. The batches were made up by mixing all of the ingredients together before heating, but the procedure of fusing a portion of the batch and adding the remaining ingredients after fusion appeared to be advantageous in certain cases. Small pieces of the glasses which showed opacity, became perfectly transparent

* Williams, *loc. cit.*

† R. Zsigmondy, Dingl. Polyt. J., **271**, 36, 80.

‡ Reich, III. Int. Cong. Appl. Chem., Wien (1898).

§ Reidell, Chem.-Zeit., 1909, **33**, 1305. Chem. Absts., **4**, 818.

|| Tschenschner, Glas-Ind. Kalender, 1902, 25.

¶ Schaller, Z. Angew. Chem., 1909, **22**, 2369.

** Enequist, Chem. Eng., 1909, 54.

†† Frink, Chem. Eng., 1909, 128.

when heated in the flame of a Bunsen burner, but on cooling again the original milkiness appeared.

The finished glass contained from 10–12% lead oxide, about 4–6% alumina, and about 5% lime; the silica averaged 66%, the remainder being alkalis, and possibly some fluorine. Several manufactured opal glass articles were examined and analysed. The analyses of two of these glasses are as follows:—

	Glass A.	Glass B.
	%	%
SiO ₂	65.71	65.60
Fe ₂ O ₃ and Al ₂ O ₃	3.73	9.78
CaO	3.50	0.30
MgO	0.50	0.50
PbO	12.97	10.40
Na ₂ O	12.95	12.50
K ₂ O	trace	trace
MnO	none	none
As ₂ O ₃	none	0.10
F	trace	0.85

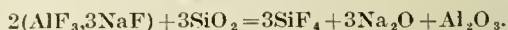
Examination of thin sections of the manufactured glasses under the microscope showed a homogeneous mass, but no crystalline structure could be detected.

In these experiments, a type of glass was chosen as previously given, and variations, either by substitution or addition, were made in the use of fluorine and aluminium compounds; the results of these tests are summarised in the following table:—

Fluorine compound used.	Aluminium compound used.	Character of glass.	Remarks.
Fluorspar, commercial.	Ignited alumina	Very slight opacity.	Probably due to silicates in fluorspar.
Fluorspar, commercial.	Felspar	Dense, opaque	
Potassium fluoride	None	Clear	
Potassium fluoride C.P.	Ignited alumina	Clear	
Potassium fluoride	Felspar	Opaque	
Aluminium fluoride	—	Clear	
Cryolite	—	Opaque	
Aluminium fluoride C.P.	Ignited alumina	Clear	
Cryolite (60% NaF) (40% AlF)	Ign. alumina	Opaque Slight opacity	Not as good as with natural cryolite
Sodium silico-fluoride C.P.	None	Dense, opaque	
Potass. fluoride	Sodium silicate	Opaque	
Sodium fluoride C.P.	Sodium silicate	Opaque	
None	Ign. alumina	Clear	
	China clay	Clear	
	Felspar	Clear	

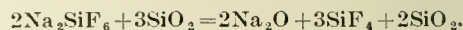
It will be seen that fluorspar and alumina produce only a very slight opalisation, while fluorspar and felspar give a dense opaque glass. Potassium or sodium fluoride may be used in place of fluorspar, giving practically the same results. Aluminium fluoride and alumina gave a perfectly clear glass. Cryolite produces opacity without the use of any silicate, as felspar, although we often find felspar in a cryolite mix. Sodium fluoride and aluminium fluoride mixed in the proportions as found in cryolite produce opacity, but not so good as natural cryolite. The results with cryolite tend to show that opalisation is not due to the separation of silica, but to the separation

of alumina, by the action of cryolite on the sand, according to the reaction:—

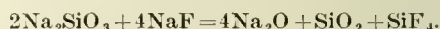


The alumina remains suspended in a low melting point glass, such as a lead glass, thus permitting a selective reaction between sodium oxide, alumina, and silica; continued heating causes the solution of alumina and renders the glass clear. Felspar, ignited alumina, or china clay heated in a glass batch, in proper proportions without a fluoride, produce a perfectly clear glass.

Passing to the silicofluorides, we find that sodium silicofluoride without any aluminium compound produces opacity. The reaction is probably as follows:—



Here the silica, like alumina, is held in suspension and here again a lead glass is best suited for the purpose. If the separation of silica takes place, as shown above, and produces opacity in the same way as alumina is thought to do, then we should expect to obtain opacity by using a silicate, free from alumina, in conjunction with some fluoride. We found this to be the case where sodium silicate and sodium fluoride were used in a lead glass batch. The reaction is expressed as follows:—



Since all natural silicates used in opal glass manufacture contain both alumina and silica in a combined form, it is probable that, under suitable conditions, there is a suspension of both these compounds in the opal glass. It is reasonable to think that in mixing an opal batch, one may first melt together the constituents which are naturally required for the glass, such as sand, soda, etc., thus forming a silicate, and to this fusion then add a fluoride and any other elements necessary. The function of the fluoride then would be to set free the silica or alumina or both, which are present in combined form, as a result of the preliminary fusion, thus producing the desired opal effect. It is possible that some of the investigators referred to may have performed their experiments in this manner, without mentioning the fact, thus obtaining results not in exact conformity with the stated facts.

Summary and Conclusions.

In general we say then (1) that opacity is the result of the separation of either silica or alumina or both, in a very finely divided, probably colloidal form in the glass; (2) the most suitable condition for this separation is a glass of low melting point, that is, one containing lead, where the silica and alumina will remain suspended for some time before going into solution; (3) the separation of silica and alumina is effected by (a) the use of silicates, such as felspar, in conjunction with a fluoride; (b) by a double fluoride, such as cryolite, with or without felspar; (c) by silicofluorides, with or without felspar; (d) by a fusion of the major ingredients of a glass, with the addition afterwards of a fluoride and other desired substances to the fused portion.

There is another probable explanation of the production of opacity, derived from a consideration of the refractive properties of glass with respect to the refractive properties of the oxides which appear to produce opacity. If alumina or silica or any other oxide is held in very fine suspension in the glass, then we may consider them in the same manner as we consider a pigment and a vehicle with respect to hiding power. In the case of a pigment, it is held that good hiding power is obtained when the refractive index of the pigment is materially different from the refractive

index of the oil, whilst if the refractive indices of the pigment and oil are the same there is practically no hiding power.

In the same way opal glass may be considered as consisting of a glass medium (which corresponds to the vehicle) and the very finely suspended particles (corresponding to the pigment). Then if the refractive index of the glass medium is materially different from the refractive index of the suspended particles, we shall have a good opal effect, but if the respective refractive indices are very nearly alike, we should expect to get transparency in our glass. Ordinary glass has a refractive index of 1.55, silica 1.44, alumina 1.76, and tin oxide 2.0; which means that under suitable conditions, opacity or opalescence may be produced by the suspension of alumina, silica, tin oxide, etc., in a glass medium, because of the differences in the refractive indices of these oxides with respect to the glass.

The work covered in this paper is considered only as a preliminary for further investigation, and is given in the hope of stimulating a thorough research to settle the disputed points which appear to exist. The work was carried out in the Research Laboratories of the National Lead Company under the direction of Mr. G. W. Thompson, to whom the author is indebted for many valuable suggestions.

DISCUSSION.

Mr. J. O. HANDY said he believed that neither alumina nor silica was precipitated as such in opal glass. The phosphate glasses doubtless contained insoluble, finely divided calcium phosphate in suspension. Glasses containing fluorides, however, he believed to owe their opacity to one or more fluorine compounds, probably silicofluorides, which were in process of further decomposition, with production of silicon fluoride gas, which is volatilised.

With reference to the Macbeth patent for a white glass free from "fire," the cause or causes of the opacity in this case seemed to be different from that of the opacity of the older types of opal glass. Photomicrographs showed the presence of numerous gas bubbles, but showed no material amount of suspended solid matter, even when a magnification of 400 diameters was used. The suspended matter in an opal glass examined microscopically could not be detected by the usual methods of microscopic examination, and bubbles were very few in number. The suspended solid matter apparently present in both glasses evidently existed in an extremely fine state of division approaching the condition ordinarily described as "colloidal."

Mr. E. ENEQUIST stated that on fusing a mixture of sand, soda, and fluorspar for a few hours, he had obtained a glass which was more opaque at the top than at the bottom, tending to show that a gas was given off, but not completely, however, since prolonged heating drove out all the gas, and rendered the glass clear. If alumina or silica were the cause of opacity, the continued heating would not cause the glass to clear, as in the case of SiF_4 .

Mr. SMULL replied that his experience in opal work had been that, on breaking the crucible to examine the glass, it was slightly more transparent near the top than at the centre or bottom. He believed the alumina and silica were separated in the reaction, rather suddenly, by the action of the fluorides, and that, just as prolonged heating of any glass mixture changed its constitution and characteristics, so in opal work, continued heating tended to dissolve the separated alumina and silica and render the glass clear.

Meeting held at Rumford Hall, Chemists' Building, on Friday, January 22nd, 1915.

MR. G. W. THOMPSON IN THE CHAIR.

PRESENTATION OF THE PERKIN MEDAL TO DR. EDWARD WESTON.

After some introductory remarks by the Chairman,

Prof. C. F. CHANDLER, in making the presentation of the Perkin Medal to Dr. Edward Weston, said that Weston was born at Brynm Castle, near Oswestry, in 1850, and came to America in 1870. His first engagement was with the W. H. Moduck Co., manufacturers of photographic chemicals and dealers in photographic supplies and apparatus: here he stayed about a year, and during this period and later, for about three years, he assisted Professor Charles S. Stone, Professor of Chemistry, at the Cooper Union. Then he went to the American Nickel Plating Company, where he found that the nickel plating works were in very poor condition, especially the galvanic batteries employed as a source of electricity. He carefully investigated all the details of the art, and made many improvements in the processes by which he improved the quality of the coating, secured great economy in nickel, and greatly reduced the time required for plating, and particularly succeeded in the preparation of the surface to which the nickel was to be applied and in the polishing of the nickel coating. He also discovered a dip which could be conveniently used for removing nickel from damaged goods in order to coat them again.

When this company gave up business in 1872, Weston went to the Silver Nickel Plating Company. He soon left this company, however, and was appointed consulting expert by the Commercial Printing Telegraph Company, operating the patents of Foot and Randall. This company was soon bought out by the Gold and Stock Telegraph Company.

Dr. Weston then formed a partnership with a Mr. Harris for general plating business—copper, brass, nickel, silver and gold. Here he built, in the latter part of 1872, a dynamo as a substitute for batteries in electroplating. This greatly increased his business, so he enlarged the plant and finally moved to Canter Street. Here he built another dynamo, larger and somewhat different. Then he built a third dynamo for a manufacturing firm in Newark. At this time he withdrew from the plating business and made an arrangement with the Newark firm to build dynamos for electroplating and made about twenty of them. They were so expensive, however, that they could only be used by large concerns. He started to design a simpler and cheaper machine, but the firm decided to give up the business. A new firm, Stevens, Robbins, and Hayville bought them out and Weston went into partnership in order to develop a new nickel anode which he had invented and for which he obtained his first patent in 1875.

Since then he has taken out over 350 patents for his various inventions, and has made radical improvements in several arts. Besides that, a great deal of his work has involved the most patient and careful scientific investigations, often of microscopic accuracy, and has contributed largely to the advance of scientific knowledge and theory.

In 1903, McGill University conferred upon Mr. Weston the degree of LL.D., in 1904 the Stevens Institute of Technology bestowed the degree of D.Sc., and in June, 1910, Princeton University conferred the same degree.

Dr. EDWARD WESTON, in accepting the medal, expressed his sincere thanks for the honour conferred upon him, and also acknowledged the debt of gratitude which he owed to Prof. Chandler for his kindly assistance on his arrival in New York in 1870.

Dr. L. H. BAEKELAND then spoke as follows: To the pioneer work of Dr. Edward Weston is due the development of several industries: the electro-deposition of metals, the electrolytic refining of copper, the construction of electric generators and motors, electric illumination by arc and by incandescent light, and the manufacture of electrical measuring instruments.

Weston's tendency to observe small details in chemical or physical phenomena led him to improve the art of nickel-plating and electrolytic deposition of metals to a point where it entered a new era. He succeeded in devising methods not only of increasing the physical texture of the deposit, but for improving enormously the speed and regularity with which the operations could be carried out; all these improvements are now embodied in the art of electro-plating, nickel, gold, and silver-plating.

At that time, attempts had already been made to refine copper commercially by means of the electric current. Here again, Weston established the true principles on which economic, industrial, electrolytic copper-refining could be carried out.

The whole problem of electrolytic refining, when Weston took it up, was hampered by the conception that a given horsepower could only deposit a maximum weight of copper, regardless of cathode or anode surface. Weston showed clearly how to increase the amount of copper deposited per electrical horse-power, by increasing the number and size of vats and their electrodes, connecting the vats in a combination of series and multiple, the only limit to this arrangement being the added interest of capital and depreciation on the increased cost of more vats and anodes, in relation to the cost of horse-power for driving the dynamos.

The electro-deposition of metals forced Weston into the study of the construction of dynamos. In 1876, he filed his first United States patent on rational dynamo construction, which was soon followed by many others, and before long, he had increased their gross electrical efficiency from a maximum of 40% to 95%, and a commercial efficiency of 85 to 90%.

In Weston's factory the electric arc was used for the first time in the United States for general illumination. In fact, from 1875 to 1886, Weston was very energetically engaged with the development of both systems of arc and incandescence illumination by electricity. He started the manufacture of arc-light-carbons by methods of his own invention, and thus he founded another new industry in America. Amongst the many objections to the electric arc was the bluish colour of its light. Weston found a complete remedy by the introduction of vapours of metals or metallic salts or oxides in the arc itself, so as to modify at will the colour of the light, and thus he became the inventor of the so-called "flaming arc."

In his endeavours to make the electric incandescence lamp an economic possibility, he first tried to utilise platinum and iridium and their alloys, which he fused in a specially constructed electric furnace, devised by him, antedating the furnace described by Siemens. This is probably the first electric furnace, excepting the furnace which Hare used in his laboratory in Philadelphia. But these platinum metals had serious defects apart from their high cost, and by that time Weston had become so familiar with the properties of good carbon that, like other inventors, he became convinced that the ultimate success lay in that direction.

To make carbon filaments homogeneous, Weston passed the current through them in an atmosphere of hydrocarbon gas, so that in every spot where the temperature was highest, on account of greater resistance due to irregular structure of the material, the hydrocarbon gas was dissociated and carbon was deposited automatically until the defect was cured, with the result that the filament acquired the same electric resistance over its whole length. By now Weston had become convinced that the ideal filament would be an absolutely structureless, homogeneous filament, and that such a filament could only be produced artificially from a structureless substance. He finally secured this result by evaporating a solution of collodion to produce a homogeneous, structureless, transparent film of nitro-cellulose. As this film could not be carbonised the nitrate group was eliminated by means of ammonium sulphhydrate. This gave a flexible, transparent sheet, very similar in appearance to gelatin; this material he called "Tamidine." Such films could be cut automatically with the utmost exactitude, producing filaments of uniform section, which could then be carbonised, before fastening them to the inside of the glass bulb of the incandescence lamp.

Weston was frequently handicapped in his work by the uncertain and time-consuming methods of electrical measurement existing at that time, so he invented for his own use a set of practical measuring instruments. He soon found that there was a great demand for such instruments, so he devoted himself to the art of making accurate, trustworthy, and simple electrical measuring instruments.

What Stas did in chemistry for atomic weights, Weston did for electrical measuring; he created radically new methods of measurement, and introduced an accuracy undreamt of heretofore. His problems were not easy ones. When Weston took up the subject, in 1884, the greatest drawback in the construction and use of accurate measuring instruments was that on account of the so-called temperature coefficient of metals, all measurements had to be corrected by calculation to the temperature at which the observation was made. The favourite metal for resistances at that time was German-silver, but he pointed out that the composition of German-silver varies very considerably. Therefore he proposed a standard copper-nickel-zinc alloy containing about 30% of nickel, and which had a specific resistance of more than twice that of ordinary German-silver and a much lower temperature coefficient. He then took up the systematic study of a large number of alloys, and in the course of the work observed remarkable properties in some manganese alloys: he first produced an alloy which had 65 times the resistance of copper, then an alloy which had no temperature coefficient whatever, and finally, produced several alloys which had a *negative* temperature coefficient. He also showed that the resistance of these alloys depended not only on their composition, but on certain treatments which they undergo, for instance, preliminary heating. After the Weston patents had been published, his alloy was called *manganin* in Germany, and publicity had been given to its properties with scant reference to its real inventor.

No less important was the invention of the Weston standard cell, which since 1908 has become the accepted universal practical standard for electromotive force. Until that time the Clark cell had been accepted as the standard of electromotive force. Weston set himself to make a cell that had no temperature coefficient and had no "lag." He found that the saturated solution of zinc sulphate in which was suspended an excess of crystals of this salt, was an unsuitable electrolyte and one of the principal causes why the

indications of the Clark cell varied considerably with the temperature. He came to the conclusion that cadmium sulphate was more appropriate than the zinc salt, and this was one of the several important improvements he introduced in the construction of a new standard of electromotive force.

Dr. Weston assures me that he has succeeded in making his alloys to show only a change of one-millionth part for a variation of 1°C . The metallic alloys he discovered are now used in nearly all kinds of electrical measuring instruments throughout the world.

Dr. EDWARD WESTON said:—When I entered the service of the American Nickel Plating Co., the art of nickel plating was in its infancy, and very little was known about the conditions necessary to carry it on successfully. In general there was no difficulty with the nickel solutions. When properly used they gave good results. The trouble was mainly due to using methods similar to those employed in depositing silver. A nickel deposit cannot be burnished like silver, because it is too hard; consequently it must be polished. The processes then employed in preparing the articles for nickel plating were mechanical. The articles, after they came from the mills, were dipped in a hot or boiling solution of caustic potash, until the fat was saponified, and a dark coating of oxide was formed on the surface. They were then scoured with a common plater's brush, dipped in rather fine pumice stone, washed in water, and placed either directly in the bath or immersed in a solution intended to remove the last faint trace of oxide which might have been formed during the scouring. In the processes then employed the standard voltage recommended was two volts, that is, two *Smee* cells. That practice was obviously wrong, because what was necessary was to cover the inferior metal as quickly as possible after it was placed in the solution; if this was not done, secondary reactions were apt to take place between the inferior metal and the nickel in solution, and then the adhesive characteristics of the coating were lost. Hence in reality one of the most important things was to increase the voltage and quickly coat the whole article with a film of nickel, transfer it to a bath in which the voltage was lower, and let the deposition go on until it reached the required thickness. If the article was very large or irregular in shape, or was a long distance from the operation, parts of the surface would get covered with secondary compounds, and any attempt at polishing would cause flaking. Now, when that relatively rough surface was plated, it was necessary to put on a sufficient coat to cover up the scratches. We lost a very large percentage of the nickel in this way, and also a very great deal of time in carefully polishing the nickel coat. The remedy seemed to be obviously chemical cleaning, and putting on the soft metal before placing it in the bath as good a finish as was wanted on the nickel after polishing. The chemical method of cleaning was adopted entirely and is still in use, except that the cleansing of iron or steel articles or other metals not readily acted upon by caustic potash or soda, is done by the aid of electrolysis.

It then occurred to me that it should be possible to get softer nickel, but at first the only way I could do it was by reducing the rate of deposition, keeping down the tendency to the evolution of hydrogen at the cathode. Some years later I found a solution which yielded a nickel deposit with characteristics closely approaching those of good copper. The metal could be rolled and drawn, and I called it "malleable nickel." It was made by using a single salt of nickel. I soon found, however,

that no single salt of nickel could be used for depositing nickel commercially, and no double sulphate of nickel and potassium or any other alkali could be used for depositing nickel. If a solution of a single salt of nickel (chloride, sulphate, bromide, or iodide) is electrolysed, a good deposit of metallic nickel is first obtained, but after a while the deposit becomes darker and darker in colour, until at last there is a tint of green on the surface of the cathode. When that begins, more and more hydrogen is evolved at the cathode until finally the cathode is covered with a green salt. Now the addition of a little sulphuric acid to the solution causes it to begin depositing nickel again. Although all the single nickel salts are acid to litmus paper, if they are electrolysed until the green deposit forms on the cathode they become basic. That led to the invention of a nickel anode and a new solution.

The anode was made from grain nickel mixed with the minimum amount of carbon, with a binder of tar or pitch, the whole being submitted to hydraulic pressure. If the nickel-carbon electrode were broken up there was apparently no change in the size of the grains, although an enormous amount of nickel had been taken out of the electrode. The only observable difference was that by the use of a sharp-pointed instrument it could be cut out in a powdered condition. If a large cast anode is used for some time it will appear to be just the same size as it was originally, but it will bend like a piece of flexible sandstone. Examined under a glass, it will be seen that the colloidal portion has dissolved out and left the crystals.

The solution used was nickel sulphate or chloride, to which boric acid had been added. If an acid had been added which had a tendency to attack the metal to be coated, secondary reactions would have been set up immediately on putting the electropositive metal into the bath.

During my connection with the plating business I discovered that the presence of colloids was often very harmful in nickel solutions, especially double sulphate or chloride solutions. The presence of 0.1% of gelatin in a plating solution is sufficient to produce a black powdery deposit and also a large amount of hydrogen.

Dynamos. Originally the platers had a very small equipment of batteries, and these were very cheap; a fair-sized plating establishment could be run with about \$15 or \$20, so that the introduction of dynamos was a very difficult problem as regards first cost. The first dynamo I built was used in my own place in Elm Street, New York. It had two armatures—one for exciting the field magnet, and the other for drawing the arm. The machine had a regulated rheostat consisting of German silver wires wound around the legs of the table. On the magnet-charging armature I had thin wire until I got the current down, and kept all the E.M.F. for running an arc light, so that I had a very powerful machine for my purposes. As soon as the success of that machine had been demonstrated another one was started, and that dynamo ran continuously until a few years ago, when it was destroyed in a fire. Later I built another type of single armature which was more efficient, but still the efficiency from the power standpoint was rather poor. We built about twenty of these. I realised, however, that a cheaper machine than this was necessary for the plating industries. To reduce the amount of work to the minimum and also the amount of material, the machine was almost entirely made in a lathe—cylindrical work. There were only

two parts in the machine which called for a milling machine or plane. I then designed two small machines. One was about four inches in diameter and about six inches long to be sold for \$65 for the use of small platers. Another size was made about 8 in. in diameter and about 6 in. long, the armature being somewhat larger; that was for a good sized plant, and to sell for \$165. Later we built very much larger machines, up to 20 in. (inside diameter of the cylinder carrying the radio magnets between the poles of which the armatures revolved). This machine had a very high output per pound of material and for unit cost.

Many difficulties were encountered in the introduction of dynamos. At that time the platers got ready during the day and ran the baths at night for 12 to 14 hours; so that the solutions and methods had to be changed to produce the same coating in one-quarter the time. The operators did not approve of the innovation, and the question of price was also a great difficulty.

In the *arc light industry* we were confronted with the opposition to the colour of the light. I started with the long arc lamp, but it failed everywhere. I modified the light for the double purpose of modifying the colour and increasing the power efficiency. The amount of light per horse-power was very largely increased by the addition of the substances that caused the flaming arc, and they also tended to keep the light steady.

Arc light carbons were manufactured on a fairly large scale toward the end of my connection with the business, but when we started to work with the arc lamp here we paid \$1.20 a dozen for carbons from France. Of course that price was fatal to the introduction of the electric light. It was a chemical proposition throughout and it required a good deal of hard work. We sold them at from \$12 to \$14 per thousand when we disposed of the plant, and I think that they afterwards went down to from \$6 to \$8 per thousand.

In the arc lamp we were also confronted with a serious mechanical problem, that of getting the regulators to keep all the arcs always of the same length when they were in series, because there must be the same amount of energy on each lamp. Therefore, the resistances of the individual lamps must be almost exactly the same for equal lighting power. That difficulty was overcome in quite a variety of ways by both Brush and myself.

In the *incandescence lamp* the chemical difficulties were vastly greater than the mechanical. One of the first problems to be solved was the irregularity of the filaments made from bamboo or paper. If a defective loop made from any of these substances is put into a hydrocarbon vapour and a current passed through it, the hydrocarbon vapour will be dissociated, and a deposit of carbon will form on the hot spots, so that finally the loop will be repaired and will glow all over uniformly. The next step is to continue the deposition of carbon all over the loop so as to bring the resistance to exactly what is required before it goes into the lamp.

Substantially, every carbon-filament lamp is made by the above process of carbon treatment. The courts have ruled that I did not invent this process. Hiram S. Maxim got the credit for it, but Sawyer got the first patent on it. I had made it very early in the history of the work, long before Mr. Maxim or Mr. Sawyer had any knowledge of it whatever.

However, when filaments were treated by the hydrocarbon method they always failed at one spot—the initial weak spot. We put a lamp between a powerful permanent magnet and passed an alternating current through it, and the loop vibrated at a rate corresponding with the rate of alternation of the dynamo. That was a severe test, but it showed us whether we had completely eliminated the defective spots, because when the loop began to vibrate if there were any weak spots they would show.

I then took up the problem of producing the structureless homogeneous carbon thread, of uniform cross section, and of uniform electric resistance from end to end for any given section.

After numerous attempts, it was decided to make the filaments from collodion, but the alcohol-ether solvent caused trouble, owing to shrinkage and pitting: this was avoided by very slow evaporation. Finally ammonium sulphhydrate was selected as the most suitable agent for re-forming the cellulose. The process was later modified by squirting a solution of cellulose containing zinc chloride through very fine tubes into alcohol. In that way the homogeneous carbon filaments were obtained.

Alloys.—The alloys at our disposal for electrical measurement work were German silver and platinum silver, which was too expensive for use. German silver generally had a resistance about thirteen times that of copper and a temperature coefficient of 0.001433; it contains from 4 to 18% Ni. I found out quite early that it varied very much in resistance, and in temperature coefficient, and that by increasing the percentage of nickel the specific resistance was increased in nearly the same proportion, and the temperature coefficient was reduced by nearly the same proportion. We made standard German silver containing 30% nickel; it had twenty-eight times the specific resistance of copper (about thirteen as given by Madison) and the temperature coefficient was almost half that of copper. These temperature coefficients were of very great importance because it was necessary where electrical instruments were used to give true results, whereas the results obtained from other alloys varied. The very best German silver that we could make was not good enough for instrument work, nor was it good enough for a standard. I therefore examined a large number of alloys, and found that none gave such a high specific resistance as manganin. Nickel stands next to it; it gives very high specific resistance not only with copper but with other metals. On the other hand, the nickel alloys have not so good a temperature coefficient as the manganin alloys, and they have a relatively high thermo-electrical effect against copper and other metals.

The standard cell. My first efforts were devoted to the improvement of the Clark cell. According to Clark there was no difficulty in making or selling standard cells of this type. I found a great deal of difficulty, and after quite a long investigation I abandoned the form of cell that Clark used. He recommended making the paste of zinc sulphate, mercurous sulphate, and metallic mercury. I started my cadmium cell and after a long, tedious investigation I finally succeeded, but the lag was very pronounced. I reduced the temperature coefficient of that cell very much and got rid of the lag by using a saturated solution of zinc sulphate which gave a very steady and reliable standard, but still it had a temperature coefficient: to avoid that I used a cadmium mercury amalgam on one side, and pure mercury with mercurous sulphate on the other. This cell with a solution of cadmium sulphate saturated at 4°C. shows practically no temperature coefficient.

Obituary.

JAMES HARGREAVES.

English chemical technology has lost one of its most notable personalities by the death, on April 4th, of Mr. James Hargreaves of Widnes, an original member of this Society.

Born in 1831, he commenced work on the recovery of sulphur from alkali waste in 1856, and in the course of this work became acquainted with William Gossage, who had been experimenting on similar lines. At that time little encouragement was offered by alkali makers to continue the work, though many years afterwards this pioneer work was applied successfully in a somewhat modified form. Entering the employ of Mr. Gossage, Hargreaves turned his attention to the oil and soap industries, and succeeded in devising a process for recovering chromates used in bleaching oils and fats for soap making, by which the cost of the process was very greatly reduced. He also practically revolutionised soap making by discovering a method for bleaching the brown soap in general use at that time, and was the first to prepare blue mottled soap. After leaving Gossage in 1865, he became interested in metallurgical work, and his suggestion to utilise sodium nitrate in place of air in making steel by the Bessemer process, was tried at Nottingham, but though the results were good the method proved too costly. He devised a method for recovering the phosphorus as sodium phosphate from blast-furnace slags, obtaining ferric chloride as a by-product, which was converted direct into the oxide and chlorine. In 1873, he erected works at Widnes to carry out his process for the production of hydrochloric acid by the action of pyrites burner gases on common salt, and this process was run successfully for many years, until the works were taken over by the United Alkali Co.

In conjunction with the late Mr. Thomas Bird, he invented an electrolytic process for decomposing salt, known as the Hargreaves-Bird process. After prolonged experiments, a large cell was constructed and worked continuously for two years, during which time the production was 95½% of that theoretically possible. Later a plant was erected at Middlewich, where the process was carried out on a large scale with great success: these works have recently been

acquired by the Electro-Bleach and By-Products, Ltd. The process has also been extensively adopted in Europe and America with very satisfactory results.

J. M. C. PATON.

Mr. J. M. C. Paton, Managing Director of Messrs. Manlove, Alliott and Co., Ltd., Nottingham, died on April 10th, after a short illness. Mr. Paton always took a keen and active interest in the affairs of this Society, and especially of the Nottingham Section, of which he was Chairman from 1893 to 1895. He also served on the Council of the Society as an Ordinary Member from 1899 to 1901 and as Vice-President from 1901 to 1903.

OTTO N. WITT.

Otto Nikolaus Witt was born in Petrograd on March 31st, 1853. He studied chemistry at the Zürich Polytechnikum and graduated at Zürich University. After spending some years in ironworks in Germany and in calico printworks in Switzerland, he came to England, where he was engaged at the works of Williams, Thomas, and Dower, Brentford. Later he returned to Germany to work at the dyestuff factory of L. Cassella und Co., and in 1894 he was appointed Professor of Chemical Technology at Charlottenburg.

From the year 1876 onwards, Witt contributed largely to our knowledge of the dyestuffs. He was one of the first to attempt a correlation of the colour and other properties of dyestuffs with their constitution, and it was he who showed that the tinctorial properties of certain aromatic compounds depend upon the presence both of a chromophore and of a salt-forming group, and that the tinctorial power of a dyestuff increases with the number of chromophoric groups present. Among the azo dyestuffs his work included the preparation of chrysoidine and the tropäolins. In the azine series, he discovered the eurhodines and eurhodols, and prepared a number of new safranines and higher indulines. In 1881 he discovered the indophenols and also prepared their leuco compounds.

Witt was one of the foremost German technologists, and acted as President of the International Congress of Applied Chemistry held in Berlin in 1903. He was an original member of this Society. He died suddenly on March 23rd.

Journal and Patent Literature.

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I.—GENERAL PLANT; MACHINERY.

PATENTS.

Centrifugal separator. E. Köpke, Honolulu, Hawaii, Assignor to Köpke Clarifier Co., Ltd. U.S. Pat. 1,119,173, Dec. 1, 1914. Date of appl., Dec. 8, 1911.

In a centrifugal separator for the clarification of liquids by stratification, cross-currents converging

towards the discharge, which would tend to disturb the established strata, are prevented by placing a permeable partition (perforated plate, wire netting, cloth) within the rotor in the path of the overflow therefrom and adjacent to the discharge opening, whereby the discharge is broken up into a multitude of small jets spread over a considerable area, the direction of the flow of liquid through the screen being preferably opposite to the direction of the centrifugal force.—J. F. B.

Centrifugal separator. E. Köpke. Honolulu, Hawaii. U.S. Pat. 1,119,176, Dec. 1, 1914. Date of appl., June 21, 1912.

THE rotating bowl constituting an imperforate stratifying chamber, is provided near the bottom with an annular guide plate, preferably inclined downwards, and forming an antechamber into which the crude liquid is first introduced. The periphery of the guide plate extends near the wall of the bowl, so that the liquid issuing from beneath it enters the stratifying chamber at a level well below the surface of the body of liquid undergoing stratification. The space between the guide plate and the floor of the drum is enclosed by a perforated screen, whereby the liquid passing beneath the guide-plate is broken up into a number of small streams. The clarified liquid may be discharged over the overhanging lip of the bowl or by means of an adjustable scoop.—J. F. B.

Separating solids from liquids; Centrifugal machine for —. Jahn und Co. Fr. Pat. 471,531. April 30, 1914. Under Int. Conv., May 3, 1913, and April 8, 1914.

SEE U.S. Pat. 1,124,907 of 1915; this J., 1915, 264. The telescopic outlet tubes are so adjusted that the solids are discharged by the action of the pressure in the drum without the use of conveyors.—W. H. C.

Filtration; Process and apparatus for —. Socié des Etablissements Daubron. Second Addition, dated July 17, 1913, to Fr. Pat. 437,614, Feb. 22, 1911 (this J., 1912, 524).

THE filter cloth is covered with coarse canvas, so that when the filter is cleaned by reversing the current, the rubbing of the canvas against the filter cloth assists in the discharge of the deposit. —W. H. C.

Filtration; Apparatus for —. C. Butters and Co., Ltd. Fr. Pat. 472,015, May 9, 1914. Under Int. Conv., Aug. 13, 1913.

THE bag of filter cloth which surrounds the frame of a suction filter is left open at the bottom, the ends hanging down below the lower part of the frame, so that when the filter is under suction, they are drawn together, and close the bag. When water is admitted to the interior of the frame to discharge the cake, the lower ends of the bag open and allow the pressure within and without the frame to be equalised.—W. H. C.

Filtration; Process and apparatus for —. C. Butters. Fr. Pat. 472,017, May 9, 1914. Under Int. Conv., June 18, 1913.

A RAPID current of the liquid or mud to be filtered is caused to flow over the surface of horizontal suction filters mounted on a frame, so that the formation of the cake is assisted by the action of gravity. To aerate the mud, it is supplied faster than the filters can receive it, and the portion which overflows is re-circulated. When the cake is sufficiently thick it is washed, and the filters are tilted to discharge the cakes.—W. H. C.

Mixing and disintegrating apparatus. J. Woltersdorf. Fr. Pat. 471,661. March 31, 1914.

AN axial shaft passing through a horizontal cylindrical casing carries at the ends two oppositely threaded screw conveyors and, in the middle, a series of beater arms projecting into the spaces between flat or wedge-shaped teeth fixed to the inner wall of the casing. Material fed into the casing is delivered by the conveyor screws to the beaters of the disintegrator, and the mixed product is discharged through a door on the lower side of the casing controlled by a spring.—W. H. C.

Disintegrators; Process and means for increasing the output of —. G. Polysius. Fr. Pat. 471,675. April 7, 1914. Under Int. Conv., April 9, 1913.

TO increase the output of disintegrators, the particles which are too large to pass through the sieves are collected by hook-shaped projections on the interior surface of the drum, and are carried round and returned to the sphere of action of the beaters when the projections reach the lowest point of their path.—W. H. C.

Filtering apparatus. M. Deacon and W. Gore. London. U.S. Pat. 1,130,382. March 2, 1915. Date of appl., Dec. 3, 1912.

SEE Eng. Pat. 29,301 of 1911; this J., 1913, 221.

Furnace tubes or chambers; Manufacture of —. R. P. Pictet, Walsall. U.S. Pat. 1,130,533, March 2, 1915. Date of appl., July 30, 1914.

SEE Eng. Pat. 15,379 of 1913; this J., 1914, 849.

Dust from air or vapour; Apparatus for extracting —. J. Herbing, Halle, Germany. U.S. Pat. 1,130,596. March 2, 1915. Date of appl., Oct. 3, 1913.

SEE Eng. Pat. 20,700 of 1913; this J., 1914, 468.

Liquids from solids; Apparatus for, and method of expressing —. J. J. Berrigan, Orange, N.J., Assignor to H. R. Worthington. U.S. Pats. 1,130,701 and 1,130,879, March 9, 1915. Dates of appl., Aug. 22, 1911, and July 8, 1913.

SEE Eng. Pat. 18,584 of 1912; this J., 1913, 933.

Drying objects formed of plastic masses; Method of —. O. Eberhard, Heidenau, Germany. U.S. Pat. 1,131,047, March 9, 1915. Date of appl., Aug. 8, 1912.

SEE Fr. Pat. 455,959 of 1913; this J., 1913, 933.

Centrifugal separator. U.S. Pat. 1,119,175. See XVII.

IIA.—FUEL; GAS; MINERAL OILS AND WAXES.

Coal and petroleum; Some relations in origin between —. D. White. U.S. Geol. Survey. J. Washington Acad. Sci., 1915, 5, 189—212.

FROM a consideration of the specific gravities of the oils, and the various degrees of regional alteration exhibited by the mother rocks and associated carbonaceous deposits, of different geological formations and regions in the Eastern United States, it is concluded that petroleum results from the geodynamic alteration of certain types of organic débris deposited in sedimentary strata. The types of oils produced are probably governed by the composition of the original organic deposits, and the rank of the oils within each type by the stage to which the natural distillation has progressed. Oils of the lowest rank of each type usually occur in those regions and formations in which the carbonaceous deposits are least altered, and oils of the highest rank in regions where the carbonaceous deposits are of correspondingly high rank, the effect of progressive regional dynamic alteration being marked by a concentration of hydrogen in the oils and a concentration of carbon in the residual débris (coal, carbonaceous shale, etc.). The sporadic occurrence of abnormally light oils in pools of lower rank is probably due to filtration, or to migration from underlying

formations of more advanced alteration. In general, at a given point, the oils found in successive underlying formations, or stratigraphically lower sands in the same formation, are progressively higher in rank. Engler's principle—that the increase in sp. gr. of the oil is inverse to the stratigraphical depth of the well—thus corresponds to Hilt's law with regard to the increasing carbonisation of coals with depth. In regions where the progressive removal of volatile substances from the organic deposits in any formation has passed a certain point, marked in most provinces by 65 to 70% of fixed carbon (pure coal basis) in the associated or overlying coals, commercial oil pools are not present in that formation or in any other formations normally underlying it, although commercial gas pools may occur in a border zone of higher carbonisation. The approximate carbonisation limits of the rocks containing or overlying oil pools may vary somewhat in different provinces according to the characters of the original organic debris, the circumstances attending its deposition, and the geological structure. Wherever the regional alteration of the carbonaceous residues passes the point marked by 65–70% of fixed carbon, the light distillates appear, in general, to be gases at rock temperatures. Occluded oils may, in some cases, have escaped volatilisation.

—W. E. F. P.

Calorimetry; Combustion —, and the heats of combustion of sucrose, benzoic acid, and naphthalene. H. C. Dickinson. Scientific Papers of Bureau of Standards, U.S.A., No. 230, July 16, 1914. Bull. Bureau Standards, 1914, 11, 189–257.

THE sources of error in bomb calorimetry can be avoided or reduced to a negligible quantity by care in the design, construction, and use of the calorimeter. The cooling corrections for a properly designed calorimeter may be made with an accuracy of about 1 part in 10,000 of the total amount of heat measured. Determinations of the heat of combustion of naphthalene gave 9622 ± 2 calories per gram, weighed in air, with a maximum deviation of about 5 in 10,000 for groups of observations upon the same sample, and about the same maximum deviation of different groups of observations from the mean of all, regardless of the sample. Benzoic acid gave 6329 ± 1 calories (20°) per gram, weighed in air, with a maximum deviation of about 1 in 1000 for the earlier experiments and 5 in 10,000 for the later ones. Sucrose gave 3949 ± 2 calories (20°) per gram, weighed in air, with a mean deviation of about 3 in 10,000. Benzoic acid is regarded as the most desirable substance for a combustion standard as indicated by the agreement between the results of different observers. Naphthalene is very reliable and convenient although it requires care in handling. Sucrose is not so satisfactory as benzoic acid because of its lower heat of combustion, its frequent failure to ignite, and the lower precision of the results obtained.—E. R. A.

Bunsen flame; Combustion in the inner cone of the —. L. Ubbelohde and O. Bommer. J. Gasbeleucht., 1911, 57, 757–765, 781–787, 805–810. Z. angew. Chem., 1914, 27, Ref., 729–730.

DIXON's observation that the presence of water vapour is necessary for the explosion of mixtures of carbon monoxide and oxygen is confirmed. The maximum accelerating effect is obtained with 7–10% of steam in the case of mixtures of carbon monoxide and air. In experiments with a carbon monoxide-air flame, equilibrium was not established at a point immediately over the inner cone. The velocity of the trimolecular reaction, $2\text{CO} + \text{O}_2 = 2\text{CO}_2$, was greater at the surface of the

inner cone than in the region outside the cone. By the use of platinum gauze or an incandescence mantle, combustion can be accelerated so that equilibrium is attained. The temperature of a carbon monoxide-air flame measured thermoelectrically is lower than the theoretical temperature calculated from calorimetric data, so that in practice a mixture of carbon monoxide and hydrogen, though less efficient theoretically, will give a higher flame temperature than carbon monoxide alone. Experiments were also made with flames of air with hydrogen, methane, acetylene, and lighting gas, respectively, and in no case was the dissociation equilibrium attained.—A. S.

Gases; Separation of — by fractional distillation in a vacuum at low temperatures. G. A. Burrell and I. W. Robertson. J. Ind. Eng. Chem., 1915, 7, 209–210.

A RESUMÉ of the authors' work on the subject (see also this J., 1914, 808; 1915, 17, 267). In the case of mixtures of paraffin hydrocarbons, the methane is distilled at the temperature of liquid air, ethane at not above -140°C , propane at not above -120°C , and butanes at not above -95°C . From mixtures of olefines ethylene is distilled at not above -140°C , and propylene at not above -120°C . When paraffins and olefines are both present, ethane and ethylene, and propane and propylene are removed together, and the proportion of each in the mixture is determined by combustion. Benzene vapour in air or gaseous mixtures such as coal gas may be distilled at the temperature of liquid carbon dioxide (-78°C), after removing the other constituents at lower temperatures, and its amount estimated from its pressure. Gasoline vapour in air is determined at the temperature of liquid air. Water vapour in air can be determined at -78°C . The distillates must be refractionated several times to obtain pure fractions.—A. S.

Gases; A rapid method of fractionating — at low temperatures. G. A. Burrell and I. W. Robertson. J. Ind. Eng. Chem., 1915, 7, 210–211.

THE gaseous mixture is fractionated at progressively increasing temperatures, then the first distillate is refractionated at the lowest temperature used, the second fraction added to the residue and fractionated at a somewhat higher temperature, and so on, the essential difference from the original method (see preceding abstract) being that the successive fractions are added to the residue in the liquefying bulb instead of each fraction separately being redistilled several times.—A. S.

Gasoline and aromatic hydrocarbons; New process of obtaining — from crude petroleum. Oil, Paint, and Drug Rep., March 8, 1915.

THE Secretary of the Interior Dept., U.S.A., has given some general details of Rittman's process of obtaining gasoline, benzol, and toluol from petroleum, which is about to be patented in the name of the United States. The process differs from that of Burton (this J., 1911, 911), in that the vaporised oil is passed downwards through an iron tube in which it is heated under pressure, and then through a condenser from which the liquefied products are withdrawn. For the production of gasoline the oil vapours are heated to 450°C , and upwards under a pressure of 90 lb. per sq. in., whilst for the production of benzol and toluol a temperature of 500°C , and pressure of 100 lb. per sq. in. are required. The greater the proportion of gases in the tube the higher is the yield of liquid products. In laboratory experiments about 80% of a heavy oil residue was utilised, and by repeated passage through the tube yielded about 8% of gasoline. A single passage of the oil through the

tube yielded about 6% of aromatic hydrocarbons, and it is anticipated that in the commercial process the yield will be 6 to 10 times greater than the quantity obtained from coal tar. It is stated that the objectionable odour of the gasoline made by Burton's process has been eliminated, and that the product is now a practicable substitute for petrol.—C. A. M.

Gasoline and kerosene from heavier hydrocarbons; Preparation of —. B. T. Brooks, R. F. Bacon, F. W. Padgett, and I. W. Humphrey. *J. Ind. Eng. Chem.*, 1915, 7, 180—185.

VARIOUS patented processes for the cracking of petroleum are reviewed briefly, and, in connection with the proposed use of nickel as catalyst, attention is called to the work of Ostromisslenski and Bujanadse (this J., 1910, 682) who found that Russian crude petroleum when heated at 600°—700° C. in presence of nickel was converted entirely into coke (40%) and gas, the latter consisting of hydrogen (72—75%) and saturated hydrocarbons. In the authors' experiments kerosene and solar oil vapours were passed, at atmospheric pressure, through an iron tube filled with a contact substance and heated to 500°—550° C.: the olefine content of the gasoline fractions obtained with burnt clay, carbon, iron, or copper as contact substance was 25—30%, but with nickel it was 48%. Burton's claim (U.S. Pat. 1,049,667; this J., 1913, 414) that in cracking petroleum under pressure olefines are not produced if the pressure-controlling valve is placed beyond the condenser instead of between the condenser and the still, could not be confirmed. The olefine content is diminished by increasing the pressure, and in Bacon and Clark's process (U.S. Pat. 1,101,482; this J., 1914, 824) the use of 100—300 lb. pressure per sq. in. is claimed. In experiments with Oklahoma crude petroleum from which the gasoline and kerosene had been removed, the yield of gasoline distilling below 150° C. increased with rise of pressure to a maximum of about 33% at 280 lb. per sq. in. pressure, and then slowly diminished, whilst the refining loss on treatment with concentrated sulphuric acid diminished as the pressure was increased up to about 200 lb. per sq. in. and then remained practically constant. According to Bacon, Brooks, and Clark (U.S. Pat. 1,131,309), within certain limits the cracking effect is approximately proportional to the heating surface in contact with the oil, and the amount of coke deposited on vertical heating surfaces is only from one-third to one-fifth of that deposited on an ordinary still bottom. The fraction of b. pt. 200°—250° C. obtained by cracking at 100 lb. pressure Oklahoma petroleum from which the gasoline and kerosene had been removed, showed an optical activity of +0.36° on the saccharimeter scale in a 400-mm. tube; the corresponding fraction from the original oil had an activity of +0.2° in a 200-mm. tube. The gasoline obtained by cracking at 100 lb. pressure contained aromatic hydrocarbons: benzene, toluene, and xylene were identified by the formation of 1,3-dinitrobenzene, 2,4-dinitrotoluene, and 2,4,6-trinitro-*m*-xylene respectively. It is suggested that the aromatic hydrocarbons are formed from petroleum hydrocarbons containing the phenyl group, derived probably from protein substances. Only small quantities of naphthenes were present in the gasoline, the predominating constituents being normal paraffin hydrocarbons.—A. S.

Petroleum: Analytical distillation of —. W. F. Rittman and E. W. Dean. *J. Ind. Eng. Chem.*, 1915, 7, 185—195.

THE authors give the results of a comparison made in the U.S. Bureau of Mines of different methods

of distilling petroleum for analytical purposes. The methods selected were that of Allen and Jacobs (this J., 1912, 18), in which the entire surface of the distilling flask is heated electrically so that no condensation occurs in the vapour space of the flask: the Engler-Ubbelohde method, in which there is a moderate amount of condensation in the distilling flask, and the Hempel method, using a flask with the fractionating column made in one piece with the bulb (Dean and Bateman, *Bull.* 112, Forest Service, U.S. Dept. Agric.); aluminium beads were found more satisfactory than glass ones for filling the column. The detailed results are given in tables and diagrams. A much higher degree of fractionation was obtained by the Hempel method than by either of the others, and the method of Allen and Jacobs was the least efficient. A single distillation with a Hempel column was more efficient than two successive distillations by the Engler-Ubbelohde method. The degree of separation increased with rise of temperature, and the amount of this increase could be ascertained roughly by determination of the specific gravities of the fractions. Even the Hempel method, however, gave but a low degree of separation, for on redistillation only about 55% of a given fraction came over within the original temperature limits: for the Engler-Ubbelohde and Allen and Jacobs' methods the corresponding figures were 25 and 14% respectively.—A. S.

*Petroleum residuum; Variations of the physical characteristics of a—*with increasing percentages of grahamite. H. Rossbacher. *J. Ind. Eng. Chem.*, 1915, 7, 205—206.

THE effects produced on the physical properties of a Mexican petroleum residuum by addition of up to 30% of grahamite are shown in a table and diagrams. The relation between the melting point and the percentage of grahamite in the mixture was practically linear. The mixtures were tested with a penetrometer at different temperatures: the temperature-penetration curves all showed a tendency to flatten out far below the melting point, indicating that too much reliance should not be placed upon the melting point or upon the penetration at one particular temperature in judging the value of an asphaltic material. The temperature-penetration curve of the mixture containing 15% of grahamite corresponded closely with that of the residue left when the original petroleum residuum was subjected to a 20-hour evaporation test at 485° F. (252° C.).—A. S.

Trinidad asphalt. C. Richardson. *J. Phys. Chem.*, 1915, 19, 241—249.

THE oil sands occurring at different depths in the locality of the mud spring in the island of Trinidad contain a highly asphaltic petroleum, which, upon meeting the fine silica and clay mud of the spring, is emulsified by the action of the natural gas under high pressures, forming the so-called "soft pitch." The natural gas contains, in addition to hydrocarbons, as much as 33% CO₂ and 3.5% H₂S. The "soft pitch" also slowly evolves gas and gradually hardens, the process being possibly catalysed by adsorbed ferrous sulphate. The approximate composition of the crude asphalt, which is remarkably homogeneous, is: water and gas 29.0%, bitumen soluble in cold carbon bisulphide 39.0%, bitumen adsorbed and retained by the disperse mineral matter 0.3%, mineral matter on ignition with tricalcium phosphate (see this J., 1909, 419) 27.2%, water of hydration of clay 4.2%. The water obtained from the melted material contains about 20 grms. of salts per litre, including sodium, ferrous, and ammonium sulphates, sodium chloride, and small amounts of iodides and borates

The mineral matter obtained on ignition consists of impalpably fine silica, clay, and the non-volatile salt residue. The preparation from the asphalt, by means of carbon bisulphide and other organic solvents, of a bitumen free from mineral matter is rendered difficult by the presence of colloidal material, consisting mainly of bitumen adsorbed by clay and other mineral matter in a state of high dispersion; about one-half of the bitumen is soluble in naphtha of 88° B. (sp. gr. 0.621), and this portion is not adsorbed. The crude asphalt thus consists of "a suspension of relatively large size mineral particles in an extremely viscous medium, together with highly dispersed mineral matter in colloid form, intimately mixed with an emulsion of a thermal water with the bitumen present." A very similar product results when a crude Bermudez asphalt, practically free from mineral matter, is softened below 100° C. and emulsified with a paste of colloidal clay and water. The presence of suspensoid and dispersoid material in asphalt enhances the surface energy and viscosity and lessens the ductility and susceptibility to change of temperature; the effect of an added mineral dust, though of the same nature, is far less than that of the highly dispersed colloids which are present in Trinidad asphalt.—J. R.

Melting point of paraffin waxes: Apparatus for determining the —. F. H. Small, J. Amer. Leather Chem. Assoc., 1915, 10, 144—146.

A narrow graduated glass tube, closed below by a cork, is fused at its upper end to a wider tube provided with a loosely-fitting plunger and containing the shaved wax, on which rests a weight. The whole is immersed in a bath of water which is heated gradually, the temperature being kept constant for 7 minutes after each degree rise. The amount of melted wax which collects in the narrow graduated tube is noted after each degree rise of temperature, the plunger being slightly raised and lowered to facilitate the flowing of the melted wax. The temperature at which 50% of the wax is melted corresponds to the melting point as usually determined.—T. C.

PATENTS.

Peat pulp or the like: Apparatus for heating —. The International Nitrogen and Power Co., Ltd., E. A. Buekle, and O. D. Lucas, London. Eng. Pat. 5845, March 7, 1914.

IN carrying out the process described in Eng. Pat. 10,370 of 1912 (this J., 1913, 590), the peat is heated by forcing it through tubes passing longitudinally through horizontal water cylinders connected to horizontal cylindrical boilers arranged beneath them. The boilers are heated by hot gases which pass through internal tubes and emerge into a chamber enclosing the whole apparatus.—W. F. F.

Coal-washing apparatus. E. G. Burks and N. Hayes, Birmingham, Ala. U.S. Pat. 1,132,433, March 16, 1915. Date of appl., July 3, 1914.

The wash water is passed through a settling tank provided with two partitions forming a pair of inlet chambers, between which is a tortuous trough. The wash water passes from a sluice above the tank into each of the inlet chambers and into the trough. Liquid is discharged from the tank at variable levels through a stand-pipe.—W. F. F.

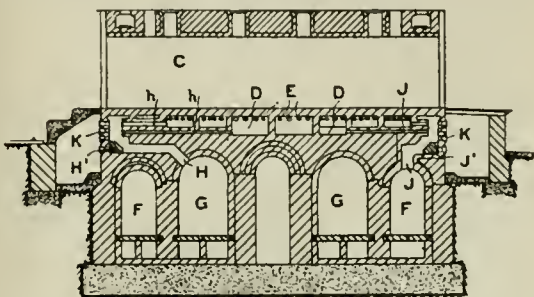
Coal briquettes; Carbonisation of —. B. Grätz. Fr. Pat. 472,402, May 19, 1914. Under Int. Conv., Jan. 26, 1914.

COAL briquettes containing a carbonaceous binding medium are heated to incipient coking in a revolving drum or series of superposed drums

placed in a current of hot gas, and then pass through a shoot into a larger drum revolving more slowly in a casing, of which one side only is subjected to the hot gas. The coking is completed in this large drum.—W. F. F.

Coke-ovens; Gas-fired —. Simon-Carves Bye-Product Coke Oven Construction and Working Co., Ltd., and J. H. Brown, Manchester. Eng. Pat. 29,367, Dec. 20, 1913.

IN a coke-oven adapted to be fired either with rich or poor gas, combustion flues extending longitudinally between the coking chambers, C, are fed



with rich gas from channels along their base, and with air from one set of regenerators, F, G, through the ducts, H, h, D, the flow being regulated by the fireclay plug, H¹. Poor gas may be supplied through the regenerator, F, to ducts, D, under one coking chamber, the corresponding ducts under the next chamber being still supplied with air from the regenerator, G; both sets of ducts open into each combustion flue. The combustion products pass through both regenerators, F, G, of the other set, so that the usual reversal may take place.—W. F. F.

Coke; Removable grate for shaft furnaces for the continuous production of —. W. Schwarz. Ger. Pat. 280,085, Oct. 1, 1913.

THE grate bars, with pointed ends, are arranged symmetrically around the periphery of the furnace, and are fixed, e.g., in sets of three, to spindles provided with screw threads. Each spindle works in a thread on the inside of a cog-wheel, and the whole of the cog-wheels may be operated simultaneously by a large toothed wheel, whereby the bars are moved into or withdrawn from the furnace in a radial direction.—A. S.

Retorts for carbonising coal or the like; Mechanism for charging horizontal or inclined —. A. McD. Duckham, Ashted, Surrey. Eng. Pat. 13,936, June 9, 1914.

IN apparatus having a plunger reciprocating over a coal shoot in front of the retort, a sleeve moves ahead of the plunger to enclose a core of fuel and prevent jamming.—W. F. F.

Coal gas retort chambers and the like; Heating —. A. G. Glasgow, Richmond, Va., U.S.A. From J. M. Rusby, Philadelphia, Pa., U.S.A. Eng. Pat. 22,425, Nov. 12, 1914.

THE chamber is heated by producer gas, generated by passing air through a burning bed of fuel, the production of clinker being prevented by passing a regulated supply of steam through the fire. The temperature of the chamber is controlled by adding an incombustible diluent, e.g., the products of combustion, to the burning producer gas.—W. F. F.

Gas furnaces: Process and apparatus for heating — either by producer gas or lighting gas.
R. Geipert. Fr. Pat. 471,644, Mar. 20, 1914.
Under Int. Conv., April 14 and Nov. 1, 1913.

DURING the use of lighting gas in gas furnaces which may be heated alternatively by producer gas or lighting gas, the producer is kept hot by the production of a small quantity of gas which is burnt with the lighting gas. The producer may be connected to the furnace by a permanently open conduit for this purpose, and by others which are temporarily closed. To avoid the passage of large quantities of producer gas to the furnace during cleaning, the lighting and producer gas conduits may be partially closed. The lighting gas may be passed through the incandescent fuel in the producer to destroy the illuminants.—W. F. F.

Gas producers [: Ash-discharging device for —].
Q. Moore, Glasgow, and The Dowson and Mason Gas Plant Co., Ltd., Manchester. Eng. Pat. 2649, Feb. 2, 1914.

A DEVICE whereby any accumulation of ash at either the ends or the middle of producers—of the type which, in sectional plan, are considerably greater in length than in width (Eng. Pat. 28,054 of 1908)—may be discharged from the ash table into a hopper without interfering with the other parts. Above the ash table is an oscillating shaft carrying a plate made in sections and depending towards the table. One or more of the sections are hinged to the shaft and the others to sleeves on the shaft.—E. R. A.

Producer-gas; Manufacture of —. L. E. Hirt. Pittsburgh, Pa. U.S. Pat. 1,130,512, March 2, 1915. Date of appl., Feb. 25, 1913.

OIL is sprayed into a combustion chamber by means of steam, and the combustion products pass through a contracted passage into an expansion chamber, and then if required through another contracted passage to a second expansion chamber, the total expansion being at least five-fold. The gas next passes through a relatively narrow passage in contact with incandescent carbon on the walls, and then steam is injected into it.—W. F. F.

Producer for hot gas. E. Fleischer. Fr. Pat. 471,341, Apr. 25, 1914. Under Int. Conv., Sept. 19, 1913.

THE process for the production of hot gas from non-bituminous fuel described in Fr. Pat. 422,699 (this J., 1911, 529) is modified for use with bituminous fuel. The producer chamber is formed of three superposed compartments of the shape of inverted cones. The hot producer gas is withdrawn from the lowest compartment, but a small part is allowed to pass upwards through the intermediate zone containing fuel almost completely coked. Secondary air is supplied to the upper part of this zone, and the burning gas passes upwards through the upper compartment and carbonises the raw fuel, the gaseous products being drawn off at the top.—W. F. F.

Gas-producer; Electrically heated —. G. Coutagne. Fr. Pat. 471,582, July 15, 1913.

AIR, or a mixture of air and steam, is passed through a mass of coal in a vertical retort, the coal being heated by an electric current passing between two electrodes, one of which is tubular and forms part of the wall of the retort, whilst the other is a central rod adjustable vertically to vary the current.—W. F. F.

Gas producers; Process for increasing the total output and yield of ammonia of —. H. Koppers. Ger. Pat. 279,550, Sept. 20, 1913.

A COMBUSTIBLE gas (hydrogen, producer gas) is used, together with a mixture of steam and air, as

diluent for the purpose of increasing the yield of ammonia, and the process is conducted at such a high temperature that the gas introduced burns continuously, and thus maintains the temperature of the reaction zone. The process may be applied to retort furnace installations heated by producer gas, in which case the gas, consisting chiefly of hydrogen, produced during the last stage of distillation, is led off separately and introduced into the gas producer.—A. S.

Gas; Production of — from finely divided fuels.
F. Claus. Ger. Pat. 279,691, Nov. 2, 1913.

A PART or the whole of the gas produced is passed again into the retorts, and the heat required for gas production is supplied by heating the gas outside the retorts, by heating the retorts externally, by burning part of the gas within the retorts, or by increasing the pressure in the retorts. The fuel is introduced into the retorts along with the portion of the gas which is returned.—A. S.

Gas; Process and apparatus for purifying [filtering] —. H. F. Smith. Fr. Pat. 472,306, May 16, 1914.

To remove tar and the like, the gas is passed through a diaphragm of glass wool at such a speed that the fibres are electrified. The very small particles are attracted to the fibres, or are carried through and coalesce into larger drops, being then removed by another filter. Large particles which are retained are removed by the gas stream on reversing the diaphragm.—W. F. F.

Motor fuel; Production of —. W. A. Hall. New York. Eng. Pat. 2948, Feb. 4, 1914.

HEAVY hydrocarbon oil is cracked at about 600° C. till about 25% is converted into gas, composed mainly of hydrocarbons of the ethylene series. The gases are mixed with alcohol vapour and the mixture is liquefied under pressure.—W. F. F.

Petroleum oils; Apparatus for distilling —.
J. B. Moore, Whiting, Ind., Assignor to Standard Oil Co., Chicago, Ill. U.S. Pat. 1,130,318, March 2, 1915. Date of appl., Oct. 19, 1914.

A LONG, inclined, air-cooled pipe extends upwards from the still to the lower end of a condenser, the upper end of which is connected to a second condenser by a pipe extending downwards. A valved by-pass connects the two vapour pipes.—W. F. F.

Petroleum; Fractional condenser for separating hydrocarbons in distilling —. J. W. Van Dyke and W. M. Irish, Assignors to The Atlantic Refining Co., Philadelphia, Pa. U.S. Pat. 1,130,862, March 9, 1915. Date of appl., April 18, 1911.

THE hydrocarbon vapours pass through vertical pipes which extend from the top of a chamber to an annular header, and are cooled by air which passes in regulated amount through a surrounding casing. Means may be provided for constricting the pipes and for relieving pressure.—W. F. F.

Liquid fuel; Process of making —. C. H. Warth, East St. Louis, Ill. U.S. Pat. 1,131,880, March 16, 1915. Date of appl., Dec. 29, 1913.

A MIXTURE of kerosene and benzol is vaporised in a retort by superheated steam, the heavier liquids are removed by two successive fractional condensations, and the remaining gas is condensed.
—W. F. F.

Mineral oils; Process and apparatus for the treatment of —. C. Guyard. Fr. Pat. 472,195, May 14, 1914.

IN the decolorisation of mineral oils, especially for the production of vaseline, by filtration through

finely divided argillaceous earth or animal charcoal in a steam-jacketed vessel, filtration is accelerated by means of air or other gas under pressure. The spent filtering material is regenerated in the filtering vessel by treating first with petroleum spirit to dissolve adherent oil and then with benzene to dissolve the colouring matter. The filtering vessel is mounted on trunnions.—W. F. F.

Gas; Art of removing tarry substances or tar from — F. W. Steere, Detroit, Mich., Assignor to Somet-Solvay Co., Solvay, N.Y. U.S. Pats. (A) 1,130,212, (B) 1,130,213, and (C) 1,130,214, Mar. 2, 1915. Dates of appl., (A) and (B) Jan. 7, (C) April 24, 1914.

(A) The gas is passed through an electrical field of alternating polarity, between receiving and discharging electrodes, and is subjected to the action of brush electric discharges from the discharging electrode, which has a pointed surface. The tarry particles coalesce and are deposited on the receiving electrode. (B) The particles of tar are agglomerated as described under (A), and are separated subsequently, the gas being passed at such a high velocity that the agglomerated particles are removed from the electric field with the gas. (C) The gas is heated sufficiently to liquefy the tar and raise the gas above its water-vapour saturation temperature, and is then passed through an electric field of alternating polarity between opposed electrodes.—E. R. A.

Heavy hydrocarbons; Conversion of — into lighter hydrocarbons. H. E. Fenchelle and F. M. Perkin, London, Eng. Pat. 6517, Mar. 14, 1914.

HEAVY liquid or liquefied hydrocarbons are cracked by forcing them under high pressure through one or more long, narrow, heated conduits, the resulting liquid being cooled under pressure and then allowed to escape at a relatively lower pressure (e.g. atmospheric) into a chamber surmounted by a rectifying column. By cooling under pressure the lighter hydrocarbons are separated by spontaneous evaporation from the unconverted portion of the liquid; the latter is subjected to further treatment in a still, for which purpose, and for raising steam, the heat abstracted during the cooling process is utilised.—W. E. F. F.

Petroleum distillation; Art of — E. M. Clark, Alton, Ill., Assignor to Standard Oil Co., Whiting, Ind. U.S. Pat. 1,132,163, Mar. 16, 1915. Date of appl., Oct. 24, 1914.

PRODUCTS of low b. pt. in the same series are obtained from liquid petroleum distillates of higher b. pt. than 500° F. (260° C.), by effecting cracking and distillation in stages, the liquid in one still being maintained under a pressure of uncondensable gases produced by more advanced cracking and distillation in another still.—W. E. F. F.

Combustion in chambers containing retorts; Apparatus for controlling — A. G. Glasgow, Richmond, Va. From J. M. Rusby, Philadelphia, U.S.A. Eng. Pat. 12,257, May 18, 1914. SEE U.S. Pat. 1,106,319 of 1914; this J., 1911, 910.

Gas; Process of making — H. Burgi and C. H. Tenney, Springfield, Mass., U.S.A. Eng. Pat. 10,972, May 4, 1914. SEE U.S. Pat. 1,095,806 of 1914; this J., 1911, 585.

Bituminous fuel; Manufacture of various products [gas, oil, etc.] from — R. Maclaurin, Stirling, Scotland. U.S. Pat. 1,139,001, March 2, 1915. Date of appl., Oct. 14, 1914.

SEE Eng. Pat. 24,426 of 1913; this J., 1914, 1148.

[Fullers'] earth-treating process. U.S. Pat. 1,132,051. See X11.

IIB.—DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Radiating bodies [gas fires]; A bolometric method of determining the efficiencies of — W. A. Bone, H. L. Callendar, and H. J. Yates. Proc. Roy. Soc., 1915, A, 91, 245—254.

THE bolometer used consisted of two exactly similar coils of platinum wire wound on thin mica, each 4 cm. square and of 20 ohms resistance, mounted back to back on either side of a circular gun-metal box through which water was circulated. The coils were coated to an even surface with hard, black enamel and could be cleaned without risk of injury; each was provided with a loose cover. When both coils were screened, their resistances remained equal however the temperature of the box changed; but when one was exposed to radiation its resistance was correspondingly increased. The instrument was calibrated by comparison with a radio-balance, the intensity of the radiation required to produce an increase of resistance of 1 ohm in the exposed coil being 27.88 kilocalories per sq. ft. per hour. The chief source of error in calibration was the uncertainty of temperature of the surrounding air and walls of the room; the correction for difference between air and bolometer was 0.028 ohm per 1° C. and sometimes amounted to 4%, but the divergence of the corrected results from the mean was generally less than 0.5%. In testing a gas fire the bolometer was mounted on a revolving sector of fixed radius ($\frac{9}{\pi}$ feet), the centre of which was adjusted to coincide with the centre of the fire; uncertainty as regards the position of the latter point was the chief source of error, a variation of 1 in. in the radius of the sector causing a difference of 6% in the central reading. A close approximation to the total radiation over a hemisphere at a distance, D, was obtained by multiplying the sum of the central reading and 4 readings taken at 60° along the equator and meridian by $\frac{\pi D^2}{3}$, the "distribution factor" of the fire being this product divided by the central reading. The method is more accurate, reliable, and rapid than the "Leeds method" (water radiometer and thermopile) hitherto employed, and may be made automatic if required.—W. E. F. F.

Determination of the composition of argon-nitrogen mixtures [for filling half-watt lamps]. Hamburger and Filippo. See VII.

PATENTS.

Charcoal kiln. A. R. Bellamy, Grantham, Eng. Pat. 5858, March 7, 1914.

THE body of a vertical cylindrical kiln, made in sections, is provided with air inlets controlled by hinged or sliding doors opening either directly into the kiln or into an annular passage communicating with the kiln. Grate bars carried by a frame fixed across the discharge opening in the conical bottom, may be partly withdrawn to vary the air supply. A horizontal door is hinged to the frame below the bars.—W. F. F.

Carbon; Manufacture of a substance suitable for the production of pure — Soc. des Combustibles Industriels. Fr. Pat. 472,082, July 24, 1913.

HYDROCARBONS such as tar, tar oil, petrol, or their derivatives, or other organic substances rich in

carbon and deficient in mineral matter which boil below 200° C., are filtered and subjected to the prolonged action of a current of air or oxidising gas while being heated to a temperature insufficient to cause coking. The mass thus obtained is treated with organic solvents and the insoluble portion carbonised. The soluble portion is heated to remove and recover the solvent, and the residue treated again.—W. F. F.

Charcoal kiln. J. M. Deschamps, Melbourne, Australia. Eng. Pat. 6536, March 14, 1914.

THE kiln consists of a vertical, cylindrical steel shell lined with brick, the cover, which is hinged to and operated from a derrick or standard mounted upon the kiln, being provided with a sand seal. The air inlets at the side of the kiln are provided with valved tubes or sleeves to retard oxidation at the circumference of the charge; the tubes may be inserted to varying distances within the kiln to promote conversion of wood into charcoal towards the centre. The discharge of charcoal into a cooling tank, and the admission of air for combustion, are controlled by means of an adjustable door in the inverted conical casting forming the bottom of the kiln, and the brick lining is supported on a ring forming the top of the latter casting. Claim is also made for a portable apparatus of similar construction.—W. E. F. P.

Flame-arc lamp and electrode therefor. G. Egly, Assignor to Gebrüder Siemens und Co., Berlin. U.S. Pat. 1,132,313, March 16, 1915. Date of appl., Sept. 9, 1914.

THE negative electrode contains a "slag-removing substance" such as an alkali carbonate, borate, etc., and the positive electrode the materials for producing luminosity.—W. E. F. P.

Incandescence filaments of metallic tungsten or molybdenum for electric incandescence lamps; Manufacture of —. A. Lederer, Atzgersdorf, Austria-Hungary. U.S. Pat. 1,132,523, March 16, 1915. Date of appl., Aug. 25, 1906.

SEE Eng. Pat. 18,738 of 1906; this J., 1907, 957.

III.—TAR AND TAR PRODUCTS.

Toluene recovery at Beckton. J. Gas Lighting, March 30, 1915.

FOR some time past the Gas Light and Coke Co. has been treating daily 15 million cub. ft. of gas at Beckton for the recovery of toluene; the quantity will be increased shortly to 20 million cub. ft. Research and large-scale experimental work during the last two years have provided information as to the most suitable wash-oil and the quantity of oil required to extract a maximum quantity of toluol without materially reducing the illuminating power or calorific value of the gas. By using a limited amount of oil in the washers, very little benzene is extracted from the gas, and a crude spirit is obtained, rich in toluene, xylene, naphthalene, etc. By this means, only a small quantity of benzol has to be returned to the gas, and the plant for dealing with the saturated oil is small compared with that required when more wash-oil is used, and a greater proportion of the benzol is removed. Rotary and centrifugal washers are used for the absorption of the toluol by the wash-oil.

The method of working is as follows: The cooled debenzolised oil is pumped from the cold-oil store-tank at a constant rate through the washer, where it meets an opposing stream of gas. From the washer, the oil, now containing the

toluol, etc., runs into a store-tank, from which it is pumped through the counter-current heat economisers to the still, in which the wash-oil and the light spirit are separated by means of steam. This method of separation is not unduly expensive in steam, provided the wash-oil in the extraction washer is not used excessively. To secure further economy it is proposed to make a trial of a direct-heated coil, an expansion chamber being worked on the outlet. The hot wash-oil from the still flows to a collecting tank, from which it is pumped through the heat exchangers, and onwards through water-coolers, after which it flows to the store-tank, from which the extraction washer is fed. The light spirit vapours, after leaving the still, are conducted through a condenser, the condensed mixture of benzol and toluol flowing to a collecting tank after the separation of the condensed water. The mixture of spirit is afterwards rectified in a fractionating boiler, where the lighter spirit is separated from the toluol, xylol, etc., before this heavier boiling portion is sent to the products works for rectification—a yield of about $\frac{1}{2}$ gall. of pure toluene per ton of coal carbonized being obtained.

PATENTS.

Tar oils which may be used as paint oils and with increased antiseptic and fungicidal properties; Production of —. Chem. Fabr. Dr. K. Albert and L. Berend. Fr. Pat. 471,671, April 6, 1914.

THE phenols in tar oils are condensed with formaldehyde, or with substances producing formaldehyde, to form resinous products; or resins formed from phenols and formaldehyde are dissolved in tar oils. Halogenated derivatives of the phenols may be employed. Compounds of lead, copper, and mercury may be added to increase the bactericidal properties, and siccatives may be added either before or after the condensation. The products may be used as paint oils, especially for submarine paints, and for impregnating wood.—F. SP.

2-Cyanoquinoline and 1-cyanoisoquinoline; Preparation of —. L. Givaudan, Vernier, u. A. Kaufmann. Ger. Pat. 280,973, June 20, 1913.

2-CYANOQUINOLINE, m. pt. 94° C., is obtained from 1-benzoyl-2-cyano-1,2-dihydroquinoline, and 1-cyanoisoquinoline, m. pt. 78° C., from 2-benzoyl-1-cyano-1,2-dihydroisoquinoline by treatment with phosphorus pentachloride, sulphuryl chloride, or thionyl chloride in presence of an anhydrous inert diluent. The products may be used for the preparation of dyestuffs and pharmaceutical chemicals.

—A. S.

Manufacture of antiseptics, disinfectants, and germicides [from peat tar]. Eng. Pat. 19,253. See X1XB.

IV.—COLOURING MATTERS AND DYES.

Indigo and other vat dyestuffs; Catalytic reduction of —. A. Brochet. Comptes rend., 1915, 160, 306—308.

THE catalytic hydrogenation of liquids in presence of common metals (this J., 1914, 612, 1113) has been extended to the reduction of solids suspended in water. 10 grms. of Indigo was suspended in 250 c.c. of water to which had been added 10 c.c. of caustic soda solution, and 5 grms. of active nickel was added in an atmosphere of hydrogen, using the glass apparatus described previously. The reaction proceeded most rapidly at 60°—80° C., giving the greenish yellow solution of Indigo White.

At the end of 40 mins. shaking at 70° C., 910 c.c. of hydrogen (measured over water at 15° C.) had been absorbed. The nickel was separated by filtration. The liquid obtained did not contain an excess of reducing agent, as is the case when hydrosulphite is used. If necessary more than the above amount of Indigo may be used in suspension; the paste is reduced more rapidly than the powder. The process may be used for obtaining Indigo White as a concentrated solution or paste. A lime or neutral vat may be used, the reaction being much slower in the latter case. The activity of the nickel is of the same order after standing under water for one year.—F. W. A.

Fustic from Jamaica and British Honduras for khaki dyeing. Chem. Trade J., April 10, 1915.

The present shortage in this country of synthetic yellow dyes has put considerable difficulties in the way of manufacturers of khaki cloth. A temporary expedient was found, however, by the increased use of fustic, a natural yellow dyestuff, consisting of the wood of a tree (*Chlorophora tinctoria*), which grows freely in Jamaica and also in British Honduras. The increased demand has now greatly raised the price of fustic, of which at the outbreak of the war there was only a small supply available in Europe, though one of the prizes captured from Germany had a considerable consignment on board. A certain amount, too, has been obtained from France, which country and the United States have hitherto taken the bulk of the fustic exported from Jamaica.

When the shortage of yellow dyestuffs in this country first became apparent, the Imperial Institute took steps to place British dye firms in touch with exporters of fustic in Jamaica. Only a moderate amount of cut fustic wood was then available in the island, but, as a result of the Institute's action, the Government of Jamaica have offered to purchase from the growers further supplies and carry these at Government cost to Kingston, the port of shipment. Negotiations are accordingly now pending for the purchase and shipment of considerable quantities of Jamaica fustic by dyers in this country. The Government of British Honduras is also taking action in this matter, and a further supply of the wood may possibly be forthcoming from that Colony. Further information may be obtained on application to the Imperial Institute, South Kensington, London, S.W.

PATENTS.

Monoazo dyestuffs; Manufacture of new——. Farbenfabr. vorm. F. Bayer und Co. Second Addition, dated April 21, 1914, to Fr. Pat. 457,810, April 21, 1913 (see this J., 1913, 1004; 1914, 414). Under Int. Conv., May 2, 1913.

In place of aminoacylaminoacylic acids, aminoacyl-*o*-aminophenols or their derivatives or substitution products may be diazotised and combined with pyrazolones or with α -methylindole.—F. W. A.

Azo dyestuffs; Manufacture of yellow——. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 471,850, May 5, 1914. Under Int. Conv., May 8 and 15, 1913.

ACYLATED aminothiazoles of the benzene series containing at least one methyl group attached to the benzene nucleus are oxidised with permanganate in neutral or alkaline solution, and if desired the acyl group is eliminated from the products. The resulting aminothiazolecarboxylic acids are diazotised and combined with aceto-acetic arylides; the products give yellow shades on cotton.—F. W. A.

Dyestuffs; Manufacture of new intermediate products and their conversion into——. Soc. pour l'Ind. Chim. à Bâle. Fr. Pat. 471,653, July 16, 1913.

A NEW series of chlorimides has been obtained by the action of hypochlorite or of chlorine on arylsulphoarylene-*p*-diamines of the type, (2)NH₂.R.NH.SO₂.Ar(1), in which R is an arylene residue of the benzene or naphthalene series. The arylsulphiminoarylenechlorimides obtained, Cl.N:R:N.SO₂.Ar, may be condensed with amines, phenols, naphthols, and especially with carbazole or its derivatives, to give products which may be used in the preparation of sulphide or sulphurised vat dyestuffs.—F. W. A.

Azo dyestuffs; Manufacture of chrome——. Soc. pour l'Ind. Chim. à Bâle. Fr. Pat. 471,698, July 17, 1913.

MONOAZO dyestuffs, obtained by combining diazotised sulphonated *o*-aminophenols or *o*-aminonaphthols or their derivatives with *m*-aminophenols in alkaline solution, are diazotised and combined with suitable compounds to obtain dyestuffs which may be after-chromed.—F. W. A.

Vat dyestuffs; Manufacture of new——. Soc. pour l'Ind. Chim. à Bâle. Fr. Pat. 471,776, July 18, 1913.

ON treatment with oxidising agents (nitric acid, manganese dioxide, lead dioxide, per-salts, etc.) in acid solution, indigo and indigoid dyestuffs give vat dyestuffs which in most cases possess greater fastness and also greater affinity for cotton than the original dyestuff. Halogenation of the products leads to the production of other vat dyestuffs.—F. W. A.

Vat dyestuffs derived from indophenols; Manufacture of——. Soc. pour l'Ind. Chim. à Bâle. Fr. Pat. 472,087, July 25, 1913.

ON treatment with warm dilute solutions of alkali or alkaline-earth sulphides, indophenols give vat dyestuffs which, unlike the original indophenols, are fast to acids and to light. For dyeing, 1 part of dyestuff is mixed with 3 parts of caustic soda, 30–40 parts of water and then 2–3 parts of sodium hydrosulphite added, and the liquid heated to 80° C. until solution is complete. After dilution, wool is dyed in the bath at 50–60° C. for half-an-hour, exposed to air for an hour, rinsed and dried. The material is then immersed for half-an-hour at 70–80° C., in a bath containing 3–4 grms. of potassium bichromate, or copper or nickel sulphate, and 2.5 c.c. of acetic acid per litre.—F. W. A.

Arylaminoanthraquinones; Manufacture of derivatives of——. Farb. vorm. Meister, Lucius, und Brüning. Fr. Pat. 472,100, May 11, 1914. Under Int. Conv., May 22 and Dec. 8, 1913, and Feb. 20, 1914.

NITRO or halogen derivatives of oxazoles, obtained from β -aminoalizarin and aromatic acids, are treated with primary aromatic amines, and the products sulphonated in the usual manner. The oxazoles may be replaced by their sulphonic acids, or by other heterocyclic derivatives of β -aminoalizarin. The sulphonic acids obtained possess a very high tinctorial power, dyeing wool fast violet shades which become green on chroming. The dyeings are very fast to potting, light, and washing.—F. W. A.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Arundo Donax for paper making. J. Beveridge. Paper Making, 1915, 34, 88—90.

THE *Arundo Donax* cane, a native of S. Africa, grows in swampy ground and in a season attains a height of 18—20 ft. with a diameter of 1—1.5 in. When mature, it has a pale golden colour and clean, glossy, silicious surface. It should be cut before it is fully mature and crushed between rollers immediately after cutting. When digested with bisulphite liquor prepared from a magnesia base, with 3.74% total SO₂, of which 66% was "free," this cane presented no difficulty and yielded under conditions similar to those employed for spruce wood, 32.2% of air-dry fibre, which could be bleached to a pure white with 10.4% of bleaching powder. By the caustic soda process, it required 24.1% Na₂O as caustic to effect a satisfactory digestion under a steam pressure of 90 lb. per sq. in. maintained for 5 hours. The yield was 33.1% of air-dry pulp which could be bleached with 13.6% of bleaching powder. The sulphite process would appear to be more economical. The fibre is long, soft, and silky and is described as superior to those of megasse and bamboo; the pulp contains less non-fibrous cellular matter than either of these and resembles the pulps obtained from coniferous woods in uniformity, though not in strength.

—J. F. B.

Ledger stock; The sizing of high-grade —. H. A. Maddox. Paper Making, 1915, 34, 75—80.

THE usual tests for the quality of gelatin intended for tub-sizing are described. The strength of the sizing solution is varied according to the condition of the paper and the preliminary engine-sizing, if any; an average concentration is about 5% of gelatin. Damp paper absorbs gelatin size more readily than dry, but the absorption may be irregular, giving a blotchy appearance when viewed by transmitted light. The penetration of the size is largely dependent on the viscosity of the solution. The viscosity of the size may be diminished and the penetration improved by increasing the temperature, but the sizing efficiency is diminished. The proportion of alum added to the pulp when the paper is made is of great importance; an excess of alum gradually destroys the ultramarine colouring matter, and opposes the thorough penetration of the size by its coagulating action, whereby the size remains mostly on the surface. The air imprisoned in the paper likewise opposes uniform penetration and its escape later, in the drying process, may disturb the regularity of the sized surface. An excessive temperature in drying is very prejudicial to effective sizing. A serious drawback of hard tub-sized ledger papers, particularly hand-made papers, is the resistance offered to writing with fountain pens which lack the sharpness or roughness necessary to scratch the horny surface; similarly this hard surface causes abnormal wear on the pens of the account-hook ruling machines.—J. F. B.

Paper; Chemical analysis of —. H. A. Bromley. Chem. News, 1915, 111, 136—140.

CHEMICAL methods may be used to determine fibrous composition in the case of esparto pulp (yield of furfural) and mechanical wood pulp. The usual loadings consist of calcium sulphate, barium sulphate, china clay, and talc, the various constituents of which are determined by an analysis of the ash. The nitrogenous constituents of paper are preferably determined by Kjeldahl's method; the factor for dry gelatin is 5.56 and for casein 4.90. Sammet's method (this J., 1913, 939)

is preferred for the determination of rosin. Starch is determined after conversion either by malt extract or by acid, the products being estimated by Fehling's solution. Colouring matters which leave characteristic compounds after incineration are estimated by an analysis of the ash; in the case of ultramarine, the composition of which is indefinite, the colour of the ash may be matched against standard mixtures of ultramarine and china clay. Salicylic acid, when present as a preservative, may be extracted with light petroleum spirit and after diluting the extract with an equal volume of 95% alcohol, may be titrated with N/10 alkali, using phenolphthalein as indicator. For the estimation of carbolic acid in paper, the bromine absorption method is useless; the author prefers a method based on Muter's process, in which the paper is extracted with alcohol and the extract evaporated with caustic soda; tar oils and naphthalene are removed by filtration, and the phenols liberated with acid and extracted with ether or light petroleum. Arsenic in fly-papers may be extracted by boiling with sodium bicarbonate, and the extract titrated with N/10 iodine.—J. F. B.

Waste products of agricultural interest—wool and leather wastes. Russell. See XVI.

PATENTS.

Wool; Washing and bleaching of — and recovery of the grease, potassium salts, and the reagents employed. R. Vidal. Fr. Pat. 471,654, July 16, 1913.

RAW wool is washed with a 5—10% solution of a sulphite or bisulphite of an alkali or alkaline-earth; the solution recovered contains the potassium salts extracted from the wool, which are converted into sulphite by treating the liquor with sulphur dioxide. The material is next treated with a solution or emulsion of hydrocarbons or chloro derivatives of hydrocarbons in solutions of castor oil or other soap, the bath containing 3—5% of the organic solvent. When this bath becomes saturated, the grease and volatile solvent are recovered by skimming, acidification, or other means.—J. F. B.

Silk; Process of making a felted mass of —. G. Diesser. Fr. Pat. 472,351, May 19, 1914. Under Int. Conv., May 20, 1913.

DEGUMMED silk waste is treated with formic acid, either as liquid or vapour, at the ordinary temperature, until the fibres are gelatinised and partially dissolved. The excess of acid is removed and the felted mass dried.—J. F. B.

Plastic material; Manufacture of —. P. Cassier. Fr. Pat. 471,390, July 8, 1913.

MECHANICAL wood pulp or other material containing cellulose is kneaded with dilute sulphuric acid (2 parts of acid of 66° B., sp. gr. 1.84, to 1 of water) until gelatinised. The mass is pressed, washed, and moulded or worked into the required shapes. The product is non-inflammable and a good electrical insulator.—F. Sp.

Threads, films, gauze, etc.; Manufacture of — from cellulose. C. Shrager and R. D. Lance. Fr. Pat. 471,471, July 10, 1913.

CELLULOSE is treated with a mixture of equal volumes of water and a strong acid, e.g., sulphuric acid of 66° B. (sp. gr. 1.84). It is then freed from acid, and treated with carbon bisulphide. After removing the excess of the latter, the mixture is dissolved in caustic soda and converted into threads or films by precipitation in an acid bath, which may contain 30% of sulphuric acid, with or without

sodium sulphate or bisulphate. If the water in the preliminary treatment is replaced by acetic acid of 8° B. (sp. gr. 1.06), the cellulose dissolves. It may then either be spun into an alkaline coagulating solution or be coagulated by ammonia and redissolved in caustic soda solution. Resin may be incorporated in the final product by the addition of resins to the caustic soda solution of depolymerised cellulose, and it may be combined in the product as resins by addition of salts of metals (e.g., zinc, magnesium, aluminium) to the precipitating bath and subsequent treatment of the coagulated threads with a faintly alkaline bath. The use of aluminium salts facilitates subsequent dyeing of the product.—F. Sr.

Celluloid and other cellulose products ; Production of permanent iridescent effects on —. E. Heusch and J. Paiseau. Fr. Pat. 471,581, July 15, 1913.

IRIDESCENT effects are produced by coating objects with a solution of a cellulose ester to which have been added dyes, pigments, bronze powder, fish scales, etc., and the iridescent surface is protected by coating it with a transparent substance, such as a different cellulose ester, which resists water, the solvents being such as do not dissolve the iridescent coating.—F. Sr.

Wood and other vegetable substances ; Process and apparatus for making cellulose from — and extracting resinous, oily and other constituents. W. K. Freeman. Fr. Pat. 471,620, Dec. 18, 1913.

THE chips of wood are digested, in an atmosphere of hydrogen, with alkaline solutions in three separate stages, first with a solution of low alkaline strength to extract gums, resins, and volatile oils, next with a strong solution to effect the complete digestion of the tissues, and lastly with a fresh dilute solution to cleanse the pulp produced in the second stage, this last liquor being used again for the first stage of the next operation. The apparatus consists of a digester, a circulating pump, a series of settling vessels for the accumulation of the heavy by-products and the separate storage of the various digesting solutions, an oil-separating chamber, and one or two condensers, all forming a closed circuit.—J. F. B.

Half-stuff from wood ; Manufacture of —. E. Bergerhoff. Ger. Pat. 279,411, Jan. 11, 1914.

THE wood is boiled with sulphite liquor and then, whilst still tolerably hard and maintaining its original form, is removed from the boiler and ground to pulp in an edge runner. The quantity of sulphite liquor used is such that the residual liquor contains sufficient sulphurous acid to be used for treating another charge of wood.—A. S.

Pulp from red beech wood ; Production of pale-coloured, easy-bleaching —. C. Braun. Ger. Pat. 279,517, June 17, 1913.

THE wood is boiled under pressure with a mixture of calcium bisulphite and alkali sulphite or magnesium sulphite, containing only 40–50% of "free" SO_2 , and after removing the liquor, the pulp is washed in the boiler, with exclusion of air, first with hot and then with cold water containing a small quantity of sulphurous acid. The yield of pulp is 43–45% of the air-dry wood, and the product can be bleached with 8–9% of bleaching powder. (See also Ger. Pat. 261,818; this J., 1913, 823).—A. S.

Fibrous material [paper] in layers for chemical and electrical purposes ; Manufacture of —. Meirowsky und Co. Akt.-Ges. Fr. Pat. 471,836, May 5, 1914.

FIBROUS material, e.g., paper in sheets or webs, is impregnated with a small proportion of oil and

coated with a natural or synthetic resinous material. The several layers are then united by the application of heat and pressure.—J. F. B.

Sulphite liquor ; Process of treating waste —. M. W. Hedden, Oregon City, Oreg. U.S. Pat. 1,130,817, March 9, 1915. Date of appl., Dec. 12, 1914.

NEUTRALISED waste sulphite liquor is digested with a cyanogen compound to remove all the sulphur-bearing groups and then saturated with sodium chloride or an electrolyte other than a mineral acid to precipitate organic cyanogen compounds.—J. F. B.

Plants ; Method for opening out — or loosening their fibres. C. F. Kübler, Wilmersdorf, Germany. U.S. Pat. 1,131,715, March 16, 1915. Date of appl., Nov. 9, 1912.

SEE Eng. Pat. 25,680 of 1912; this J., 1913, 747.

Sulphite cellulose ; Process of producing —. E. Oman, Stockholm. U.S. Pat. 1,130,192, March 2, 1915. Date of appl., Jan. 19, 1914.

SEE Eng. Pat. 1145 of 1914; this J., 1914, 348.

Artificial silk threads or similar products ; Process for precipitating copper-ammonia solutions of cellulose for the purpose of manufacturing —. E. G. Legrand, St. Adresse, France. U.S. Pat. 1,130,830, March 9, 1915. Date of appl., Aug. 29, 1912.

SEE Ger. Pat. 250,357 of 1911; this J., 1912, 1120.

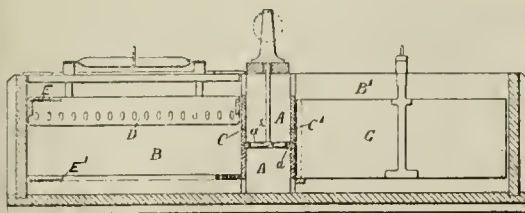
VI.—BLEACHING ; DYEING ; PRINTING ; FINISHING.

Indigo and other vat dyestuffs ; Catalytic reduction of —. Brochet. See IV.

PATENTS.

Dyeing machines. A. R. Whitehead, Leeds, and J. Farrar, Halifax. Eng. Pat. 5569, March 5, 1914.

A CIRCULATING chamber, A, contains two propellers, a^2 , which fit into circular openings in the horizontal partition, a . The division boards,



C and C^1 , may be mounted in slides and so arranged that the dye liquor circulates in either or both the dye-vats, B and B^1 , in a direction determined by the propellers. In the case shown, the vat, B, contains a rack, D, for hanks with circulating sticks, E and E^1 , and the vat, B^1 , contains a cage, G, for loose wool or balls of wool.—F. W. A.

Dyeing process. A. J. Rau, Clifton, N.J. U.S. Pat. 1,131,083, March 9, 1915. Date of appl., March 4, 1914.

THE fabric is wrapped in layers or coils and the dye liquor forced through the layers. The order

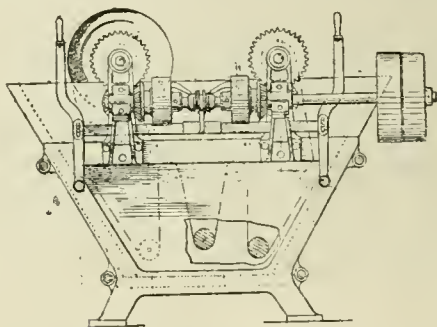
of the layers or the coil is then reversed, and the dye liquor forced through in the opposite direction.—F. W. A.

Dyeing apparatus. A. J. and J. A. Rau, Clifton, N.J. U.S. Pat. 1,131,084, March 9, 1915. Date of appl., March 11, 1914.

AN apparatus for carrying out the process described in the preceding abstract. Two drums rotating in the dye-bath are used, the fabric being unrolled from one and wound on to the other, so that opposite surfaces of the fabric are presented to the drums in succession.—F. W. A.

Jigger for dyeing fabrics and similar purposes. H. L. Quick, New York. U.S. Pat. 1,131,269, March 9, 1915. Date of appl., Jan. 7, 1914.

THE jigger is fitted with gears, for operating the shafts driving the revolving rollers, which are mounted independently of these shafts and of the



rollers. Flexible connections are provided for connecting the gears mounted on bearing sleeves to the shafts, and clutches for independently disconnecting gears from the shafts.—F. W. A.

Fabrics; Method of treating—[with dye liquor, etc.]. H. L. Quick, New York, N.Y. U.S. Pat. 1,131,270, March 9, 1915. Date of appl., Jan. 7, 1914.

THE liquor with which the fabric is to be treated is placed in the interior of a tight roll of the fabric, and the roll rotated to force the liquor through by centrifugal force. The fabric may be wound in layers on a perforated shell to form the roll.—F. W. A.

Multicolour designs; Production of—[and of "shadow" designs]. I. Orloff. Fr. Pat. 472,092, July 26, 1913.

THE effects of the non-registering of the rollers in printing multicolour designs are avoided by making the impressions of the second multicolour design overlap the impression from the principal roller. In case these impressions are geometrically similar, the illusion of shadow is obtained. The complete design is printed in one operation, the printed colours meeting on the fabric in a moist condition.—F. W. A.

Waterproofing of fabrics, yarns, and other materials. A. M. Hart, Assignor to Viking Manufacturing Co., Ltd., London. U.S. Pat. 1,131,929, March 16, 1915. Date of appl., Aug. 4, 1911.

SEE Eng. Pat. 18,607 of 1910; this J., 1911, 1448.

Satinising cotton fabrics; Process of—H. Dutschke, Elberfeld, Germany. U.S. Pat. 1,132,001, March 16, 1915. Date of appl., Feb. 10, 1914.

SEE Fr. Pat. 467,670 of 1914; this J., 1914, 860.

Washing and bleaching of wool, and recovery of grease and potassium salts. Fr. Pat. 471,651. See V.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Indian chemical industries. A retrospect. P. G. Shah. Paper read before the Indian Industrial Conference, Madras, Dec., 1914.

THE Indian chemical manufactures, which have been confined to the small scale production of such materials as saltpetre, sulphuric acid, alum, borax, alkali salts, and ammonium compounds, show great possibilities of development. Local conditions, however, in many respects favour small scale production and militate against the establishment of large factories. At present, owing partly to the undeveloped state of other Indian industries, local resources are very incompletely utilised in chemical manufactures. The growing demand for chemicals is evidenced by the following figures showing the annual value of imported chemicals in lakhs of rupees: 1876, 0.98; 1895, 4.6; 1906, 29.7; 1911, 96.4; 1912, 93.2; 1913, 101.4. The 1912 figures include sulphuric acid 3.7, sulphates of alumina 4.6, calcium carbide 1.5, disinfectants 3.8, potassium cyanide 3.7, sodium bicarbonate 4.2, sodium carbonate 11.1, caustic soda 8.0, sulphur 5.3, and ammonium compounds 3.75 lakhs. Compared with the rising imports, the exports of chemicals are insignificant and partly declining. The value of exported chemicals (92% of which was saltpetre), drugs, and tanning materials for 1912 amounted to 36.6, 20.7, and 104.0 lakhs, respectively. On the whole, raw materials are abundant, but skilled labour is difficult to obtain. Numerous small pharmaceutical works have recently been started throughout the country, in addition to a few larger factories, such as the Bengal Chemical Works (Calcutta), the Alembic Chemical Works (Baroda), the Pioneer Alkali Works (Bombay), the Gujarat Chemical Works (Ahmedabad), and the Eastern Chemical Works (Bombay); but owing to the rapidly increasing demand for chemicals these works have not caused any diminution in chemical imports. There is an extensive demand for chemicals used in the sizing, bleaching, and dyeing of cotton goods. Saltpetre is obtained chiefly from the Gaya, Tirhoot, Saran, and Champaran districts of Behar, which have an agricultural population of over 500 per square mile. The effloresced earth is boiled with water and the sodium chloride and potassium nitrate roughly separated by fractional crystallisation. There are 40,000 factories and 600 refineries engaged in this work, the latter employing 50,000 hands. The methods are rather wasteful and capable of improvement. The present annual production of the refined material averages about 25,000 tons, of which 15,000 tons valued at 40 lakhs are exported, chiefly from Calcutta, to Hongkong (32%), U.S.A. (23%), and the United Kingdom (20%). It is suggested that the product should be utilised in local chemical manufactures rather than exported. The annual Indian consumption of sulphuric acid is below 10,000 tons. Sulphuric acid is made by the Government Cordite Factory (Nilgiris), Messrs. Waldie and Co. (Calcutta and Cawnpore), Messrs. Perry and Co. (Madras), the Burma Chemical Industries Co. (Rangoon), the Bengal Chemical and Pharmaceutical Works, Ltd. (Calcutta), and by several smaller works, from Sicilian and Japanese sulphur and Indian saltpetre. No workable deposit of sulphur or iron pyrites has yet been

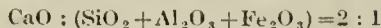
located in the country. The amount of imported acid fell from 79,772 cwt. in 1910 to 38,780 cwt. in 1912, while the amount of imported sulphur rose from 104,301 cwt. in 1911 to 114,498 cwt. in 1912. The cheapness of saltpetre renders Gay Lussac and Glover towers unnecessary, and the high sea and railway freights act as a protection to the industry; the cost of the acid in India is about ten times the English price. Lack of cheap sulphuric acid has been largely responsible for the annual importation of over £20,000,000 worth of products manufactured in Europe from minerals which are obtainable in India. Potassium carbonate is prepared solely from wood ashes, though Indian saltpetre might be utilised for this purpose. In 1913 the imported potassium salts, apart from potassium cyanide, reached a value of 2.25 lakhs. Sodium carbonate occurs in appreciable quantities in the Reh efflorescence and it is also obtained from calcined seaweed (barilla) and from certain lake-waters. Washing soda is manufactured by the Pioneer Alkali Works from partly imported material. Sodium salts of the value of £70,000 were imported in 1904, and £183,822 in 1912. In 1912, 11,633 cwt. of ammonium compounds, valued at £25,403, was imported, but ammonium chloride is now being made from ammoniacal gas-liquor at Bombay. Ammonium sulphate has not been made to any appreciable extent, and in the "coking" operations in the Bengal coalfield the annual wastage of nitrogen has been equivalent to ammonium sulphate of the value of 20 lakhs of rupees; recovery plants are now being introduced. The imports of chemical manures rose from £2040 in 1907 to £42,592 in 1912; in the same years the value of exported bones rose from £363,002 to £525,739, the price of sulphuric acid being here again a decisive factor. Soda alum is made in Behar and other localities by adding soil scrapings to the aqueous extract from roasted pyritous shale; the product is practically wholly utilised in the Indian tanning and dyeing industries: in spite of the abundance of aluminous clays and laterite the production is declining, and in 1912, 101,088 cwt. of sulphates of alumina (including alum) valued at £31,146 was imported. The so-called Indian borax is largely imported from Kashmir and Tibet and is used as a mordant, antiseptic, insecticide, glazing material, etc.; in 1912, the exports, which are declining, amounted to 4770 cwt. valued at 111,869 rupees, and the imports from Great Britain to 6688 cwt. valued at £6141. Among the problems awaiting investigation are the effective utilisation of the crude saltpetre and saltpetre refuse, of the Reh efflorescence, and of the large deposits of laterite and clays; the purification of the magnesium compounds which accumulate in the extensive manufacture of salt from seawater; and the efficient separation of magnesium and potassium salts from the Punjab rock-salt. (Note: Lakh=100,000 rupees=£6666).—J. R.

Selenic and telluric acids and their salts; Reactions of—G. Denigès. Ann. Chim. Analyt., 1915, 20, 57—59.

WHEN a solution containing selenic acid or its salts is mixed with one-half its volume of a solution of 10 grms. of mercurous nitrate in a mixture of 10 c.c. of nitric acid (sp. gr. 1.39) and 100 c.c. of water, a white precipitate of mercurous selenate is formed; this precipitate rapidly becomes crystalline and the crystals exhibit a characteristic form when examined microscopically. Selenous acid also yields characteristic crystals of mercurous selenite when treated with the reagent. Telluric acid or a tellurate yields a yellow crystalline precipitate of mercurous tellurate.—W. P. S.

Potash extraction from felspar, etc., in cement-burning; Jungner's method of—Stein u. Cement, 1914. Chem.-Zeit., 1915, 39, Rep. 63.

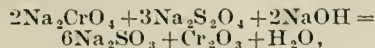
RAPID and complete volatilisation of potassium and sodium oxides occurs when a mixture of felspar and lime is heated to 1400°—1450° C. The most suitable proportion is that employed in the manufacture of cement, i.e.,



or 1 part of felspar to 3 parts of calcium carbonate; the process effects a clean separation of cement and alkali. A mineral containing 12% K₂O gave a residual cement clinker containing only 0.05% K₂O, and cement prepared from the so-called "röd fyr" contained 0.07% K₂O after burning for only 20 mins. The total amount soluble in acid was 0.21% for the latter cement, 0.26% for a cement made from a gneiss rich in potash, and 0.15% for a felspar cement. Upon applying the Jungner method to the ordinary process of cement manufacture the volatilised potassium oxide is converted into potassium carbonate by the combustion gases and condenses as a fine white powder. At very little extra cost a rotary cement kiln with an annual capacity of 4000 metric tons of clinker could be utilised to produce simultaneously 1600 metric tons of potash (K₂O); the total annual production of thirty to forty million metric tons of cement, if obtained from a mineral of medium potash content, would correspond to an accompanying production of one million metric tons of potash. (See Eng. Pats. 26,497 and 28,970 of 1912; this J., 1913, 486, 534.—J. R.)

Hydrosulphites; New method of valuing—E. Knecht. J. Soc. Dyers and Col., 1915, 31, 94—96.

HYDROSULPHITES are oxidised quantitatively to sulphites by alkaline solutions of chromates,



whereas sulphites are without action on such solutions: 0.1—0.2 gm. of commercial solid hydrosulphite is added to 20 c.c. of N/10 potassium bichromate which has been made alkaline with an excess of caustic soda, the solution is boiled for 4—5 minutes, the precipitated chromium hydroxide is separated and boiled with water and sodium peroxide until it has dissolved and the excess of sodium peroxide has been destroyed. The solution is acidulated with sulphuric acid, and the chromium estimated by adding an excess of standardised titanous chloride and titrating back with iron alum, or by the ordinary ferrous sulphate method.

—F. W. A.

Silver chloride; Solubility of—Z. Glowczynski. Kolloidchem. Beihefte, 1914, 4, 147—176. Z. angew. Chem., 1914, 27, Ref., 721.

THE high values for the solubility of silver chloride found by Stas were probably due to the fact that his specimens contained substances which exerted a specific action on the solubility. The solubility of precipitated silver chloride increases considerably with its degree of dispersion. Precipitates produced by a concentrated solution of potassium chloride show varying solubility according to the conditions of precipitation, but with a dilute solution of potassium chloride, constant values are obtained. Silver chloride is less soluble in very dilute solutions of potassium chloride and ammonium chloride than in water, but the values are considerably higher than corresponds with the law of mass action. The solubility is increased by nitric acid.—A. S.

Mercuric cyanide; Action of metals upon [and detection and determination of] —. C. Pertusi. *Chem.-Zeit.*, 1914, **38**, 1203—1204.

MERCURY is partially displaced from mercuric cyanide by magnesium, zinc, aluminium, and other metals. The calculated amount of magnesium displaced 40% of the mercury after 24 hours, and by using ten times this amount of magnesium, 92—94% of the mercury was displaced. By passing carbon dioxide or by boiling, the reaction attained completion in half an hour; a similar result was achieved by passing hydrogen for 1½ to 2 hours. The resulting solutions contained CN' ions and were usually alkaline. The reaction failed with iron, nickel, and tin, but was given by lead, antimony, and bismuth. For qualitative work carbon dioxide was slowly passed through the solution to which had been added a little magnesium or antimony powder, two drops of copper acetate, and one drop of bezuidine acetate. A sky-blue precipitate after not more than a minute indicated the presence of CN'. A distinct colour was given by 0.00005 gm. of mercuric cyanide in 10 c.c. In the presence of iodate or periodate it was necessary to add a little saturated baryta water before testing. For quantitative work hydrogen was passed slowly into a flask containing the solution of mercuric cyanide (0.5 gm.) in distilled water (40 c.c.) to which magnesium powder (0.6 gm.) had been added. The gas issued into a second flask graduated from 100 to 110 c.c. and containing about 30 c.c. of N/1 potassium hydroxide. After two hours the contents of the first flask were transferred to the second, washing being accomplished with alkaline water. The mixture was made up to 110 c.c. and the cyanide estimated in 100 c.c. of the filtered solution. The mean of five experiments gave 21.35% HCN instead of 21.46%.—J. R.

Ferric oxide; Hydrous —. W. D. Bancroft. *J. Phys. Chem.*, 1915, **19**, 232—240.

THE properties of ferric oxide are affected by its water content and the size of the particles, and an indefinite number of distinct colloidal solutions of the hydrous oxide may be prepared. Graham's highly hydrous form, prepared by dialysing cold ferric acetate solution, is gelatinous and changes slowly into less hydrous forms; it is not homogeneous since it yields both limonite and hæmatite on heating. The oxide obtained by Péan de St. Gilles by boiling a dilute solution of ferric acetate, is sandy and less hydrous than Graham's modification; the particles are also coarser (about 7 μ), but they coalesce less readily and are peptonised more readily after precipitation by hydrochloric or nitric acids. Various salts and acids readily precipitate the Péan de St. Gilles oxide in a gelatinous and more hydrous form.—J. R.

Copper sulphate; New method for the technical preparation of —. P. Falciola. *Annali Chim. Appl.*, 1915, **3**, 89—95.

A HOT mixture of sulphur dioxide and air, e.g., the gas from sulphur or pyrites burners, is passed upwards through a glass tower surrounded by a hot-air jacket and packed with copper turnings or shot, and nitric acid or nitrous gases are introduced at the upper part of the tower. Copper sulphate free from nitrate has been obtained in this way in laboratory experiments, and it is suggested that towers packed with copper might be used in place of Glover towers in the manufacture of sulphuric acid by the chamber process.—A. S.

Zinc and manganese; Precipitation of — by ammonium sulphide. F. Seeligman. *Z. anal. Chem.*, 1915. *Pharm. J.*, 1915, **94**, 389.

THE precipitation of manganese, but not of zinc, by ammonium sulphide is hindered by the presence

of ammonium salts unless a few drops of hydrogen peroxide solution are added.—T. C.

Nitrogen; A chemically active modification of —, produced by the electric discharge. VI. R. J. Strutt. *Proc. Roy. Soc.*, 1915, A, **91**, 303—318. (See also this J., 1914, 548.)

THE very small yield of active nitrogen obtainable from perfectly pure nitrogen is very largely increased by the presence of about 1/1000 part of almost any foreign gas (not necessarily containing oxygen), the increase due to the addition of 1/30,000 part of methane being particularly noticeable. It is suggested that the impurity (catalyst) acts by loading the electrons in the discharge and thus altering the character of their impact with the nitrogen molecules, this view being supported by the fact that gases containing oxygen, sulphur, chlorine, carbon, or hydrogen (atoms capable of attaching themselves to electrons in the discharge) promote, whereas argon, helium, and nitrogen itself (atoms incapable of loading electrons) do not promote the formation of active nitrogen. A nitride was produced when active nitrogen was shaken with cold, liquid mercury, but no development of mercury spectrum occurred as during the combination of active nitrogen with mercury vapour; similar results were obtained with other melted metals. The colour of a weak solution of indigo in sulphuric acid was slowly discharged when active nitrogen was bubbled through the liquid. Active nitrogen was found to react freely with pure pentane and heptane, and to a less extent with pure methane, producing hydrocyanic acid.—W. E. F. P.

German Potash Syndicate. *Brit. and Col. Drug.*, April 9, 1915.

AS a result of the bringing into operation of numerous new potash mines during the past few years, the number of members of the German Potash Syndicate has gradually been increased from 40 or 50 to close upon 200 at the present time. The recent imposition of a veto on the export trade, combined with a scarcity of rolling stock in the inland market, has produced chaos in the industry, and the turnover of the syndicate, which in December, 1914, had again risen so far as to reach the level of the deliveries in the corresponding month in 1913, only amounted to the value of £1,300,000 in January and February, as contrasted with £2,450,000 in the corresponding months in 1914. The cost of production has increased largely, and many mines are only able to effect delivery at a large loss.

Thorium content of the earth's crust; The average —. J. H. J. Poole. *Phil. Mag.*, 1915, **29**, 483—489.

THE thorium content of a large number of rocks and rock mixtures was determined by Joly's method, the material being fused with alkali carbonate at 1000° C., the product extracted with water, the residue dissolved in dilute hydrochloric acid, and after setting aside for some days for the thorium disintegration products to develop, the thorium determined by boiling off the emanation in a constant stream of air, which was then passed through an electroscope, and the rate of discharge compared with that produced when a thorianite solution of known strength was treated in a similar way. The solutions were boiled, before being tested, to expel any radium emanation present. The presence or absence of silica in the solutions, and actual manipulative details in the treatment of the rock, had no influence on the final results, and the activity after the first few days remained constant. The results showed that the thorium

content varied from 2.3×10^{-5} gm. per gram in acid rocks to 0.22×10^{-5} — 0.81×10^{-5} gm. in basalts. On the assumption that the lithosphere approximates in composition to that of a diorite or intermediate rock, the average thorium content would be about 1.6×10^{-5} gm. per gram. From the values obtained for 86 acid, 48 intermediate, and 56 basic rocks, the arithmetic mean values are 2.13, 1.50, and 0.51×10^{-5} respectively. The ratio of radium to thorium increases in passing from acid to basic rocks.—G. F. M.

Radium elements; Adsorption investigations with —. K. Morovitz and F. Paneth. *Chem.-Zeit.*, 1914, **38**, 1206. (See also this J., 1914, 22; 1915, 281.)

AN adsorbent is most efficient when the solvent is an acid possessing the same anion, probably owing to diminished solubility of the adsorbent. Nitric acid increases the effect of oxide adsorbents in the same way as sulphuric acid increases that of sulphates, hydrochloric acid that of chlorides, etc. The character of the adsorption is often appreciably altered by small differences in the mode of preparing the adsorbent.—J. R.

Argon-nitrogen mixtures [for filling half-wall lamps]; Determination of the composition of—by means of liquid air. L. Hamburger and H. Filippo. *Z. angew. Chem.*, 1915, **28**, 75–76.

Two reservoirs, communicating at their lower ends with a mercury levelling tube, terminate above in bent connections, each sealed to one of a pair of German silver tubes, the lower ends of which are closed. One reservoir, with corresponding tube, is permanently filled with pure argon, and the other, after pumping out air, is charged with an equal volume of the gaseous mixture, which is admitted through a coil containing glass wool, at about -80°C ., to remove impurities. The metal tubes are plunged into liquid air, and the difference of mercury level in the reservoirs, that is the difference in vapour pressures, is read off. Each apparatus is calibrated with mixtures of known composition, so that the difference of level gives the percentage of nitrogen present. Results, with an error of about 0.5%, may be obtained in a few minutes.—F. SODN.

PATENTS.

Sulphuric acid from waste pickle [containing iron sulphate]; Recovery of—. E. Howl, Dudley, and F. Perry, Tipton. Eng. Pat. 5830, March 7, 1914.

THE pickle is evaporated until the free acid acquires a concentration of about 75%, whereupon almost the whole of the iron sulphate is precipitated in the anhydrous form.—F. SODN.

Nitric acid; Process for the production of—. F. Raschig, Ludwigshafen, Germany. U.S. Pat. 1,130,104, March 2, 1915. Date of appl., April 21, 1914.

NITRIC acid is produced continuously by distilling a mixture of sodium nitrate and sulphuric acid under high vacuum at about 170°C . The fresh mixture is supplied, and the bisulphate removed, through vertical conduits containing heads of liquid corresponding to the vacuum employed.—F. Sp.

Ammonia; Production of liquid anhydrous—. H. Pollard, Manchester. Eng. Pat. 6274, March 12, 1914. Under Int. Conv., Oct. 21, 1913.

PURIFIED ammonia gas is passed into cooled vessels containing crystals of ammonium nitrate. The

salt absorbs one-third of its weight of ammonia, forming a liquid which is completely decomposed at 190°F . (88°C .), sufficient pressure being developed to liquefy the cooled gas. Moisture, pyridine, and oil are eliminated by the above process. The heat necessary is small as compared with that required to run a compressor.

—W. H. H. N.

Nitrate of ammonia; Process of making granular—. F. L. Gallup, Media, Pa., Assignor to E. I. du Pont de Nemours Powder Co., Wilmington, Del. U.S. Pat. 1,131,361, March 9, 1915. Date of appl., May 18, 1912. Renewed July 28, 1914.

AMMONIUM nitrate solution is concentrated to a degree depending on the size of grain required, and the salt is then crystallised by cooling, whilst stirring and aerating the solution.—F. SODN.

Aluminium nitride; Manufacture of—. Soc. Générale des Nitrures, Paris. Eng. Pat. 24,533, Dec. 24, 1914. Under Int. Conv., Dec. 24, 1913.

A FINELY divided mixture of an aluminous compound and carbon is passed into a flame produced by the combustion of coal dust, the proportion of air for combustion being adjusted to give almost exclusively carbon monoxide. For example, 30 kilos. of bauxite and 12 kilos. of carbon are employed with 100 kilos. of coal dust and not more than 440 cub. metres of air. A heavy-oil or gas blowpipe, or other in-blown flame, may be used to assist the combustion of the coal dust.—F. SODN.

Double nitride composition of matter. [Fixation of atmospheric nitrogen.] S. Peacock, Chicago, Ill., Assignor to Internat. Agricultural Corporation, New York. U.S. Pat. 1,123,585, Jan. 5, 1915. Date of appl., May 31, 1913.

A DOUBLE nitride of a metal and a non-metal (especially of calcium and silicon), such as may be produced, together with carbon monoxide, by heating a mixture of carbon, metallic oxide, and silica, to 1600° — 2000°C ., in an atmosphere of nitrogen. Sufficient carbon is used to reduce the silica and form SiC_2 as an intermediate product.—F. SODN.

Sodium sulphide; Process of making—. H. K. Moore, Berlin, N.H. U.S. Pat. 1,130,317, March 2, 1915. Date of appl., Aug. 14, 1913.

SODIUM sulphate, sodium carbonate, and a reducing agent, such as carbon, are fed into a heating chamber in which they are melted together and from which the fused reduction product is continuously withdrawn; sublimed material is recovered by passing through a liquid spray.—F. SODN.

Sulphur and alkali compounds; Process for making and preserving—. C. E. Hite, Burlington, N.J., Assignor to W. Pincus, Philadelphia, Pa. U.S. Pat. 1,132,476, Mar. 16, 1915. Date of appl., Sept. 19, 1914.

EQUAL quantities of sulphur and soda are heated together at a regulated temperature till the product is substantially soluble in water. The reaction is then arrested and the product sealed to exclude moisture and air, which decompose it to a compound soluble with difficulty in water.—W. H. H. N.

Silicic acid; Manufacture of soluble, chemically pure—. Ges. f. Elektro-osmose m. b. H. Fr. Pat. 471,678, April 10, 1914. Under Int. Conv., April 14, 1913.

A SOLUTION of alkali silicate is electrolysed in the anode compartment of a diaphragm cell, fitted

preferably with perforated electrodes applied against the diaphragm wall. The alkali diffuses through the diaphragm into the cathode compartment, which contains water, and by maintaining suitable conditions, e.g., by using a diaphragm of corundum and corundum, especially of the kind described in Fr. Pat. 426,072 (this J., 1911, 1942), the silicic acid remains entirely in the anode compartment. Acid impurities are removed from the silicic acid by similar treatment in the cathode compartment of a diaphragm cell.—F. SODN.

Rock salt or sea salt; Process for obtaining pure white—by fusion. F. Strumberg. Fr. Pat. 472,203, May 14, 1914.

SALT is fused by direct or indirect electric heating and agitated by direct passage of an electric current, and the product, after settling, is run into moulds. Sodium phosphate or phosphite or an analogous compound may be added to the fused salt.—F. SODN.

Boroformates; Manufacture of—. H. Weitz Auslages. m. b. H. Fr. Pat. 472,233, May 15, 1914.

AN alkali or alkaline-earth hydroxide or carbonate is dissolved in water in the presence of boric and formic acids or their soluble alkali or alkaline-earth salts. For example, 431 grms. of crystallised sodium carbonate and 575 grms. of borax are dissolved by warming in 1250 c.c. of water, and 347 grms. of 80% formic acid is added; crystals of the composition, $\text{CBO}_3\text{H}_4\text{Na}_2\text{H}_2\text{O}$, are deposited on cooling.—F. SODN.

Graphite; Recovery of—from pieces of used graphite crucibles. A. Teichmann. Ger. Pat. 279,006, Feb. 7, 1914. Addition to Ger. Pat. 263,653.

THE pieces of graphite are soaked in water instead of being treated with acid as described in the chief patent (this J., 1913, 1068), the subsequent treatment being the same.—A. S.

Hydrated aluminosilicates or artificial zeolites; Process for the production of—. R. Gans, Pankow, Assignor to J. D. Riedel A.-G., Berlin. U.S. Pat. 1,131,503, March 9, 1915. Date of appl., Aug. 4, 1911.

SEE Fr. Pat. 425,343 of 1911; this J., 1911, 1014.

Silicic acid; Manufacture of chemically pure, soluble—. B. Schwerin, Assignor to Elektro-Osmose A.-G. (Graf Schwerin Ges.), Frankfurt, Germany. U.S. Pat. 1,132,394, March 16, 1915. Date of appl., April 18, 1914.

SEE Fr. Pat. 471,678 of 1914; preceding.

Washing and bleaching of wool, and recovery of grease and potassium salts. Fr. Pat. 471,654. See V.

Absorbent for carbon dioxide in breathing apparatus, etc. Eng. Pat. 22,719. See XIXB.

VIII.—GLASS; CERAMICS.

Glass Research Committee of the Institute of Chemistry; Report of the—.

THE Glass Research Committee was appointed in October last to conduct investigations with a view to arriving at suitable formulas to be freely available to manufacturers willing to assist in maintaining the continued supply of laboratory glassware. The Committee consisted of Prof. R.

Meldola (then President of the Institute), Mr. B. Blount, Mr. O. Hehner, Prof. H. Jackson, Mr. W. C. Hancock, and Mr. T. R. Merton.

The chief aims of the research have been: (i.) to produce working formulas for all glasses used in laboratory work, and (ii.) to ascertain the influence of various ingredients on the physical and chemical properties of glasses. The work was extended to include glass for miners' lamp glasses, at the suggestion of the Home Office; and also glass for ampoules, to meet the needs of wholesale pharmaceutical chemists engaged in the production of Army Medical requirements. The Committee have also examined and reported on samples of British and French laboratory glassware, produced since the beginning of the war, a number of the specimens being made from formulas similar to, and in some cases almost identical with, those recommended by the Committee. Mixtures prepared in accordance with the analytical results were not always satisfactory; but the analyses were helpful in suggesting synthetic experiments.

Up to the present time, the Research Committee have reported eleven formulas for glasses for various purposes based on the results of about 400 experimental melts on a scale large enough for drawing rods and blowing small vessels. No formula has been issued without submitting the specimens made to rigorous tests to prove their suitability for the purposes for which they are intended. The question of workable temperatures has been carefully considered and, so far as it is possible to judge, the melts on a small scale indicate that even better results will be obtained on the industrial scale. This view has been justified by the samples already received from manufacturers who have tried some of the formulas.

Special attention has been paid to the proportions of basic and acidic substances in respect of the action of glass mixtures on clay crucibles during fusion, and it has been shown by careful investigation that the formulas proposed give melts in which the influence of the ingredients of the crucibles is very slight and in some cases practically inappreciable.

The following formulas have been communicated to a number of manufacturers who have expressed their interest in the progress of the investigation and to scientific workers who are conducting similar experiments.

Soft Glasses, suitable for ordinary chemical laboratory ware:—

(1) Sand, 67.0 parts; sodium carbonate (Na_2CO_3), 34.2; calcium carbonate, 11.6; alumina (Al_2O_3), 6.5. A soft glass which does not give up alkali readily to water, works well in the blowpipe and does not devitrify readily.

(2) Sand, 67.0 parts; sodium carbonate, 29.0; calcium carbonate, 9.6; calcium fluoride, 1.6; alumina, 8.3; boric anhydride (B_2O_3), 2.0. A soft glass of higher quality. Does not give up alkali under severe tests. A kindly working glass before the blowpipe, and very difficult to devitrify.

A Resistant Glass suitable for pharmaceutical purposes, ampoules, etc.:—

(3) Sand, 67.0 parts; alumina, 10.0; calcium carbonate, 12.5; magnesia, 0.5; potassium nitrate, 1.0; sodium carbonate, 17.0; boric anhydride, 8.0. This glass is intermediate in hardness between soft glass and combustion tubing, is highly resistant to chemical action, withstands changes of temperature well, and should be a very suitable glass for high class beakers, flasks, etc.

Glasses for Combustion Tubing:—

(4) Sand, 68.2 parts; alumina, 6.2; barium carbonate, 8.8; calcium carbonate, 13.0; potassium nitrate, 4.3; sodium carbonate, 5.5; boric anhydride, 5.5; calcium fluoride, 1.0. This glass resembles Jena combustion tubing very closely indeed. It has practically the same fusing point.

It fuses on to Jena glass perfectly, and is indistinguishable from it before the blowpipe and in its behaviour on prolonged heating below its fusing point. The presence of the small quantity of calcium fluoride facilitates the incorporation of the ingredients. The sodium carbonate can be reduced to 1.31 parts provided 7.93 parts of anhydrous borax be used in the place of boric anhydride.

(5) Sand, 68.2 parts; alumina 6.2; barium carbonate, 8.8; calcium carbonate, 14.2; potassium nitrate, 4.3; sodium carbonate, 5.5; boric anhydride, 5.5. This glass is practically of the same composition as (4). It is not so easy to make or to work, but it does not become so opaque as Jena combustion tubing on prolonged heating. As in No. (4), the proportions given for sodium carbonate and anhydrous borax can be substituted for the figures for sodium carbonate and boric anhydride.

Miners' Lamp Glasses:—

(6) Sand, 65.0 parts; alumina, 1.0; calcium carbonate, 0.6; arsenious oxide, 2.0; antimony oxide, 1.0; potassium nitrate, 3.0; sodium carbonate, 11.0; boric anhydride, 24.0. A colourless and fusible glass withstanding rapid changes of temperature exceptionally well.

(7) Sand, 65.0 parts; alumina, 1.0; calcium carbonate, 0.6; arsenious oxide, 2.0; antimony oxide, 1.0; potassium nitrate, 3.0; anhydrous borax, 26.68; boric anhydride, 5.5. The same glass as (6) but the ingredients have been varied to avoid the use of so much boric anhydride, which is at present apparently difficult to obtain on a commercial scale.

Resistance glass:—

(8) Sand, 65.5 parts; alumina, 2.5; magnesia, 5.0; zinc oxide, 8.0; sodium carbonate, 10.2; anhydrous borax, 13.0. A glass almost identical in its general behaviour with Jena resistance glass; withstands changes of temperature well, but, like Jena, is not suitable for working before the blowpipe. It darkens and tends to devitrify; operations—such, for instance, as sealing side tubes into flasks—are difficult, if permanent and neat joints are required.

Formula No. 3, recommended for pharmaceutical purposes, ampoules, etc., may be substituted for the resistance glass with advantage, as the ampoule glass lends itself very well to blowpipe work, and is also especially resistant chemically.

Alternative for combustion tubing:—

(9) Sand, 72.0 parts; alumina 10.0; calcium carbonate, 11.0; magnesia, 0.5; potassium nitrate, 3.0; sodium carbonate, 11.2; borax anhydrous, 7.2. This glass is capable of withstanding high temperatures and rapid changes of temperature; works well before the blowpipe and is free from the chief defect of Jena glass, namely, the readiness with which it becomes cloudy and finally quite opaque after prolonged use.

By slight modifications of this formula, almost any degree of hardness can be obtained.

In formulas (8) and (9) substances such as magnesia and zinc oxide can be added in the form of carbonates if the actual percentages of MgO and ZnO respectively present in the carbonates are known.

Soft Soda-Glasses suitable for tubing and for X-ray bulbs:—

(10) Sand, 68.0; alumina, 4.0; calcium carbonate, 12.8; potassium nitrate, 14.5; sodium carbonate, 26.0; and

(11) Sand, 68.0; alumina, 4.0; calcium carbonate, 12.8; potassium carbonate, 10.0; sodium carbonate, 26.0. These glasses do not lose their easy-working qualities after repeated heating and blowing, and are plastic over a long range of temperature. They require a temperature of at least 1400° to 1500° C. for complete incorporation

of the ingredients in order to obtain that homogeneity which is necessary for resistance to rapid changes of temperature and ease of working before the blowpipe. No. (10), containing potassium nitrate, is considered the better of the two, and is more easily incorporated.

The Committee is of the opinion that there is now information available for the manufacture of all the important glasses used in the laboratory and for industrial purposes, which have hitherto been mainly obtained from abroad.

Glass for optical instruments. Report of the British Science Guild. Chem. News, 1915, 11f, 178—180.

IN a report presented to the Government by the British Science Guild, on the manufacture of optical instruments in this country, it is stated that the Guild is satisfied that the supply of optical glass for telescopes, binoculars, range-finders, and other service instruments, is sufficient for the purpose. As regards glass for photographic and microscopic lenses, a greater variety of glasses should be available than are at present manufactured in this country. The attention of the authorities might be drawn to the opportunity for developing British glass manufacture in this direction. The defective supply of pure barium compounds is understood to be a difficulty. Barium glass of high refraction and low dispersion is reported to be especially difficult to obtain. Attention is also called to the desirability of the provision of facilities for research, and to the necessity for finding a refractory lining of the melting pot which would resist the action of the materials used at the working temperature. The Guild therefore recommends:—(a) That better provision should be made at the National Physical Laboratory for the testing of samples of glass as to their physical and optical properties. (b) That facilities should be provided as speedily as possible for the carrying out, at the National Physical Laboratory, or elsewhere, of the researches connected with the manufacture of optical glass referred to in this report. (c) That steps should be taken as speedily as possible to provide facilities for systematic, scientific, and manual training in technical optics.

Optical qualities of glass plates; Sensitive method for examining some —. Earl of Berkeley, and D. E. Thomas. Phil. Mag., 1915, 29, 613—617.

THE Zeiss interferometer may be used for examining the optical qualities of glass plates—echelon spectroscopy plates, etc.—by measuring the difference in the displacement of the interference bands when light (the green mercury line is suitable) traverses the plate placed first at 45° to the optic axis in front of the silvered reflecting mirror, and then when rotated through 180°. The factor measured is $D(\mu-1)$ and it is the constancy of this product which is the essential condition for a perfect echelon plate, and not $D\mu$, the factor determined by Michelson's method, which method also is some 30% less sensitive.—G. F. M.

PATENTS.

Glass; Composition for making —. O. Schott, Assignor to Schott und Gen., Jena, Germany. U.S. Pat. 1,130,767, March 9, 1915. Date of appl., Sept. 12, 1912.

The glass contains at least 50% of silicic acid, and has as its other glass-forming components, alumina 4 to 15 (6 to 12)%, lime 3 to 11%, boric acid 5 to 15%, and soda 8 to 12%, the total percentage of alumina and lime being at least half, and at most five times that of the boric acid.—W. C. H.

Ceramic materials; Process of shaping —. E. R. Berry, Malden, Mass., Assignor to General Electric Co., New York. U.S. Pat. 1,131,463, March 9, 1915. Date of appl., June 21, 1913.

A MIXTURE, for example, of clay, talc, and sodium silicate in the moist state, is extruded under pressure, and the articles formed are air-dried, baked at about 130° C., machined, and finally hardened by firing to about 800° C.—W. C. H.

Clay and like materials; Process of treating [removing iron from] —. F. Thompson, Newark, Del., Assignor to The Crescent Clay Refining Co., Baltimore, Md. U.S. Pat. 1,132,537, March 16, 1915. Date of appl., Aug. 23, 1913.

CLAY is treated with dilute hydrochloric acid under heat and steam pressure, whereby the iron compounds are removed in solution without decreasing the plasticity of the clay. The acid may be added direct or formed *in situ* by the action of another acid on an alkali chloride.—A. B. S.

Binding medium for granular materials; Production of a "non-greasy" — from "fat" clay. M. Bertram. Ger. Pat. 279,385, May 11, 1911.

A SLOP made from "fat" clay is mixed with Portland cement or other materials (slag cement, iron Portland cement) containing decomposable calcium silicates, and allowed to stand. By this treatment the clay is converted into a non-plastic product suitable as a binding medium for granular materials, and which, unlike "fat" clay, can be treated satisfactorily in a filter-press.—A. S.

IX.—BUILDING MATERIALS.

Cement drain tile; Investigation of the durability of — in alkali soils. R. J. Wig. G. M. Williams, and others. U.S. Bureau of Standards. J. Franklin Inst., 1915, 179, 354—356.

A PRELIMINARY report on the behaviour of over 8000 cement drain tiles after 12 months' practical use in various American States, where they were exposed to the action of alkali water, fresh water, and ordinary weathering. The tiles were manufactured from 16 different mixtures varying from the leanest to the richest commercially practicable. Those containing not less than 1 part of cement to 3 of aggregate were apparently unaffected structurally in the very concentrated alkali soils of Grand Junction and Montrose, Colo., and Garland, Wyo.; and those consisting of 1 part of cement to 4 of aggregate (the leanest mixture employed) were similarly unaffected by the concentrated alkali soils of Fort Shaw, Mont., Sunnyside, Wash., Yuma, Ariz., and Roswell, N.M.—W. E. F. P.

Heat-conductivity of refractory building materials; Determination of the —. E. Heyn. Stahl u. Eisen, 1914, 34, 832—834. Z. angew. Chem., 1914, 27, Ref., 722.

THE following method is used in the Kgl. Materialprüfungsamt, Gross-Lichterfelde West. The block of material to be tested is built into a structure of blocks of the same or a similar kind, and is in contact at one end with a slab of highly refractory material which is heated electrically by means of a granular carbon resistance. At regular intervals of time, the temperatures at different parts of the block along its longitudinal axis are observed by means of thermo-elements, and curves are plotted with the times as abscissae and temperatures (difference between the atmospheric and observed temperatures) as ordinates.—A. S.

Timber preservatives; Risk of poisoning by —. F. Moll. Z. angew. Chem., 1915, 28, 73—75.

THE relative activities of various preservatives and their virulence as poisons (measured as reciprocals of lethal doses) are tabulated and shown to exhibit, as a rule, about the same ratio.—F. SODN.

Mercuric chloride; Risk of poisoning by volatilised —. F. Moll. Z. angew. Chem., 1914, 27, 559. Chem.-Zeit., 1915, 39, Rep. 59.

THE fatal dose of 0.2 gm. of mercuric chloride is contained in 500 cb. metres of air completely saturated with the vapour at 20° C. Since this volume of air suffices a human being for 50 days, any danger of poisoning by the occasional inhalation of air contaminated with volatilised mercuric chloride, e.g., from wood impregnated with that substance, may be dismissed.—J. R.

Jungner's method of potash extraction from felspar, etc., in cement burning. See VII.

PATENTS.

Cement; Manufacture of —. J. F. Goddard, London. Eng. Pat. 13,542, June 3, 1914.

A MIXTURE of 1 part of tannin and 5 parts of gypsum with sufficient water to make a paste is allowed to dry and is then ground to powder. This powder is mixed with Portland cement clinker, which is then ground in the usual manner, the temperature not being allowed to exceed 300° F. The addition of tannin makes the cement stronger and more waterproof and does not affect its soundness.—A. B. S.

Rotary [cement] kilns; Lining for —. Dynamidon G. m. b. H. Fr. Pat. 472,033, May 11, 1914. Under Int. Conv., July 31, 1913.

WHEN a layer of non-conducting material is interposed between the outer casing and the refractory lining of a rotary kiln to reduce the loss of heat by radiation, the lining is rapidly attacked by the clinker when made of ordinary refractory bricks. This difficulty is overcome by using a special brick containing over 60% of fused alumina for the lining.—W. H. C.

Concrete; Process of treating masses of —. C. Ellis, Montclair, N.J., Assignor to New Jersey Testing Laboratories. U.S. Pat. 1,130,717, March 9, 1915. Date of appl., Sept. 25, 1911.

THE surface of concrete masses is roughened by the removal of very fine cement material, impregnated with a water-resistant binding material, and the depressions of the surface are filled to the level of the peaks with a dust-preventing, waterproof, organic binding material. By this means the wear is taken substantially by the peaks of aggregate or sand in the concrete.—W. C. H.

Acid-proof and fireproof material; Manufacture of an —. I. Schlossberg. Ger. Pat. 279,386, May 24, 1913. Addition to Ger. Pat. 258,683.

THE material prepared as described in the chief patent (this J., 1913, 605), although capable of withstanding very high temperatures, is deficient in strength between 800° and 1200° C. To overcome this defect powdered glass or powdered brick is incorporated, so that sintering takes place at the temperature range in question. Quartzite is mixed intimately with colloidal silicic acid and calcium oxide or hydroxide, powdered brick is added, and the mass is formed into blocks which are hardened in the usual way.—A. S.

Cement; Process for manufacturing a hydraulic —. A. V. Carlson, Degerhamn, Assignor to C. L. Carlson, Stockholm, Sweden. U.S. Pat. 1,130,143, March 2, 1915. Date of appl., Feb. 8, 1913.

SEE Fr. Pat. 452,399 of 1912; this J., 1913, 659.

Production of tar oils which may be used as paint oils and with increased antiseptic and fungicidal properties. Fr. Pat. 471,671. See 111.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Iron, cobalt, and carbon; The chemical and mechanical relations of —. J. O. Arnold and A. A. Read. Inst. Mech. Eng., Mar., 1915. Engineering, 1915, 99, 362—364.

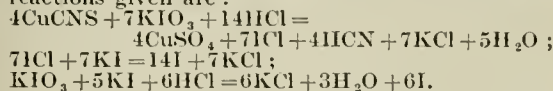
AN investigation of 5 steels containing C 0.02—0.93, Co 2.68—20.85, Si 0.05—0.11, Mn 0.16—0.25, P and Al each less than 0.02, and S less than 0.04%. The forged specimens were all "tough" in the lathe but easily machinable, the tenacity being gradually increased, and ductility and resistance to alternating stress decreased, by increasing cobalt. The carbides—separated from the specimens by electrolysis in dilute hydrochloric acid (sp. gr. 1.02) with a current density of 0.18 amp.—varied in composition between $50\text{Fe}_3\text{C} + \text{Co}_3\text{C}$ and $8\text{Fe}_3\text{C} + \text{Co}_3\text{C}$, and contained only 5—6% of the total cobalt present in the steels. By annealing steels containing 2.68, 5.5, and 11.18—20.85% Co, 1.5, 7.4, and 100%, respectively, of the combined carbon was converted into graphite. Cobalt is less effective than nickel in precipitating graphite, and forms no definite solid solution corresponding to Fe_7Ni .—W. E. F. P.

Steel at moderately high temperatures; Elastic properties of —. F. E. Rowett. Proc. Roy. Soc., 1915, A, 91, 291—303.

UNDER alternating torsional stress applied at 5 secs. per cycle, hard-drawn, unannealed steel tube

Copper in steel; Determination of —. W. D. Brown. J. Ind. Eng. Chem., 1915, 7, 213.

FIVE grms. of the steel is dissolved in a mixture of 40 c.c. of nitric acid of sp. gr. 1.20 and 25 c.c. of sulphuric acid (1:1), the solution is evaporated to expel nitric acid, cooled, and diluted to 400 c.c. with hot water. When the ferric sulphate is completely dissolved, 50 c.c. of strong ammonium bisulphite solution is added, with stirring, and then 25 c.c. of a 5% solution of potassium thio-cyanate: precipitation of the copper is complete after boiling for 5 mins., and the cuprous thio-cyanate is filtered off and washed with cold 1% sulphuric acid solution. The paper with the precipitate is then treated with 20 c.c. of hydrochloric acid (1:1) and a quantity of standard potassium iodate solution (19.64 grms. KIO_3 per litre; 1 c.c.=0.005 gm. Cu) corresponding to 2 c.c. for each 0.1% Cu expected. The mixture is diluted to 500 c.c., treated with a volume of a 10% solution of potassium iodide equal to that of the iodate solution added previously, and the free iodine titrated with thiosulphate of strength equivalent to that of the iodate solution: the difference between the volumes of the iodate and the thiosulphate corresponds to the copper. The reactions given are:



—A. S.

Blister copper; Occurrence of some of the rarer metals in —. A. Eilers. Trans. Amer. Inst. Min. Eng., 1914, 47, 217—218.

THE relative proportions of metals recovered from 100 tons of blister copper at 8 refineries are given below. Ores treated at No. 1 and 2 occur in porphyry. No. 3 treats concentrated copper-lead mattes from different lead smelters of the Rocky Mountain region. Nos. 4 and 5: ores occur near diorite. No. 6 works up mattes resulting from the smelting of silver and gold ores with low-grade copper ores, from all parts of Mexico. At No. 7, the ore comes from veins found in limestone near andesite.

No.	Refinery	Au	Ag	Pt	Pd	Se	Te	Bi	Ni
		oz.	oz.	oz.	oz.	lb.	lb.	lb.	lb.
1	Garfield, Utah	288	3480	0.342	1.183	56.0	5.54	6.1	40
2	Steptoe, Nev.	169	550	1.016	4.402	110.1	none	0.33	64
3	Omaha, Nebr.	360	23,090	1.825	6.486	26.6	67.1	18.6	944
4	Mountain, Cal.	1418	10,960	1.320	0.607	36.0	3.3	27.3	11.5
5	Tacoma, Wash.	2187	8710	0.710	3.327	42.0	none	5.7	770
6	Aguaesalientes	482	67,300	0.416	0.226	170.0	none	4.0	12
7	Cerro de Pasco	170	9900	0.319	0.589	13.7	none	13.5	32
8	Mount Lyell	464.5	7205	0.624	1.374	42.0	none	4.3	166

—W. R. S.

was only slightly less elastic at about 300° C. than at ordinary temperature, but flowed perceptibly when the stress was applied at 15 mins. per cycle, the area of the closed stress-strain loop in the latter case being about 4 times that in the former; with annealed tube at 300° C., the energy lost per cycle was almost independent of the time. At about 540° C., hard-drawn tube flowed rapidly, and for a long period, under a shear stress of less than 1 ton per sq. in., and when the stress was suddenly removed, the immediate elastic recovery was followed by a slow, backward flow which persisted for several minutes; under the same conditions, annealed tube also exhibited some flow and elastic after-working, but both were much less than in the hard-drawn tube.—W. E. F. P.

Copper ores; The smelting of — in the electric furnace. D. A. Lyon and R. M. Kenney. Trans. Amer. Inst. Min. Eng., 1914, 47, 233—270.

THE electric furnace is intended, not to replace the reverberatory or blast-furnace in the smelting of copper ores, but to be used as a substitute for them in localities where fuel is dear but hydro-electric power easily available. The reverberatory, as well as the blast furnace in ordinary coke smelting, is essentially a means of melting the charge, and this can be done in the electric furnace with a much higher heat efficiency. Michigan native-copper concentrate (Cu 37.35%) smelted in a Siemens electric furnace gave black copper assaying 98.59%, with a slag loss of 0.15%. The volatilisation loss was smallest when producing a low-melting,

monosilicate slag. Power and electrode consumption are given as less than 640 kilowatt-hours per ton of ore and 10 lb. per ton of charge, respectively. Matte-smelting experiments were made with low-grade pyritic, silicious, and roasted ores; the slag and volatilisation losses were low, and power and electrode consumption are given as 480 kilowatt-hours per ton of ore, and 5 lb. per ton of charge. A discussion on the adaptability of the electric furnace to partial pyritic and pyritic smelting is added.—W. R. S.

Copper-zinc alloys; Hardness of —. D. Meneghini. *Annali Chim. Appl.* 1915, 3, 95—101.

The hardness was determined by a ball test, using a steel ball of 2.9 mm. diameter and a load of 10.87—25.15 kilos., and measuring the indentation under the microscope with the aid of a micrometer. The results confirm Guertler's generalisation that a diminution in electrical conductivity is accompanied by an increase in hardness.—A. S.

Zinc; Determination of — in ores and pyrites cinder. H. Rubricius. *Chem.-Zeit.* 1915, 39, 198.

THE method is specially applicable to materials containing zinc in small quantities. Five grms. of the finely powdered substance is heated to boiling with 15 c.c. of concentrated hydrochloric acid, and after about 15 mins. a few c.c. of strong nitric acid is added, and the whole concentrated to a very small volume. If it solidifies on cooling it should be gently warmed again with a few drops of hydrochloric acid. The cold residue is mixed with 30 c.c. of concentrated ammonia and filtered; the treatment with ammonia is repeated two or three times, and finally the filter is washed with hot water. If the liquid is not distinctly blue a few drops of dilute copper sulphate solution are added, as the presence of copper sulphide facilitates the subsequent filtration of the zinc sulphide. The liquid is heated to boiling and treated with a few crystals of sodium sulphide. After a short time the precipitate is filtered off, washed with hot water, and at once extracted with hot hydrochloric acid which dissolves the zinc (oxidation of the copper sulphide must be avoided). The acid solution of zinc is precipitated by sodium carbonate and the zinc weighed as oxide. If manganese is present it may be removed from the mixed sulphide precipitate by dilute acetic acid, or it may be precipitated from the ammoniacal liquid by means of ammonium persulphate or bromine.—J. H. L.

[Tin] dross [and zinc slags]; The smelting of — in the electric furnace. R. S. Wile. *Amer. Electrochem. Soc. Min. and Eng. World*, 1915, 42, 501—504.

AT the works of the American Sheet and Tin Plate Co., Demmer, tin dross is smelted in shaft furnaces of greater depth than diameter, employing direct current at 220 volts and 800—1000 amp. After the initial formation, by arcing, of a molten slag containing SiO_2 , CaO , and Na_2O in the proportions of 4:1:1 respectively, the furnace is worked on the resistance principle, a mixture of the dross with carbon and sufficient silica to maintain the silica content of the slag being charged continuously. The temperature of the slag is kept above 3000°F . (1650°C .) to reduce the dross rapidly and to prevent the formation of tin silicates; the tin content of the slag under these conditions is practically constant at about 0.5%. The power consumed is about 350 kw. per ton for dross containing Sn 50, Zn 8—12, and Fe 10—18%. The power factor of the furnace being 93—95. A furnace of this type has been successfully employed in the treatment of molten zinc slags by a process

depending on the formation of easily fusible zinc-ferro-silicates and the subsequent decomposition of these (with volatilisation of the contained zinc oxide) by lime at a high temperature.

—W. E. F. P.

Tin, antimony, and arsenic; Rapid analysis of alloys [matte, slags, etc.] for —. F. A. Stief. *J. Ind. Eng. Chem.* 1915, 7, 211—212.

THE following methods have been used for six years with satisfactory results:—*Alloys*. 0.5 gm. of fine shavings or drillings is dissolved in 8 c.c. of concentrated sulphuric acid, the solution is boiled, cooled, treated with 5 c.c. of cold water, cooled, and 20 c.c. of concentrated hydrochloric acid and about 0.5 c.c. of granulated pumice are added. The solution is then distilled gently for 12—15 mins., the temperature being kept at 107°C . (bulb of thermometer 1 in. above surface of liquid) for at least 5 mins.; the exit tube for the vapours is bent downwards and connected with an S-tube, one bend of which is nearly filled with water and submerged in cold water, whilst the free end dips into about 75 c.c. of water in a beaker. The distillate, amounting to about 200 c.c., is treated with an excess of about 2 grms. of sodium bicarbonate, warmed to 27°C ., and the arsenic determined by titration with iodine solution (1 c.c. = 0.010672 gm. I or 0.00315 gm. As), in presence of starch, to a blue tint corresponding to that obtained with 0.2 c.c. of iodine solution in a control determination. The residue in the distilling flask is diluted with about 130 c.c. of water and titrated with permanganate solution (2.6315 grms. per litre; 1 c.c. = 0.005 gm. Sn). The solution is then, if necessary, mixed with sufficient antimony trichloride to bring the antimony content up to 0.07 gm., 6 c.c. of concentrated sulphuric acid, 60 c.c. of concentrated hydrochloric acid, and about 6 ins. of clean, soft No. 14 pure iron wire are added, the solution is boiled gently for $\frac{1}{2}$ hour, and after adding 4—6 ins. more of iron wire, again boiled for $\frac{1}{2}$ hour. A rubber stopper is placed loosely in the neck of the flask, and, after two minutes, the flask is stoppered tightly, cooled in water, the solution transferred to a beaker, the flask rinsed with 150 c.c. of recently boiled water, and the solution (300—350 c.c.) titrated with the iodine solution (see above; 1 c.c. = 0.005 gm. Sn) to a blue colour corresponding to that given by 0.4 c.c. of the iodine solution. When more than 3% Cu is present 0.5—1 gm. of potassium iodide crystals is added just before titrating the tin.

Mattes, soluble furnace products, chilled slags, etc. Antimony and tin may be determined directly and rapidly by the following method, even when much copper, iron, and arsenic are present: 0.5 gm. of the sample is heated for at least 15 mins. with 10 c.c. of concentrated sulphuric acid; if much silicon is present 15 c.c. of water is added before the acid. The cooled solution is treated with 10 c.c. of water and 10 c.c. of hydrochloric acid, boiled for 2 mins., treated with at least 1.5 grms. of potassium chlorate, heated to expel chlorine and chlorine compounds, treated with about 0.1 gm. of sulphur, and boiled for $\frac{1}{2}$ hour. After cooling, the solution is diluted with 6 c.c. of water, cooled, treated with 20 c.c. of concentrated hydrochloric acid and some pumice, boiled to expel arsenic, and antimony and tin determined as described above. If much carbon is present, nitric acid is used in place of potassium chlorate, and somewhat more sulphur is added subsequently. Slags or ores containing insoluble stannic oxide or silicate must first be fused with caustic soda.—A. S.

Tungsten; Occurrence and output of —. *Engineering*, 1915, 99, 442—443.

TUNGSTEN is widely distributed throughout the earth's crust, there being few countries in which

it has not been found. The following figures give the production, in tons of 60% WO_3 concentrates, as far as it is known:—

	1912.	1911.	1910.	1909.	1908.	1905.
<i>Europe:—</i>						
Portugal.....	982	1140	1320	609	684	320
England.....	193	266	274	376	233	172
All other countries	623	610	584	430	597	750
<i>America:—</i>						
United States ...	1207	1120	1821	1619	671	303
Argentina.....	637	800	1061	990	518	—
Peru.....	—	500	100	—	—	—
All other countries	243	265	315	168	187	75
<i>Asia and Africa:—</i>						
India.....	1698	400	396	7	—	—
Elsewhere.....	175	183	169	153	—	—
<i>Australasia:—</i>						
Queensland.....	928	900	1145	679	516	1582
New Zealand.....	—	199	187	78	87	64
Elsewhere.....	67	310	325	291	182	249

Portugal.—The Borralha mines in the Castelo Branco district are the chief producers; the concentrates contain 70 to 72% WO_3 , and are free from tin, sulphur, bismuth, or phosphorus. The tungsten is found in quartz veins, and in some localities it is also disseminated through granites. The Portuguese output is exported to Great Britain, France, and Germany. Within the last two years tungsten mines have been opened out on concessions in the Concelho of Sabrosa and Villareal, the total area exceeding 3000 hectares. The average content when the mines were started was found to be 70% WO_3 , and even reached 75%, although the concentrating methods were imperfect. Most of the labour of picking, crushing, and concentrating is cheap local handwork, until improved methods can be made available. Water power from the River Pinhao is available for electric-power installation.

Great Britain, Spain, and France.—Wolframite occurs in the tin ores of Cornwall, from which it has to be separated and recovered; the output during recent years has found a ready market in Germany. In Spain the ore is found in the Marmolejo district of Andalusia; improved milling facilities and increased mining developments are noteworthy during the last four or five years. In France the ore occurs in the St. Leonard district, Haute Vienne, and in the Limonsine district.

The United States.—The United States output in 1910 reached 1821 tons of 60% tungsten trioxide concentrates. The Boulder County field in Colorado, and the Atolia field in California, have for many years been the largest producers in the States. When the steel market is overstocked, the larger mines close down. The Colorado ore is a ferberite (iron tungstate) with rather less than 60% WO_3 ; whilst the Californian ore is scheelite, averaging 67% WO_3 ; the veins vary from stringers to a width of 4 ft. There are mines of lesser importance in Arizona, both scheelite and wolframite; in Nevada, tungsten-bismuth ores; in Idaho, ores of hübnerite and wolframite; also in Washington, where a wolframite is found, which is exported to Germany; some of these mines and mills are owned in Germany.

Canada.—Tungsten has been found in many places in Canada, but there is only one mine of any extent, on a deposit in Nova Scotia, consisting of scheelite. It is in the central part of Halifax County, 12 miles from the Atlantic coast. Hübnerite occurs in Cape Breton island; both wolframite and scheelite are found in the Kootenay district, B.C., but elsewhere the mineral has not been found in commercial quantities.

Asia.—Tungsten deposits are mined in India and in Tonkin, and some quantities of wolframite are recovered from the cassiterite in nearly all the important tin-mining centres of Malacca and the East Indies. In India wolframite occurs in schists and granites in the Mergui and Tavoy districts, in Lower Burma. A small quantity has been obtained from the southern Shan States. In Burma wolframite is the main object of exploitation, cassiterite being a sort of by-product, although occasionally the tin ore forms a larger percentage of the alluvial deposits than the wolframite.

South America.—Tungsten deposits are very numerous, and have been worked on a profitable scale throughout the central portion of the Cordilleras, including Argentina, Chile, Bolivia, and Peru. The mine with the largest output in the world—the Hausa Sociedad de Minas—is in Argentina; the ore ranges from 65 to 75% concentrates; the bulk of the output in normal times is exported to Germany. The very extensive deposits of low-grade tungsten ore found in Bolivia are only worked when the demand for the metal is good. The largest deposits occur near Izara, in the Province of Inquisivi. The ore is a tungstate of iron and manganese, assaying in the pure form about 75% WO_3 . It occurs in quartz veins in a pyritiferous diorite; about 50% WO_3 is the average of the crude ore. Deposits are also known in Potosi, and in the Cochabamba and Oruro Departments.

In Peru there were important tungsten mines in the province of Angaraco, from which, however, there has not been any very recent output. Considerable development work was reported some time ago on the Conchico, or Huaura deposits in the Pallasca province, Anecha; these mines are 13,000 ft. to 14,500 ft. above sea-level. The ore is a hübnerite, occurring in at least two main quartz reefs 15 ft. to 75 ft. in thickness. An ore body of 112,500,000 tons has been reported, of which 10% is estimated as minable, containing 1% of hübnerite (75% WO_3); there is enough 2% ore to provide an output for many years. In Chile thin veins of tungsten associated with bismuth and other minerals are known to exist at Agua Colgada, in the Carrizal district, not far from Huasco.

Australia.—There are important deposits of tungsten ore in South Australia in the Tankalella field, not far from Adelaide; also in Queensland and New South Wales. Some of the ore is wolframite, bismuth-wolframite, and scheelite. The Queensland tungsten comes from the Heberton field and the Chillagoe or Hodgkinson river field. The ores are generally in quartz veins, usually accompanied by tin ore near granite contacts, but some veins are free from tin. In New South Wales tungsten and tin occur together, the former as wolframite and scheelite. Tasmania and New Zealand also have tungsten deposits.

The selling value of tungsten is based on a unit of 1% WO_3 per ton. During the first half of 1914, up to the commencement of the war, the value of the unit was 22s. 6d. At the commencement of 1913 it was 23s. 9d.; during the spring of that year it rose to 26s. 8d., and continued at that level all through the year, when it fell to 22s. 6d. During the latter half of 1911, and during the spring of 1912, it was as high as 31s. 3d., but in April of the latter year it fell to 20s. 10d., and it continued at that level until December, when it rose to 23s. 9d.

Concentration.—The concentrating-mill of a tungsten-ore mine with electro-magnetic separation may be described as follows:—The ore from the mine is dumped over grizzlies at the shaft-house, the fine going to the bin, whilst the coarse is conveyed to the sorting-table, where it is readily hand-picked, the ore going to the bin, and the waste rock to the dump. From the sorting-room ore-bin the ore is hoisted to the ore-bin in the

mill building, the fines passing through a $\frac{1}{2}$ -in. grizzly, and the coarse through a crusher set to $\frac{1}{2}$ in., the whole passing through a shoot and, by bucket elevators, to a main storage-bin of large capacity—100 to 150 tons. The ore is then crushed, wet, by rolls, the product from the rolls going to the trommel, the over-size returning to the rolls, the fines going to three cone sizers and then to two slow-current spitzkastens, distributing to tables and the slime-table. The concentrates from the tables are conveyed to drainage boxes and then to a steel drying-table, from which they pass to a roaster hopper and revolving roaster. An electric magnetic separator follows, from which the tungsten concentrates are bagged. The mill equipment may be operated by engines of 50 horse-power and 30 horse-power, the larger engine being required for the crushing department, and the smaller one for the concentrating section.

Alloys; Formation of—by electrolysis. G. Bruni and M. Amadori. Atti R. Accad. Sci., Lett., ed. Arti, Padova, 1913—14, 30, 349. Annali Chim. Appl., 1915, 3, 147.

On electrolysing solutions of mixed salts of two metals (Cu—Ni, Fe—Ni, Fe—Co, Ni—Co) capable of forming solid solutions in all proportions, the deposits contained the two metals in proportions varying with the composition of the solution and with the current density and voltage. With moderately high current density and voltage the ratio between the two metals in the deposit was, in general, approximately the same as in the solution, but with low current density and voltage a larger proportion of the less electropositive metal was deposited. In the case of nickel and iron, using low current density (0.05 ampère per sq. dm.), solutions in which the proportion of iron varied from 40 to 75% yielded deposits in which the iron content was practically constant at 52%. Solutions of iron and cobalt salts in which the proportion of iron varied from 33—50% also yielded deposits of constant iron content. In the case of copper and nickel, and copper and cobalt, the percentage of nickel or cobalt in the deposits was increased by adding ammonia or an ammonium salt and diminished by rotating the cathode.—A. S.

Alloys; Quantitative effect of rapid cooling upon the constitution of binary —, Part III. G. H. Gulliver. Inst. of Metals, March, 1915. [Advance proof.] 31 pages.

A CONTINUATION of previous work (J. Inst. Metals, 1913, 9, 120; 1914, 11, 252), leading to the establishment of formulae by which the constitution of an alloy cooled at a rate not consistent with equilibrium can be calculated from the data of the equilibrium diagram. From the calculated results the apparent solidus curve of the alloys for a given rate of cooling can be drawn. For a rate of cooling between extremely slow and extremely fast, the proportion of liquid, or eutectic, in a binary alloy of simple type, at a temperature just above the eutectic or transition point, is given by a formula

of the type: $\left(\frac{X-x}{X_E-x}\right)^n$, where X is the percentage

of one component in the alloy, X_E is the percentage of that component in the liquid or eutectic, and x is the apparent saturation limit of the solid solution at the rate of cooling in question. If the

liquidus and solidus are straight, $n=1+\frac{X_s-x}{X_E-X_s}$,

where X_s is the percentage of the one component in the saturated solid solution; when the liquidus and solidus are curved, n is a more complex function of X , X_E , X_s , and x . The calculated

results for Pb—Sn and Al—Cu alloys agreed satisfactorily with the experimental results of Degens (this J., 1909, 1041) and of Gwyer (this J., 1908, 1066) respectively. The results calculated for Al—Sn alloys from the equilibrium diagram of Shepherd (this J., 1904, 826), in conjunction with the experimental results of Gwyer (this J., 1906, 639), indicated that the saturation limit of 20% Sn given by Shepherd for the aluminium-rich solution is too high: examination of some annealed alloys showed that the real limit is probably below 10% Sn.—A. S.

PATENTS.

[Iron] ores; Process of reducing —. A. E. Greene, Chicago, Ill. U.S. Pat. 1,129,862, March 2, 1915. Date of appl., July 15, 1912.

ORES containing phosphorus are partially reduced with a suitable solid reducing agent in an electric furnace in presence of lime, the reduction being completed with a reducing gas not capable of reducing calcium phosphate.—W. R. S.

Steel; Vacuum process for production of —. E. Dolensky, Frankfurt, Germany. U.S. Pat. 1,131,488, March 9, 1915. Date of appl., Oct. 22, 1912.

THE molten metal is cleared by subjecting it to the action of a vacuum in a preheated clearing-vessel.—W. R. S.

[Silicon steel] alloys; Method of making —. A. Smith, Leetonia, Ohio, Assignor to The Youngstown Iron and Steel Co., Youngstown, Ohio. U.S. Pat. 1,131,799, March 16, 1915. Date of appl., Sept. 18, 1914.

HIGH-SILICON steel is produced by pouring an entire charge of refined steel from an open-hearth or other furnace into a ladle, then withdrawing a fraction, not exceeding 25 tons, into another ladle and mixing it with a silicon compound.—W. R. S.

Steel; Preventing the formation of poisonous dust during the hardening and tempering of —. Verein. Schwarzfarben- und Chem. Werke, Akt.-Ges. Fr. Pat. 471,768, May 4, 1914.

HARDENING mixtures containing potassium cyanide, etc., are used in the form of small tablets, balls, or the like to prevent dusting.—W. E. F. P.

Steel high in manganese; Process for rendering — easily machinable. Poldihütte Tiegelgussstahlfabrik. Fr. Pat. 472,185, May 14, 1914. Under Int. Conv., May 27, 1913.

THE piece of steel is maintained between 350° and 800° C. for 1 hour or longer according to its size, and then allowed to cool.—W. E. F. P.

Furnace for heating or annealing. A. Smallwood, London. Eng. Pat. 4480, Feb. 20, 1914.

THE material under treatment is conveyed to and from the heating chamber upon a hollow carrier or truck heated internally by the gases from a portable fire-chamber, which may form part of the carrier. The heating gases pass from the fire-chamber through longitudinal and transverse flues within the carrier, provided with openings which can be controlled independently.—W. E. F. P.

Crucible-furnace. F. M. Iler, Denver, Colo. U.S. Pat. 1,129,983, March 2, 1915. Date of appl., May 20, 1912.

IN a cylindrical furnace having an open top, a spiral air-heating flue is provided in the wall of the crucible chamber. Air is supplied to the upper

end of the flue from a pressure chamber at the base of the furnace, and discharged, heated, into the fuel duct at the lower part of the crucible chamber. The furnace is made in two sections to permit removal of the crucible.—W. E. F. P.

Metallurgical furnace. U. Wedge, Ardmore, Pa. U.S. Pat. 1,131,449, March 9, 1915. Date of appl., July 16, 1913.

A MULTIPLE-HEARTH furnace, with a central rotating shaft carrying rabble arms, and a valved passage through each hearth for permitting a flow of ore from an upper to a lower chamber whilst preventing upward flow of gas. The valves are operated at regular intervals by the arms carried by the shaft above the uppermost hearth.

—W. R. S.

Furnaces; Cooling electric [smelting]—by air. H. Magrou, Fos, France. U.S. Pat. 1,131,609, March 9, 1915. Date of appl., Feb. 9, 1915.

COOLED air is circulated and expanded in contact with the walls of the furnace, to cool the outer portion of the charge below its melting point.

—B. N.

Ores; Concentration of— H. L. Sulman, and Minerals Separation Ltd., London. Eng. Pat. 4938, Feb. 25, 1914.

IN concentrating ores by flotation, e.g., by the agitation-froth process, a silicofluoride or hydrofluosilicic acid is added to the aqueous medium, in place of the sulphuric acid commonly used.

—W. E. F. P.

Galvanising wire, sheets, and other products; Baths for— N. K. Turnbull, Manchester. Eng. Pat. 5089, Feb. 27, 1914.

THE wire, etc., is galvanised continuously in a bath in which the molten zinc is supported on, and heated by molten lead. The tank is divided into compartments and by means of partitions a greater depth of zinc is maintained in the inlet and exit compartments than in the middle one, so that as dross is formed it descends out of the path of the material under treatment.—W. E. F. P.

Cadmium from zinc ores; Removal of— G. Rigg, Palmerton, Pa., Assignor to New Jersey Zinc Co., New York. U.S. Pat. 1,129,904, March 2, 1915. Date of appl., Dec. 3, 1914.

THE ore is roasted and the cadmium is then converted into sulphate by leaching with an aqueous solution of zinc sulphate; the zinc sulphate is derived in part directly from the roasted ore and in part by adding sulphuric acid to the leaching liquid. The roasted ore is added gradually to the leaching liquid, and the resulting liquid drawn off.—W. E. F. P.

Tungsten powder; Process for producing— R. Rafn, Porsgrund, Norway, Assignor to General Electric Co., Schenectady, N.Y. U.S. Pat. 1,130,197, March 2, 1915. Date of appl., Sept. 20, 1912.

TUNGSTEN trioxide is heated to dull redness in ammonia to produce the blue oxide, which is reduced to metal by heating in hydrogen at a higher temperature.—W. E. F. P.

Aluminium alloy. A. Wilm, Berlin. U.S. Pat. 1,130,785, March 9, 1915. Date of appl., July 31, 1911.

AN alloy of aluminium with Mg about 0.5, Cu not more than 6 (e.g., 3) and Mn not more than 3 (e.g., 1)%.—W. E. F. P.

Aluminium and its alloys; Solder for— G. Bendel, Fr. Pat. 471,641, March 17, 1914. Under Int. Conv., April 3, 1913.

AN alloy of Cd 13, Sn 1, and Zn 6 parts by weight. The surfaces to be joined are heated to the melting point of the solder, rubbed with the latter until good contact is effected, pressed together, and quenched while under pressure.—W. E. F. P.

Aluminium; Low-temperature solder for— L'Omnium des Industries Nouvelles. Fr. Pat. 472,393, May 19, 1914.

THE solder is prepared by adding 80 parts of tin, 10 of zinc, 5 of bismuth, and 5 of aluminium to molten potassium chloride, additions of the latter being made at intervals to bring the total quantity up to 30 parts; when the charge is at a cherry red heat, 4 parts of bismuth chloride is added and the mixture well stirred, poured, and allowed to cool. The solder can be used with a soldering iron.

—W. E. F. P.

Ores; Plant for the reduction and smelting of— E. D. Kendall, Elizabeth, N.J., Assignor to executors of J. B. Haggin. U.S. Pat. 1,131,709, March 16, 1915. Date of appl., July 14, 1914.

A SHAFT furnace, closed at the top, has within its walls a conduit for delivering ore and reducing agent to the crucible, and within the conduit a removable perforated pipe connected with an exhausting fan for the removal of the gases; the perforations are protected by hoods. Another similar conduit is provided for introducing a flux.

—W. R. S.

Copper; Process of extracting— C. H. Benedict, Lake Linden, Mich. U.S. Pat. 1,131,986, March 16, 1915. Date of appl., April 18, 1914.

COPPER-BEARING sands are leached successively with a series of cupric-ammonium salt solutions of decreasing strength; copper and ammonia are recovered from the strongest solution, and the weaker ones are used again for leaching.—W. R. S.

Colloidal metal solutions; Manufacture of stable— Ges. f. Elektro-osmose m. b. H. Fr. Pat. 471,679, April 10, 1914. Under Int. Conv., April 14, 1913.

COLLOIDAL metal solutions are stabilised by soluble silicic acid, especially that prepared as described in Fr. Pat. 471,678 (see page 423), a salt of the metal being added to the silicic acid solution and then reduced, preferably by hydrazine hydrate.

—F. SODX.

Iron alloy for dynamo-electric purposes; Process of manufacturing an— W. Rübel, Berlin. U.S. Pat. 1,130,678, March 2, 1915. Date of appl., July 9, 1912.

SEE Addition of July 10, 1912, to Fr. Pat. 429,758 of 1911; this J., 1913, 146.

Metals from low percentage ores; Process for extracting— H. S. Mackay, Norwich, Conn., U.S.A. Eng. Pat. 26,138, Nov. 14, 1913.

SEE U.S. Pat. 1,094,371 of 1914; this J., 1914, 598.

Sulphide ores; Concentration of— Minerals Separation and De Bavay's Processes Australia Proprietary, Ltd., Melbourne, Australia. Eng. Pat. 5856, March 7, 1914. Under Int. Conv., April 3, 1913.

SEE Fr. Pat. 469,677 of 1914; this J., 1915, 35.

Magnetic separator. G. Ulrich, Magdeburg, Assignor to F. Krupp Akt.-Ges., Grusonwerk, Magdeburg-Buckan, Germany. U.S. Pat. 1,130,618, March 2, 1915. Date of appl., Nov. 25, 1913.

SEE Fr. Pat. 464,156 of 1913; this J., 1914, 425.

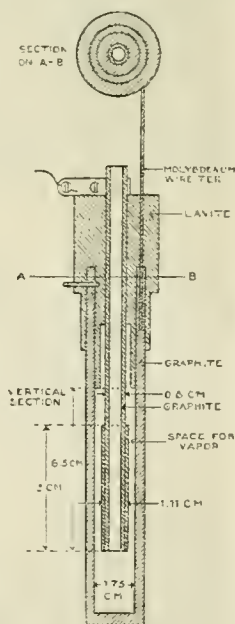
Desulphurising ores; Process for —. G. Fusina, Genoa, Italy. U.S. Pat. 1,131,691, March 16, 1915. Date of appl., April 25, 1912.

SEE Fr. Pat. 442,280 of 1912; this J., 1912, 931.

XI.—ELECTRO-CHEMISTRY.

Electrical conductivity above 1500° C. of vapours at normal pressure; Methods, data, and new apparatus for measuring —. E. F. Northrup. J. Franklin Inst., 1915, 179, 337—352.

PRELIMINARY experiments showed the character of the electrical conduction of metallic vapours to depend upon the form (and probably the material) of the container, the applied voltage and its direction, the temperature, the nature of the metal, and the frequency when an alternating voltage was employed; and it was found necessary to make the measurements with direct e.m.f. which could be commutated, and then repeat them with alternating e.m.f. of different known frequencies. The vertical electric furnace employed had a cylindrical chamber, 2.2 cm. in diameter, and a heating length of 13 cm. An interchangeable heater-unit of graphite, employing a metal of very high m. pt. as resistor material, was used. The furnace resistance bearing a definite relation to the temperature of the furnace when the latter was heated slowly. The metal resistor was protected from oxidation by the gases (CO+N) developed in the furnace at red heat. To heat the furnace rapidly to 1500° C., about 1600 watts were required, and an equilibrium temperature of 1645° C. was attained in about 2½ hours, the maintenance of the latter requiring 28.6 volts and 58 amperes; in one test a heater-unit lasted for 137½ hours. The container for the vapour (see fig.), made of Acheson graphite, was held in position and insulated from the crucible by a piece of baked "lavite" which also formed a cover for the furnace chamber, the resistance measured being that of the hot vapour in the space between the outer surface of the inner cylinder and the inner surface of the cylindrical crucible, the internal diameter of which was 1.75 cm. The temperature to which the vapour might be raised was limited by the m. pt. of lavite (about 1525° C.). In using the apparatus, a small piece of the metal to be examined was placed in the bottom of the graphite crucible and the temperature of the furnace steadily increased (never being allowed to decrease while the measurement was in progress). Measurements were made of the conductivity of the crucible



gases (CO+N) from 900° to 1550° C., of the asymmetric resistance of the latter at 1510° C., and of the conductivity of mercury vapour from 900° to 1500° C.: but it is recognised that quantitative measurements as regards metallic vapours will be of little practical value until means are provided for maintaining the vapours under pressure; above 1200° C., minute particles of carbon (from the graphite container) are intermingled with the vapour or gas in the crucible, and these particles probably are largely responsible for the electrical conduction observed. Considering that the electrical conductivity found for all oxide powders and refractory materials might be due in part to the conductivity of the hot gases permeating the solid material, a container was packed full of very pure alumina, and the resistance (milliamperes vs. ° C.) measured at 50 volts, the central electrode being maintained positive. From the results obtained, in conjunction with previous measurements, it was found that about 21% of the conductivity of the alumina was due to that of the hot gases in its interstices, and it is therefore concluded that at temperatures exceeding 1500° C. it is impossible to obtain even approximately good electrical insulation by any means.—W. E. F. P.

Silver voltameter; Studies on the —. G. A. Hulett and G. W. Vinal. J. Phys. Chem., 1915, 19, 173—192. (See also this J., 1914, 482; 1915, 91.)

COMPARATIVE tests made with porous cup voltameters employed at the U.S. Bureau of Standards and Princeton University, respectively, resulted in good agreement. Several kinds of porous cups were used, and the voltameters differed appreciably in size and shape. In making determinations of acidity to ascertain when the porous cups were in equilibrium with the electrolyte, methyl red was used as indicator in preference to iodeosin. In the final washing of the deposit with conductivity water the change of conductivity of the water is the best criterion of the efficiency of the washing, but the operation must be accomplished speedily, as owing to electrochemical action even conductivity water slowly dissolves silver which has been deposited on platinum.—J. R.

PATENTS.

Furnace; Electric arc —. E. Troye and E. Edwin, Assignors to Norsk Hydro-Elektrisk Kvaestof-aktieselskab, Christiania, Norway. U.S. Pat. 1,122,555, Dec. 29, 1914. Date of appl., June 26, 1914.

THE arcs are arranged in a multiphase star circuit, to render them stable, and a multiphase transformer is connected to the circuit, with an arc for each phase connection. A grounded metallic neutral connection, common to all the phase connections, is connected to the neutral point of the transformer, and switches are arranged in the metallic connections between the arcs and the neutral point. Each phase connection is provided with a reactance, tuned to pass only the first harmonic of the current. Different arrangements are described in which a furnace is in each phase connection of a three-phase transformer, and connected to a neutral wire, or with the furnaces in induction currents, or with several furnaces supplied with induced currents from the same primary winding, or in which choking coils are employed.—B. N.

Furnace; Electric —. J. Blatchford, Oak Park, Ill. U.S. Pat. 1,129,842, March 2, 1915. Date of appl., Aug. 19, 1914.

THE outer and inner walls of a horizontal tubular double-walled body portion are spaced apart by end pieces, each provided with a rib, projecting

backwards, which receives the walls on its outer and inner edges respectively. The inner wall forms a refractory core, and three heater resistance conductors are distributed uniformly upon its outer surface and embedded in cement; the space between the walls is filled with refractory packing material. The conductors are connected to a source of current and to three single-pole double-throw knife switches mounted on the furnace, so that the resistances may be connected in various ways, with relation to each other and to the source of current, to produce different temperatures. A door is arranged in one of the end pieces, and a plug, slotted diagonally and adapted to provide an adjustable vent, in the other.—B. N.

Oven and kiln; Electrical —. L. H. Giddings, Pasadena, Cal. U.S. Pat. 1,130,392, March 2, 1915. Date of appl., June 29, 1911. Renewed July 20, 1911.

The oven is provided with an inner and outer wall, the upper portion of the outer chamber between the walls forming an air compartment. Bridges are arranged in the outer chamber with electrical resistances on them, and air is admitted to the chambers through inlets which may be closed. Ports, at the top and bottom of the inner wall, connect the two chambers, and are controlled by plugs sliding in them. An outlet, below the levels of the ports, connects the inner chamber with a flue and stack, and means are provided "to yieldingly seal the outlet."—B. N.

Furnace; Electric —. W. S. Horry, Niagara Falls, Assignor to Union Carbide Co., New York. U.S. Pat. 1,130,734, March 9, 1915. Date of appl., Jan. 21, 1914.

MULTIPHASE current is supplied to several sets of electrodes, disposed symmetrically, by a number of conductors, arranged in parallel for each phase. Each of the electrodes receives current of different phase from that of neighbouring electrodes, and the conductors extend to the electrodes by different routes, each interlinked with others carrying current of opposing phase, whereby the self-induction of the system is minimised; each set of electrodes is connected in delta to its own supply.—B. N.

Gases; Process for the synthesis of —. [Electrical] process for producing reactions in gases and apparatus for practising the same. L. L. Summers, Chicago, Ill. U.S. Pats. (A) 1,130,940 and (B) 1,130,941, March 9, 1915. Date of appl., Nov. 25, 1911.

(A.) ONE or more of the constituent gases is strongly heated, and a relatively cool gas is then injected under pressure, whereby the gases are made to combine; the resulting gases are quickly removed from the heat zone. (B.) An arc is established, and the more inert gas is fed into the arc. A second gas is injected under pressure, thus extinguishing the arc, which is then immediately re-established.—B. N.

Battery-separator and process of making the same. J. M. Skinner, Assignor to Philadelphia Storage Battery Co., Philadelphia, Pa. U.S. Pat. 1,130,640, March 2, 1915. Date of appl., May 13, 1914.

THE wood of coniferous trees is shaped into the form of separators, and boiled in water for from 24 to 48 hours at atmospheric pressure.—B. N.

Ozone; [Electrical] apparatus for generating —. W. J. Knox, New York, Assignor to Knox Terpezzone Co. of America. U.S. Pat. 1,130,827, March 9, 1915. Date of appl., Dec. 1, 1910.

Two concentric glass tubes are separated by an annular space closed at one end, one of the tubes

being roughened on the inner surface and forming a dielectric. A body of mercury in the annular space acts as the electrode, the metal entering the indentations of the roughened part, and forming a number of fine discharge points.—B. N.

Liquid; [Electrical] process of treating [separating suspended matter from] —. C. P. Landreth, Philadelphia, Pa. U.S. Pat. 1,131,067, March 9, 1915. Date of appl., June 10, 1911.

SUSPENDED matter is separated by passing an electric current through the liquid to form a coagulant. A part of the deposited sediment and coagulant, separated by settling, may be again introduced into the liquid, subsequent to the electrical treatment.—B. N.

Manufacture of soluble, chemically pure silicic acid. Fr. Pat. 471,678. See VII.

Influence of electricity upon plant growth. Dorsey and Clements. See XVI.

XII.—FATS; OILS; WAXES.

Cotton-seed; Nitrogen and fat in short-staple —. C. A. Wells and P. H. Smith. J. Ind. Eng. Chem., 1915, 7, 217.

SPECIMENS of eighteen varieties of upland short-staple cotton, grown on red clay soil which had been uniformly fertilised, were ground under uniform conditions in the same machine, and the remaining lint was removed from the seed by hand: the amount of lint not removed by the gin may vary from 97 to 124 lb. per 1000 lb. of seed. The moisture content of the kernels of these eighteen varieties ranged from 6.42 to 9.75%, the fat from 35.20 to 48.04%, and the nitrogen from 5.16 to 6.22%. Arranging the eighteen varieties in two groups of nine, according to the nitrogen content of the kernels, a ton of mixed cottonseed from one group would contain 8.3 lb. more nitrogen (value about 8s. 4d.) and 13.6 lb. less oil (value about 2s. 1d.) than a ton from the other group, leaving a balance of 6s. 3d. per ton in favour of the seed of high nitrogen content. The nine varieties in the high nitrogen group (N, 5.63—6.22; average 5.90%) were Schley, Pevy's improved, Cook's improved, Jarman K. sunbeam, Willet's ideal, Cook's No. 675 Ala. Exp. Station, Wanamaker's ext. big boll—storm proof, King and triumph hybrid, and Hite's early prolific.—A. S.

Unsaponifiable matter in greases [; Determination of —]. E. Twitchell. J. Ind. Eng. Chem., 1915, 7, 217—218.

FIVE grams of the sample or, preferably, of the fatty acids prepared for the "titer" test, is saponified with alcoholic potash, and the mixture evaporated nearly to dryness, treated with a small quantity of alcohol and with water, and washed into a separating funnel: the volume of the soap solution should be 150—200 c.c., and the ratio of alcohol to water 1:4. The solution is shaken with two successive 50 c.c. portions of ether, and the united ether extracts are washed once with water, once with dilute hydrochloric acid, then again with water, transferred to a weighed dish, evaporated, and the residue dried at 110° C. and weighed. It is then dissolved in neutral alcohol and titrated with standard alkali; the quantity of fatty acids (derived from a small quantity of soap dissolved by the ether) thus found, calculated as oleic acid, is deducted from the weight of the original residue.—A. S.

Emulsions; Experiments on—. *Adsorption of soap in the benzene-water interface.* T. R. Briggs. J. Phys. Chem., 1915, 19, 210—231.

THE amount of sodium oleate removed from aqueous solution by emulsifying with benzene depends upon the specific surface of the benzene phase and the concentration of the soap solution; it increases rapidly at first with small increases of concentration, but subsequently is practically unaffected by large increases. The emulsification depends upon the formation of a viscous semi-solid film of soap about the benzene globules; the condensation of solute in the liquid interface is regarded as a special case of adsorption. Discrepant results were obtained with hand-shaken emulsions owing to the varying size of the benzene globules. Such emulsions were "homogenised" by impinging upon a baffle wall from an orifice of 0.5 mm. diam. at about 1 at. pressure: after eight or ten treatments most of the globules were reduced to less than 5μ diam. The adsorption was then much more pronounced, and the stability of the emulsion was greatly enhanced. With a "homogenised" solution having a final equilibrium concentration of 6.36 grms. of sodium oleate per litre, the observed amount of oleate adsorbed by a litre of benzene was 0.44 grm., the amount calculated from Freundlich's adsorption equation being 0.12 grm.—J. R.

PATENTS.

Oil or grease from animal or other matter; Extraction of—. D. Adamson, Hyde. Eng. Pat. 5709, March 6, 1914.

THE material (fish refuse) is extracted in a rotating vessel by means of a volatile solvent, which is admitted through a passage in the trunnions, whilst the extract is drawn off through a grid covered with filtering material. Steam may be supplied to a coil within the vessel through another passage in the trunnions.—C. A. M.

Oils; Mixing device for use in the hydrogenation of— and in similar processes. G. Calvert, London. Eng. Pat. 5967, March 9, 1914.

THE mixture of oil and catalyst is treated with hydrogen in a closed vessel containing a rotating comb-shaped agitator surrounded by a stationary gauze screen, which finely subdivides the oil, whilst a centrifugal propeller at the base flings the mixture upwards to be beaten and subdivided again. Hydrogenation is accelerated by the impact of the oil against the screen.—C. A. M.

Fatty matter; Hydrogenising—. F. W. de Jahn, New York. U.S. Pat. 1,131,339, March 9, 1915. Date of appl., April 1, 1913.

THE finely-divided fat is agitated with hydrogen in one vessel and then passed through a second vessel containing the catalyst. Air is withdrawn from both vessels, and the circulation of the fat continued until hydrogenation is complete.

—C. A. M.

Fats; Apparatus for the catalytic hydrogenation of—. R. P. Pictet. Fr. Pat. 472,080, July 24, 1913.

THE oil, with or without the addition of a catalyst, is made to pass by gravitation through a series of communicating tubes the walls of which are composed of a catalytic metal. The inner surface of the walls of the tubes is submitted to a preliminary treatment to increase the catalytic activity of the metal. Hydrogen in suitable proportion is introduced into the tubes, and the oil is subdivided by rotating devices, which constantly brush against the inner walls.—C. A. M.

Oils; Process of refining animal and vegetable—. C. Baskerville, New York. U.S. Pat. 1,130,698, March 9, 1915. Date of appl., March 13, 1914.

THE oil, e.g., cottonseed oil, is neutralised with caustic alkali, with or without the addition of a saline electrolyte, the alkali soap dehydrated by heating with an anhydrous salt (e.g., sodium carbonate), and the coagulum separated.—C. A. M.

[Fullers'] earth-treating process. M. J. Welsh, Assignor to The Atlantic Refining Co., Philadelphia, Pa. U.S. Pat. 1,132,054, March 16, 1915. Date of appl., June 7, 1913.

FULLERS' earth which has been used to treat oily liquids, is revived by treating it with a suitable solvent, or calcining it, and then treating it with acid, which removes the ingredients "tending to produce fusion."—A. B. S.

Detergents; Preparation of stable oxygenated—. H. Siebold. Ger. Pat. 279,306, April 23, 1913.

A PERPHOSPHATE is mixed with soap or other detergent material. The products are more stable than perborate preparations.—A. S.

Washing and bleaching of wool, and recovery of grease and potassium salts. Fr. Pat. 471,651. See V.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Granular substances [pigments, etc.]; Valuation of—by counting the particles. C. Kühn. Z. angew. Chem., 1915, 28, 126—128.

FROM 0.1 to 0.5 gm. of the powder is shaken for 15 mins. with a suitable distributing medium (turpentine, linseed oil, glycerol, water) in a 10 c.c. brass cylinder, and 0.01 c.c. of the homogeneous mixture is withdrawn with a micro-pipette, diluted to 1 c.c. with the liquid, and again shaken for 15 mins. One drop is then placed on the object glass of a Zeiss-Thoma chamber for counting the corpuscles in blood, covered with the cover-glass, and the number of particles counted (after 1 to 12 hours) under a magnification of 550 diam. Duplicate results should agree within 4%. The method affords a criterion of the fineness of ground and precipitated products, such as flour, pigments, oil-paints, etc., and may be used in the examination of explosives. For example, 1 gm. of heavy spar contained the following number of particles:—Once ground, 4.5; twice ground, 12; and thrice ground 18.4 milliards. One gm. of lamp black (sp. gr. 1.57) contained 960 milliards of particles: an average particle thus weighed 1.04×10^{-12} grm., had a diam. of 1.08 μ , and contained 26 milliard mols. of carbon.—C. A. M.

Paints to prevent electrolysis [of iron and steel] in concrete structures. H. A. Gardner. J. Franklin Inst., 1915, 179, 313—336.

AS the result of an investigation to ascertain the best type of paint for insulating iron, etc., when embedded in concrete (thereby inhibiting the corrosion caused by the action of stray currents of electricity), it was concluded that the vehicle of the paint should contain boiled or bodied oils or products which dry—by polymerisation rather than oxidation—to a fairly saturated film having a dull rather than a glossy surface; that the solid portion of the paint should contain a percentage of pigments which are inert, electrically non-conducting, and coarse (so as to produce a film

having a rough surface), and also pigments of the basic or chromate type; and that, if possible, sand should be applied to the painted surface whilst it is still tacky, to improve the adhesion of the cement or concrete.—W. E. F. P.

Linseed oil treated with cobalt, lead, and manganese elvostearates; Drying properties of —. L. E. Wise and R. A. Duncan. *J. Ind. Eng. Chem.*, 1915, 7, 202—205.

AN aqueous solution of the potassium soap of Chinese wood oil was treated with solutions of lead acetate, manganous chloride, and cobaltous chloride respectively, and the precipitated soaps were filtered off, washed with water, and dried *in vacuo* over fused calcium chloride: the lead soap contained 28% Pb, the manganese soap 10% Mn, and the cobalt soap 9% Co. The effect of equivalent quantities of these soaps on the drying of linseed oil under identical conditions was studied, comparative tests with litharge being made at the same time. The oil containing the manganese soap dried most rapidly and showed the lowest maximum gain in weight. The lead soap gave results very similar to those obtained with litharge, except that there was a somewhat greater gain in weight during the first stage of the drying. The effect of the cobalt soap was similar to that of the lead soap, but the film lost weight more rapidly after the maximum gain in weight had been attained.—A. S.

Floor polishes; Examination of —. A. A. Besson and R. Jungkunz. *Chem.-Zeit.*, 1914, 38, 1141—1142; 1173—1175; 1182—1185.

FLOOR polishes usually consist of a mixture of wax and turpentine or turpentine substitutes (petroleum products); some contain benzene. The solvent is separated by steam distillation, and the residue submitted to the ordinary methods of wax analysis in order to ascertain its composition. The oily portion of the distillate is separated from the water, and its specific gravity, refraction, iodine value, boiling point, ignition point, and flash point are determined. Whilst turpentine ignites at 31.7°—35.2° C., petroleum products used as turpentine substitutes ignite at 24.2°—28.7° C., and naphtha and benzene burn at ordinary temperatures. Many of the turpentine substitutes have an iodine value of less than 16. The polymerisation test described by Eibner and Hue (this J., 1910, 890) is useful for the determination of the amount of turpentine substitutes present, but Sangajol behaves like turpentine with the test. The refractometer value of turpentine is 69—72, of Sangajol, 81, and of other substitutes, less than 39. In the case of mixtures such as the above, fractional distillation must be carried out under definite conditions to obtain any useful data; the point at which the product commences to boil affords some indication of the nature of the solvent. In the case of turpentine this point is 156° C.; for Sangajol it is 95°—104° C., and for other substitutes 133°—145° C.—W. P. S.

PATENTS.

Anti-corrosive composition. G. Carter, Leeds. Eng. Pat. 22,533, Nov. 14, 1914.

A PREPARATION for preventing the rusting of machinery, etc., is obtained by dissolving rosin (100 oz.) in hot petroleum spirit (100 oz.), adding a liquid drier (5 oz.) and "solid spirit-soluble red" ($\frac{1}{4}$ to $\frac{1}{2}$ drn.), and, when cold, straining the liquid.—C. A. M.

White pigment; Method of making a —. H. W. Kessler, Assignor to The Kessler Co., Cleveland, Ohio. U.S. Pat. 1,131,144, Mar. 9, 1915. Date of appl., Dec. 22, 1909.

A COMBUSTIBLE mixture of powdered metallic lead, air, and a gaseous hydrocarbon fuel is ignited and introduced into an atmosphere of carbon dioxide, with or without admixed steam, and the resulting carbonate is separated from the gases.—C. A. M.

Turpentine-distilling apparatus. H. E. Bryant, Assignor to American Patent Manufacturing Co., Jacksonville, Fla. U.S. Pat. 1,130,743, Mar. 9, 1915. Date of appl., Sept. 5, 1911.

THE products of the distillation are collected in a separating chamber surrounded by a cooling tank and the turpentine is drawn off into a receiver, also within the cooling tank, means being provided for watching the distillation and taking samples of the distillate.—C. A. M.

Varnishes and other like materials and process for producing same. A. B. and F. P. Walker, Assignors to W. R. Wood, Cincinnati, Ohio. U.S. Pat. 1,131,578, Mar. 9, 1915. Date of appl., Oct. 31, 1910.

A VARNISH free from organic resins or gums, is composed of a solution of aluminium soap and an oxide of an alkaline earth metal diluted with a suitable "carrier."—C. A. M.

Furfural; Use of — in the manufacture of varnish resins. G. Meunier. Fr. Pat. 472,384, Aug. 2, 1913.

RESINOUS products, suitable for varnish making, are obtained by heating furfural alone or in admixture with ketones or aldehydes, in the presence of an inorganic or organic base, either at atmospheric or increased pressure. For example, aniline heated with an equal volume of furfural in a closed vessel for 48 hours at 70° to 80° C. yields a black resinous compound soluble in benzene. A yellow resin may be obtained by heating a mixture of furfural and acetone with an aqueous solution of sodium hydroxide beneath a reflux condenser.—C. A. M.

Resin oil; Process of manufacturing pure —. M. Melamid, Freiburg, Germany. U.S. Pat. 1,131,939, March 16, 1915. Date of appl., June 10, 1913.

SEE Eng. Pat. 9852 of 1912; this J., 1913, 820.

Production of tar oils which may be used as paint oils and with increased antiseptic and fungicidal properties. Fr. Pat. 471,671. See III.

Cleaning and disinfecting liquids. [Paint remover. Fr. Pat. 471,717. See XIXb.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Rubber and latex; The proteins in —. F. Frank. Rubber Industry, London, 1914, 141—148.

THE following process for the estimation of the total insoluble proteins in rubber has given uniform results in the hands of different workers:—1 to 2 grms. of raw rubber is heated in a test-tube, 30 mm. diam., with 30 c.c. of boiling cymene, limonene, or dipentene until a thin, homogeneous solution is formed. The tube is then run in a centrifugal machine at 2500—3000 revs. per minute, for 1 to 1½ hours, the clear solution is poured off, and the residue is boiled with xylene and again separated by centrifuging. The process

is repeated with benzene, and again with ether, after which the residue is dried and weighed. The separation is not quite quantitative, but the proportion lost is constant. The protein is not decomposed by the process of separation. It gives the biuret, xanthoproteic, lead sulphide, and Millon's reactions. Liebermann's reaction is uncertain, but the product gives all precipitation reactions characteristic of albumins. For the products of hydrolysis, see this J., 1915, 187. From a technical point of view it appears desirable so to manage the coagulation of the latex that the albumins remaining with the rubber may be present in a form which is not liable to disintegration. (See Eng. Pat. 22,255 of 1912; this J., 1913, 298.)—E. W. L.

Rubber latex; Chemical coagulation of—F. Kaye. Rubber Industry, London, 1914, 137—143. (See also this J., 1913, 760.)

THE amount of phosphorus present in samples of *Hevea* rubber prepared by different processes varies considerably; in Fine Hard Para from various sources the amount is fairly constant. For example, the amount of phosphorus (as P_2O_5) in a sample of Pale Plantation Crêpe was 0.035; in Best Smoked Sheet (unwashed), 0.092; in "Byrne Process" Rubber (unwashed), 0.162; in four samples of Fine Hard Para, 0.0520, 0.0805, 0.0624 and 0.0620%, respectively, calculated on the rubber. Study of the quality and nature of the phosphorus in the latex would probably help to elucidate the chemical character of the changes taking place in the protein components during coagulation under the influence of enzymes, dilution with water, and acid- or alkali-hydrolysis.

—E. W. L.

Rubber; A study of some recent methods for the determination of total sulphur in—J. B. Tuttle and A. Isaacs. U.S. Bureau of Standards. J. Franklin Inst., 1915, 179, 353—354.

THE direct solution methods of Spence and Young (this J., 1912, 651), and Deussen (this J., 1913, 951), involving the use of concentrated nitric acid, were found to give low results; and the direct fusion methods of Alexander, The Joint Rubber Insulation Committee (this J., 1914, 150), and Kaye and Sharp, and the solution and fusion method of Frank and Marckwald, were reliable only with rubber having a low content of free sulphur. The most satisfactory results were obtained by the method of Waters and Tuttle (this J., 1911, 1268). It is suggested that separate determinations be made of the free sulphur and that remaining after extraction, and the sum of these reported as the total sulphur.—W. E. F. P.

Crystalline compound of isoprene with sulphur dioxide. De Bruin. See XX.

PATENTS.

Vulcanised india-rubber goods; Manufacture of—W. E. Muntz, London. Eng. Pat. 4955, Feb. 25, 1914.

THE fabric in vulcanised rubber goods is preserved from attack by sulphurous and sulphuric acids formed by oxidation of free sulphur, by (1) adding to the mixing, or impregnating the fabric with, additive compounds of ammonia with certain salts, e.g., zinc sulphate ($ZnSO_4 \cdot 5NH_3$) or magnesium sulphate ($MgSO_4 \cdot 5NH_3$); or forming such compounds *in situ* by first adding the salts to the mixing or fabric, and then treating the goods, before, during, or after vulcanisation, with ammonia; (2) adding to the mixing, or impregnating the fabric with, acetic acid or other organic acids, subsequently treating the goods with liquid or gaseous ammonia or other alkali; (3) applying to

the goods, either together or successively, ammonia and carbon dioxide, in the proportion of 2 vols. to 1 vol., preferably under pressure in a closed vessel.—E. W. L.

Rubber goods; Process of and apparatus for vulcanising—P. M. Matthew, Edinburgh. Eng. Pat. 5464, March 3, 1914.

RUBBER sheeting, inserting, belting, etc., is vulcanised by leading it continuously in a sinuous path around and between the surfaces of heated rotating cylinders. To obtain a highly polished surface the members of one or more pairs of cylinders may be caused to rotate at different speeds. A pattern may be applied to the rubber by using engraved rollers.—E. W. L.

Rubber and rubber-like substances; Process for accelerating the vulcanisation of natural and artificial—S. J. Peachey, Stockport. Eng. Pat. 7370, March 24, 1914.

VULCANISATION is accelerated by adding to the mixing, before vulcanisation, a compound resulting from the interaction of an aromatic amine with an aliphatic or aromatic aldehyde, or of an aromatic aldehyde with ammonia. For example a mixing consisting of *Hevea* rubber, 100 parts, sulphur, 10 parts, and formaldehyde-aniline (or benzylidene-aniline) 1 part by weight, can be vulcanised in 40 minutes at $140^\circ C$. Hydrobenzamide is also mentioned as a suitable accelerator.—E. W. L.

Rubber and rubber-like substances; Process for accelerating the vulcanisation of natural and artificial—S. J. Peachey, Stockport. Eng. Pat. 10,833, May 2, 1914. Addition to Eng. Pat. 4263, Feb. 19, 1914 (this J., 1915, 368).

VULCANISATION may be accelerated by adding to the mixing *p*-nitrosodiphenylamine, or a reduction product of the nitroso-compounds named in the prior specification, e.g., dimethyl-*p*-phenylenediamine.—E. W. L.

Rubber; Process for accelerating the vulcanisation of natural or synthetic—Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 280,198, Jan. 1, 1914.

BASES or basic ammonia derivatives having a dissociation constant greater than about 1×10^{-8} , are added to the mixture before vulcanisation. Suitable substances are *p*-phenylenediamine, aldehyde-ammonia, benzylamine, naphthylenediamine, ammonium borate, and sodium-amide. The process is applicable to the product obtained by Kondakow by polymerisation of $\beta\gamma$ -dimethylbutadiene.—A. S.

Caoutchouc-like substances; Process for improving synthetic—Badische Anilin und Soda Fabrik. Ger. Pat. 279,780, Jan. 10, 1914.

SYNTHETIC caoutchouc-like substances which are entirely or partly insoluble or sparingly soluble in benzene, are treated with organic acids or acid derivatives, with the exception of acids or derivatives in which the carboxy group is attached directly to a ring. The process is applicable, for example, to the products obtained from butadienes by polymerisation with alkali metals in presence of carbon dioxide or by autopolymerisation, or to those obtained by heating synthetic caoutchouc-like substances at ordinary or diminished pressure (see Eng. Pat. 975 of 1913; this J., 1914, 93).—A. S.

Indiarubber and ebonite goods; Process of manufacturing—from old or waste vulcanised rubber. H. Gare, Wembley. Eng. Pat. 10,030, April 23, 1911.

WASTE rubber is ground to a paste with water or other inert liquid and moulded, the fluid expressed

or evaporated, and the mass vulcanised or reformed by heating. Colouring, bleaching, or hardening agents, etc., may be added.—C. A. M.

Vulcanised rubber; Process for separating — from fabric, metal particles, and other foreign substances. Process of regenerating vulcanised rubber. J. Frydman. Fr. Pats. (A) 471,913 and (B) 471,996, July 22 and 23, 1913.

(A). VULCANISED rubber waste (100 kilos.) containing fabric insertion, metal particles, etc., is soaked for several hours at the ordinary temperature in 200 kilos. of the fraction of b. pt. 140°—170° C., obtained from certain petroleum distillates from the Dutch Indies, in particular that known as "Sangajol." The rubber is thus converted into a friable colloidal gel, and can be readily separated from the fabric, etc. The fabric may then be subjected to successive hot extractions with the same solvent to recover the high-grade rubber with which, in the case of a tyre cover, it is impregnated, and to cleanse the fabric for further use. (B). Vulcanised rubber is heated at 140° C., in an autoclave, or in a vessel fitted with a reflux condenser, with the fraction of b. pt. 140°—170° C. from "Sangajol." The rubber and most of the organic constituents of the vulcanised rubber, as well as the sulphur, pass into solution, and are separated from the insoluble constituents by centrifuging. The rubber is then precipitated by the addition of ethyl or amyl alcohol or acetone, and is freed from the hydrocarbon solvent by washing or digesting with the precipitant and drying *in vacuo*.—E. W. L.

Materials impregnated with rubber mixtures; Preparation of —. W. Golombek. Ger. Pat. 278,717, Aug. 15, 1913.

The emulsion of regenerated rubber, rubber solvent, and water, formed as an intermediate product in the regeneration of rubber, is used as an impregnating agent, either alone or in conjunction with raw rubber.—A. S.

Caoutchouc; Production of vulcanised synthetic —. F. Hofmann and K. Gottlob, Elberfeld, Germany, Assignors to Synthetic Patents Co., New York. U.S. Pat. 1,130,903, March 9, 1915. Date of appl., Oct. 16, 1913.

SEE Ger. Pat. 268,917 of 1913; this J., 1914, 365.

XV.—LEATHER; BONE; HORN; GLUE.

Tanning materials and cellulose extract in leather; Distinction and detection of —. R. Lauffman. Ledertechn. Rundschau, Dec. 24 and 31, 1914. J. Amer. Leather Chem. Assoc., 1915, 10, 160—165.

SAMPLES of leather made with quebracho and chestnut extracts, with mixtures of these extracts, and with mixtures of quebracho extract with mangrove extract and with sulphite-cellulose extract, were dried, ground, and extracted with water. The aqueous infusions of leathers tanned with quebracho and with chestnut extracts, when tested by the usual methods, gave results similar to those given by the extracts themselves, whilst the infusion from leather tanned with a mixture of these extracts gave results more nearly resembling those obtained with chestnut extract, unless the leather was first partly tanned with chestnut and the tannage completed with quebracho. The infusion from leather tanned with a mixture of equal parts of quebracho and sulphite-cellulose extracts contained these in nearly equal amounts,

whilst that from leather tanned partly with quebracho and completed with sulphite-cellulose extract more nearly resembled the latter, the reverse being the case when the mixed tannage was carried out in the reverse order. In general, when leather is tanned partly with one extract and the tannage completed with another, the aqueous infusion more nearly resembles the latter, but a part of the tannin in all cases may be so firmly combined with the hide fibre that it does not appear in the aqueous infusion. Leathers containing sulphite-cellulose extract, in which this material can be detected immediately after tannage, may show no reaction when tested after three months.—T. C.

Tannery effluents; Purification of — and recovery of by-products. E. P. Veitch. J. Amer. Leather Chem. Assoc., 1915, 10, 126—144.

TANNERY effluents should always be subjected to sedimentation, with or without the addition of alum, before filtering. Lime mud should be kept separate from all other waste and the clear liquid mixed with the rest of the effluent after settling. The liquid is allowed to settle until the suspended matter is not more than 300 parts per million, and passed through a trickling filter not less than 6 ft. deep, the rate of flow being not more than 2 million gallons per acre per 24 hours. The effluent from the trickling filter is rarely satisfactory and must be further purified by sedimentation, by filtering through spent bark or sand, or by treatment with hypochlorite at the rate of 5 to 10 parts of chlorine per million. The approximate area, cost, and capacity of works capable of treating 1,000,000 gallons of effluent per 24 hours are given in the following table:—

	Area.	Capacity in galls.	Cost (in dollars)
Settling tanks.....	3000 sq. ft.	150,000 to 200,000	8000 to 15,000
Filter presses for sludge ..	—	—	1000
Rotary dryers	—	—	2300 to 3000
Sprinkling filters (9 ft.) ...	$\frac{1}{2}$ acre	—	22,000 to 37,000
Final settling tanks	1000 to 2000 sq. ft.	75,000 to 100,000	5000 to 10,000
Hypochlorite treatment ..	400 sq. ft.	—	1000

The dry sludges obtained from tannery effluents vary considerably in composition, containing nitrogen, 0.8 to 8.0%; phosphoric acid, 0 to 0.8; volatile matter, 20 to 85; ash, 14 to 60; lime, 0.5 to 35; fat, 0 to 11; chromium oxide, 0 to 1; arsenic, 0 to 7%. The value of the dried sludge is increased by keeping the waste lime separate from other wastes. The volume of effluent from tanneries is usually unnecessarily large, and it is generally possible to reduce it to about 100 galls. per day per hide without detrimental effect on the finished leather, with consequent cheapening of purification.—T. C.

Waste products of agricultural interest — wool and leather wastes. Russell. See XVI.

PATENTS.

Tanning of bulls or hides, and apparatus to be used therefor. E. Wilson, Bootle. Eng. Pat. 7762, Mar. 27, 1914.

BUTTS or hides are kept in constant motion during tannage and the strength of the liquor is maintained throughout. The apparatus consists of a drum composed of an inner and outer frame, with an annular space, in which the hides are suspended

from sticks forming a skeleton or open periphery to the drum, which rotates in tanning liquor contained in a semi-cylindrical vat. An adjustable automatic feed supplies fresh liquor to the vat, which is provided with an adjustable overflow orifice.—F. C. T.

Tanning products; Manufacture of——. Deutsch-Koloniale Gerb- und Farbstoff-Ges. Fr. Pat. 471,924, May 7, 1914.

FORMALDEHYDE (1 or 2 mols.), or a substance capable of yielding it, is condensed in aqueous solution with 2 mols. of α - or β -naphtholmonosulphonic acid, or heteronuclear α - or β -naphthylaminemonosulphonic acid. Mixtures or salts of these acids may be used. The products may be used in conjunction with vegetable tannins. —F. C. T.

Sheep-skins; Preservation of—— during unhairing (sweating) of fresh or dry pelt, and recovery of ammonia. Soc. M. et A. Gasc. Fr. Pat. 471,966, May 8, 1914.

THE skins are treated with very dilute sulphurous acid before sweating. Sulphur dioxide is also mixed with the air entering the sweating chamber as soon as sufficient fermentation has taken place; the gases leaving the chamber are aspirated through a bath of dilute acid to recover ammonia. Fresh or dry pelt is washed in cold water and then treated with a solution of sodium sulphide, sulphurous acid, or common salt.—F. C. T.

Leather-board, and process of producing the same. A. L. Clapp, Braintree, Assignor to Hide-It Leather Co., Boston, Mass. U.S. Pat. 1,131,039, March 9, 1915. Date of appl., Jan. 11, 1913.

LEATHER-BOARD stock is prepared from comminuted dry chrome leather scrap by beating it out in presence of tannic acid, or of ordinary tanned leather scrap, or of some other reagent capable of converting the chrome salts, and finally alum is added to precipitate the soluble matters present. —E. W. L.

Casein; Manufacture of plastic masses from——. Soc. anon. L'Oyonnaxienne. Fr. Pat. 472,192, May 14, 1914.

PLASTIC masses are obtained from casein by the addition, in varying proportions, of amines, amides, or their derivatives (e.g., aniline, acetanilide). The products can be kneaded, sheeted, pressed, sliced, or drawn into tubes or rods in the same manner and with the same plant as celluloid.—F. Sp.

XVI.—SOILS; FERTILISERS.

Ammonia in soils; Determination of——. R. S. Potter and R. S. Snyder. J. Ind. Eng. Chem., 1915, 7, 221—226.

EXISTING methods for the determination of ammonia in soils were found to be unsatisfactory. Good results were obtained by the application of Folin's aeration method of determining ammonia in urine (Z. physiol. Chem., 1902, 37, 161; see also Kober, J. Amer. Chem. Soc., 1913, 35, 1591): 25 grms. of soil is treated with 50 c.c. of water and a few drops of a heavy oil to prevent foaming, in a 500 c.c. Kjeldahl flask connected with a 16 oz. absorption bottle which, in turn, is connected with a pump. A current of air is drawn through the apparatus, the inlet tube reaching to within $\frac{1}{8}$ in. of the bottom of the flask. About 2 grms. of sodium carbonate is added to the mixture

in the flask, and the liberated ammonia is absorbed in water to which 10 c.c. of N/10 sulphuric acid is added; in the subsequent titration alizarin red is used as indicator. Using an air current of 250 litres per hour no appreciable quantity of ammonia is carried over after 15 hours. The results are concordant, and if an ammonium salt be added to the soil, the whole of its ammonia is recovered in the subsequent determination. Methods based on extraction of the soil with hydrochloric acid give higher, and direct distillation with magnesia gives lower results than the aeration method.—A. S.

Soil carbonates; Determination of——. W. H. MacIntire and L. G. Willis. J. Ind. Eng. Chem., 1915, 7, 227—228.

THE method described by the authors (this J., 1915, 93) for the decomposition of soil carbonates by phosphoric acid (1:15), did not give satisfactory results with a soil containing 5.2% carbonates calculated as CaCO_3 and in which magnesium carbonate was probably present. They recommend, therefore, that hydrochloric acid (1:10) be used instead of phosphoric acid for miscellaneous work; this has no appreciable action on soil organic matter at the ordinary temperature. The carbon dioxide is absorbed in a 4% solution of caustic soda in a tower packed with beads, and determined by the double titration method of Amos (J. Agric. Sci., 1907, 1, 322), i.e., by using first phenolphthalein and then methyl orange as indicator. —A. S.

Soil bacteria; Influence of protozoa upon——. T. Goodey. Roy. Soc. Proc., 1915, B 83, 437—456.

EXPERIMENTS were made with three soils from Rothamsted: A had been stored since 1846 and contained no protozoa; B dated from 1870 and contained amœbæ and flagellates, but no ciliates; C was a fresh field soil (Hoosfield). After moistening with water, the bacterial content of B became much greater than that of A. When A was inoculated with soil bacteria, their number increased enormously up to 32 days, but then rapidly declined to, and remained lower than, the number present in untreated soil over 366 days. The presence of protozoa did not influence the bacterial content. In presence of vorticelli the number of organisms began to diminish after 63 days, and then kept at about the same level as in the untreated soil; the number in A alone showed marked diminution after 181 days. When soil A was inoculated with cultures of amœbæ and of flagellates, both obtained from soil B, the bacterial content was well above that of untreated soil, and this remained true even when amœbæ were present in very large numbers and under conditions favourable to their active growth. The number of organisms in soil A was greater, up to 232 days, than that in A treated with 10% of B, but thereafter they were approximately equal, and after 519 days the treated soil contained the most. A comparison of the organisms in C alone, in C treated with toluene, in C treated with toluene and then inoculated with protozoa, showed that the number was lowest of all in the first case, and much lower in the second case than in the third. After 487 days the inoculated soils were tested and the presence of protozoa established. The general conclusion is drawn that the hypothesis of Russell and Hutchinson (this J., 1909, 1213) that protozoa act as a factor limiting soil fertility by destroying nitrifying and other bacteria, is unwarranted so far as the forms of protozoa mentioned are concerned, and the results strengthen the author's previously expressed view (see this J., 1912, 243) that the ciliated protozoa exist in the soil in an encysted, inactive condition.—E. H. T.

Plant growth; Influence of electricity upon—
H. G. Dorsey and F. O. Clements. *Electrotechn. Zeit.*, 1911, 9, 236. *Chem.-Zeit.*, 1915, 39, Rep., 5.

GREENHOUSE experiments on the effect of electricity and of different kinds of lamp-radiations upon radishes and lettuce, showed that high-frequency currents were the most stimulating, and that direct and alternating currents, passed between electrodes sunk in the soil, were entirely without effect.—E. H. T.

Gram plant, Cicer arietinum; Acid secretion of the—
D. L. Sahasrabudhe. *Agric. Research Inst., Pusa*, 1914, Bull. No. 45. 12 pages.

GRAM is the most common of all Indian pulse crops, covering an area of 13 million acres. It exudes an acid secretion through hairs present on every part, and this is washed off with a wet cloth and used medicinally. The secretion contains malic and oxalic acids in the proportion of 19:1. The acidity rises considerably at the flowering period, attains a maximum when the pods are fully developed, and then rapidly decreases as they become ripe. Pruning has no effect on the relative proportions of the two acids, but it increases their total amount. The secretion is a continuous process, and the amount normally found on the plant is a week's yield. The maximum yield of acid is obtained when the plants are washed every six days. An acre of gram produces nearly 6 lb. of malic acid, of which the cost of collection is 14 rupees (18s. 8d.).—E. H. T.

Waste products of agricultural interest—wool and leather wastes. E. J. Russell. *J. Board Agric.*, 1915, 21, 1087—1092.

MIDDLE-GRADE shoddies, containing 5—10% N, have long been used for fruit and hop farming, especially on the lighter soils. Experiments at Rothamsted have shown that they are also good for ordinary farm crops, and on heavy soils. The main effect is produced in the first year, but the residual value persists for another year or two. Shoddy is one of the cheapest nitrogenous manures on the market; it sells at 4s.—5s. per unit of nitrogen at the Yorkshire mills; in the south, transport charges increase the price to 7s.—8s. "Processed" shoddies, which have been treated with sulphuric acid or freed from oil, are of no more value than the untreated material. Untreated leather waste has no manurial value, but experiments with scrap that has been roasted or treated with sulphuric acid have given promising results. Untanned leather and scrap derived from the glove-making industry, have been proved to possess marked fertilising value.—E. H. T.

PATENTS.

Superphosphate; Tilling reaction chamber for—
H. W. Hall, Zürich, Switzerland. *Eng. Pat.* 22,645, Nov. 17, 1914.

THE reaction chamber consists of an iron cylinder, lined with masonry, prepared wood, or superphosphate, mounted upon bearings so that its axis can be tilted from the horizontal. The cylinder has an opening in the top to admit the mixture and to draw off the reaction gases to the ventilating flue, and a slit in the bottom through which the material detached by a cutter falls into a conveyor below. Under the slit and fixed to the cylinder are runways for the cutting machine, which are protected from the falling superphosphate. The slit and ends are suitably closed before filling and the covers removed when the mass has set. The cylinder is then tilted back and the revolving cutter, worked by a motor, advances down the inclined runway against the superphosphate by the component of its own weight. When

the whole is excavated the cutter runs out at the back, or the cylinder is tilted forward and the machine travels out on to a trolley.—W. H. N.

Phosphate compounds for manures and fertilisers; Manufacture of—
A. Dickson, Dublin, U.S. Pat. 1,132,171, March 16, 1915. Date of appl., Sept. 12, 1914.

SEE *Eng. Pat.* 18,999 of 1913; this J., 1914, 1067.

XVII.—SUGARS; STARCHES; GUMS.

Beetroots; Gummy malady of—
G. Arnaud. *Comptes rend.*, 1915, 160, 350—352.

SOME beetroots taken recently from silos in two districts of Northern France had become gummy as the result of bacterial action. The flesh of the roots was somewhat translucent owing to the bacteria partially dissolving the cells and filling the intercellular spaces with a colourless viscous fluid. The affected roots first exhibited translucent spots on the surface; these afterwards extended to the interior, and cavities were produced in the parenchyma adjacent to the bast fibres. In the worst cases the roots acquired a hard spongy consistence, but the interior did not become brown nor was there any offensive odour. The bacterium responsible somewhat resembled the *B. Mori* of Murier, and developed rapidly in beet juice at 38°—40° C., producing fine regular filaments; some of these showed no trace of segmentation even after staining with magenta, but others gradually became transformed into chains of isolated elements varying in length from 1 to 10 diameters. In some cases these chains closely resembled those of *Leuconostoc mesenteroides*, but there were always some filaments present, although these were rare in the viscous fluid which exuded spontaneously from the infected roots. The infected roots had probably been injured by cold, for it was found impossible to communicate the malady to sound roots. From the industrial point of view the malady is objectionable in that it causes inversion of the sucrose and gives rise to a gum which is difficult to eliminate.—J. H. L.

Sucrose; Inversion of—
Studies in catalysis.
Part II. A. Lambie and W. C. McC. Lewis. *Chem. Soc. Trans.*, 1915, 107, 233—248.

THE rate of inversion of sucrose by hydrochloric acid of varying concentration at 25°, 35°, and 45° C. was measured, and the values of the temperature-coefficients and their change with the concentrations of the catalyst were determined. It is shown that there is a slight fall in the critical increment (the extra amount of energy required to render 1 gm.-mol. "active") as the concentration of the catalyst increases, when the assumption is made that the undissociated molecule is active as well as the ions. These conclusions are in agreement with Rice's modification of the Marcellin equation, and with the theory that chemical reactivity is due to infra-red radiation.—J. P. O.

Sugars; Purity of the molasses adhering to raw (beet)—
A. Herzfeld. *Z. Ver. deut. Zuckerind.*, 1915, 65, 1. *Chem.-Zeit.*, 1915, 39, Rep. 43.

EXPERIMENTS made on 58 samples of raw beet sugars which had been stored for some time, indicated that the purity of the adhering molasses varies irregularly between the extremes of 60° and 75°. No relationship could be detected between the crystal content, the rendement value, the dry substance, and the calcium content of the sugars. The refining value of a raw sugar appears to depend largely upon its appearance, its purity,

the colour of its grain, and the nature of its solution in water.—J. P. O.

Sucrose : The direct and the invert polarisation of pure —. H. S. Walker. Hawaiian Chem. Assoc., Oct. 22, 1911, J. Ind. Eng. Chem., 1915, 7, 216—217.

SUCROSE was prepared from a high-grade sugar of such a degree of purity that it contained only 0.02% H_2O , 0.004% ash, and less than 0.016% reducing sugars (using Ost's solution). The direct polarisation of this sugar (26 grms. dissolved in 100 true c.c. of solution) was 99.80 at 22° C. By adding 0.06 as temperature correction and 0.02 for reducing sugars and ash, the polarisation of 26 grms. of pure sucrose dissolved in 100 true c.c. of solution is given as 99.88 at 20° C. By the double polarisation (Clerget-Herzfeld) method the percentage of sucrose, corrected for reducing sugars and ash, was 100.07. In a similar manner a sample of pure sucrose from the U.S. Bureau of Standards (H_2O , 0.002%; ash, 0.002%; invert sugar, less than 0.003%; theoretical direct polarisation, more than 99.99%) gave a direct polarisation of 99.90 and a sucrose content of 100.09 by the Clerget-Herzfeld method. These results indicate that to obtain a reading of 100% for pure sucrose with the present sugar scale, the Clerget factor should be increased from 112.66 to 142.78, whilst to give the same figure as the direct polarisation irrespective of the scale used, it should be increased to 142.92.—A. S.

Starch : Modification of — by gaseous hydrochloric acid. P. C. Frary and A. C. Dennis. J. Ind. Eng. Chem., 1915, 7, 214—216.

LAUNDRY starch was powdered until 70% passed a 100-mesh screen, and the fine powder (12.7% H_2O by drying at 105° C.) was treated in a revolving mixer with hydrogen chloride gas dried by sulphuric acid : 20 grms. of starch was used in each experiment, and the amount of acid absorbed was determined by titrating a 1 gm. sample with $N/10$ alkali in presence of methyl orange. The results indicate that the method is suitable for obtaining dextrin of good adhesive power, but not for producing soluble starch, because at low temperatures the amount of acid required is excessive, and at higher temperatures it is difficult to prevent rapid conversion to dextrin. Dextrin of good adhesive power and colour was obtained in 5 mins. at 80°—100° C. with 1.42% of acid, in 20 mins. at 90° C. with 1.81%, in 30 mins. at 80° C. with 2.96%, in 15 mins. at 50° or 20 mins. at 60° C. with 3.88%, and in 30 mins. at 100° C. with 0.33% of acid.—A. S.

Manufacture of spirit and pressed yeast from raw sugar. Reinke. See XVIII.

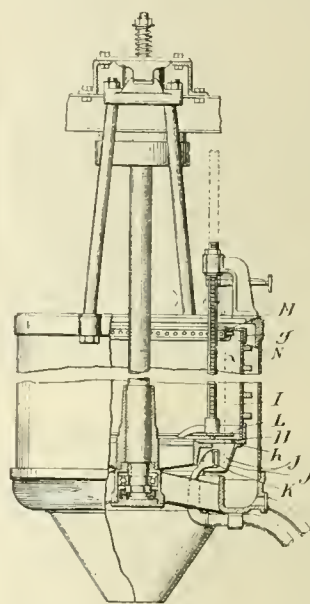
Diastase preparations from various carbohydrates. Panzer. See XVIII.

PATENTS.

Sugar solutions : Method of clarifying —. Centrifugal separator. E. W. Kopke, Honolulu, Hawaii, Assignor to Kopke Clarifier Co., Ltd. U.S. Pats. (A) 1,119,174 and (B) 1,119,175, Dec. 1, 1914. Date of appl., Sept. 28, 1911.

(A.) IN the continuous clarification of liquids, e.g., sugar juices, by centrifugal stratification, in order that the crude liquid may enter the stratifying chamber with the proper angular velocity, without emulsification and without disturbing the established strata, it is first introduced in the form of a thin ribbon at an acute angle upon a previously introduced body of the same liquid contained in a smooth, unobstructed, annular antechamber of the rotating vessel, so that each

stratum of the introduced liquid is accelerated by the preceding stratum in an outward direction. The outermost layer of the liquid in the antechamber, having attained the full velocity of the apparatus, is admitted as a thin, hollow cylinder, moving axially, beneath the surface of the liquid contained in the superposed stratifying chamber, in which separation of the suspended solid matters takes place, and a selected stratum of the separated liquid is discharged from the stratifying chamber by cylindrical overflow at the end opposite to that at which the liquid was introduced. (B.) In the figure, 1 is the imperforate, unobstructed stratifying



chamber having a relatively shallow radial depth indicated by the dotted line x . J is the antechamber having an inclined outer wall j , and a number of apertures, h , in the outer portion of the partition, I , separating the two chambers. The crude liquid is introduced through the pipe, K , and ascends through the apertures, h , being then distributed by the baffle plate, L , so as to enter the chamber, I , as a continuous tubular body of liquid at a point between the outer wall and the level indicated by the line, x . At the upper end of the stratifying chamber, the in-turned flange, g , is provided with a channel, M , the outer wall of which is perforated with apertures, into which nozzles, N , of variable length are inserted to collect the liquid for discharge from any desired depth of the stratified body.—J. F. B.

Dextrins : Process for obtaining crystallised —. H. Pringsheim. Ger. Pat. 279,256, Sept. 23, 1913.

CRYSTALLISED dextrins are produced by the action of *Bacillus macerans* on starch and are isolated by precipitation with light petroleum spirit. (See also this J., 1911, 439; 1912, 1001; 1913, 985.)—A. S.

Centrifugal separators. U.S. Pats. 1,119,173 and 1,119,176. See 1.

Process for rapidly preserving in sugar (crystallising) fresh fruit. Eng. Pat. 3867. See XIXA.

XVIII.—FERMENTATION INDUSTRIES.

Hops : Investigations on —. V. Aroma. J. Schmidt. Comptes rend. Trav. Lab. Carlsberg, 1915, 11, 149—163. (See also this J., 1915, 43.)

OWING to the difficulty of preventing fertilisation by foreign pollen in hop gardens, even in Germany

and Austria where the male plants are eliminated as far as possible, probably all the older commercial varieties of hops are more or less mixed types. Investigations on hops, for scientific or industrial purposes should be based on the study of clones (a clone is a group of plants derived originally from one individual by cuttings, all shoots and seedlings being eliminated). In 1911, individuals of several foreign varieties (Saaz hops from Bohemia, and two American types with very pronounced odour reminiscent of turpentine) were employed for the propagation of clones in the garden of the Carlsberg Laboratory. The clone-plants obtained up to the present have shown no deviation from the original types, as regards either aroma or appearance of the hops, so that the aroma of hops does not appear to be so "volatile" a character or so entirely due to local conditions as has been generally believed. When the two American types were crossed with Danish male plants, the characteristic aroma was transmitted to between 50 and 75% of the offspring; this result confirms some experiments made by E. S. Salmon at the Wye Agricultural College, Kent ("Notes on hops, 1912—1914").—J. H. L.

Wort; Preservation of——. F. Schönfeld. *Woch. Brau.*, 1914, 31, 351. *J. Inst. Brewing*, 1915, 21, 201.

To meet the fluctuating demand of an uncertain trade in beers for quick consumption, it may be economical to make large brews and to preserve the wort in a sterile condition for fermentation as and when required. Suitable storage is provided by cylindrical metal tanks, after the pattern of those used for the cultivation of pure yeast by the Stockhausen-Coblitz method, holding 1—10 hectolitres (22—220 galls.) of wort. These are filled with the hot wort and closed with a cover having a rubber washer and held down by a weak spring; as the wort cools the cover is drawn down and closes the tank gas-tight. To prevent the collapse of the tank under the partial vacuum, the bottom, which is constructed of relatively thin metal, is made convex and is drawn inwards as the contents of the tank contract.—J. F. B.

Wort and beer; Free and combined organic acids in——. W. Windisch and K. ten Doornkaat Koolman. *Woch. Brau.*, 1914, 31, 225—228, 235—237, 252—255, 275—282, 295—296, 303—308, 311—316. *J. Inst. Brewing*, 1915, 21, 205—208.

The separation of the organic acids from other substances which affect indicators, e.g. phosphates, proteins, etc., is effected by continuous extraction for 48 hours with ether in a modified form of the Partheil-Rose apparatus, before and after acidification of the beer with a mineral acid. The ethereal extracts are titrated with barium hydroxide in presence of rosolic acid and the volatile acids then separated by distillation with steam under reduced pressure. Wort contains considerable quantities of combined organic acids but very little in the free state; after fermentation the quantities of both are large. The composition of the wort as regards inorganic salts has an important influence on the production of acids by the yeast; hence the effect of the brewing water. A high proportion of carbonates in the water stimulates the yeast to produce acids; a wort prepared with such a water showed an increase of organic acids, from 3.1 to 6.3% during primary fermentation and a further increase to 7.9% during storage of the beer. Wort from the same malt with the same water de-carbonated by treatment with sulphuric acid contained an initial 6% of total organic acids, which increased to 8.6% during fermentation and then fell to 8.4% during storage. Wort made with de-carbonated water, under conditions specially favourable to proteolysis, contained initially

7.7%, rising to 12% during fermentation but falling to 8% during storage. Hence it would appear that the yeast tends to produce a quantity of acid which ultimately approximates to a definite value for a given wort. The formation of free organic acids is subject to the same conditions; these affect the flavour both directly and after esterification. When brewing water rich in carbonates is employed the free organic acids, like the total organic acids, increase during storage; long storage of such beers is therefore likely to improve their flavour, and it might be advisable to rack them at an earlier stage than beers made with waters only moderately rich in carbonates and sulphates. As regards lactic acid, worts made with waters rich in carbonates contain least, but after fermentation the beers may contain as much or more than those made with de-carbonated waters. In general an increase in the acidity of wort or beer is best detected by titration in presence of litmus, as the results are only affected by the hydrogen ions present. Wort prepared with a water rich in carbonates are less acid to litmus and less alkaline to methyl orange than those made with the same water after de-carbonation either by boiling or neutralisation. Of the volatile acids of beer, the greater part is in the free state, whereas the greater part of the non-volatile acids is combined with bases. Of the total lactic acid about one-third is free.—J. F. B.

Yeasts; Assimilation of nitrogenous matters by top-fermentation——. F. Schönfeld and R. Klok. *Wochensch. Brau.*, 1914, 31, 315—316. *J. Inst. Brewing*, 1915, 21, 204—205.

In bottom-fermentation beer worts, 45—65% of the total nitrogen is assimilable by yeast but only about one-third of this is actually consumed in brewery fermentations. In general, yeasts which produce high attenuations assimilate more nitrogen than low-attenuating varieties, but with top-fermentation yeasts a higher proportion of the assimilable nitrogen is taken up by the yeast even when the attenuation is low (*Doppelbier*, *Karamelbier*). In the case of Berlin *Weissbier*, with an apparent attenuation of 75%, the yeast absorbs as much as two-thirds of the total assimilable nitrogen of the wort. The difference between the behaviour of top- and bottom-fermentation yeasts in this respect is probably partly due to the higher temperature at which top-fermentation is conducted and partly also to the racial characters of the yeasts.—J. F. B.

Alcoholic fermentation; Pyruvic acid as catalyst for——. M. Oppenheimer. *Z. physiol. Chem.*, 1914, 93, 233—261.

Sodium pyruvate was found to accelerate the fermentation of dextrose by yeast maceration juice in a remarkable degree. In one experiment, addition of 0.1% to juice containing 1% of dextrose increased the production of carbon dioxide nearly sevenfold during the first hour, and about threefold during 24 hours, the total gas theoretically obtainable being produced within the latter period. Addition of only 0.01% of sodium pyruvate had practically the same effect, but the acceleration produced by higher concentrations, such as 1%, was much less. Various investigators have stated that free pyruvic acid is not readily fermented (cp. Neuberg and others, this J., 1911, 379, 1179, 1180; 1913, 620, 803), but the author found that 1% solutions in yeast juice were fermented as continuously as, and more rapidly than, 1% solutions of dextrose, and further that the free acid accelerated the fermentation of dextrose, though not to the same extent as its salts. At concentrations of 0.1 or 0.01% it had little effect, but at 1% the acceleration was

considerable. In view of these facts the results of fermentation experiments with pyruvic acid in presence of carbohydrates must be interpreted with caution: effects attributed to the action of carboxylase may have been due to some extent to stimulation of fermentation of carbohydrates. The fermentation of dextrose by yeast juice was found to be somewhat accelerated by very low concentrations (about 0.0005%) of acetaldehyde, which is a product of the decomposition of pyruvic acid by carboxylase (cp. v. Lebedeff and Griaznoff, this J., 1913, 1195; Kostytschew and Hübner, this J., 1913, 711). Sodium pyruvate considerably accelerated the fermentation of dihydroxyacetone by yeast juice, but not that of glyceraldehyde. In view of the general catalytic influence of pyruvic acid on fermentation, the author finds evidence for the fermentability of lactic acid (see this J., 1914, 156) in the observation that the production of carbon dioxide from a solution of these two acids in yeast juice was greater than from a control solution of pyruvic acid alone.—J. H. L.

Beers containing iron. F. Schönfeld. Wochensch. Brau., 1914, 31, 321—322. J. Inst. Brewing, 1915, 21, 213—215.

BEERS containing iron and possessing medicinal or dietetic qualities are manufactured in Germany: the percentage of iron ranges between 0.0002 and 0.011, without rendering the beer unpalatable. The introduction of iron may be effected by leaving the beer in contact with chemically pure iron, or more rapidly by the addition of insoluble compounds of iron, such as the hydroxide, the acids present in the beer exerting a solvent action. The same end is more readily attained by adding to the beer certain soluble pharmacological preparations, e.g. *Ferrum albuminum*, *F. peptonatum dial.*, *F. oxydatum sacch.*, *F. lacticum*, *F. citricum oxydat.*, *F. glycerino-phosphoricum*. The chief difficulty is due to the instability of the mixtures on storage, part of the iron being deposited as a "haze" or even as a sediment, owing to secondary reactions with the phosphates, organic acids, and tannin constituents of the beer. *Ferrum lacticum* is one of the most stable preparations, but its use is restricted on account of its marked influence on the flavour. There are two commercial preparations of sugar containing iron (*Eisenzucker*), one of which is alkaline and relatively stable; this remains soluble in beer for a considerable time, but eventually a precipitate is formed. The most suitable types of beer are the dark varieties which have been heavily primed with sugar. The sugars and caramels disguise the flavour of the iron and, as these beers contain less phosphoric acid and tannins than other types, there is less likelihood of precipitation. A high temperature of storage accelerates the secondary reactions which lead to precipitation of the iron.—J. F. B.

Wines: Acidity of —. C. Mensio and E. Garino. Annali R. Accad. Agric. Torino, 1914, 56, 138. Annali Chim. Appl., 1915, 3, 148—149.

THE values for the acidity of wine as determined by the effect on the inversion of sucrose at 76° C. and on the hydrolysis of ethyl diazoacetate are not always equal. As determined by the effect on the inversion of sucrose, the acidity of ordinary table wines was equal to that of N/1000 HCl, the acidity of dry, white wines was equal to that of N/1700 HCl, and the acidity of bouquet wines was equal to that of N/3000 HCl. The addition of 150—300 grms. of calcium sulphate per hectolitre produced a great increase in the acidity, whilst a similar addition of dicalcium phosphate had no effect. The increase of acidity produced by addition of phosphoric acid was less than that

caused by addition of sulphuric acid but about equal to that produced by addition of calcium sulphate.—A. S.

Vinegar eels; Destruction of —. J. F. Sacher. Chem.-Zeit., 1914, 38, 1186.

THE author has stated recently that vinegar eels are killed within a few days when 0.1% of hydrochloric acid is present in the vinegar in the free state (see this J., 1915, 193), whilst Henneberg found (Biologie des Essigaales, 1899) that the eels survived in vinegar to which 0.2% of hydrochloric acid was added. In explanation of this apparent difference it is pointed out that the greater part of the acid added would combine with the acetates, particularly calcium acetate, in the vinegar and but a small quantity, if any, of the acid would remain in the free state. Henneberg himself found that a 0.1% solution of hydrochloric acid in distilled water was fatal to the eels, whereas the addition of 0.1% of the acid to a vinegar containing 6.5% of acetic acid was without effect. It is evident that the eels are not destroyed by the gastric juice.—W. P. S.

Spirit and pressed yeast; Manufacture of — from raw sugar. O. Reinke. Chem.-Zeit., 1915, 39, 149.

THE Prussian government has permitted the use of raw sugar denatured with 2% of lampblack for distillery purposes, with a reduction of the sugar tax to M.2 per 100 kilos. In employing raw beet sugar the addition of the sugar must be regulated in accordance with the quantities of nitrogen and phosphoric acid contributed by the other materials, such as cereals, yeast extract, etc.; the sugar must be sterilised by heat and its alkalinity corrected either by an increased acidity of the preliminary malt and rye mash or by the addition of lactic or mineral acid. If the sugar already has an acid reaction, the addition of 0.01% of sulphuric acid to the wash will be sufficient; the total acidity should be 0.2%, equivalent to 0.09% of lactic acid. Pure sucrose yields in practice 49.8% of alcohol, equal to 0.6274 litre per kilo. Raw beet sugar contains 90—96% of sucrose and 0.9—2.8% of ash; a raw sugar containing 92% of sucrose would yield 57.7 litres of alcohol per 100 kilos. If the wash is made up in the form of a 20% solution of sugar, with additions of malt-combs, malt, barley grist, or of large quantities of brewery yeast. In the latter case, 20 kilos. per 1000 litres is employed, of which 18 kilos. is pressed and submitted to plasmolysis at 68° C. for 2 hours, whereby soluble phosphates and nitrogenous matters are formed and the yeast is killed. With smaller additions of sugar, the thin mashes are made up to a total concentration of 20%; the same holds good for yeast cultivation either by the old Vienna process or the aeration process.—J. F. B.

Yeast; Measurement of the fermentative action of — by means of the liquid interferometer. O. Wolff. Chem.-Zeit., 1915, 39, 197—198. (See also this J., 1915, 371.)

THE interferometer was applied to the measurement of the rates of fermentation produced by different yeasts in 10% sucrose solutions. In standardising the instrument, a reading of 1817 was obtained when one 0.5 cm. cell was filled with a 10% solution of sucrose (by weight) and the other with a 10% solution of alcohol (by volume), the reading with both cells filled with the same solution being zero. The intermediate readings observed when mixtures of the two solutions in various proportions were used in the second cell, were strictly proportional to the alcohol-content of the mixtures. The experiments with yeast were carried

out as follows:—10 c.c. of a 5% suspension of yeast was added to 100 c.c. of 10% sucrose solution. Half of the liquid was at once heated to 60° C. to kill the yeast, and then centrifuged, and the clear liquid was employed in the first cell (1 cm.). The other half was maintained at 28.5° C. and portions were withdrawn at intervals of 1 hour, heated rapidly and centrifuged, and the clear liquid introduced into the second cell. The readings observed, plotted against the duration of fermentation, gave in all cases a fair approximation to a straight line graph, though in some cases there were irregularities during the first three hours. The curves for the seven yeasts investigated showed marked differences in their inclination to the axes, and the method thus affords a means of comparing the rates of fermentation produced by different yeasts.

—J. H. L.

Alcoholic liquors: Determination of the iodine value of— by Hübl's method. Iodine value of essential oils. R. Marcille. Ann. Chim. Analyt., 1915, 20, 52—57.

EXPOSURE to light and the alcoholic strength of the solution have a considerable influence on the results obtained in the determination of the iodine value of alcoholic liquors containing essential oils. In the following table the figures express grms. of iodine per grm. of essential oil, and grms. of iodine per litre in the case of absinthe:—

	In the dark.	In diffused light.	In bright light.
Aniseed oil dissolved in 95% alcohol	1.35	1.51	1.62
do. do. 50% do.	1.27	1.80	1.57
Turpentine oil do. 95% do.	3.19	—	2.67
do. do. 50% do.	3.36	3.18	1.78
Absinthe liqueur	2.7	3.7	3.1

The concentration of the essential oil solution and the temperature during the time of contact of the solution with the Hübl reagent have also some influence on the results. Therefore, in determining the quantity of essential oil in an alcoholic solution by means of the Hübl method, a control experiment should be made at the same time and under the same conditions, using in this control or standard, a solution of equal alcoholic strength and containing approximately the quantity of the oil present in the solution under examination.—W.P.S.

Diastatically active substance from lactose: Production of a—. XII. T. Panzer. Z. physiol. Chem., 1914, 93, 316—330. (See also this J., 1913, 41, 411, 547, 620, 669, 707, 708, 837, 920.)

Dry powdered lactose exposed to a current of dry hydrogen chloride and afterwards to ammonia, by the method previously applied to invertase and diastase, acquired a feeble capacity for saccharifying starch. In two cases the product was sufficiently active to yield saccharification tests showing only a red coloration with iodine; but such products could not be prepared at will, and in most cases the only evidence of diastatic power was a slight increase in the reducing power of the test liquids. By boiling solutions of the treated lactose the activity was destroyed. The treatment with ammonia was indispensable for the preparation of active products, for lactose which had been simply exposed to hydrochloric acid and then stored *in vacuo* over sulphuric acid and soda-lime remained inactive. The effect of the latter treatment in conferring slight activity on diastase previously made inactive by heat (see this J., 1913, 837, 920) may be due to the presence of nitrogenous matters which renders exposure to ammonia unnecessary.—J. H. L.

Diastase preparations from various carbohydrates.

T. Panzer. Z. physiol. Chem., 1915, 93, 339—351.

Products similar to that obtained from lactose (see preceding abstract) are also obtained when starch, dextrin, gum arabic, sucrose, maltose, dextrose, and galactose are treated successively with hydrochloric acid gas and ammonia gas. In the case of sucrose and dextrose, the diastatic product is obtained only when the sugar is subjected to the successive action of ammonia, hydrochloric acid, and ammonia. Lævulose was the only sugar which did not give an active product.

—W. P. S.

Apple cider; Manufacture of concentrated— in America. J. Roy. Soc. Arts., 1915, 63, 461.

THE U.S. Department of Agriculture, through its Fruit and Vegetable Utilisation Laboratory, is about to make a commercial test of a new method of concentrating apple cider, in which the cider is frozen and the ice crushed and submitted to centrifugal action, whereby the concentrated juice is expelled, leaving about 80% of the water as ice.

Prizes for methods of denaturing and utilising spirit in Russia.

THE Russian Ministry of Finance offers prizes of 30,000, 15,000, and 5,000 roubles to international competition, for new denaturing agents for improving the existing methods of denaturing. The agents must convert the spirit into a liquid unfit for direct use as a beverage, and should be of such nature that they do not spread a suffocating odour which renders the use of the spirit inconvenient or injurious. They should not leave a residue on combustion, nor contain elements which would damage the apparatus in which the spirit is burning. The separation of the denaturants from the spirit by means of simple methods (by water, salting, filtering through charcoal, simple distillation, etc.) must be impracticable. The primary substances, from which the denaturing agents are prepared, must be obtainable in Russia in suitable quantities.

Prizes of 60,000, 30,000, and 10,000 roubles are also offered for a new method of adapting spirit to the preparation of a product different from the spirit used in its preparation (e.g., vinegar, ether, chloroform, etc.).

Prizes of 50,000, 20,000, and 5,000 roubles are offered for a new method to apply spirit for the preparation of a product in which the spirit or its derivatives (sulphuric ether, etc.) form one of the constituent parts of the product or serve as solvent (e.g., pharmaceutical and perfumery preparations).

Prizes of 30,000, 15,000, and 5,000 roubles are offered for methods for applying spirit in an industry in which the spirit or its derivatives (sulphuric ether, etc.) should serve either as a transitory intermediate solvent or an extracting or precipitating substance; as, for instance, in the preparation of smokeless powder or artificial silk.

Four prizes respectively of 75,000, 50,000, 30,000, and 20,000 roubles for an invention or improvement relating to apparatus for utilizing spirit in internal combustion engines, and similar prizes for apparatus for utilizing spirit or its derivatives as fuel.

Four prizes respectively of 50,000, 30,000, 15,000, and 5,000 roubles are offered in connection with apparatus for applying spirit to lighting purposes.

Competitors must present their declarations not later than January 1st, 1916, in Russian or French languages, to the Department of Unassessed Taxes and Spirit Monopoly (Glavnoe Oupravlenie Neokladnich Sborov i Casennoi Prodady Pitei, Petrograd). Further particulars may be obtained from Messrs. E. P. Alexander and Son, 306, High Holborn, W.C.

PATENTS.

Beer, stout, and other liquids: Machines for carbonating—P. Wilkinson, Manchester. Eng. Pat. 12,109, May 16, 1914.

The supply of liquid to the carbonating vessel is controlled by a by-pass pipe fitted to the bottom of the vessel and connecting it with the suction-side of the pump. The orifice of this pipe inside the vessel is closed by a valve controlled by a float which opens the by-pass when the liquid rises above the desired level.—J. F. B.

Amylaceous materials: Process for the liquefaction, saccharification, and fermentation of—A. Boidin and J. Effront. First Addition, dated July 11, 1913, to Fr. Pat. 461,853, Nov. 7, 1912 (this J., 1914, 213).

Hot water is circulated in the vessel in which the grain is steeped and through an external pipe provided with injectors for steam and compressed air to maintain the temperature and circulation. When sufficient water has been absorbed, depending on the hardness of the corns, the grain is discharged through the same pipe into a screw-conveyor working in a perforated trough. The excess of water drains back into the steeping tank, while the grain is delivered through crushing rollers into the starch-converting vessel.—J. F. B.

Amylaceous materials: Saccharification and fermentation of—A. C. Molhant. Fr. Pat. 471,775, July 18, 1913.

STARCHY materials are liquefied by digestion with boric acid or its compounds, the quantity of malt required for their ultimate saccharification being thereby reduced. Fermentation is effected by special yeasts acclimatised to boric acid.—J. F. B.

Alcoholic fermentation: Product intended to promote and control—and process of making same. V. A. Sebastian. Fr. Pat. 471,784, July 19, 1913.

SULPHITED citrophosphate of ammonium is added to the must in the proportion of about 40 grms. per 130 kilos. of grapes or per 100 litres of wine. The components of the sulphited citrophosphate may be combined in various ways, e.g. by passing sulphur dioxide into a solution containing citric acid, phosphoric acid, and ammonia, suitable proportions being equivalent to 280 grms. of triammonium phosphate and 260 of sulphur dioxide.—J. F. B.

Yeast: Manufacture of—from worts containing little or no sugar. Verein der Spiritusfabrikanten in Deutschland. Fr. Pat. 472,073, May 6, 1914. Under Int. Conv., May 6, 1913.

YEAST is cultivated by the "aeration" process, without appreciable production of alcohol, by growth in worts previously deprived of sugar by bacterial acidification. The yeast derives its carbon nutrition from the organic acids, which may be neutralised during the process of acidification by the addition of alkalis, being afterwards liberated by means of mineral acids. If sugar be present during the cultivation of the yeast, the proportion of free organic acids should be at least 10% of the total extract. Spent wash from distilleries may be used for making up the wort, and the process may be combined with that of the manufacture of starch by the acidification process, the yeast being cultivated in the clear liquor separated from the starch or from the mixture of liquor and ungelatinised starch. In certain cases the yeast and lactic acid bacilli may be cultivated simultaneously.—J. F. B.

Enzymes and toxins: Method and apparatus for the manufacture of—by oxidising ferments. A. Boidin and J. Effront. Fr. Pat. 471,516, July 11, 1913.

ENZYME solutions of high diastatic power are prepared by cultivating micro-organisms in worts very rich in nitrogenous constituents, particularly in extracts of soy beans or the oil-cake derived therefrom. The apparatus is constructed of aluminium or enamelled metal and consists of a digester for preparing the extract, a closed cultivation vessel which can be charged under sterile conditions from the digester, and means for providing a free circulation of sterilised air from above downwards. The micro-organisms are cultivated in the form of films, the vessel being filled with a number of superposed shallow trays to which a slight reciprocating motion may be imparted at intervals by means of a central shaft and external gearing to assist diffusion without submerging the film. A strong superficial aeration is provided in the early stages, being gradually decreased as the growth accumulates; when the culture is ready the trays may be emptied by centrifugal force and refilled with further quantities of sterilised wort.—J. F. B.

Amylaceous substances: Process and apparatus for the liquefaction, saccharification, and fermentation of—A. Boidin, Seelin, France, and J. Effront, Brussels. Eng. Pat. 23,738, Oct. 20, 1913.

SEE Fr. Pat. 461,853 of 1912; this J., 1914, 213.

Maturing or ageing wines, spirits, or other potable liquors: Process for artificially—V. Henri, A. Helbrunner, and M. von Recklinghausen, Paris, Assignors to The R.U.V. Co., New York. U.S. Pat. 1,130,400, March 2, 1915. Date of appl., May 31, 1910.

SEE Fr. Pat. 403,674 of 1909; this J., 1910, 101.

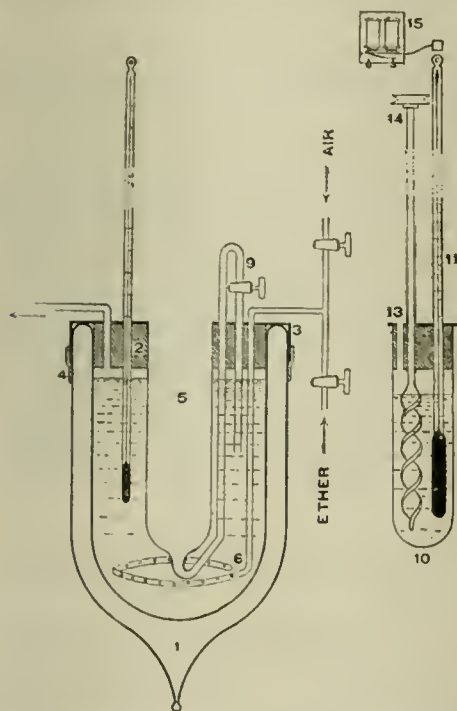
XIXA.—FOODS.

Milk: The freezing point of—considered in its relation to the detection of added water. G. W. Monier-Williams. Report to the Local Gov. Board, 1914, Food Report No. 22, 1—32.

THE first part of the Report deals with the factors influencing the correct determination of the freezing point of a solution, e.g., sources of error inherent in a mercury thermometer, mechanical production of heat by the stirrer, too low a temperature of the freezing bath, increase in the concentration of the solution owing to separation of ice (supercooling), etc. The accuracy of the thermometer scale is best controlled by a comparison of the freezing points of sucrose solutions of known strength with the very accurate values given by Raoult (*Z. physik. Chem.*, 1898, 27, 617); a table showing these values is given in the Report. The errors introduced by the stirrer and by having the temperature of the bath too low, may be eliminated by so regulating the temperature that the freezing point of the solution coincides with the so-called "temperature of convergence," i.e., the point at which the solution is in exact heat equilibrium with its surroundings. The convergence temperature varies with the apparatus and must be determined by experiment; in the apparatus described below it was found to be 0.24° C. above the bath temperature. The error due to increase in concentration owing to the formation of ice may be very large and appears to have been overlooked by most investigators. If a solution is cooled below its freezing point and a minute fragment of ice is introduced, formation

of ice occurs in the liquid and the temperature rises immediately to a point which approximates the true freezing point. Owing to the separation of the ice, however, the observed freezing point will be that of a solution more concentrated than the original solution. Raoult has shown that the effect of supercooling may be expressed by the equation: $K = \frac{C' - C}{CS}$, where C' = the observed value, C = the true depression, S = degrees of supercooling, and K = a constant. The latter is found by determining the freezing point for different degrees of supercooling; if the values found are plotted as ordinates and the degrees of supercooling as abscissa, an approximately straight line is obtained from which the true freezing point for supercooling *nil* may be found. K is then calculated from the above formula. For sucrose solutions $K = 0.015$ and for milk $K = 0.017$.

The apparatus used in the determinations is shown in the illustration. A Dewar vacuum vessel, 1, of 10 cm. internal diameter and 16 cm. internal



depth, was closed with a cork disc, 2, about 1 inch thick, glued to a metal plate and ring, 3, and the cover thus formed could be made air-tight by a rubber ring, 4. Through the middle of the cork disc passed a glass tube, 5, of 3.8 cm. internal diameter, the joint with the metal plate being made air-tight with glue-cement. The cork disc also carried a copper inlet tube for ether and air, an outlet tube, a thermometer graduated to 0.01° C. and a siphon, 9, connected with the lower end of the tube, 5, and so designed that ether could be admitted or withdrawn from the Dewar vessel. The freezing tube, 10, was a thin glass test-tube, 3.5 cm. internal diameter; it was closed by a cork, 1 inch thick, carrying the thermometer, 11, a spiral glass stirrer, and a small opening, 13, provided with a stopper. It also carried another thermometer, not shown in the figure, graduated to 0.1° C., to indicate the degree of supercooling. The freezing point was determined in the following manner:—Ether, dried over calcium chloride, was

drawn into the Dewar vessel until the latter was full. About 60 c.c. of liquid, of which the freezing point was to be determined, was introduced into the tube, 10, which was then closed with the cork and introduced into the freezing tube, 5. Ether was allowed to flow from the Dewar vessel through the siphon, 9, into the space between the tubes, and the stirrer was connected with the rotating spindle, 14, driven by an electric motor. The supply of ether was now shut off, and a rapid current of air drawn through the apparatus. As the ether evaporated it was replenished by shutting off the air supply and opening the tap connecting with the ether supply. In this way the temperature of the bath could be lowered to -4° C. in 15–20 minutes. The ether in the space between the tubes, 5, and 10, served as a heat conducting medium, and the temperature of the solution was lowered far more rapidly than when the space contained air. The stirrer was rotated at a constant speed of about 1300 revolutions per minute. When the solution had reached the desired degree of supercooling, i.e. about 0.5° C. below the expected freezing point, the air supply was shut off, and the tap on the siphon tube, 9, opened. The ether in the space between the tubes, 5, and 10, was thus replaced by air. The tap on the siphon tube was now closed and ether at the ordinary temperature drawn into the Dewar vessel until the temperature of the bath had risen to a point about 0.24° C. below the expected freezing point. The degree of supercooling was noticed, and a minute fragment of ice introduced through the opening, 13. A small electric hammer, 15, was then set in motion (the succession of sharp taps given to the thermometer by this hammer prevented the "lag" or sticking of the mercury in the fine capillary), and the point to which the mercury of the thermometer, 11, rose, was observed through a telescope at a distance of a few feet, the temperature of the bath being kept constant by drawing ether or air through it as required. The thermometer, 11, had a total range of about 1° C., divided into intervals of 0.005°; each 0.005° division occupied a length of about 0.4 mm. The observed freezing point remained constant for an indefinite period, provided that the bath temperature and the speed of the stirrer did not alter. For practical purposes, the process may be simplified by dispensing with the determination of the zero point given by distilled water, and comparing the freezing point of the milk sample with that of a solution of 9.495 grms. of pure sucrose in 100 grms. of water; this solution freezes at exactly -0.5345° C., the average freezing point of normal milk. If the two determinations are carried out in precisely the same manner, the difference between the two results will indicate fairly accurately the true freezing point of the milk in question. The bath may be ice and salt and the temperature as low as -5° C. The freezing point of milk is not appreciably affected by the removal of the fat, but the development of acidity to any great extent has a considerable influence. The increase of acidity, however, is very slow during the preliminary stages of souring and the taste and smell of the sample are very good guides as to whether or not the freezing point method is applicable; a sample has to smell and taste distinctly sour before the freezing point is depressed by as much as 0.002° C. Pasteurisation for 20 minutes at 60° C. raises the freezing point by about 0.002° C.

The average freezing point of 141 samples of genuine milk was found to be -0.5345° C., the values found ranging from -0.558° to -0.514° C.; these values have been subjected to all the necessary corrections and are probably accurate to about ±0.002° C. The freezing point appears to be the most constant of any of the

properties exhibited by milk. It is unaffected by the addition of separated milk to genuine milk, but it is raised by the addition of water. The method may, in certain cases, be applied with advantage, as a confirmatory test, to the detection of added water and to the approximate determination of the amount present, but owing to the experimental difficulties involved in obtaining reliable results, it does not appear to be capable of general application for purposes of milk control.—W. P. S.

Milk; Coagulation of—, and the solubility of the curd in salt solution. Orla-Jensen, B. Meyer, and A. D. Orla-Jensen. Z. physiol. Chem., 1914, 93, 283—306.

THE investigation relates to coagulation by calcium chloride, rennet, and acids. Mono-, di-, and tri-calcium and sodium caseinates are all salted out from aqueous solution by calcium chloride in the cold, the mono-salts most readily and the tri-salts least readily. Similar coagulation of the casein in milk by calcium chloride takes place only on warming. It is probable that the first step is a disturbance of the equilibrium between the salts of the milk, resulting in increased acidity and precipitation of lime as phosphate and probably as citrate, after which the dicalcium caseinate is coagulated by the calcium chloride as in pure aqueous solutions. A 3% solution of dicalcium caseinate containing 0.08% of calcium chloride is curdled by rennet in the same way as cow's milk. Solutions of mono- and tri-calcium caseinates may also be coagulated by rennet if they contain at least half as much calcium chloride as would by itself produce coagulation. To coagulate solutions of sodium caseinates with rennet, a slight excess of calcium chloride over that necessary to convert the casein into calcium salts, must be added. The coagulation of milk or solutions of pure caseinates with rennet, which, according to Hammarsten, is a proteolytic transformation, is not accompanied by any increase in the quantity of free amino-groups as measured by titration with acid after treatment with formaldehyde (see Sørensen, this J., 1908, 135). In the curdling of milk by acids at about 35° C., coagulation begins before all the caseinates have been converted into free casein, but is only complete when sufficient acid has been added to extract completely the calcium from the casein. At 60°—80° C. smaller quantities of acid suffice for complete coagulation, but this is partly due to the dissolved calcium salts; for not only does the coagulating power of the latter increase with rise in temperature, but the added acid, by partially decomposing calcium caseinates, increases the concentration of the active calcium salts and converts dicalcium into monocalcium caseinate which is more readily coagulated by calcium ions. The calcium salts of casein and paracasein (the coagulable product of the action of rennet; see Hart and van Slyke, this J., 1905, 509) form clear liquids with sodium chloride solutions, being converted into sodium salts, but the presence of other calcium salts tends to inhibit this reaction, especially with the dicalcium compounds. Hence the dicalcium caseinate in milk is difficult to bring into solution with salt, unless sufficient acid is first added to convert it into monocalcium caseinate; and the same applies to the paracaseinates in milk curdled by rennet. By using larger amounts of acid than are necessary to extract the calcium completely from the casein (or paracasein), soluble acid-albumins are formed, which are less soluble in 5% sodium chloride solutions than the original proteins. With milk the maximum solubility of monocalcium caseinate or paracaseinate lies at a concentration of 5—10% of sodium chloride; at a concentration of 25%

monocalcium caseinate is salted out as completely as the dicalcium compound.—J. H. L.

Condensed milk, evaporated milk, concentrated milk. U.S. Dept. Agric., Food Inspection Decision 158.

THE Joint Committee on Definitions and Standards of the American Association of Dairy, Food, and Drug Officials, the Association of Official Agricultural Chemists, and the United States Department of Agriculture, on November 20th, 1914, adopted the following definition and standard for condensed milk, evaporated milk, concentrated milk:—

Condensed milk, evaporated milk, concentrated milk, is the product resulting from the evaporation of a considerable portion of the water from the whole, fresh, clean, lacteal secretion obtained by the complete milking of one or more healthy cows, properly fed and kept, excluding that obtained within fifteen days before and ten days after calving, and contains, all tolerances being allowed for, not less than 25.5% of total solids and not less than 7.8% of milk fat.

Food Inspection Decision No. 131 is revoked.

Proteins; Well-characterised organic sulphur compound obtained from—by treatment with nitric acid. C. T. Mörner. Z. physiol. Chem., 1914, 93, 175—202.

IT is known that the whole of the sulphur present in proteins cannot be oxidised to sulphuric acid by nitric acid, and the author attempted to ascertain the nature of the resistant compound or compounds formed under these conditions. Large quantities of serum albumin, egg albumin, casein, ovomucoid, haemoglobin, keratin (sheep's wool), and gluten (gelatin) were oxidised by excess of nitric acid, and from the products in all cases methylsulphonic acid was isolated in the form of its barium salt, $(\text{CH}_3\text{SO}_3)_2\text{Ba} + 1\frac{1}{2}\text{H}_2\text{O}$. The amounts obtained varied from 1.4 to 12.4 grms. (of barium salt) per kilo. of protein, and bore no relation to the quantities of cystin present. Moreover, under the conditions of oxidation employed, cystin does not produce methylsulphonic acid, so that all the proteins investigated must contain some other form of combined sulphur.—J. H. L.

Fatty acids and other ether-soluble constituents of feeding stuffs; Determination of the total—. J. B. Rather. J. Ind. Eng. Chem., 1915, 7, 218—220.

ALCOHOLIC alkali is used to extract the fatty matter. 10 grms. of the sample, or 5 grms. if it is bulky or contains more than 4% of matter soluble in ether, is boiled with 50 c.c. of 2N alcoholic soda for 1 hour under a reflux condenser, the mixture is filtered through asbestos, the residue washed ten times with boiling redistilled alcohol, the solution evaporated to 10 c.c., transferred to a separating funnel with hot water, acidified with 10 c.c. of acetic acid, and extracted warm with five successive 50 c.c. portions of redistilled ether. The ether extract is treated as described previously (this J., 1915, 195) to determine the unsaponified matter. The aqueous soap solution obtained in this process is heated to expel dissolved ether, cooled, treated with 8 c.c. of glacial acetic acid, and extracted with 40 c.c. of petroleum spirit of b. pt. below 75° C.; the suspended matter which settles to the bottom is removed with the aqueous layer, and this is extracted three times more with petroleum spirit. The united petroleum spirit solutions are washed with two 50 c.c. portions of water, and the aqueous liquid extracted with petroleum spirit, the extract being washed twice with water and added to the main portion, which is then evaporated and the residue of fatty acids dried till of constant weight. The aqueous liquid from the extraction of

the fatty acids contains saponified matter other than fatty acids. It is treated with hydrochloric acid and extracted as described above, but using ether instead of petroleum spirit. The above method gives results for total fatty acids one-fifth higher in the case of concentrated feeding stuffs and more than twice as high in the case of hays and excrements from them than those obtained by extraction with ether. The ether extracts of concentrated feeding stuffs contain on the average 14% and the ether extracts of hays and excrements 68% of non-fatty substances.—A. S.

Nitrogen and fat in short-staple cotton-seed. Wells and Smith. See XI1.

PATENTS.

Fruit; Process for rapidly preserving in sugar (crystallising) all kinds of fresh —. J. Anfossi, Aix, France. Eng. Pat. 3867, Feb. 14, 1911. Under Int. Conv., Feb. 21, 1913.

THE fruit is immersed in a solution of sucrose and "glucose" of 10° B. (sp. gr. 1.075) heated to 60°–70° C.; fresh quantities of the solution are added to compensate for evaporation until, at the end of 24 hours, the solution has become concentrated to 33° B. (sp. gr. 1.297); the fruit is then removed, drained, washed with hot water, and glazed with sugar in the usual way.—W. P. S.

Bread; Manufacture of —. W. A. Hobbs, Pittsburgh, Pa., Assignor to C. Adams, New Rochelle, N.Y. U.S. Pat. 1,131,698, March 16, 1915. Date of appl., April 30, 1911.

To obtain loaves of superior whiteness, a small quantity of calcium hypochlorite is added to the flour, the mixture is allowed to stand, and, after being made into dough, is treated with sufficient of a neutralising agent to remove the alkalinity of the hypochlorite.—J. H. J.

Coffee; Process of manufacture from cereals of a substitute for colonial —. A. Pietsch. Fr. Pat. 471,901, May 7, 1914. Under Int. Conv., Oct. 29, 1913.

A CEREAL, such as barley, is steeped in a solution of substances giving rise to the aroma and taste of coffee, namely, tannin, furfural, citric acid, sugar, infusion of hops, pyridine, etc.; caffeine is not used. The mixture is heated, and when the grains have absorbed most of the liquid, they are removed, roasted and ground. This powder is added to about ten times its weight of boiling water and the infusion strained. More tannin, sugar, and pyridine are added to it, and a fresh supply of barley. When this grain has absorbed the infusion, it is roasted and ground, and possesses the aroma of coffee.—J. H. J.

Frail and vegetable dust and process of making same. H. Friedenthal, Berlin-Nicolassee, Germany. U.S. Pat. 1,130,588, March 2, 1915. Date of appl., July 30, 1913.

SEE Eng. Pat. 17,723 of 1913; this J., 1914, 330.

XIXB.—WATER PURIFICATION; SANITATION.

Chemotherapeutic preparations and other antiseptics; Effects of — on bacteria. O. Schiemann and T. Ishiware. Zeits. Hyg., 1914, 77, 49. Chem.-Zeit., 1915, 39, Rep. 37.

SALVARSAN has a very strong antiseptic action on the germs of anthrax, erysipelas, and glanders,

Ethylhydrocupreine is similarly potent against pneumococci; even in dilutions of 1:500,000—1:1,000,000 the inhibitive action is marked, although the germs are killed but slowly; towards other germs it is less powerful. The selective action is approximately the same in serum as in broth; it is more pronounced in activated serum than in unactivated, whilst the reverse is the case with mercuric chloride. The effect of phenol is diminished less than that of mercuric chloride by using a serum medium, and to about the same extent in both kinds of serum. Salvarsan is markedly less active in ox-serum than in rabbit-serum. The action of salvarsan, mercuric chloride, and phenol in broth cultures is reduced considerably by addition of lecithin or cholesterol.

—E. H. T.

Saponin; Influence of — upon disinfectants. K. Rotky. Zentralbl. Bakteriol., 1914 (1), 73, 195. Chem.-Zeit., 1915, 39, Rep. 58.

BY the addition of saponin the disinfecting action of carbolic acid, tar preparations such as lysol and odorite, formalin, etc. is increased; that of hydrochloric acid, potassium hydroxide, and mercuric oxycyanide is unaffected; and that of silver nitrate and corrosive sublimate is decreased.

—J. R.

Dental cements; Germicidal efficiency of —. P. Poetschke. J. Ind. Eng. Chem., 1915, 7, 195–202.

AN investigation of the germicidal efficiency of so-called "copper cements" or "copper oxyphosphates," which are mixed for use with a concentrated solution of phosphoric acid to which aluminium hydroxide and sometimes iron and nickel salts have been added. The cements usually consist of copper salts and zinc oxide, with various filling materials and colouring matters. They differ widely in germicidal activity, which is best determined by mixing the cement, allowing it to set and harden, then grinding it, adding a known quantity of the powder to saliva at 37° C., and preparing cultures at different dilutions on nutrient agar-agar in the usual way. Cuprous and cupric oxides and zinc oxide were found to possess marked germicidal properties, and the bactericidal effect of zinc oxide was enhanced by addition of cuprous oxide or iodide or cupric phosphate.—A. S.

Purification of lunnyery effluents. Veitch. See XV.

Risk of poisoning by volatilised mercuric chloride. Moll. See IX.

PATENTS.

Water and other liquids; Process and apparatus for determining the degree of impurity of —. Z. Wegrzecki. Fr. Pat. 471,351, April 25, 1914.

A KNOWN volume of the water is treated with a precipitant, such as basic lead acetate or alum, the mixture filtered through a layer of paper or other white material, and the filter is dried and the stained surface compared with a series of standard stains produced by known amounts of impurity.—J. H. J.

Liquids; Means for sterilisation, filtration, and similar treatment of —. L. Linden, Brussels. Eng. Pat. 5512, March 4, 1914. Under Int. Conv., March 10, 1913.

THE liquid is passed successively through a settling tank, a horizontal filter, a chamber divided by a vertical partition over which the liquid flows, a second horizontal filter, and a second settling tank.

On leaving the upper part of the latter, the liquid is treated with a suitable reagent, and passes through two mixing tanks and thence through a series of vessels exactly similar to the first set. The direction of flow of the liquid through the whole apparatus may be reversed to cleanse the filters, etc., and the liquid in the chamber between the filters may be drawn off through a tap at the bottom, thus causing any liquid above the surface of the filters to pass downwards and aid in the cleansing operation.—W. P. S.

Sterilisation, filtration, and similar treatment of liquids. L. Linden, Brussels. Eng. Pat. 6273, March 12, 1914. Under Int. Conv., April 19, 1913. Addition to Eng. Pat. 5512 of 1914. (See preceding abstract.)

IN the treatment apparatus, each filter compartment has a settling compartment associated with it, and each pair is arranged in series. At the extremes of the series are reaction chambers. The liquid flows downwards through each filter and upwards through each settling compartment. Along the top of the compartments is a frame covered with filtering cloth impregnated with a cream made from chalk, alum, or other substance which will act as a filtering and sterilising agent. The filters are cleansed by reversal of flow, and conical spaces are provided below each pair of vertical compartments for the collection of the removed matters.—J. H. J.

Sterilising liquids; Process of and apparatus for —. J. Mérie, Paris. Eng. Pat. 9495, April 16, 1914. Under Int. Conv., April 26, 1913.

IN apparatus where the liquid to be sterilised is passed through a heat-exchanger before it enters the steriliser, means are provided for filling the steriliser and the outlet passage of the heat-exchanger with water. The steriliser is then heated, and, when the water has been sterilised, the liquid to be treated is introduced under constant pressure, driving the water out of the apparatus. At the end of the operation, the apparatus is again filled with water in readiness for subsequent use.—W. P. S.

Sterilising water; Process and apparatus for —. G. Ornstein. Fr. Pat. 471,627, Feb. 12, 1914. Under Int. Conv., Feb. 14, 1913.

GASEOUS chlorine, supplied from a cylinder of the liquefied gas, is passed into the bottom of a tower filled with contact material where it meets a current of the water to be sterilised trickling downwards: the proportions of chlorine and water can be adjusted by taps on the respective supply pipes. The solution obtained runs from the bottom of the tower into a main pipe of the supply to be treated. A pressure regulator may be placed on the pipe admitting the chlorine gas to the tower. Four types of apparatus are described and illustrated.—J. H. J.

Carbon dioxide: Absorbent for — in breathing apparatus for use in mine rescue work or like purposes. E. J. Bevan and R. H. Davis. London. Eng. Pat. 22,719, Nov. 18, 1914.

WOOD pulp is ground with caustic soda solution until a crumbly substance is produced, which is more efficient than caustic soda in lumps or sticks as an absorbent of carbon dioxide and has special advantages in breathing apparatus.—J. H. J.

Furnace for burning detritus, night soil, and the like. Stettiner Charnotte-Fabrik Akt.-Ges. vorm. Didier. Fr. Pat. 471,411, April 27, 1914.

THE furnace is of the grateless type in which combustion takes place in the lower portion of the

descending refuse. The combustion chamber is surrounded by a water jacket, and at the level of the bottom of the jacket air is introduced through several tuyères which are of the shape of a double cone and form a circle round the chamber. To remove the layer of burnt material, a clinker cutter worked by hydraulic pressure is introduced through an opening in the wall of the furnace and detaches the clinker; it is then withdrawn on to its platform, which moves along rails to the next furnace to be operated. The bottom of the furnace is closed by a plate when combustion is going on, but when the cutter is to be operated, the plate is drawn out and its place taken by a cylinder, through which the clinker detached by the cutter falls and is guided on to a travelling band below.—J. H. J.

Antiseptics, disinfectants, and germicides [from peat tar]; Manufacture of —. G. T. Morgan. Dublin, and G. E. Scharff, Bray, Ireland. Eng. Pat. 19,253, Aug. 31, 1914.

PEAT tar is dried at 100° C. and distilled until a sample of the distillate solidifies on cooling. The distillate is extracted with a 10–15% solution of caustic soda, the extract is separated and neutralised with mineral acid, and the acidic oils which separate are fractionally distilled, the fractionation being controlled by bactericidal tests. The fractions obtained at different temperatures have different coefficients against *B. typhosus*, the higher fractions, which distil at 200°–266° C. and consist of aromatic hydroxy compounds, having the stronger germicidal action. The various fractions can be used as disinfectants either in the concentrated state, in solution in an organic solvent, in suspension in water, in emulsion in mucilage, or made up into a solid form.—J. H. J.

Schweinfurt Green or other compounds of copper and arsenic; Process for rendering — soluble in water. Chem. Fabrik Schweinfurt G. m. b. H. Fr. Pat. 471,466, Apr. 29, 1914. Under Int. Conv., Aug. 21, 1913.

THE compound is mixed with a nitrogenous substance, such as gelatin or protein substances or their derivatives, and with a caustic alkali or alkaline-earth hydroxide and water, and, if necessary, heated until the solution has a blue tint. The liquid contains only traces of free ammonia and is suitable for a plant insecticide.—C. A. M.

Cleaning and disinfecting liquids. [Paint remover.] 1. L. Hahman. Fr. Pat. 471,747, May 2, 1914. Under Int. Conv., May 7, 1913.

A CAUSTIC alkali, an ammonium salt, and an alkali carbonate are dissolved successively in water, and an alcohol is added, preferably in the proportion, 9.8% KOH, 2.5% NH₄Cl, 1.25% K₂CO₃, 80–82% water, and 4.95–5% alcohol.—F. SOHN.

Electrochemical treatment of liquids. [Water softening.] C. P. Landreth, Philadelphia, U.S.A. Eng. Pat. 3181, Feb. 6, 1914. Under Int. Conv., Feb. 21, 1913.

SEE Fr. Pat. 468,277 of 1914; this J., 1914, 971.

Liquid-steriliser. V. Henri, A. Helbronner, and M. von Recklinghausen, Paris, Assignors to The R.U.V. Co. U.S. Pat. 1,132,265, March 16, 1915. Date of appl., Feb. 26, 1910.

SEE Addition of March 1, 1910, to Fr. Pat. 400,602 of 1909; this J., 1910, 1129.

Water and other liquids; Apparatus for the treatment of — by ultra-violet rays. V. Henri, Paris, and A. Helbronner and M. von Recklinghausen, Suresnes, France, Assignors to The R.U.V. Co. U.S. Pat. 1,132,266, March 16, 1915. Date of appl., Nov. 10, 1913.

SEE Eng. Pat. 25,509 of 1909; this J., 1910, 1471.

Apparatus for detecting and estimating the impurities and dissolved matter in water and other liquids. Eng. Pat. 12,735. See XXI.H.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Opium; Influence of mould fungi on the alkaloid-content of —. O. v. Friedrichs. Z. physiol. Chem., 1914, 93, 276—282.

PETRI dishes containing moistened opium, in some cases mixed with 10% of lactose, were inoculated with four different moulds and incubated at 18°—22° C. for 20 hours. In all cases profuse mycelial growth was observed, but two of the organisms, *Penicillium viridicatum* and *Citromyces glaber*, were without any action on the alkaloids determined (morphine, narcotine, and codeine). *Aspergillus niger* did not attack morphine but destroyed small quantities of narcotine and codeine. *Aspergillus Ostianus*, found on opium from the Levant, decomposed all three to some extent, but morphine only slightly. Growth of moulds on pharmaceutical preparations of opium is therefore not likely to reduce their content of alkaloids to any considerable extent.—J. H. L.

Digitalis leaves; Physiological valuation of —, and the enzymes of digitalis. Rapp. Apoth.-Zeit., 1911, 29, 860, 865—867. Z. angew. Chem., 1915, 28, Ref., 19.

THE physiological value of digitalis preparations can be determined accurately only by a biological process. The author prefers Hale's method to that of Focke. The guaiacum reaction is useful only as affording indications of the method of drying and preservation. In moist digitalis leaves the physiological value diminishes owing to enzyme action. The quantity of sugars formed in the digitalis plant by enzyme action is not an exact measure of the amount of digitalis glucosides lost thereby. A digitalis preparation free from enzymes can be obtained by heating the drug for 10 minutes in an autoclave at 105° C., but the secondary gastric effects produced by digitalis powder are observed also with the enzyme-free preparation.—A. S.

Cusparine: Isomerisation and decomposition of —. Investigations on the alkaloids of Angostura. J. Troeger and W. Müller. Arch. Pharm., 1914, 252, 459—480. Z. angew. Chem., 1915, 28, Ref., 19. (See also this J., 1910, 294; 1911, 152; 1912, 1050.)

CUSPARINE, $C_{18}H_{14}NO_2 \cdot OCH_3$, m. pt. 93° C., is a quinoline derivative. By the action of moist silver oxide or potassium hydroxide on its methiodide, ethiodide, or propiodide, iscusparine, $C_{18}H_{14}O_2 \cdot NCH_3$, m. pt. 194° C., is produced. When cusparine is heated in a current of dry hydrogen chloride, pyrocusparine, $C_{18}H_{13}NO_2$, m. pt. 255° C., is formed. This yields a nitro-derivative, $C_{18}H_{12}NO_2(NO_2)$, m. pt. 283° C., when treated with dilute nitric acid.—A. S.

Calcium-theobromine; Crystallised —. L. Rousseau. Comptes rend., 1915, 160, 363—365.

THEOBROMINE (2 mols.) and calcium oxide (1 mol.) are heated together in the presence of water, and the fine long needles obtained on cooling are dried over sulphuric acid. The product, $(C_7H_7N_4O_2)_2Ca \cdot 9H_2O$, is soluble in 64 parts of water at 16° C., and in 14 at 100° C.; and in 625 parts of alcohol at 90° C., being thus 25 times

more soluble in cold water, 10 times in boiling water, and 7 times in boiling alcohol than theobromine. Carbonic and other acids liberate the theobromine in the colloidal state, and this is probably the cause of the rapidity and intensity of the diuretic effect of the salt when it comes into contact with gastric juice in the stomach.—J. P. O.

Pepsin; Use of edestin in the determination of —. R. Delaunay and O. Bailly. Bull. Sci. Pharmacol., 1915, 21. Pharm. J., 1915, 94, 389.

EDESTIN, a vegetable globulin from hemp seed, can be advantageously substituted for fibrin in determining the activity of pepsin. It is prepared by extracting bruised, fat-free hemp seed with 10% sodium chloride solution, in which edestin is readily soluble and from which it can be obtained either by the addition of large excess of water, or by removing the salt by dialysis, or in a crystalline state by strongly cooling the hot solution. Edestin is insoluble in pure water but soluble in dilute solutions of neutral salts and in 2.5% hydrochloric acid, from which latter solution it is precipitated by nitric acid. 0.2 gm. of pepsin of the strength of the French Pharmacopœia completely digests the edestin in 20 c.c. of a 0.5% solution in 2.5% hydrochloric acid in 15 minutes at 50° C. The presence of undigested edestin is shown by the turbidity produced by the addition of 30 drops of nitric acid to the cooled solution.—T. C.

Cholesterol; Oxidation of — by the blood tissue. J. Lifschütz. Z. physiol. Chem., 1914, 93, 209—227.

EXPERIMENTS have shown that cholesterol is oxidised to some extent on digestion at 60° C. for several days with glacial acetic acid and dried fat-free blood, thus confirming the author's view that in the body the oxidation of cholesterol takes place in the blood.—J. H. L.

Eucalyptus globulus of California; Oil of —. C. E. Burke and C. C. Scandone. J. Ind. Eng. Chem., 1915, 7, 206—209.

LARGE quantities of *Eucalyptus globulus* oil could be produced in California and other parts of the Pacific coast where the tree is grown for timber, but the oil does not fulfil the requirements of the U.S. Pharmacopœia. It has sp. gr. 0.9052 at 20° C., $[\alpha]_D^{20} = 14.42^\circ$, $n_D^{20} = 1.46053$, and is insoluble in 70% alcohol, differing notably from the Australian oil. The Californian oil contains the same constituents as the Australian oil, but in different proportions. It contains butyric, isovaleric, and capronic aldehydes, 6; pinene, 21—22; cineol, 47; alcohols (eudesmol, globulol), 23%; the high content of pinene is the chief cause of the difference in properties from the Australian oil. In distilling the oil the burrs should be separated from the leaves, as the oil from the former is inferior to the leaf oil.—A. S.

Aniseed oil; Quantity of iodine absorbed by —. E. Morin. Ann. Chim. Analyt., 1915, 20, 49—52.

IT was found that pure aniseed oil absorbed iodine in the average proportion of 1.6961 gm. per gm. of oil, when the absorption was determined by Hübl's method, using a solution of the oil in 50% alcohol and allowing the reaction to proceed for 3 hours. The quantity of iodine absorbed was not, however, constant; it varied with the amount of oil in the solution, e.g., from 1.651 gm. per gm. of oil, when a 0.08% solution of the latter was employed for the determination, to 1.7356 gm. in the case of a 0.12% solution.—W. P. S.

Camphor production in the United States. Oil, Paint, and Drug Rep., March 29, 1915.

IMPORTS of camphor into the United States from Japan during 1914 amounted to over 5,000,000 lb., and in view of the tendency of the Japanese monopoly to demand high prices and to encourage home consumption, increasing efforts are being made to develop camphor forests in the southernmost portions of the United States and also to produce camphor synthetically from a turpentine base. Many difficulties, however, are still being encountered and, despite many years of experimental work and an enormous outlay of money, the results attained to date have been meagre, and have appeared far from warranting the expenditure already made.

Recent activities in camphor forestry include the entrance into this field of three new enterprises, two of which are conducted in Florida and one in Texas. A pioneer enterprise, backed by the manufacturers of nitrocellulose products, had previously invested heavily in these trees and, a year ago, added 500 acres of new camphor trees; now it has many thousands of young trees in its nursery. The company, like others which have more recently embarked upon the industry, was encouraged by the suggestion of the United States Department of Agriculture, which repeatedly pointed out the desirability and practicability of producing the natural product in the United States. It was soon discovered that the Government's statistics on the growth, development, and yield of camphor trees were both deficient and inaccurate and all available figures on production had to be revised materially. Nevertheless, this enterprise, whose camphor forest is at Satsuma Heights, Fla., has already obtained 10,000 lb. of crude camphor from its trees and is now looked upon as a promising venture, although the returns from the investment have fallen far short of the originally sanguine expectations of its backers.

Of the three other enterprises mentioned, the Florida Essential Oils Company has the nucleus of a camphor forest at Green Cove Springs, Fla., and has recently bought 10,000 acres of land in that locality, in which it is planning to set out thousands of new camphor trees. St. Mary's Florida Colony Company has lately purchased 10,000 acres of land at Glen St. Mary, Fla., and expects to utilise 2,000 acres of this property in the near future for camphor tree growing. The Alvin Japanese Nursery Company has acquired 100 acres of land for camphor tree growing near Alvin, Tex., and reports that 500 acres of land close to its property are already devoted to a small forest of these trees.

The greatest handicap with which these enterprises have to contend is the relatively small yield of the new trees. Many of the Japanese and Chinese trees are 50 to 100 years old and some of them from 200 to 500 years old; even from comparatively young trees, there have been obtained yields valued at \$3,000 to \$5,000 each.

The Schering interests in Germany have long since succeeded in making a comparatively large quantity of synthetic camphor from a turpentine base, which meets all commercial and pharmaceutical requirements, but have been unable to produce it cheaply enough to compete with the natural product except when prices have been abnormally high. This has also been the experience of the numerous American experimenters in this field. Recently, however, the American Camphor Corporation, of Philadelphia, has contended that it can produce enough gum camphor in this way to meet the requirements of the manufacturers of nitro-cellulose compounds as well as the drug trade. However, it seems that the makers are not yet in a position to make camphor in sufficient quantities, although some of the refined synthetic

gum made by this company has been employed by the drug trade.

Alcohol in pharmaceutical preparations; Determination of —. Reuss. Pharm. Zentralh., 1915. Pharm. J., 1915, 94, 489.

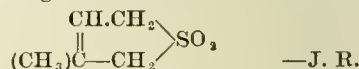
RICHTER's method is modified as follows:—25 c.c. of the preparation, 25 c.c. of 20% sodium chloride solution, and 15 c.c. of petroleum spirit (b. pt. 40°–55° C.) are shaken together in a separator for one or two minutes; the salt solution containing the alcohol is separated, and after some time a further layer of alcohol in salt solution is formed, which is also separated. The traces of alcohol remaining in the petroleum spirit are shaken out with fresh salt solution, the alcoholic extracts are distilled, after neutralisation if volatile acids are present, and the alcohol is collected in a pycnometer and determined in the usual manner.

Urease of soya beans, and its application to the determination of urea. F. Eigenberger. Z. physiol. Chem., 1915, 93, 370–377.

THE urease present in soya beans may be used for the determination of urea in urine. The urease solution is added to the urine and a current of air drawn through the mixture, the ammonia formed being absorbed in standard acid. The whole of the ammonia is liberated from the urea in about 1 hour, and the results obtained agree well with those found by the Kjeldahl and other methods. The urease solution is prepared by mixing an aqueous extract of the beans with a large excess of acetone, separating the precipitate, and dissolving it in ten times its weight of water to which is added, for every gm. of the precipitate, 0.6 gm. of dipotassium phosphate and 0.4 gm. of monopotassium phosphate.—W. P. S.

Isoprene; A crystalline compound of — with sulphur dioxide. G. de Bruin. Koninkl. Akad. van Wetenschappen, Amsterdam, June 27, 1914. Chem.-Zeit., 1914, 38, 1205.

AFTER keeping in a sealed tube at the ordinary temperature for two days, a mixture of isoprene and liquid sulphur dioxide deposited white crystals of an addition product, melting at 62.5° C., and probably possessing the structure:



Halogens; Catalytic addition of the — [to unsaturated organic compounds]. L. Bruner and J. Fischler. Z. Elektrochem., 1914, 20, 84. Chem.-Zeit., 1915, 39, Rep. 57.

IODINE and antimony tribromide act as catalysts in presence of bromine not only in substitution reactions, but also in addition reactions with such substances as acetylene dichloride and ethyl cinnamate; the relation between the amount of catalyst and the reaction-velocity is different in the two classes of reaction.—J. R.

Chemical action of light. G. Ciamician and P. Silber. Ber., 1915. Apoth.-Zeit., Mar. 6, 1915. Pharm. J., 1915, 94, 489.

NICOTINE in aqueous solution exposed to light for six months, was converted by autoxidation into resinous compounds and oxynicotine, which was further oxidised to nicotinic acid and methylamine. Similarly piperidine is converted into a base containing oxygen, and formic and glutaric acids are formed. Copper benzoate suspended in acetaldehyde and exposed to light for seven months, was reduced to metallic copper, which was separated partly as a precipitate and partly in the

form of a mirror: benzoic acid is liberated, and apparently acetic acid is formed.

Formaldehyde; Determination of—and of hexamethylenetetramine in formalin pastilles. W. Stüwe. Arch. Pharm., 1914, 252, 430–435. Z. angew. Chem., 1915, 28, Ref., 18.

THE solution containing formaldehyde is added to freshly-prepared Nessler's solution, whereupon reduction to metallic mercury occurs. After acidifying with dilute acetic acid, the mercury is dissolved by treatment with excess of N/10 iodine solution, and the excess titrated with N/10 thio-sulphate. The process may also be used for the determination of hexamethylenetetramine, e.g. in formalin pastilles.—A. S.

Acid secretion of the gram plant, Cicer arietinum. Sahasrabuddhe. See XVI.

Determination of the iodine value of alcoholic liquors by Hübl's method. Iodine value of essential oils. Marcille. See XVIIII.

PATENTS.

Aminophenyl arsenic compound. A. H. C. Heitman, Assignor to Parke, Davis and Co., Detroit, Mich. U. S. Pat. 1,119,279, Dec. 1, 1914. Date of appl., April 5, 1913.

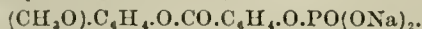
AROMATIC amino compounds in which an amino group is combined with at least one carbo-ethoxy group, are prepared by treating aminophenyl arsenic derivatives with carbo-ethoxy compounds such as ethyl chlorocarbonate, then nitrating, and reducing the nitro group. Examples mentioned are carbo-ethoxy-*p*-aminophenylarsenoxide, $C_6H_5O.CO.NH.C_6H_4.AsO$, and carbo-ethoxy-4,5-diaminophenylarsenoxide. The compounds are claimed as specifics, e.g. for hog cholera.—F. Sp.

Acetylsalicylic acid compounds; Derivatives of—W. Hiemenz, Elberfeld, Germany, Assignor to Synthetic Patents Co., New York. U. S. Pat. 1,122,201, Dec. 22, 1914. Date of appl., Sept. 3, 1914.

ANTIPYRETIC and antineuralgic compounds of the general formula, $RO.CO.R'O.CO.R''$ (in which RO is the radical of salicylic acid or a derivative thereof, R' is an aliphatic radical, and R'' is any organic radical) are claimed. Example:—Acetyl-glycolyl chloride is condensed with salicylic acid in the presence of dimethylaniline diluted with benzene, forming acetyl-glycolylsalicylic acid, $COOHC_6H_4O.CO.CH_2O.CO.CH_3$, m. pt. 103° C. The following compounds are also mentioned:—Acetyl-glycolyl-*m*-cresotinic acid (m. pt. 108°); acetyl-glycolyl-*p*-cresotinic acid (m. pt. 151°); acetyl-glycolylchlorosalicylic acid (m. pt. 135°); acetyl-glycolyl-iodosalicylic acid (m. pt. 144°); acetyl-lactyl-*p*-cresotinic acid (m. pt. 128°); cinnamoyl-glycolylsalicylic acid (m. pt. 135°), and anisoyl-glycolylsalicylic acid (m. pt. 123° C.)—F. Sp.

Carboxylarylphosphoric acids; Esters of—M. Engelmann, Elberfeld, Germany, Assignor to Synthetic Patents Co., New York. U. S. Pat. 1,125,081, Jan. 19, 1915. Date of appl., May 12, 1914.

CLAIM is made for compounds of the type, $ROOC.aryl.O.PO(OH)_2$, and more particularly for the guaiacol ester of *p*-carboxylphenylphosphoric acid, m. pt. 182° C., the sodium salt of which probably has the formula,



Other examples are the iso-cresyl ester (m. pt. 179°) and the thymol ester (m. pt. 163° C.) of *p*-carboxy-

phenylphosphoric acid. The compounds are prepared by the interaction of alcohols, phenols, phenol-alcohols, or hydroxy acids with the halogen-carbonyl-arylphosphoric acid halides produced by the action of phosphorus halides on aromatic hydroxy acids. They are said to be valuable remedies against infectious diseases. They are crystalline, odourless products soluble in alcohol and sparingly soluble in water; their salts are mostly soluble in water.—F. Sp.

Perfumes; Process of obtaining—by means of solvents. Lautier Fils. Fr. Pat. 472,256, July 30, 1913.

RAPID evaporation of the solvent at low temperatures is secured by projecting the solution of the perfume in a spray against a warm surface in a special still, with or without vacuum. The vapours of the solvent pass off and are condensed, and the concentrated solution of the perfume is drawn off, either continuously or intermittently, at the bottom of the still.—F. Sp.

Hydrastinine derivatives; Preparation of—E. Merck. Ger. Pat. 279,191, Dec. 24, 1912.

DIHYDROISOQUINOLINE bases (hydrastinine derivatives) are prepared by treating homopiperonylamine derivatives of the general formula, $CH_2O_2 : C_6H_3.CH_2.CH(alkyl).NR.CH_2O$ (R = hydrogen, alkyl, or aralkyl), with acid condensing agents, such as phosphorus pentoxide or pentachloride, aluminium chloride, or zinc chloride. When R = hydrogen, the 6,7-methylenedioxy-3,4-dihydro-3-alkylisoquinolines obtained are subsequently converted into N-alkyl or N-aralkyl derivatives.—A. S.

***α*-Methylcoumaranes; Preparation of**—Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 279,864, Oct. 9, 1913.

o-ALLYLPHENOLS having the allyl group united to a carbon atom are treated with a hydro-halogen acid or other acid condensing agents, and the products distilled *in vacuo*. The *α*-methylcoumaranes thus obtained are colourless liquids useful for pharmaceutical purposes.—A. S.

Ferrous salts of aromatic hydroxycarboxylic acids and their derivatives; Preparation of acid—M. Claass. Ger. Pat. 279,865, Jan. 29, 1914.

ALKALI salts of hydroxybenzoic acids or of their derivatives, nuclear homologues or substitution products, are treated in hot aqueous solution with ferrous salts in presence of a small quantity of a reducing agent, such as sodium hydrosulphite; on cooling, the acid ferrous salt, e.g. acid ferrous salicylate, crystallises. The products may be used as antiseptics.—A. S.

2-Halogen-2-methylbutane; Preparation of—Badische Anilin und Soda Fabrik. Ger. Pat. 279,955, Sept. 10, 1913.

THE fraction distilling up to about 45° C., resulting from the cracking of high-boiling hydrocarbons, is treated with a hydro-halogen acid. The 2-halogen-2-methylbutane so obtained is purified by distillation. It can be used for the synthesis of isoprene.—A. S.

Mercury compounds of tyrosine and its derivatives; Preparation of—F. Hoffmann-La Roche und Co. Ger. Pat. 279,957, Sept. 25, 1913.

ALKALINE solutions of tyrosine or its derivatives are treated with mercuric compounds at the ordinary temperature. The products are sparingly soluble in water but readily soluble in alkalis: the alkaline solutions change to jellies when kept for

a long time. Mercuric sulphide is precipitated gradually from the cold solutions by ammonium sulphide.—A. S.

Mercurised aminoarylsulphonic acids; Preparation of —. Chem. Fabr. von Heyden A.-G. Ger. Pat. 281,009, April 24, 1914.

MERCURY aminoarylsulphonates, or mixtures of aminoarylsulphonic acids with mercury compounds capable of reacting with the acids to form salts, are heated until the organic mercury compound becomes soluble in alkali. In the products obtained, e.g. sodium mercuri-*m*-aminobenzenesulphonate, sodium mercuri-aminophenolsulphonate, and acid sodium mercuri-*m*-aminosulphobenzoate, the mercury is more firmly combined than in corresponding compounds not containing an amino group. When sodium mercuri-*m*-aminobenzenesulphonate, for example, is treated with ammonium sulphide solution, darkening is observed only after 24 hours. Introduction of a hydroxyl group renders the mercury less firmly combined.—A. S.

Alkyl esters of triacetyl-gallic acid; Preparation of —. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 279,958, March 13, 1913.

THE alkyl esters of gallic acid, with the exception of the methyl ester, are acetylated. or triacetyl-gallic acid is converted into its alkyl esters, with the exception of the methyl ester, by the usual methods. The products are of value as astringents.—A. S.

Hydro-derivative of colchicine; Preparation of a —. F. Hoffmann-La Roche und Co. Ger. Pat. 279,999, June 10, 1913.

COLCHICINE is treated with hydrogen in presence of finely divided palladium or a colloidal solution of palladium. The product, probably tetrahydro-colchicine, is less toxic than colchicine.—A. S.

p-Acylaminophenol alkyl ethers; *Preparation of [hydroxy] derivatives of* —. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 280,025, April 13, 1913.

COMPOUNDS of the general formula, (acyl)- $RN.C_6H_4.OR_1$ (R = hydrogen, alkyl, acyl, aryl, or aralkyl; R_1 = alkyl with one or more substituted hydroxy groups), are obtained by treating *N*-acyl-*p*-aminophenols with polyhydric alcohols or their anhydrides or with halogen-substituted alcohols, or by acylating the amino group of *O*-hydroxyalkyl ethers of *p*-aminophenol. They exhibit pronounced analgesic action but are only slightly antipyretic, and are less active than phenacetin in forming hæmoglobin.—A. S.

Phosphorus compounds of derivatives of higher fatty acids; Preparation of lipid —. F. Hoffmann-La Roche und Co. Ger. Pat. 280,411, Dec. 4, 1913.

LIPID phosphorus compounds, which are readily resorbed, are obtained by the action of hypophosphorous acid or its salts on higher keto-fatty acids or their derivatives, e.g. esters or amides of the acids, diketone-acids, or hydroxyketo-acids. The new compounds when in the form of free acids are sparingly soluble in water, insoluble in petroleum spirit, and readily soluble in glacial acetic acid, ether, and alcohol; the alkali and ammonium salts are readily soluble in water. The compounds are not decomposed by bases, even on boiling. They possess reducing properties corresponding to those of phosphorous acid.—A. S.

Hydrolecithin; Preparation of —. J. D. Riedel A.-G. Ger. Pat. 280,695, March 1, 1914. Addition to Ger. Pat. 256,998 (this J., 1913, 507).

LECITHIN in aqueous colloidal solution or suspended in water is treated with hydrogen or a gaseous mixture containing hydrogen in presence of a finely-divided or colloidal metal of the platinum group. Other animal or vegetable phosphatides can be hydrogenised in a similar manner. (See also Ger. Pat. 279,200; this J., 1915, 250.)—A. S.

Morphine; Preparation of alkylormethyl ethers of —. C. Mannich. Ger. Pat. 280,972, June 15, 1913.

ALKYLOXYMETHYL ethers of morphine are obtained by the interaction of alkali compounds of the alkaloid and halogen alkyl ethers of the general formula, $hal.CH_2.O.alkyl$. The methoxymethyl ether of morphine has a physiological action stronger than that of the alkyl ethers of morphine but weaker than that of morphine itself. It may be used for the preparation of other morphine derivatives, being readily converted into *N*- or *O*-alkyl derivatives. When heated for a short time with sulphurous acid the methoxymethyl group is removed.—A. S.

Chondroitin-sulphuric acid; Preparation of soluble salts of —. J. D. Riedel A.-G. Ger. Pat. 280,974, Dec. 19, 1913.

A MIXTURE of concentrated solutions of equivalent quantities of a salt of a heavy metal and an alkali salt of chondroitin-sulphuric acid is dialysed against water, and the resulting solution of the heavy metal salt of chondroitin-sulphuric acid is evaporated to dryness at a moderate heat or treated with a precipitant such as alcohol or ether. The products are useful for treating affections due to parasites.—A. S.

Esters of 8-hydroxyquinoline; Preparation of [the salicylic and acetylsalicylic] esters of —. R. Wolfenstein. Ger. Pat. 281,007, June 5, 1913.

THE salicylic and acetylsalicylic esters of 8-hydroxyquinoline are prepared by treating it with the corresponding acid chlorides. They are of value therapeutically by reason of their effect on the metabolism of purine derivatives.—A. S.

Bile; Process for obtaining a therapeutically active preparation from —. R. Nöhring. Ger. Pat. 280,108, June 14, 1913.

BILE, preferably diluted with water, is treated with acid, the precipitated colouring matter filtered off, and the solution treated with alkali to precipitate the active substance. The product is toxic towards pathologically altered organisms but practically non-poisonous to normal organisms.—A. S.

Lithium acetylsalicylate; Process of manufacturing —. A. Busch, Brunswick, Assignor to J. A. Wülling, Berlin, Germany. U.S. Pat. 1,129,953, March 2, 1915. Date of appl., Feb. 25, 1914.

SEE Eng. Pat. 9266 of 1913; this J., 1914, 613.

Protocatechuic acid and protocatechuic aldehyde; Preparation of — from piperonal. L. Schmidt. Fr. Pat. 471,986, May 8, 1914. Under Int. Conv., Sept. 15, 1913.

SEE Ger. Pat. 278,778 of 1913; this J., 1915, 249.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Solubility of silver chloride. Glowczynski. See VII.

PATENTS.

Printing photographic negatives or positives on sensitive films of all kinds; Method of—. A. Schwarz and W. Riebensähn. Ger. Pat. 279,232, Feb. 10, 1914.

A SUBSTANCE, such as quartz, which possesses a high degree of transparency for the chemically active ultra-violet rays, is used as a support for the film on which the negative or positive is produced. Prints can then be obtained in a fraction of the time required when a glass plate is used.—A. S.

Polychrome screens; Preparation of—. M. Petzold. Ger. Pat. 279,932, June 26, 1913.

A RED and a green acid or azo dyestuff, each dissolved in a chromate solution, are printed successively, in juxtaposition, on a gelatin plate, and the intervening spaces are then coloured with a blue dyestuff of the rosaniline series. The chromate is reduced by the gelatin and forms insoluble or sparingly soluble colour lakes with the red and green dyestuffs.—A. S.

XXII.—EXPLOSIVES; MATCHES.

PATENTS.

Explosive mixtures containing chlorates or perchlorates. E. C. R. Marks, London. From Pala Companhia Himalayite, Lisbon. Eng. Pat. 29,507, Dec. 22, 1913.

POTASSIUM, sodium, or ammonium chlorate or perchlorate (76 to 82 %) is mixed with a solid combustible substance such as starch or sawdust (8 to 21 %), a liquid combustible substance such as mineral or vegetable oil (3 to 8 %), and finely divided aluminium or other readily oxidisable metal, or an aluminium alloy, iron carbide, or ferrosilicon (2 to 8 %), together with less than 2 % of a "detonating compound," such as a permanganate or chromate, or sulphur or sulphur compound.—C. A. M.

Explosive; Manufacture of a new—, and products comprising the same. F. E. Matthews, London. Eng. Pats. 6447 and 6448, March 13, 1914.

CLAIM is made for nitro-isobutyl-glycerol trinitrate, $\text{NO}_2\text{C}(\text{CH}_2\text{ONO}_2)_3$, obtained by nitrating nitro-isobutyl-glycerol. It is very stable to heat, and, in many cases, may be used as a substitute for nitroglycerin, e.g., in admixture with kieselguhr nitro-cotton, etc.—C. A. M.

Explosive containing liquid air or oxygen and lampblack. G. Claude, Assignor to Soc. l'Air Liquide (Soc. anon. pour l'Etude et l'Exploit. des Proc. G. Claude), Paris. U.S. Pat. 1,131,994, March 16, 1915. Date of appl., Dec. 20, 1913.

SEE Fr. Pat. 463,876 of 1912; this J., 1914, 376.

XXIII.—ANALYTICAL PROCESSES.

Sulphuric acid drying vessel; New form of—. Earl of Berkeley, and E. G. J. Hartley. Phil. Mag., 1915, 29, 609—613.

SULPHURIC acid is as efficient for drying gases as phosphorus pentoxide, and it is moreover not

necessary to bubble the gas through the acid but suffices to lead it over the surface, thus avoiding the risk of introducing acid spray into the stream of gas and uncertain changes in its volume. The drying vessel described consists of four horizontal tubes, 22 cm. long, and 2 cm. diam., connected together in series so as to form four separate compartments, which are each about half filled with sulphuric acid (about 70 c.c. in all). The two ends of the series of tubes terminate in vertical tubes with glass stoppers and detachable mercury cups. In tests with this apparatus, 600 litres of air saturated with water vapour at 30° C. was completely dehydrated after a week's run, and a phosphorus pentoxide tube placed in series beyond the sulphuric acid tube only gained 0.0001 grm. during the whole experiment, whilst the acid had absorbed 5.52 grms., nearly all of which was taken up in the first (inlet) branch. After running for three days at 30° C., only about 0.0001 grm. of sulphuric acid had been carried over. An alternative method for drying air is to use stick potash, which is also nearly as efficient. Pure anhydrous copper sulphate will absorb about 0.05 % of its weight of water-vapour, and is a very efficient drying agent for air containing little more than traces of moisture; it can be used again after heating to 210°—220° C. in a current of air.—G. F. M.

Iron, aluminium, chromium, manganese, and zinc; Methods for separating and determining—. G. Van Pelt. Bull. Soc. Chim. Belg., 1914, 138. Ann. Chim. Analyt., 1915, 20, 68—70.

A SOLUTION of the chlorides of iron, aluminium, chromium, manganese, and zinc is diluted to 200—300 c.c. and heated on a water-bath with a few drops of nitric acid and 2 grms. of ammonium persulphate, until the chromium is oxidised completely. The solution is cooled and poured into a solution containing ammonium chloride, concentrated hydrogen peroxide, and an excess of ammonia; the mixture is warmed, the hydroxides of iron, aluminium, and manganese are then collected, washed, dried, and fused with a mixture of equal weights of sodium carbonate and potassium nitrate. The cooled mass is extracted with water, and the insoluble ferric oxide collected and weighed. The filtrate, containing aluminate and manganate, is concentrated on a water-bath, acidified, and treated with hydrogen peroxide to convert the manganate into manganese salt, diluted to 250 c.c., treated with an excess of sodium hydroxide, and the manganese precipitated by hydrogen peroxide. The manganese hydroxide is separated, the filtrate is acidified with hydrochloric acid, and the aluminium precipitated by adding ammonia to the boiling solution. The first filtrate, containing the chromium and zinc, is acidified, concentrated, and treated with hydrogen peroxide. The residue is dissolved in water containing ammonium chloride, the solution boiled, and the chromium precipitated by ammonia. Zinc is precipitated in the filtrate from the chromium hydroxide by boiling with sodium carbonate until all ammonia has been expelled.—W. P. S.

Selenium; Reaction for identifying traces of—. G. Denigès. Ann. Chim. Analyt., 1915, 20, 59—61.

A SMALL quantity of the material is boiled with a few drops of concentrated nitric acid, then diluted with an equal volume of water and treated with a solution of mercurous nitrate containing nitric acid. If selenium is present, a characteristic crystalline precipitate of mercurous selenite is obtained. When dealing with traces of selenium, the test may be carried out on a microscope slide. (See also page 421.)—W. P. S.

Molybdic acid [used in analysis]; Recovery of—
W. D. Brown. *J. Ind. Eng. Chem.*, 1915, 7,
213—214.

THE solution containing molybdic acid is heated to boiling and treated with five times the theoretical quantity of sodium phosphate, the yellow precipitate is filtered off, washed, dried, and 210 grms. of it is mixed with 800 c.c. of water and 600 c.c. of ammonia solution and treated with 35 grms. of magnesium nitrate dissolved in 100 c.c. of water. The precipitated ammonium magnesium phosphate is filtered off and washed with 100 c.c. of water or dilute ammonia solution, and the filtrate and washings are added to 1900 c.c. of nitric acid (1:1), giving 3500 c.c. of ammonium molybdate solution containing the usual amounts of ammonia and nitric acid.—A. S.

Refrigeration in toxicological analysis; Use of—
G. A. Le Roy. *Comptes rend.*, 1915, 160, 313—
314.

To facilitate the reduction of viscera, etc., to a homogeneous condition, as a preliminary to extracting alkaloids, they are placed in a freezing chamber at -6° to -10° C. for 10 to 24 hours. The congealed mass may then be reduced to a fine state of division by the usual method.—F. W. A.

Combustion calorimetry and the heats of combustion of sucrose, benzoic acid, and naphthalene. Dickinson. See IIA.

Separation of gases by fractional distillation in a vacuum at low temperatures. Rapid method of fractionating gases at low temperatures. Burrell and Robertson. See IIA.

Analytical distillation of petroleum. Rittman and Dean. See IIA.

Apparatus for determining the melting point of paraffin wax. Small. See IIA.

Bolometric method of determining the efficiencies of radiating bodies [gas fires]. Bone and others. See IIB.

Chemical analysis of paper. Bromley. See V.

Reactions of selenic and telluric acids and their salts. Denigès. See VII.

New method of valuing hydrosulphiles. Knecht. See VII.

Action of metals upon [and detection and determination of] mercuric cyanide. Pertusi. See VII.

Precipitation of zinc and manganese by ammonium sulphide. Seeligman. See VII.

Determination of the composition of argon-nitrogen mixtures [for filling half-watt lamps] by liquid air. Hamburger and Filippo. See VII.

Sensitive method for examining some optical qualities of glass plates. Earl of Berkeley, and Thomas. See VIII.

Determination of the heat-conductivity of refractory building materials. Heyn. See IX.

Determination of copper in steel. Brown. See X.

Determination of zinc in ores and pyrites cinder. Rubricius. See X.

Rapid analysis of alloys [matte, slags, etc.] for tin, antimony, and arsenic. Stief. See X.

Determination of unsaponifiable matter in greases. Twitchell. See XII.

Examination of floor polishes. Besson and Jungkunz. See XIII.

Valuation of granular substances [pigments, etc.] by counting the particles. Kühn. See XIII.

Determination of total sulphur in rubber. Tuttle and Isaacs. See XIV.

Distinction and detection of tanning materials and cellulose extract in leather. Lauffman. See XV.

Determination of ammonia in soils. Potter and Snyder. See XVI.

Determination of soil carbonates. MacIntire and Willis. See XVI.

The direct and invert polarisation of pure sucrose. Walker. See XVII.

Measurement of the fermentative action of yeast by means of the liquid interferometer. Wolff. See XVIII.

Determination of the iodine value of alcoholic liqueurs by Hubl's method. Iodine value of essential oils. Marcelle. See XVIII.

Freezing point of milk considered in relation to the detection of added water. Monier-Williams. See XIX.

Determination of the total fatty acids and other ether-soluble constituents of feeding stuffs. Rather. See XIX.

Use of edestin in the determination of pepsin. Delaunay and Bailly. See XX.

Physiological valuation of digitalis leaves and the enzymes of digitalis. Rapp. See XX.

Urease of soya beans and its application to the determination of urea. Eigenberger. See XX.

Determination of formaldehyde, and of hexamethylenetetramine in formalin pastilles. Stüwe. See XX.

Determination of alcohol in pharmaceutical preparations. Reusz. See XX.

PATENTS.

Water and other fluids; Apparatus for the detection and estimate of impurities and dissolved matter in—Evershed and Vignoles, Ltd., and W. Clark, London. Eng. Pat. 12,735, May 23, 1914.

IN apparatus for determining the amount of impurities in water and other fluids by measuring the electrical conductivity (see Eng. Pat. 23,706 of 1907; this J., 1908, 1036), a thermometer fitted in a sliding bearing is inserted in the tube containing the electrodes; the diameter of the thermometer is only slightly less than the bore of the conductivity tube. By altering the position of the thermometer according to the temperature of the liquid, and thus modifying the dimensions of the column of liquid through which the current passes, the conductivity may be read directly and no temperature correction need be applied. A scale and a pointer are provided to denote the position of the thermometer.—W. P. S.

Process and apparatus for determining the degree of impurity of water and other liquids. Fr. Pat. 471,351. See XIXb.

XXIV.—MISCELLANEOUS ABSTRACTS.

Enzymic decomposition of hydrogen peroxide. P. Waentig and O. Steche. *Z. physiol. Chem.*, 1914, 93, 228—231.

It has already been demonstrated (*Z. physiol. Chem.*, 1913, 83, 315) that the activity of catalase towards hydrogen peroxide is destroyed by trypsin, and the conclusion has been drawn that the former enzyme is a protein. It is now shown that the peptolytic enzyme, erepsin, exerts a similar destructive action on catalase, and, although erepsin preparations are not free from tryptic enzymes, the action referred to is probably due to the peptolytic components.—J. H. L.

Trade Report.

Patents, Designs, and Trade Marks; 32nd Report of the Comptroller General for 1914. [H.C. 160.] Price 2½d.

THE number of applications for patents in 1914 was 24,820 compared with 30,077 in 1913, and 15,036 patents were sealed, as against 16,599 in the preceding year. To the end of the year, 250 applications for avoidance or suspension of patents were made, under the temporary Acts of 1914. Licences were granted, or are to be granted in 172 of these cases, two patents were avoided, and one has been suspended: 20 applications were refused and 39 withdrawn. In 10 cases the applications were returned because the patents had expired, etc., 5 applications are standing over, and one licence under a patent has been avoided.

German chemical companies; Dividends of —. Brit. and Col. Drug., April 9, 1915.

THE following announcements have been made by the companies mentioned:—Chemische Fabrik vorm. Goldenberg, Geromont und Co., Winkel, a dividend of 14% for 1914 as in the preceding year; Verein Chem. Fabriken, Mannheim, 12½% as against 20%; Ges. für Chemische Industrie, Gelsenkirchen-Schalke, 8% as compared with 10%; Chem. Werke Lubzyski und Co., Berlin-Lichtenberg, 10% as contrasted with 15%; Rhein. Gerbstoff und Farbholz Extrakt-Fabrik, Benrath, 16% as against 18%; and the Verein für Chemische Industrie, Mainz, 15% as compared with 22%; in 1913. On the other hand, the Wilhelmsburger Chemische Fabrik, of Hamburg, incurred a loss of £9000 in 1914, this contrasting with a dividend of 10% in the previous year.

Germany. Prohibited exports. Chem. and Drug., April 17, 1915.

ACCORDING to a decree of April 1st, the following articles have been added to the list of war requirements the exportation of which from Germany is prohibited: Lycopodium; methyl salicylate (artificial); vegetable gelatin and glue-powder; barium chloride and other barium salts; barium oxide, barium peroxide, and other barium compounds; sulphur chloride; carbon bisulphide; sal ammoniac; ammonia; sodium bicarbonate; salts of nitrous acid; acetic acid, and acetic anhydride; acetates; calcium carbide; sodium sulphide; sulphates; potassium chromate and bichromate; sodium chromate and bichromate; lactic acid; zinc ashes and zinc oxide; malonic acid and its derivatives; sulphites; carbolic acid and its derivatives; calcium phosphide; artificial magnesium carbonate; lead acetate and solution

of lead subacetate. Another decree of April 1st extends prohibition of exportation from Germany to aluminium naphtholdisulphonate (alumol), argentamine (ethylidenediamine silver-phosphate solution), silver lactate (actol), silver citrate (itrol), silver-albumin compounds, such as silver proteinate, silver protalbinat, silver nucleinate, sophol (silver formonucleinate), albumose silver, novargan, largin, hegonone, gelatose silver, silver caseinate and sodium silver caseinate, gliadine silver, argyrol, silver sulphoichthyolate, colloidal silver; silver nitrate and the fused nitrate, organic and inorganic silver compounds, and preparations thereof which are not mentioned by their names in this decree; perugen (artificial Peru balsam); ointments and pastes made of vegetable, animal, or mineral fats; thallium salts, zinc acetate, zinc permanganate, zinc phenol-sulphonate, zinc sulphate. The prohibition of exportation of kaolin has been revoked.

Books Received.

MOLECULAR ASSOCIATION. By W. E. S. TURNER, D.Sc. Longmans, Green, and Co., 39, Paternoster Row, London. Price 5s.

THIS is the sixth of the series of Monographs on Inorganic and Physical Chemistry, edited by Dr. A. Findlay. The various chapters deal with molecular association in gases; molecular complexity of dissolved substances, molecular complexity in the liquid state and methods for its determination; the molecular complexity of water and the theory of dynamic allotropy; the selection and use of molecular formulae; molecular association and physical properties; molecular association and chemical combination. An appendix of 43 pages contains a summary of the investigations of molecular complexity of dissolved substances. The volume is 8vo, and occupies 170 pages.

DYESTUFFS AND COAL-TAR PRODUCTS. THEIR CHEMISTRY, MANUFACTURE, AND APPLICATION. By T. BEACALL, F. CHALLENGER, G. MARTIN, and H. J. S. SAND. Crosby, Lockwood and Son, 7, Stationers' Hall Court, Ludgate Hill, E.C. Price 7s. 6d.

LARGE 8vo volume, containing 146 + x. pages. The work is based very largely on Martin's "Industrial and Manufacturing Chemistry: Organic," and is subdivided into the following chapters: I. Industry of coal tar and coal-tar products. II. Industry of the synthetic colouring matters. III. The industry of natural dyestuffs. IV. The dyeing and colour-printing industry. V. Modern inks. VI. Saccharine and other sweetening chemicals. VII. The industry of modern synthetic drugs. VIII. The industry of photographic chemicals.

KEY TO THE CLASSIFICATIONS OF THE PATENT SPECIFICATIONS OF FRANCE, GERMANY, AUSTRIA, NETHERLANDS, NORWAY, DENMARK, SWEDEN, AND SWITZERLAND, IN THE LIBRARY OF THE PATENT OFFICE. 3rd Ed. The Patent Office, 25, Southampton Buildings, London, W.C. 190 pages 6½ by 4½ in. Price 6d.

NOTES ON THE SAMPLING AND ANALYSIS OF COAL. By A. C. FIELDNER. U.S. Bureau of Mines, Washington. Technical Paper 76. 61 pp. 8vo. Price 10c.

THESE notes relate principally to the sampling and analysis of coal in place in a mine or outcrop.

THE CONSTITUTION OF THE NATURAL SILICATES. By F. W. CLARKE. U.S. Geological Survey. Bulletin 588. 128 pp. 8vo.

THIS Bulletin is subdivided as follows: I. Introductory. II. The silicic acids. III. The silicates of aluminium. IV. Silicates of dyad bases. V. Silicates of tetrad bases, titanosilicates, and columbosilicates.

THE ELECTRIC FURNACE IN METALLURGICAL WORK. By D. A. LYON, R. M. KEENEY and J. F. CULLEN. U.S. Bureau of Mines, Bulletin 77. Price 25c.

THIS Bulletin is divided into three parts. Part I., by D. A. Lyon and J. F. Cullen, contains a general account of the electric furnace as applied to metallurgy. Part II. (Lyon and Keeney) deals with the smelting of various metals in the electric furnace, and Part III. (Keeney) relates to the manufacture of ferro alloys in the electric furnace. The Bulletin occupies 216 pages, 8vo; it contains a glossary and bibliography, and is illustrated by 56 figures.

* Dissertations.

[Prices vary, ranging from three to four shillings.]

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Blendermann, K.: Eine neue Methode in cyclische Ketone Alkyle einzuführen, und deren Einfluss auf die Substitution. Göttingen 1913. 47 S. 8°.

Erben, A.: Zur Kenntnis der Dicarvelone und Dieucarvelone. Göttingen 1913. 62 S. 8°.

Fischer, E.: Ueber Phosphorsäureester des Methylglucosids und Theophyllinglucosids. Nach gemeinsamen Versuchen mit Kurt Steglich. Berlin 1914. 12 S. Lex.-8°.

* Compiled by H. Grevel and Co., 33, King Street, Covent Garden, London, W.C., from whom all the works in the preceding list can be obtained.

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Official Notices.

ANNUAL GENERAL MEETING, 1915.

In accordance with the provisions of By-law 84, notice is hereby given that the Annual General Meeting will be held at the Municipal School of Technology, Manchester, at 10.30 a.m. on Wednesday, July 14th, 1915.

PROVISIONAL ARRANGEMENTS.

Wednesday, July 14th, 1915.

Morning: Annual General Meeting and Address from the President, Prof. G. G. Henderson, D.Sc.

Afternoon: "Research and Chemical Industry." Dr. M. O. Forster, F.R.S., and Dr. Chas. C. Carpenter.

Evening: Annual Dinner.

Thursday, July 15, 1915.

Morning: "Legislation and its Effect upon Chemical Industry." Mr. I. Levinstein, M.Sc.Tech.

Afternoon: "Chemical Engineering." Dr. G. T. Beilby, F.R.S.

Evening: Visit to the University Laboratories. Demonstrations by Sir Ernest Rutherford, F.R.S., Prof. W. J. Pope, F.R.S., and Prof. Harold Dixon, F.R.S.

Friday, July 16th, 1915.

Morning: "Economic Utilisation of Coal and the Production of Cheap Power." Mr. Walter F. Reid.

Afternoon: Visit to Works.

Evening: Social Meeting.

In accordance with the provisions of By-law 24, those members whose names are printed in *italics* in the List of Council will retire from their respective offices at the forthcoming Annual Meeting.

Dr. C. C. Carpenter has been nominated to the office of President under By-law 20; Prof. G. G. Henderson has been nominated a Vice-President under By-law 20; Prof. E. C. C. Baly, F.R.S., Mr. R. H. Clayton, and Mr. Julius Hübner have been nominated Vice-Presidents under By-law 21, and Mr. Thos. Tyrer and Dr. R. Messel, F.R.S., have been reappointed Hon. Treasurer and Hon. Foreign Secretary respectively.

Members are requested to nominate, on or before May 22nd next, fit and proper persons to fill four vacancies among the Ordinary Members of Council. Forms for this purpose can be obtained from the Secretary of the Society.

By-law 23:—An Ordinary Member of Council shall be nominated by ten or more members upon Form B in the Schedule, a copy of which form shall be furnished by the Secretary upon the written or verbal request of any member, but a member shall not be eligible to sign more than one such nomination form, and the member nominated shall sign the declaration set forth on the form. A nomination shall be declared invalid by the Council if:

a. The member thereon nominated is disqualified for election, or ineligible to be elected, as provided by the By-laws.

b. The nomination is not made on the authorised printed form or substantially not in the manner directed thereon.

c. The nomination form is signed by less than ten members not disqualified or not ineligible to nominate as provided by the By-laws.

d. The nomination form is not received before or upon the day appointed therefor.

e. The member nominated has not signed the declaration printed upon the form.

A member whose nomination aforesaid is declared to be invalid, shall receive notice thereof from the Secretary, and shall not be submitted for election.

CHARLES G. CRESSWELL,

Secretary.

GOVERNMENT ASSISTANCE FOR INDUSTRIAL RESEARCH.

BOARD OF TRADE ANNOUNCEMENT.

May 7th, 1915.

A joint Deputation from the Royal Society and the Chemical Society was received by the President of the Board of Trade and the President of the Board of Education at the Board of Trade Offices, 7, Whitehall Gardens, S.W., on Thursday, the 6th May. With Mr. Runciman and Mr. Pease were Dr. Addison, M.P., Sir H. Llewellyn Smith, Sir L. A. Selby-Bigge, Mr. Ogilvie, Dr. Heath, and Mr. Percy Ashley.

The Deputation, which was introduced by Sir William Crookes, consisted of: Professor A. W. Crossley, Dr. H. J. H. Fenton, Dr. M. O. Forster, Professor W. H. Perkin, Professor W. J. Pope, Professor Arthur Schuster, Professor A. Smithells, Professor J. F. Thorpe, and Mr. R. W. F. Harrison, representing the Royal Society; Dr. Alexander Scott, Professor F. G. Dorman, Professor Percy F. Frankland, Professor J. C. Philip, Sir William A. Tilden, and Dr. Samuel Smiles, representing the Chemical Society; Mr. A. Chaston Chapman (President of the Society of Public Analysts), Professor G. G. Henderson (President of the Society of Chemical Industry), Professor Jackson, and Mr. Edward W. Voelcker, representing the Institute of Chemistry.

Professor Perkin, Sir William Tilden, Professor Frankland, Professor Pope, and Dr. Forster spoke in support of Memorials from the Royal Society and the Chemical Society which had been submitted to H.M. Government on the position of the chemical industries, and the steps which might be taken to improve their status and efficiency in the United Kingdom. The speakers drew attention to the fact that the comparatively backward state of certain industries in this country is due to a failure to realise that modern industry to be successful must be based on scientific research, and to the lack of association between manufacturers and science combined with a want of scientific knowledge and appreciation of the importance of scientific work amongst the public generally, and the lack of organisation among the various chemical and allied industries.

The Deputation advocated Government assistance for scientific research for industrial purposes, the establishment of closer relations between the manufacturers and scientific workers and teachers, and the establishment of a National Chemical Advisory Committee for these purposes.

Mr. Runciman, in reply to the Deputation, pointed out that the Board of Trade fully appreciated the extent to which national industrial progress is dependent upon the utilisation of the services of men of science, and the importance of provision for the thorough training of a very much larger number of industrial chemists than are at present available. He agreed with the views expressed as to the need of closer co-operation between manufacturers and scientific workers and

teachers. The War had shown the weakness of our position in certain important respects, and he was in full sympathy with the general views expressed by the Deputation. The actual proposals would receive careful and sympathetic consideration.

Mr. Pease informed the Deputation that the particular problems to which they had drawn attention had been present to the Board of Education for some time past, and that a scheme had been approved in principle by which substantial additional assistance would be given by the Government to scientific education and to industrial research. He hoped that though the funds immediately available might not be large, they would be sufficient to enable an organisation to be brought into being at an early date, which would be capable of expansion subsequently. Mr. Pease further expressed his appreciation of the offer of assistance and advice by members of the Societies represented at the Deputation.

The text of the Memorial presented by the Royal Society was as follows:—

MEMORIAL TO THE PRIME MINISTER ON THE DEVELOPMENT OF CHEMICAL INDUSTRIES.

The President and Council of the Royal Society have recently had under consideration the state of certain chemical industries in this country as revealed by the effects of the war. These industries are of the greatest national importance; they supply materials required in many different industries, including material required for war purposes, and on them depends the welfare of immense numbers of skilled workers. We are aware that the Government at an early stage foresaw the difficulties with which the country was likely to be confronted, and an Advisory Committee, formed under the auspices of the Board of Trade, has rendered and is rendering service in the desired direction.

As representatives of Science in this country we urge that the main causes of the comparatively backward state of certain industries are: (1) Failure to realise that modern industry, to be successful, must be based on scientific research; and (2) Want of more intimate association between the manufacturers and the workers in science. The Board of Trade has already given facilities for bringing together manufacturers, merchants, and consumers, and the Treasury has recently formed a war trade department in such specialised branches of industry as we have had under consideration. It is essential for the future welfare of the country and for the permanent retention of such industries as may be established here as the result of the war, that some permanent central national organisation should be created. We venture to hope that the Government will take the necessary steps, and we submit the case for your favourable consideration now because of its urgency, and because as a body of scientific workers we know that something more is required than temporary Committees. It is generally admitted that the foreign industries which have outstripped our own, and others which increasingly threaten us, have been built up as the result of about half-a-century's recognition by our competitors of the bearing of scientific research upon manufacturers. If, as we believe, there has been neglect of this recognition here, the present crisis will no doubt lead to the development of more enlightened ideas, and we feel confident that a fresh departure in this country, under the lead of the Government, would have a most important influence upon the future of the growing industries.

It is not for us to formulate any definite scheme for giving practical effect to the representations submitted in this Memorial, but there are certain

special reasons for bringing forward the matter now. One of these reasons is that the Advisory Committee which has been already appointed by the Board of Trade contains the nucleus of such a permanent organisation as in our opinion is essential for the future maintenance of our chemical industries in face of foreign competition. This Committee, which now comprises experts in several branches of chemistry bearing upon industry, might furnish material for the establishment of a larger standing committee, of the nature of an Intelligence Department, serving the chemical industries in the same way that the Commercial Intelligence Department serves merchants and traders. A further reason for our urging the matter at the present time is that in view of the existing state of some of our industries, the chemists of this country generally consider that it is imperative on national grounds that all proposed new developments should be pushed forward with as little delay as possible. Should such an organisation as we suggest be called into existence, we have reason to believe that the services and laboratories of the Chemical Fellows of the Society will be, so far as possible, at the disposal of the Government for the purpose of advising and, if necessary, of carrying out investigations which may be required by manufacturers for the solution of special problems.

We venture to hope that this memorial may receive your favourable consideration for the reasons summarised below:—

(1) Many branches of industry dependent upon foreign chemical manufacture have been seriously affected by the war. The development of these industries in this country requires a very large amount of expert co-operation, and in view of the leeway which has to be made up a considerable increase in the number of research workers is necessary in order to hasten progress and to insure the permanent retention of the new manufactures after the war.

(2) A Standing Advisory Committee comprising some of the foremost chemists in the country is already available as an organisation for the service of the nation in the present emergency. We suggest that this Committee, if suitably strengthened, might form the nucleus of an organisation such as we have in view.

(3) It is believed that if the Government would give official support to the formation of such a Chemical Committee under the auspices, say, of the Board of Trade, the confidence of manufacturers would be secured to an extent that has hitherto been unrealisable. With increased facilities of communication between manufacturers and expert advisers, it may confidently be anticipated that such advice would be more and more sought by those concerned, and our chemical industries benefited to a corresponding extent.

The President and Council of the Royal Society beg leave to assure you that the services of the Fellows are, as they always have been, at the disposal of the Government. In presenting this Memorial they are actuated solely by the desire to promote the interests of a group of large and important industries which have been particularly affected by the war. It is outside the province and beyond the resources of the Society as a purely scientific organisation to undertake administrative control of any scheme which may be formulated with the immediate object of developing trade and manufacture, but realising the vital importance of, and necessity for, a more intimate association between scientific experts and the leaders of industry, they urge most earnestly upon your Government to take the subject of this Memorial into serious consideration.

London Section.

Meeting held at Burlington House on Monday,
April 5th, 1915.

PROF. W. R. HODGKINSON IN THE CHAIR.

THE DETECTION OF SMALL QUANTITIES OF PARAFFIN WAX IN BEESWAX, AND THE DETERMINATION OF A NEW CONSTANT FOR EAST INDIAN AND EUROPEAN BEESWAXES.

BY M. S. SALAMON, B.SC., AND W. M. SEABER, B.SC.,
F.I.C.

The detection of small quantities of paraffin wax in beeswax is by no means an easy task, and the present methods leave much to be desired.

The most satisfactory qualitative test is that devised by Weinwurm, which consists in saponifying 5 grms. of wax, evaporating off the alcohol, dissolving the residue in 20 c.c. of glycerin and adding 80 c.c. of hot water. With pure waxes an almost clear solution should be obtained, while with those containing as little as 4% of paraffin wax, the solution is no longer clear, but thick and opaque, and with 8% flakes are observed. Unfortunately this test is not reliable. Certain waxes of European type often give a cloudy solution, although quite pure; nearly all the waxes of the East Indian type also give a cloudy solution. Insect waxes and carnauba wax when present in the sample behave like paraffin wax. If the paraffin wax used to adulterate the beeswax has a low melting point, such as 42°–45° C., even 8% can be present without affecting the Weinwurm test.

The determination of hydrocarbons affords a fairly satisfactory means for the detection and estimation of large quantities of paraffin wax, but it is a long and somewhat tedious process, and on account of the rather wide limits for the natural hydrocarbons, it is not of much use for small quantities.

Then, again, a consideration of the acid and ester values is capable of giving an approximate estimate of paraffin that may have been added to a European type of beeswax, but in the case of East Indian beeswax the limits for those figures are too wide to admit of more than a very rough estimate. In fact, if the amount of paraffin present were small, these figures would not reveal its presence at all. By "European type" is meant a beeswax with an acid value of 17 to 20 and an ester value of 68 to 78, while the East Indian waxes have acid values of 6 to 10 and ester values of 75 to 120.

We therefore have been searching for some time for a method that shall afford an easy means of detecting small quantities of paraffin wax, particularly in waxes of the East Indian type, and have arrived at the following conclusions:—All pure beeswaxes, whether of the European or East Indian type, yield, after an hour's saponification with $N/2$ alcoholic potash (in the proportion, 10 c.c. $N/2$ alcoholic potash and 10 c.c. alcohol for every gram of wax) a perfectly clear solution. If about 15%, or more, of paraffin wax is present, insoluble oily droplets are distinctly noticeable at the bottom of the flask or floating through the hot liquid. If, however, the percentage of paraffin wax falls much below 15%, it appears to be soluble in the soaps present and cannot be detected in the course of the saponification, hence a special method is necessary for its detection.

It occurred to us that the paraffin wax would be far less soluble in the hot alcoholic solution

than the hydrocarbon natural to the beeswax, and that by observing the temperature at which the hot alcoholic solution becomes turbid, some indication would be obtained as to the presence or absence of paraffin wax, and from a considerable number of observations we find this to be the case.

With pure beeswax the temperature at which a cloudiness appeared in the hot saponified alcoholic solution is practically constant, both in the case of waxes of the European type and those of the East Indian type, but owing to the difference in composition of these two types of wax, it is only to be expected that the two varieties will have different clouding points, and this we found to be the case.

Over a hundred samples, embracing nearly every commercial variety, have been examined, and the extreme limits of temperature at which a cloudiness appeared in the hot alcoholic solution were 59.5° C. to 60.5° C. for waxes of the European type, and 56° C. to 57° C. for waxes of the East Indian type.

In the presence of as little as 5% of paraffin wax, however, these points are considerably disturbed. The method of carrying out the operation is as follows:—One grm. of wax is saponified over the flame for one hour with 10 c.c. of $N/2$ alcoholic potash, and 10 c.c. of alcohol (industrial alcohol may be used for the purpose). The flask is taken off the flame and a thermometer inserted, and the liquid stirred continuously until at a certain temperature the solution becomes cloudy. The point is very sharp and constant. In the case of pure waxes, the cloudiness is followed by immediate precipitation of large flocks; with adulterated samples, however, the clouding is gradual and flocculation does not occur until a lower temperature is reached. The presence of carnauba, stearin, insect, or Japan wax, does not appear to interfere appreciably with this point, but the presence of as little as 5% of paraffin wax raises the point considerably. In the case of waxes of the East Indian type, 5% of paraffin will raise the point from 56° C., the figure for pure waxes, to 61°–62°, and 10% raises it to 69°–70° C. With waxes of the European type, the temperature of clouding rises from 60° C. for pure waxes, to 63°–64° C. for 5% paraffin, and to 71°–73° C. for 10% paraffin.

We append some figures showing the effect of the addition of 5% and 10% of paraffin wax to some of the usual varieties met with in commerce.

Waxes of the European type.

	Original pt.	5% Paraffin.	10% Paraffin.
Benguella beeswax	60°	61°	74.5°
Spanish beeswax	60°	63°	73.5°
Morocco beeswax	60°	65°	75°
East African beeswax	60°	64°	74°
English beeswax	60°	66°	75°
West African beeswax	60°	64°	75°
Abyssinian beeswax	60°	64.5°	75°

Waxes of the East Indian type.

	Original pt.	5% Paraffin.	10% Paraffin.
Chinese beeswax	56°	62°	70°
Calcutta beeswax	56°	62°	70°

The paraffin wax used varied in melting point from 50° C.—60° C.; for paraffin of very low melting point such as 42° C. the clouding point is a little lower, usually about 63° C. for 5%, but the presence of such a paraffin so affects the

melting point and the other physical characters that its presence is usually easily detected, and moreover it is very rare for a low-melting paraffin to be used as an adulterant, the adulterators usually selecting one with a melting point nearer that of beeswax itself.

The following figures on three commercial samples recently examined may be of interest.

No.	Acid value.	Ester value.	Melting pt.	Clouding pt.
1.	18.5	68	62° C.	Not clear
2.	17.9	71.7	63° C.	64° C.
3.	17.9	70	63° C.	67° C.

It will be noticed that the ester and acid values of all of them are somewhat low, and this, coupled with the clouding point, leaves little doubt that they were all adulterated with from 5—15% of paraffin.

It also may be noticed that although these samples were adulterated, yet the figures are well within the limits laid down by the new B.P.

We do not claim that the clouding point is capable of estimating accurately the percentage of paraffin wax present, but it does give a very fair approximation, and so constant is the clouding temperature of pure beeswax that any disturbance of this point should be a valuable indication of adulteration or abnormality.

DISCUSSION.

Mr. W. F. REID said the observation recorded by the authors was most interesting, and no doubt would prove to be of great use in testing samples; but he would like to see some evidence that the impurity was paraffin wax. When control experiments were made in the laboratory, they might be certain that the reaction was due to paraffin wax; but he had come across many samples of undoubtedly pure beeswax that contained a good deal of unsaponifiable matter. As Vice-Chairman of the British Bee Keepers' Association he had examined many hundred samples of wax. Undoubtedly bees under some conditions produced wax containing unsaponifiable matter which was not paraffin. By taking a comb of virgin wax, which was white, a wax free from propolis could be obtained; but usually in melting wax the propolis was partly absorbed by the wax, so that there was always a certain proportion present. If old, pollen-clogged combs were melted down in boiling water no wax was obtained at first; but later it was possible to get a wax quite different from that obtained from new combs, which had only been bred in for one year. Those were points that he would commend to the authors' attention on which to make experiments on wax, the origin of which was known, if possible produced by their own bees.

The wax was chiefly used for shoe-polishes; another use was for making the foundation on which the bees made their combs. Instead of leaving the bees to spend their time building combs, nowadays a bee keeper supplied them with a sheet of foundation with the impress of the cells on it. The bees drew this wax out into cells, and they did not have the trouble of secreting the wax, and consequently did not lose the time during the honey harvest which was necessary for secreting the wax. It had been said that those combs were sometimes made of ceresin or paraffin wax; but that was quite untrue in this country. He had never met with a sample of foundation made with mineral wax. If such materials were given to bees, they at once tore them down. The wax from Africa and East India was made by a different kind of bee; it generally had a lower melting point,

and if it were used for a foundation for British bees, they tore it down. The odour of another species of bee was hateful to our bees, and they rejected it.

A METHOD OF ASSAYING COPPER.

BY ARTHUR FRASER.

The following modification of the well-known "iodide" method of assaying copper has been in use in the writer's laboratory for over fourteen years. As he is unaware that anyone else has tried it, and as it has proved exceedingly useful in his own work, he ventures to bring it to the notice of other assayers, especially those who have much routine work in determining copper, either in ores or other compounds.

It depends on the action of sodium fluoride on acid solutions of ferric salts, with the iron of which it forms a stable compound, Fe_2F_6 , preventing any subsequent reaction between these salts and potassium iodide. So strong, indeed, is the "affinity" of fluorine for ferric iron, that if sodium fluoride be added to a solution containing ferrous and cupric salts the latter are immediately reduced to the cuprous state, or, if in acetate solution, cuprous oxide is precipitated.

The idea of employing sodium fluoride to prevent the reaction between ferric salts and potassium iodide occurred to the late Mr. R. Wightwick Roberts in 1898, and the following process was subsequently elaborated by the writer.

The following are the reagents required:—A standard solution of sodium thiosulphate, 1 c.c. = 10 mgrms. Cu; a solution of iodine in potassium iodide, 10 c.c. = 1 c.c. thiosulphate; a solution of starch (if the starch solution is made with caustic potash, as recommended in Sutton's "Volumetric Analysis" (ninth edition), it is necessary to acidify with acetic acid before using); a solution of sodium acetate, about 1 in 5, rendered just acid with acetic acid; a solution of sodium fluoride—about 45 grms. of the commercial salt are well shaken up in a litre of water, allowed to settle, and the clear solution drawn off.

The process, as carried out in the writer's laboratory, is as follows:—1 grm. of the sample—or, if very rich in copper, 0.5 grm.—is weighed into a porcelain evaporating-dish, of about 14 cm. diameter, and treated with 5 c.c. of hydrochloric acid and 15 to 20 c.c. of a mixture of nitric and sulphuric acids (12 to 1). Unless the results are wanted quickly, the samples are weighed out in the evening and left standing all night in the acids. In the morning the contents of the basins are evaporated to dryness by gentle heat. The heat is then increased till almost all the free sulphuric acid is driven off, the dish is cooled, 5—6 drops of dilute sulphuric acid (1 : 1) are added, followed by about 20 or 30 c.c. of water, a stirring-rod is put in, and the dish is warmed till all the copper sulphate is in solution and then allowed to cool.

About 10—20 c.c. of sodium acetate solution is now added, followed by from 20 to 50 c.c. of sodium fluoride solution. In practice the fluoride is poured in till the red colour of the iron acetate has disappeared, and 10 or 15 c.c. more added. Excess has no effect on the accuracy of the assay.

Potassium iodide crystals (3 to 5 grms.) are now added, and the liberated iodine is titrated in the usual way with thiosulphate and starch indicator. To avoid possible loss of iodine by volatilisation, it is well to begin running in the thiosulphate when commencing to stir gently the contents of the basin.* Iodine solution is then dropped in from

*When the ore contains lead or bismuth the starch should be added betimes, as the yellow colour due to the former, or the brownish colour due to the latter, may be erroneously attributed to free iodine. Except for this brownish colouration, in which, however, the disappearance or reappearance of the blue starch iodide is quite marked, bismuth seems to have no influence on the results.

a burette till the blue starch-iodide colour reappears, and the amount—less the 2—4 drops required to give a distinct blue tinge to the liquid—deducted from the reading of the thiosulphate burette. This is especially necessary with ores containing a dark gangue, which, on being briskly stirred, imparts a purple tinge to the mixture, and is apt to lead to a few drops excess of thiosulphate. The operator, however, soon learns to distinguish between the colour of the starch iodide in the creamy cuprous iodide, and that due to the gangue, and he seldom requires more than 2—10 drops of iodine (equal to 0.01—0.05 c.c. of thiosulphate) to come back to the neutral point.

With low grade ores of 1—2% Cu, the reaction with potassium iodide is often very slow, especially when the presence of a large quantity of iron has led to the addition of an excess of sodium acetate, and the blue starch-iodide colour keeps on returning in a disconcerting manner. Thiosulphate must be added, however, till the liquid remains permanently decolorised. When many such ores are to be tested it saves time to have a dozen burettes in use at once. The reaction may also be accelerated by using little more acetate than is sufficient to neutralise the free sulphuric acid. Care must be taken, however, to add fluoride in excess; 50 c.c. of this solution is sufficient for 0.5 gm.

With sulphide ores containing much antimony or arsenic, a slight variation in the process is necessary, as the antimonious and arsenious acids are apt to be partially reduced during drying, probably by unoxidised sulphur, and, reacting subsequently with the liberated iodine, cause an apparent shortage in the copper contents. It is well, therefore, with such ores, after drying and driving off any residual sulphur, to treat them a second time with the three acids and again dry. Then, after dissolving in water, and before adding the acetate, a solution of potassium permanganate (1 c.c. = 0.5 c.c. thiosulphate) is added drop by drop, at intervals, as the reaction is rather slow towards the end, till a last drop permanently changes the green colour of the liquid to a greyish violet. If the oxidation by the nitric acid has already been complete, one drop of permanganate is sufficient. The operator then proceeds as above, deducting, however, 0.02 c.c. (= 0.02% Cu) from the reading of the thiosulphate burette. Or he may just destroy the violet, and bring back the green colour, with a very dilute solution of ferrous sulphate, and make no deduction. The writer has made many tests, adding as much as 150 mgrms. of As or Sb to half-gram portions of a matte of known copper contents, and, by means of the above precautions, has obtained no sensible difference in the percentage of copper.

When the result of a copper assay is required in a hurry the method may be shortened in the following manner:—The sample is weighed into a flask, attacked with the three acids, boiled down and dried over a naked flame, cooled, dissolved in water, and poured into a dish, using the acetate and fluoride solutions to rinse out the flask, in order to reduce the volume of the liquid. The titration then proceeds as usual. The results are accurate, and the time required 25 to 30 minutes. The whole process could be equally well performed in the flask, but the fluoride is apt to attack the glass. With rich sulphide ores and mattes, however, it is not always easy to get all the copper into solution by this quick treatment.

Though the addition of sodium acetate is convenient in giving an indication of the amount of iron present, and also in preserving the glaze of the dishes, copper may be titrated almost equally well in the presence of a little free sulphuric or hydrochloric acid.

Iron may also be estimated by a similar process, and with sufficient accuracy for all technical

purposes, in chloride solutions containing free acid. The writer was pleased to find his own experience on this point fully confirmed, and, indeed, anticipated, by A. F. Joseph (this J., 1910, 29, 187). In acetate solutions the reduction of the ferric salt is only partial. In sulphate solutions it is complete, but the reaction is so slow that the operator is left in doubt as to the exact end-point of the titration. In the presence of copper, however, the reduction of ferric sulphate by potassium iodide is both rapid and complete.

A rapid and simple process for the determination of copper and iron in the same sample or solution thus becomes available. Two equal portions, A and B, are taken; B is treated with sodium fluoride (using a drop or two of thiocyanate solution as indicator), while to A an equivalent volume of water is added; and both are then titrated with potassium iodide and thiosulphate. The amount of thiosulphate consumed by A gives the Cu + Fe, and that by B the Cu only; the difference in c.c. of thiosulphate $\times 0.8786$ gives Fe.

In a sample containing 10.05% Fe and 0.20% Cu, the writer found 10.06% Fe and 0.19% Cu.

The presence of arsenic acid does not interfere with the technical accuracy of the test, but it causes the blue colour of the starch iodide to return slowly after the titration is finished. To ascertain the amount of this subsequent reaction in the ordinary course of work, and also to illustrate various points in the foregoing paper, tests were made with a matte containing 32.49% Cu and 38.10% Fe, to which arsenic or antimony was added. The samples were treated as above described with acids, and titrated, some with the addition of sodium fluoride and some directly. The results showed that, even in the presence of a large amount of arsenic, the error is insignificant, and the subsequent liberation of iodine, during the 30 minutes succeeding the titration, is very small (maximum 0.13 c.c. of thiosulphate). Indeed, by observing the time from the addition of iodide till the end-point of the titration, and then just destroying the returning blue at the end of a similar period, the operator can calculate back to the exact amount of thiosulphate required for the Cu + Fe.

The advantages claimed for the method are:—

(1) General applicability. It serves equally well for poor copper ores of 0.5%, and rich ores and regulus of 70%.

(2) Accuracy. Tested frequently against the electrolytic method it has proved itself fully equal, if not superior, to it, especially in the presence of other metals liable to be deposited on the cathode. The results of twelve check assays against the electrolytic method showed a maximum difference of 0.1% Cu (mean 0.052%). It gives, moreover, very concordant results, and differences of 0.1% in duplicate assays from the same packet may be confidently attributed either to insufficient preliminary treatment with acids or to spurling during evaporation. To give an idea of the concordance of results obtained in the course of everyday work by the method described above, the writer has made a list of the differences shown between all the duplicate copper assays made in his laboratory during the first six months of last year (and by different operators). Many of these assays were of loose stones brought by miners and prospectors, in which great accuracy was not required, nor were any pains taken to obtain it. The list comprises ores of all kinds and grades, as well as mattes and regulus of from 20% to 65% of copper. In a total of 663 assays in duplicate the average difference was 0.014% Cu. 453 showed differences varying between 0 and 0.05%. In only 18 cases were there differences of over 0.15% Cu, and of these last such as had been repeated proved that the discrepancies were due either to insufficient treatment with acids, or to spurling during evapo-

ration; that is to say, the higher of the two results was almost always the correct one.

(3) Rapidity. One assayer, with an assistant to wash the vessels and attend to the evaporation, can easily, provided he has plenty of heating surface, and a sufficient number of burettes, make over sixty accurate assays of copper in a day.

(4) Simplicity of operation. No separations, filtrations, or transfers from one vessel to another are required. The sample is weighed into its evaporating-dish, where it remains till it is finally washed down the sink after titration with thio-sulphate.

THE ACTION OF DILUTE SOLUTIONS OF ACIDS, ALKALIS, AND SALTS UPON CERTAIN METALS.

BY A. J. HALE AND H. S. FOSTER.

The object of the work, here recorded, has been to compare the corrosive action of dilute solutions upon eight different metals, by estimating the loss in weight which results after immersion for a certain time. The total area of sheet metal used was in each case one square decimetre, the temperature of the solutions was between 17° and 20° C., and the metals were commercial samples, cold hard rolled and polished. (Analyses given in Table 6.)

In one series of experiments, the metals were immersed for seven days in half a litre of solution which was renewed each day (Tables 1 and 4). In a second series of experiments the metals were immersed for twenty-eight days in half a litre of solution which was not renewed (Tables 3 and 5). In a third series the metals were immersed in one litre of dilute acid during four hours (Table 2). The solutions used were *N*/5, and the metals were cleaned, after removal, by rubbing them with a piece of soft wood or a cork, and dried by vigorous rubbing with a duster.

All the results have been checked, and in many cases the number given is the mean of three or more observations. Each metal was well cleaned with pumice before being re-immersed, because it was found that unless the old semi-corroded coating was removed, concordant results were not obtained, since this coating acted as a resistant.

TABLE 6.

Percentage of impurities in metals used.

Zinc	.....	Fe 0.055, Pb 1.10, As trace.
Cast iron	....	Si 2.85, S 0.07, P 1.19, C 3.38.
Wrought iron	Si —, S 0.07, P —, C 0.095.	
Aluminium	..	Si 0.23, Fe 0.28, Na 0.05, Cu trace.
Lead	.....	Ag trace, Zn absent.
Copper	.....	Pb 0.15, Bi 0.03, Fe trace.
Tin	.....	Pb 0.61, Fe 0.014, Zn 0.15, As trace, Cu trace.
Nickel	.....	Si 0.20, Fe 0.46, Cu 0.16.

Table 1. Those numbers marked * were calculated, after proving that the loss in weight per day was constant in all cases where the metal dissolves rapidly.

Table 2. The action of dilute acids during four hours upon zinc and cast iron is similar, but wrought iron is only slowly attacked at first, especially by hydrochloric and sulphuric acids. If the period of immersion be longer, the numbers for wrought iron are similar to those for cast iron. The time needed to reach the maximum velocity of solution varies. During the fifth hour wrought iron lost as much weight in sulphuric acid as during the first four hours, while nitric acid dissolved as much wrought iron during the fourth hour as during the first three hours. Zinc in sulphuric acid lost twice as much during the third hour as during the first two hours, while the maximum rate of action for cast iron in nitric acid and sulphuric acid was during the second hour.

Table 3. Corrosion is, to some extent, due to oxidation, and in some cases the loss in weight is greater than that which would result by direct solution in the amount of acid used.

In conclusion, the results obtained accord generally with published statements, but the following qualifications may be made:—

(1) Copper is acted upon by cold dilute hydrochloric acid to a much greater extent than by sulphuric or nitric acids. Each of the last-named acids attacks the metal to about the same extent.

(2) Aluminium is slowly attacked by dilute nitric acid and sulphuric acid.

(3) Lead is more rapidly attacked by hydrochloric acid than by sulphuric acid, the action of the latter acid being negligible.

(4) Tin is soluble in caustic soda and in sodium carbonate solution, but not in ammonia.

TABLE 1.

TABLE 2.

TABLE 3.

	$\frac{1}{2}$ -litre per day. Loss in grms. per 7 days.			1 litre. Loss in grms. per 4 hrs.			Loss in grms. per 28 days in $\frac{1}{2}$ -litre.		
	HNO ₃	HCl	H ₂ SO ₄	HNO ₃	HCl	H ₂ SO ₄	HNO ₃	HCl	H ₂ SO ₄
Zinc	*17.0	*21.5	*22.0	3.80	4.7	4.0	2.65	3.10	3.0
Cast iron	*15.4	*18.2	*16.0	2.60	3.0	2.8	2.5	2.9	3.2
Wrought iron	*14.5	*19.0	*17.0	1.30	0.17	0.35	2.0	3.3	3.3
Aluminium	0.10	0.35	0.09	0.02	0.01	0.05	0.54	1.68	0.28
Lead	*9.8	1.20	0.01	0.36	0.06	0.00	6.3	0.69	0.02
Copper	0.25	3.0	0.25	0.02	0.03	0.02	0.53	3.20	0.45
Tin	4.0	0.42	0.22	1.62	0.02	0.02	7.20	0.90	0.25
Nickel	4.2	0.25	0.25	0.04	0.01	0.02	2.1	0.45	0.40

TABLE 4.

TABLE 5.

	$\frac{1}{2}$ -litre per day. Loss per 7 days.						Loss per 28 days in $\frac{1}{2}$ -litre.					
	MgCl ₂	NaOH	CaCl ₂	NaCl	NH ₄ OH	Na ₂ CO ₃	MgCl ₂	NaOH	CaCl ₂	NaCl	NH ₄ OH	Na ₂ CO ₃
Zinc	0.95	0.30	0.35	0.10	0.35	0.02	0.30	0.20	0.17	0.20	0.17	0.02
Cast iron	0.85	0.00	0.20	0.10	0.00	0.00	0.45	0.00	0.17	0.32	0.18	0.00
Wrought iron	0.85	0.00	0.30	0.25	0.00	0.00	0.41	0.00	0.25	0.24	0.00	0.00
Aluminium	0.16	20.0	0.05	0.00	0.35	0.80	0.13	2.65	0.03	0.01	0.02	0.14
Lead	0.55	1.0	0.40	0.02	0.02	0.00	0.12	0.69	0.15	0.08	0.01	0.10
Copper	0.25	0.00	0.20	0.02	0.50	0.01	0.10	0.00	0.10	0.03	0.37	0.01
Tin	0.16	0.30	0.13	0.00	0.00	0.01	0.10	0.50	0.08	0.08	0.00	0.00
Nickel	0.05	0.00	0.03	0.00	0.00	0.00	0.10	0.00	0.05	0.00	0.00	0.00

Yorkshire Section.

Meeting held at Leeds on Monday, March 15th, 1915.

MR. F. W. RICHARDSON IN THE CHAIR.

THE THERMAL CONDUCTIVITY OF REFRACTORY MATERIALS.

BY G. DOUGILL, M.Sc., H. J. HODSMAN, M.Sc., AND
J. W. COBB, B.Sc.

Introductory.

A refractory material must primarily resist high temperatures, but advance in the design of high temperature furnaces necessitates, to an increasing degree, the consideration of qualities other than infusibility, and among these thermal conductivity is one of the most important. Refractory materials are used most commonly to bound a space in which a high temperature operation is carried out, and the less heat they conduct the higher is the thermal economy attained. If, however, a little heat is sacrificed by using a material of considerable thermal conductivity, a lower infusibility in the material is permissible. The cylinder of an internal combustion engine is an example of the extreme application of this principle: the temperature attained in it reaches at times the melting point of platinum, but the walls may be made of cast iron on account of its high thermal conductivity. Most of the containing bricks of a steel furnace are cooled on the outer side by exposure to air, and the conduction of heat so permitted undoubtedly affects the length of life of the furnace, and indeed makes the working of such a furnace economically possible. The block of a steel furnace is its most vulnerable part because natural air cooling of the kind just indicated is impracticable, but the use of water pipes and hollow, water-cooled castings is an increasingly common feature in the design of such parts in modern furnaces; the aim is always local protection effected by the dissipation of heat by conduction. The importance of conductivity attaches most obviously to processes in which heat, of necessity, has to be transferred through the refractory material, as through the wall of a gas retort or by-product coke oven. There the speed of working the carbonisation process is limited by the conductivity of the material. Plainly, high conductivity may be advantageous or disadvantageous according to the special circumstances. The dominating necessity of infusibility has so far influenced practice that, in the great bulk of fire-clay refractories, conductivity has been little considered; the manufacture has been the same whether the material was for heat transmission or insulation, but now both manufacturers and users are inclined to give more consideration to the conductivity of their materials. We have been concerned with measuring this property, and particularly with a method which did not involve the preparation of special test-pieces but could be applied to ordinary bricks and blocks.

Conductivity. If a plate of material be taken of uniform thickness, d , and with parallel faces maintained at temperatures θ_2 and θ_1 ,

$$Q = \frac{ka(\theta_2 - \theta_1)t}{d}, \dots \dots \dots (1)$$

where Q is the quantity of heat transmitted in a time, t , a is the area of the plate, and k a constant dependent on the material of the plate; k is termed the "thermal conductivity" of the material, and in C.G.S. units it is the number of calories transmitted from one face of a cube of side 1 cm.

to the opposite face in one second when the two faces are maintained at temperatures differing by 1°C . k , however, is a constant in a limited sense only, and it has long been known that the conductivity of a material might vary considerably with temperature. The experiments here recorded deal with the measurement of k and its variation with temperature.

Until recently the data available with regard to refractory materials were exceedingly meagre, and these only for low temperature ranges, and so of uncertain validity under high temperature conditions. And yet, in the case of refractory materials employed for the transmission or retention of heat at high temperatures, the thermal conductivity at those temperatures is of paramount importance. Some of the data, too, were only relative.

The most complete study of the conductivity of refractory materials hitherto made is due to Wologdine (Bull. Soc. d'Encour., 1909, 879; this J., 1909, 709). In this research the relation of conductivity to temperature, to porosity, permeability, and temperature of firing was studied in the case of almost the whole range of materials found in practice. The results have been widely copied into technical literature and are in general use. Wologdine's experimental methods invite certain criticisms. The material studied was specially prepared in the form of a disc 5 cm. thick, which formed the top of a gas-heated furnace. The temperature difference across this was arrived at by inserting thermo-couples at varying depths, and by extrapolation from the temperatures observed, those of the upper and lower faces were calculated. From special experiments, he deduced that the temperature fell regularly from one face to the other, although this does not accord with other experiments which show that the conductivity varies with temperature. The heat transmitted by the disc was measured in a water-flow calorimeter placed on the top of the disc, the product of the mass of water and its rise in temperature in passing through the calorimeter giving this in ordinary units for a working area taken as equal to the area of contact of the calorimeter and test-piece. From these measurements k was calculated in accordance with equation (1).

It is a serious initial objection to these experiments that they were not made on the refractory materials in the form in which they generally come into commerce, viz., bricks of ordinary shape and size. Again, it is incorrect to take the area of contact of the calorimeter with the test-piece as the effective area of transmission.

By definition, the faces of the slab are supposed to be maintained at uniform temperatures so that the heat flow shall be rectilinear and parallel. On placing a water calorimeter on the disc, the upper surface of the latter becomes locally cooled and the lines of flow of heat thereby distorted in accordance with the new temperature gradients set up. As a result, the area of contact of calorimeter and test-piece can no longer be regarded as the effective area of transmission, which will widen out towards the lower face. In our own apparatus we believe that these objectionable features have been eliminated. Bricks of ordinary size and shape are employed as test-pieces. Parallel heat flow has been attained by jacketing the calorimeter with a second calorimeter at the same temperature on the well-known "guard ring" principle. The water-flow calorimeter has been rejected on account of complications of manipulation, in favour of one in which temperature is constant, and the amount of water evaporated at 100°C . forms a measure of the heat transmitted. A detailed account of the apparatus, which has been in use in these laboratories for two years, will be given below.

Simultaneously and independently, the work of Wologdine has been criticised and the subject investigated by Heyn, Bauer, and Wetzel (Mitt. K. Materialprüfungsamt. Berlin, 1914, [2], 89), and Goerens (Stahl u. Eisen, 1914, 12, 500).

Heyn, Bauer, and Wetzel include a theoretical examination of the transmission of heat through solids and a valuable survey of the various methods of experiment which have hitherto been used. For various reasons they reject all these. In the case of the calorimetric method referred to above, they give as reasons the uncertainty of the effective area of transmission, although we believe that the difficulty is eliminated by the use of the "guard ring" principle mentioned above. They prefer a method based on measurements of the temperature gradients in a brick heated at one end in a special apparatus (see this J., 1915, 426). The deduction of the conductivity from these observations, though perhaps theoretically sound, is a process of considerable complexity, and the results obtained would suggest that it is scarcely justifiable. Thus, they find that the conductivity of a magnesia brick is less than that of common fireclay brick. The magnesia brick employed, judging from the chemical and physical data furnished, is one of a normal type which, it is a matter of common experience, conducts heat very much better than fireclay brick. The same applies to their results for a graphite brick. Contrary to our experience, they find that the conductivity of magnesia increases slightly with temperature.

Goerens, on the other hand (*loc. cit.*), retains the calorimetric method but seeks to obtain parallel heat flow through the brick by means of the "guard ring" principle. Both calorimeter and jacket are of the flow type as used by Wologdine. The temperature slope through the specimen was measured by a series of couples, while the heating was effected by an electrical hot plate. Normal bricks of commerce were tested. Goerens' results agree substantially with ours, although they appear to be generally slightly lower, and he finds with us a decrease in conductivity of magnesia with rise of temperature.

Clement and Egy (Physical Review, 1909, 28, 71) have employed an entirely different method in some measurements on fireclay material; this was prepared in the form of a hollow cylinder, along the axis of which heat was developed electrically and hence the quantity of heat generated per unit of length could be calculated. Thermo-junctions, placed in the cylinder at different distances from the centre, enabled the temperature gradient along a radius to be arrived at and thence, by calculation, the thermal conductivity of the material. The results obtained were slightly lower than ours. The chief practical objection to the method seems to be the necessity of constructing special test-pieces for the measurement. In this and other methods there has also to be considered the probable disturbance of the flow of heat resulting from the insertion of a number of thermo-couples into the test-piece.

The apparatus employed in our experiments is shown in Fig. 1. It consisted of a gas-heated furnace built up in two sections. The lower section, AA, was a rectangular body of fireclay encased in sheet iron and stayed together with tie rods. It was heated by means of a large rectangular (15×95 mm.) Meker gas burner, B, operated by compressed air, and introduced into the base of the furnace. A round hole, O, in each end of the furnace permitted the escape of products of combustion. The top of this furnace body was closed by a thin sheet iron plate, P ($\frac{1}{8}$ in.), in the experiments at the lower temperatures. This had a double advantage, in separating the

flame from the thermo-couples used in temperature measurement, and also in helping to keep uniform the temperature on the lower face of the test brick. Of course this plate did not last long on account of oxidation, and in the higher temperature experiments, when optical methods of temperature measurement could be employed, it was omitted altogether.

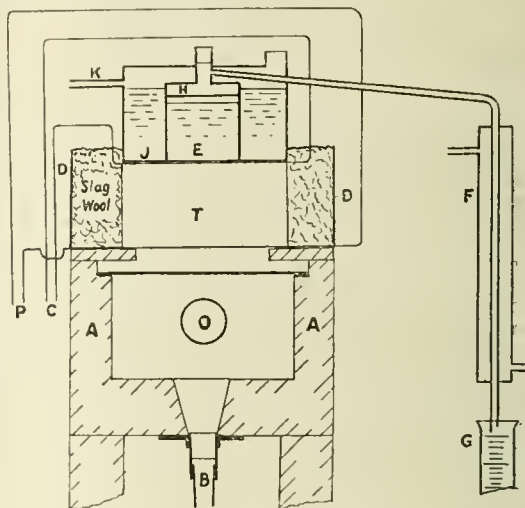


FIG. 1.

The upper section of the furnace contained the test brick, T. This was carried by pieces of firebrick $\frac{1}{8}$ in. thick, which rested on the lower section, and all chinks were sealed by means of fireclay and thin firebrick pieces. Then a sheet iron casing, D, of the same size as the lower casing, was placed in position round the brick and all the space intervening between it and the brick (3 in. to 4 in.) was filled with slag wool, or, for the high temperature experiments, kieselguhr. One advantage of this design of top section was its small heat capacity combined with high thermal resistance, which shortened materially the time necessary to get the apparatus into thermal equilibrium during an experiment.

The temperature fall across the brick was measured usually by two thermo-couples, and this required considerable care. After repeated trial a satisfactory method was found. It was necessary to isolate the lower couple, P, from any possible contact with flame gases. To this end it was enclosed in a thin-walled silica tube of small bore (1.5 mm.) which was cemented into a groove cut in the lower face of the brick. A cement of composition adjusted to the temperature attained was employed, usually a mixture of magnesia, sodium silicate, and fireclay slip. The depth of the groove was such that the couple was flush with the surface of the brick. The silica tube projected sideways on each side of the brick, and to allow for this a slot was cut in the outer iron case of the upper section. A platinum-platinum-rhodium couple was used.

When the temperature of the lower face exceeded 900° C., it was taken with a Holborn-Kurlbaum optical pyrometer sighted on the middle of the lower face through one of the round flue holes of the furnace, the iron plate being discarded. Comparison of the temperatures thus determined with those deduced by means of the thermo-couple showed agreement to 10° C. over the range 900°—1400° C. The determination with the optical pyrometer was much the more convenient

method when possible, and had the advantage of really measuring surface temperatures. The inside of the furnace was doubtless for our purpose a close approximation to an optically black body. The temperature of the upper face of the brick was measured by means of a couple, C, of silver and constantan, lying in a groove cut so that the couple was flush with the surface. Good contact with the brick and care in the placing of the couple were essential. To attain this, a groove of such a size that the couple had to be lightly tapped in was cut by means of a hack saw. The groove being of the correct depth, the couple was so fixed in the proper position. This was a detail of great importance, particularly in the study of high conductivity bricks, for only by care in the determination of the temperatures, and particularly that of the upper face, could adequately concordant results be obtained. The cold junctions of the couples were maintained at constant temperature by immersion in a vessel through which cold water flowed.

Special experiments were made to confirm the reliability of this mode of measuring the temperatures of the faces. Holes were bored right through the brick parallel to, and $\frac{1}{4}$ in. from the groove carrying the thermo-couples. By means of thermo-couples passed through these holes the temperatures of the brick at the region of the holes could be measured and thence those of the surfaces deduced by extrapolation. It was found that the temperatures of the surface thus arrived at were in satisfactory agreement with those measured directly as above. The experiments were made on a certain magnesia brick, and the value for k obtained when using the temperatures of the surface measured directly was 0.0163, and 0.0164 when using those deduced by extrapolation. An exploration of the temperature distribution of the faces of the brick showed that an adequate uniformity over the centre portion was attained.

On the top of the brick was placed the calorimeter (Figs. 1 and 2). This was made of sheet copper of 20 gauge. It was 9 in. long, $4\frac{1}{2}$ in. wide, and 3 in. high, the bottom being made as flat as

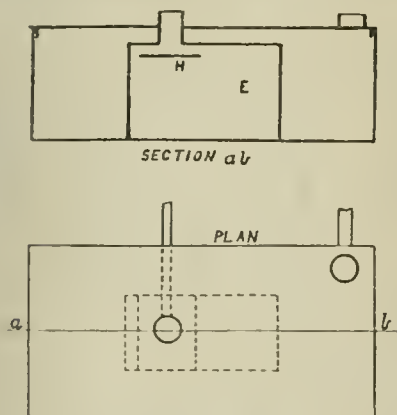


FIG. 2.

possible. In the calorimeter there was fixed an inner chamber, E, 4 in. long by 2 in. wide and $2\frac{1}{2}$ in. high, which formed the calorimeter proper on which measurements were made. The volume of water distilled from this inner chamber was taken as a measure of the quantity of heat transmitted by a central portion of the brick 4 in. by 2 in. in section. The whole calorimeter was covered by a loosely fitting lid, through which projected a tube by which fresh water could be added to the inner chamber when desired. During an experiment this was closed by a rubber stopper. Steam

distilling from the inner vessel passed by a sloping tube running through the outer vessel to a metal condenser, F, at the side. The condensed water was collected in a measuring cylinder, G. The bridge, H, fixed across the inner vessel near the top, was intended to prevent "priming." It was found to be quite effective unless the boiling was exceedingly violent.

The outer chamber, J, was furnished with an overflow tube, K, to maintain the level therein constant during the preliminary heating, the requisite hot water being fed in through an opening made in the lid. During the experiment proper, the feed to the outer chamber was cut off and the water therein boiled away, just like that of the inner chamber, except that it was not collected. It served to form a hot water and steam jacket to the true inner calorimeter. It proved advantageous to surround the inner chamber with a non-conducting jacket, for which purpose, sheet rubber was found very satisfactory.

The joint between the calorimeter and the test brick was another detail on which not a little care had to be expended. The most satisfactory jointing was found to be a mixture of clay slip and magnesia brick dust ground to pass a 90-mesh sieve. This was mixed with water to form a thin paste, which was applied to the wetted surface of the calorimeter, and spread out into a smooth layer thicker at the middle than at the side. The calorimeter was then quickly placed in position, pressed down with a little working backwards and forwards, and a very thin joint with good contact resulted. With care any undesirable entrapping of air bubbles in the joint could be avoided.

To carry out an experiment, the apparatus was set up in accordance with the description given above. The burner was lit and the temperature of the lower face brought quickly to the required temperature and kept there for about one hour before readings were taken, during which time the apparatus gradually acquired thermal equilibrium. During this period the water in the inner chamber was not allowed to distil over. Instead, a reflux condenser was attached to the inner vessel and the steam was condensed and returned to the calorimeter. The metal condenser at the side was meanwhile plugged. The waste water from the reflux condenser was used to maintain constant level in the outer compartment of the calorimeter.

When it was desired to make measurements, the reflux condenser was removed and the opening to the inner chamber tightly closed with a rubber stopper. The steam passed over and was condensed at the side and collected in a measuring cylinder, usually for an interval of 5–10 minutes. From the volume of water collected per minute, the temperature difference, the distance across the brick, and the dimensions of the base of the inner chamber of the calorimeter, the average coefficient of conductivity was calculated for the range of temperature in question, assuming the validity of equation I.

Thus, suppose that 22.6 c.c. of water is collected in five minutes in testing a brick $1\frac{1}{2}$ in. thick when the temperatures of its lower and upper-faces are 1290° and 485° C. respectively. The area of the base of the inner vessel is 8 sq. ins. or 51.6 sq. cms. We are measuring then the transmission of heat by a portion of the brick 51.6 sq. cm. in area and 3.81 cm. thick. The mean coefficient of conductivity for the temperature-range is then:—

$$k = \frac{Qd}{a(\theta_2 - \theta_1)t} = \frac{22.6 \times 536 \times 3.81}{51.6 \times (1290 - 485) \times 5 \times 60} = 0.0037.$$

A number of results obtained with common-refractory materials are included below. The

fireclay bricks were of an ordinary commercial brand. The "soft fired" specimens referred to were made from the same batch as the "hard fired" but had not been kilned at such a high temperature. The tests were made on bricks $1\frac{1}{2}$ in. thick because the temperature range across the brick was smaller than in the case of 3 in. and $2\frac{1}{2}$ in. bricks, and therefore the variation of conductivity with temperature could be more closely followed. The same applies to the experiments with the magnesia bricks, which were of a commercial brand.

The chemical and physical data in Table 1 will serve to characterise the specimens. In this table the apparent specific gravity is the ratio of the mass of the brick to the total volume, *i.e.*, including pores, and the true specific gravity is the ratio of the mass to the volume occupied by the solid matter of the brick, *i.e.*, excluding pores. The method of determination would take no account of closed pores. The corresponding porosities are also given. P_a is the ratio of the volume of the pores to the total volume of the brick, and P_b the ratio of the volume of the pores to the volume of the solid portion of the brick.

θ_1 and θ_2 a space is enclosed, the area of which is

$$\int_{\theta_1}^{\theta_2} k_{\theta} d\theta = \int_{\theta_1}^{\theta_2} (a + b\theta + c\theta^2) d\theta \\ = a(\theta_2 - \theta_1) + \frac{b}{2}(\theta_2^2 - \theta_1^2) + \frac{c}{3}(\theta_2^3 - \theta_1^3)$$

The area will also equal the product of the mean ordinate and the temperature difference, *i.e.*, $k_m(\theta_2 - \theta_1)$ where k_m is the mean conductivity in the range θ_1 to θ_2 .

$$\text{Then } k_m(\theta_2 - \theta_1) = a(\theta_2 - \theta_1) + \frac{b}{2}(\theta_2^2 - \theta_1^2) + \frac{c}{3}(\theta_2^3 - \theta_1^3)$$

$$\text{or } k_m = a + \frac{b}{2}(\theta_2 + \theta_1) + \frac{c}{3} \left(\frac{\theta_2^3 - \theta_1^3}{\theta_2 - \theta_1} \right) \dots \dots \dots (2)$$

$$\text{when } k_{\theta} = a + b\theta + c\theta^2 \dots \dots \dots (3)$$

The curves given in Fig. 4 show how the conductivities of the magnesia (II.) and fireclay (I.) bricks studied vary with temperatures. The curve for silica does not differ much from No. 1 over the range studied. Each cross represents the experimental values of the average conductivity over a range of

TABLE 1.

Specimen.	Chem. analysis.	Thick-ness.	Apparent sp. gr.	True sp. gr.	P _a	P _b	Temp. range of measurement.		Mean k.	Remarks.	
							Lower surface.	Upper surface.			
Fireclay brick (Farnley)	SiO ₂ 66.0	1½"	1.95	2.54	23.3%	30.3%	825°	260°	0.0029	Hard fired to Seger cone 10—11 approxim'tly another specimen	
	Al ₂ O ₃ 31.0						970°	300°	0.0029		
	Fe ₂ O ₃ 1.2						1080°	330°	0.0036		
	CaO 0.3	1½"					1440°	550°	0.0040		
	MgO 0.9						1100°	420°	0.0033		
	Alk. 1.0						1350°	510°	0.0039		
Fireclay brick (Farnley)	as above	1½"	1.90	2.67	28.7%	40.4%	1005°		0.00165	Soft fired to Seger cone 8—9 approxim'tly	
							1020°		0.00120		
Silicious brick (Farnley)	SiO ₂ 82.5	3"	1.82	2.53	28.2%	39.3%	1300°	310°	0.0025	With many silica grains	
	Al ₂ O ₃ 16.1										
	Fe ₂ O ₃ 1.2										
	CaO & MgO Tr.										
	Alk. 1.3										
Silica brick (Gregory)	SiO ₂ 95.3	2½"	1.75	2.32	24.6%	32.6%	1240°	440°	0.0039	Another specimen. Both coarse grained.	
	Al ₂ O ₃ 2.0	2½"	1.74	2.32	24.8%		995°	295°	0.0030		
	Fe ₂ O ₃ 1.1										
	CaO 1.5						1210°	370°	0.0035		
							1395°	440°	0.0042		
	Magnesia brick (Mabor)	SiO ₂ 5.0	2½"	2.40	3.51	31.4%	45.9%	380°	270°		0.0170	Finer grained than the above.
Al ₂ O ₃ 0.4		560°						325°	0.0151		
Fe ₂ O ₃ 1.6		600°						400°	0.0148		
CaO 1.7		700°						450°	0.0132		
MgO 92.1		750°						470°	0.0116		
		875°						525°	0.0110		
		1025°						580°	0.0101		
		1040°						590°	0.0098		
		1370°						690°	0.0091		

The chemical analysis and porosity data were not derived from measurements on the actual test brick but on similar specimens of the same make. They will correspond approximately with those of the test bricks.

The experimental values obtained by the method described in this paper are for mean conductivities, *i.e.*, they are calculated on the supposition that the conductivity remains constant over the temperature interval in question, and the values have no precise meaning apart from the temperature limits. It was, however, desirable to know how the conductivity actually varies with temperature so that the true conductivity at a given temperature could be ascertained from our results.

The relation between the true and mean conductivities can be stated as follows:—Let the true conductivity at θ° C. k_{θ} , vary with temperature as shown in the curve in Fig. 3, when $k_{\theta} = a + b\theta + c\theta^2$. When ordinates are raised at

temperature, the mean point of which is shown in the abscissa. If this range of temperature be not excessive so that the conductivity may be taken as fairly constant over it, then these values will approximate to the true conductivities at the temperatures given.

By inserting the experimental numbers into equation 2 and solving for 3 cases, the values of a , b , and c have been deduced and thence the equation connecting the true conductivity with temperature. For the magnesia brick it is:—

$$k_{\theta} = 0.0285 - 0.379 \times 10^{-4} \theta + 0.179 \times 10^{-7} \theta^2$$

This equation approximates closely to the curve II. in fig. 4.

The variation in the case of the fireclay brick may be taken as linear and similarly:—

$$k_{\theta} = 0.00155 + 0.25 \times 10^{-5} \theta$$

These curves show in striking contrast the influence of temperature on the conductivities of

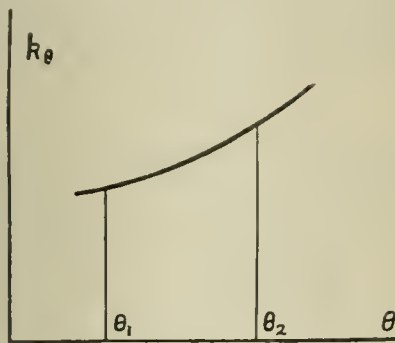


FIG. 3.

magnesia and fireclay. The apparently linear increase found in the latter case appears to be quite normal and usual in refractory materials. It is therefore difficult to account for the fall in the conductivity of magnesia at higher temperatures, although from our experiments there seems to be no doubt about it. Goerens (*loc. cit.*) found a similar fall in his experiments made on a magnesia brick richer in iron oxide than the one we used and probably denser. Even at the high temperatures, however, the conductivity of magnesia bricks is much greater than that of fireclay.

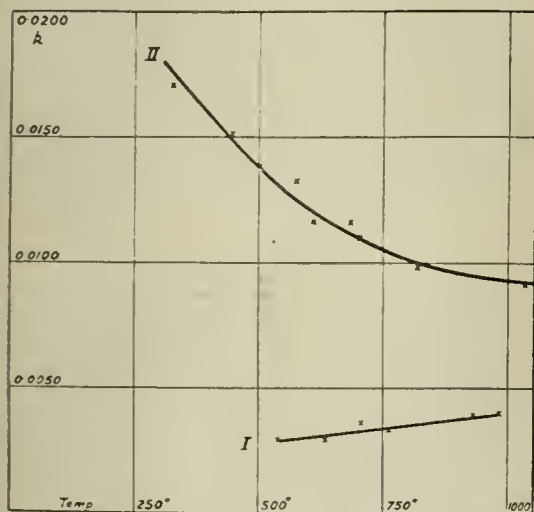


FIG. 4.

The variations of conductivity with temperature in the case of silica and silicious bricks are of particular interest in view of the growing importance of these refractories, but the data accumulated are as yet insufficient to allow definite conclusions. Some typical values are given for these materials and, as will be seen, they do not differ considerably from those of fireclay, although silica appears to have the slightly higher conductivity. The low value for the "soft fired" brick calls attention to the desirability of high temperature kilning where rapid heat transmission is important.

Thermal resistance of a joint.

In the construction of furnaces, the character and thickness of the joints of the brickwork may exercise a considerable influence on the transmission of heat, especially when the joint is disposed at right angles to the direction of heat flow. How great this influence may be in any particular case will depend on the nature and porosity of the jointing material. Experiments were made to get an idea of the thermal resistances of joints. The experiments, which were of a preliminary character only, indicated that the conductivity of the joint was of the order of one-tenth of that of the bricks.

Porosity.

It is well known that the transmission of heat by refractory materials is impaired by porosity, and heat-insulating materials are frequently rendered porous intentionally. It has been suggested recently by Mellor (J. of Gas Lighting, Mar. 10, 1914) that the heat insulating properties of pores will vanish at high temperatures, on account of the increase in importance of the radiation of heat across them, with rise of temperature, as compared with the conduction of heat through the solid material. This is doubtless true in part, because the rate of transmission of heat by radiation across a pore is, by Stefan's law, proportional to the difference in the fourth power of the temperatures, whereas the conductivity in the solid depends on simple temperature differences. Mellor, apparently overlooking the influence of the size of the pores and intervening solid grains, calculated that the rate of radiation across a pore would equal the rate of conduction through the solid at a red heat. The size—and also shape—of the solid grains and pores is, however, very important, because it determines largely the rate of conduction through the solid but does not affect the rate of radiation across pores. Taking this into consideration for pores of the size usual in refractory materials, it may be calculated that only at temperatures of several thousands of degrees does radiation become of the same importance as conduction. Thus, suppose we compare the transmission of heat across a parallel-faced slab of solid material 0.01 cm. thick by conduction and the transmission by radiation across a similarly shaped air space, when the two parallel faces are in each case at T_1° and T_2° absolute. The quantity of heat transmitted by conduction across the solid per sq. cm. per second equals $100k(T_2 - T_1)$ calcs. and by radiation across the pore:—

$1.26 \times 10^{-12}(T_2^4 - T_1^4)$ calcs., where 1.26×10^{-12} is the constant of the Stefan-Boltzmann equation.

When the transmission of heat by radiation has become equal to that by conduction we can equate these, giving:—

$$100k(T_2 - T_1) = 1.26 \times 10^{-12}(T_2^4 - T_1^4) \dots \dots \dots (4)$$

It is easy to calculate, from equation 4, at what order of temperature the transmission of heat across a pore by radiation would become equal to that through a solid grain of the same size—say 0.01 cm.—by conduction, bearing in mind that $T_2 - T_1$ would be very small compared with either T_2 or T_1 . Calling $(T_2 - T_1) \Delta T$, then:—

$$\frac{k}{0.01} \Delta T = 1.26 \times 10^{-12}[(T_1 + \Delta T)^4 - T_1^4] \dots \dots \dots (5)$$

$$= 1.26 \times 10^{-12} \cdot 4 \Delta T \cdot T_1^3 \text{ when higher terms of } \Delta T \text{ are neglected.}$$

$$\therefore T_1^3 = \frac{k \times 10^{12}}{0.01 \times 1.26 \times 4}, \text{ whence assuming } k = 0.003$$

$$T_1 = 3910^\circ \text{ abs.}$$

The true value for k for the solid material of the brick will be greater than 0.003, and if that

were inserted, then still higher values of T_1 would be found.

The average pore diameter in a refractory material is, of course, much less than 0.01 cm., so that only at temperatures far above the melting points of refractory materials does the heat insulating effect of pores vanish, and porosity increases the heat insulating effect at all temperatures in use. Moreover, the smaller the size of the pores in the direction of heat transmission, the greater is the heat insulating effect for the same actual pore space.

The absolute temperature at which the breakdown of insulation by pores in any material occurs is given by an expression got by modification of equation 5:—

$$T = 10^4 \sqrt[3]{\frac{k}{5d}} \dots\dots\dots (6)$$

where d is the pore or grain diameter and k the conductivity of the solid material.

The ratio, r , of heat conducted by a solid grain to that radiated across a pore is given by

$$r = \frac{2k \times 10^{11}}{dT^3}$$

The size of the space has then an important influence, and if it were of the order of 1 cm. in thickness, then Mellor's conclusion would be sound, and with T_2 and T_1 differing by 100° C. at a red heat, the transmission by radiation would become of the same order of magnitude as that by conduction across the solid.

While this does not apply, as has been shown, to the ordinary pores of a brick, yet it has considerable practical importance in other directions. It shows the limitations of the effectiveness of air spaces as heat insulators in furnace construction. It is clear from this calculation that at a red heat the radiation of heat across an air space would render it ineffective as a heat insulator, and that it would be better to fill the air space with solid material—for preference highly porous. Convection in the air space would also lower its insulating efficiency. That a loosely filled space is a better heat insulator at a high temperature than an empty one appears to have been verified experimentally by Ray (Fischer's Taschenbuch für Feuerungstechniker, p. 119) but we have had no opportunity of consulting the original.

Another interesting corollary to these considerations is that if radiation across pores is negligible at all ordinarily attainable temperatures, it cannot operate in causing the rise of thermal conductivity with temperature occurring in most refractory materials. The abnormality of magnesia confirms this, suggesting that the variation in conductivity is dependent on the nature of the solid material.

Diffusivity.

In all the measurements recorded in this paper the temperature conditions in the test brick have been steady. This answers to the definition of conductivity and is essential to the deduction of k by this method. But until such thermal equilibrium has been reached, the influence of heat conducted across the brick in causing a temperature rise is not determined by the conductivity solely, but also by the heat capacity per unit volume of the material—the greater the latter the smaller the temperature rise produced. In such cases, *i.e.*, in all heating-up operations, it is the "diffusivity" or "thermometric conductivity" with which we are concerned. This is the quotient of the thermal conductivity by the heat capacity per unit volume, or $\frac{k}{cs}$, where c is the specific heat and s the specific gravity of the material. The "diffusivity" in C. G. S. units

measures the rise in temperature produced in 1 c.c. of the substance by 1 calorie flowing in one second through 1 sq. cm. of a layer 1 cm. thick having a temperature difference of 1° C. between its faces.

To compare the diffusivities of the materials used in these experiments it will be necessary to measure their specific heats, for the available data are very meagre. Heyn and Bauer give some specific heat measurements made on their materials, which will doubtless be approximately true for ours and serve to give an idea of relative diffusivities.

TABLE 2.

Material of brick.	Thermal conductivity.	Temp.	Specific gravity.	Specific heat.	Temperature diffusivity.
Fireclay .	0.0028	500° C.	1.95	0.23	0.0062
	0.0040	1000° C.		0.26	0.0079
Silica	0.0024	500° C.	1.74	0.26	0.0053
	0.0046	1000° C.		0.27	0.0098
Magnesia .	0.0141	500° C.	2.40	0.26	0.0226
	0.0085	1000° C.		0.28	0.0126

The results we have obtained for silica and fireclay material do not disclose any appreciable difference in conductivity for lower temperatures, but at higher temperatures the thermal conductivity of silica seems to be rather greater. The difference in conductivity is emphasised if the fireclay material is soft-fired, which induces low conductivity. This is of some note. Gas retort material, for example, when the retort is made in one piece, is often soft-fired to maintain straightness of line in burning, although in high temperature carbonisation the harder firing may be effected in use, and the defect remedied. Built-up retorts have an advantage in this connection, as hard-fired bricks can be used. The temperature diffusivity of silica appears to be, at high temperatures, appreciably greater than that of fireclay materials, and in intermittent heating operations, including many carbonising processes, the changes of temperature in the refractory may be so considerable as to make this property of more importance than the thermal conductivity alone. It would seem desirable to investigate the point more closely. The high thermal capacity of magnesia moderates its diffusivity but still leaves it markedly superior to the other materials.

DISCUSSION.

Mr. F. W. RICHARDSON said that some years ago he had had to ascertain the conductivity of various packings for boilers, and he was surprised to find what a splendid non-conductor magnesia was. Had the authors considered the influence of the presence of iron oxide on the conductivity?

Mr. T. FAIRLEY asked whether the density of the bricks had been determined, and if the effect of subjecting them to high pressures had been studied. He thought the latter would reduce the size of the pores, and thus affect the conductivity.

Mr. C. P. FINN asked what was the influence on the conductivity of a coke oven wall, of the deposited carbon which permeated the joints and fireclay blocks after the ovens had been in use for some time.

Professor COBB, in reply, said that the excellence of porous light magnesia coverings for heat insulation and of hard calcined magnesia bricks for heat transmission, illustrated the impossibility of associating conductivity with chemical composition alone, and the necessity of considering physical constitution also. The influence of pressure in increasing the density of bricks by diminishing pore space was not so great as might be expected at first sight, for several reasons, but in so far as

pressure had that effect, it would presumably increase conductivity. Deposition of carbon in pores of brickwork would also in all probability increase conductivity unless a disintegrating effect accompanied it. Iron oxide if present in quantity would increase fusibility, shrinkage, and density on burning, and by lessening pore space would also be expected to increase conductivity.

Meeting held at The Queen's Hotel, Leeds, on Monday, April 19th, 1915.

MR. F. W. RICHARDSON IN THE CHAIR.

THE COMPOSITION OF SOME TYPES OF CHEMICAL GLASSWARE.

BY F. W. BRANSON, F.I.C.

The problems arising out of the present war as regards the supply of chemical glassware very soon became acute, owing to the fact that practically the whole of the glass apparatus used in this country was obtained from Continental sources, chiefly Germany and Austria. I therefore took early steps to ascertain by means of chemical analyses the composition of typical chemical glassware in general use (more particularly beakers and flasks) and miner's lamp glasses. The composition of these having been ascertained, it was possible to give manufacturers working formulae in October last. In order to secure economy and facility of output, one glass—a zinc borosilicate—was selected for the manufacture of beakers and flasks which were by that time urgently needed, by Ordnance Works more especially. This glass has been adopted by the British Laboratory Ware Association, Ltd., as exhaustive tests have proved it to be similar to what was the best obtainable previously, namely, Jena "zinc borosilicate" glass. Reports on "B.L.W." glass from various expert and other sources (particularly from Ordnance Works) prove it to be, if carefully annealed, a reliable and economical substitute for the various types of chemical glassware previously in use. A 750 c.c. flask made from an early batch was reported on as follows on December 14th, 1914:—"About 250 c.c. of water was put in the flask and well boiled, then quickly cooled by holding under the tap. The water was boiled again and quickly poured out and cold water run into the flask whilst as hot as possible. About 10 grms. of drillings was dissolved in hydrochloric acid, evaporated to dryness, baked hard, cooled, and dissolved in hydrochloric acid. This was repeated three times. In the last case baking was continued for 1½ hours on the hottest plate. 300 c.c. of 20% caustic soda solution was put in the flask and kept at a steady boil for 2 hours. The soda was quickly poured out and the flask plunged under cold water. There was no indication of 'frosting' on drying the flask."

The constituents of a large number of glasses will be found in:—Thorpe's Dictionary of Applied Chemistry, Vol. 2, page 719, also in "Formulas for Glass Manufacture" by the Institute of Chemistry, and in "Notes on Glass"† by the National Physical Laboratory.

The work I have carried out is partly covered by the "Notes on Glass" and "Formulas for Glass Manufacture" alluded to above, therefore I have not given any analytical data of glasses for which analyses have been recently published

except in the case of Kavalier's potash-soda glass, which show the close similarity between the two analyses, the figures in the second column being those given in "Notes on Glass."

	%	%
SiO ₂	75.96	76.02
Al ₂ O ₃	0.40	0.61
Fe ₂ O ₃	0.08	trace
CaO	8.48	7.38
MgO	0.14	0.30
K ₂ O	7.48	7.70
Na ₂ O	7.34	7.60
	99.88	99.64

This glassware was found to be next in order of merit to the Jena zinc boro-silicate glass, but owing to the war the supplies of potassium salts practically failed, therefore this type of glass was not recommended for manufacture. Experiments were also made (and are being continued) with a hard soda glass which works well in the blowpipe flame, the analysis being as follows:—SiO₂, 76.18%; Al₂O₃, 2.86%; Fe₂O₃, 0.07%; CaO, 4.52%; MgO, 0.14%; Na₂O, 16.43%.

No analyses were made of soft soda glasses, as these were already obtainable of British manufacture for the production of test tubes, etc.

Analyses were also made of two distinct types of glass combustion tubing. A Jena sample contained SiO₂, 66.90%; Al₂O₃, 6.38%; Fe₂O₃, 0.22%; BaO, 7.27%; CaO, 7.91%; MgO, 0.61%; K₂O, 2.40%; Na₂O, 1.25%; B₂O₃, 7.22%.

The other type of combustion tubing (Kavalier) gave the following figures:—SiO₂, 79.57%; Al₂O₃, 0.32%; Fe₂O₃, 0.038%; CaO, 7.80%; MgO, 0.11%; K₂O, 11.60%; Na₂O, 0.66%. The infusibility of this glass is due to the high percentage of silica present.

A further problem investigated was the miner's lamp glass, the Continental supply having practically ceased. So far as my knowledge goes the Jena miner's lamp glass was the best then in use, and the analysis of one specimen gave the following:—SiO₂, 73.08%; Al₂O₃, 1.98%; Fe₂O₃, 0.15%; CaO and MgO, traces; Na₂O, 7.76%; B₂O₃, 17.22%.

With instructions as to procedure these figures were given to a manufacturer, but the glass was found difficult to work, being rather pasty, even at a high temperature. The working formula was then altered with much better results, and the lamp glasses will bear the Board of Trade test of immersing in cold water and raising to boiling point, continuing at that temperature for 20 minutes, then suddenly plunging the glass into cold water (temperature 15° C.); no fracture resulted. It is a very tough glass and is broken with difficulty, say by a miner's pick.

The sand used in my experiments was of French origin and almost entirely free from iron. The calcium carbonate and aluminium hydroxide were of British origin and were commercially pure.

The high temperature coke furnace I used for the experiments was a very convenient one for the purpose, as the temperature could be readily regulated up to white heat and each experiment could be carried out in duplicate under the same conditions, similar to those obtaining in glass works. Each melt could be started cold and continued at the desired temperature for many hours.

In conclusion I beg to express my indebtedness for analytical and other assistance to Mr. F. H. Branson and Mr. W. McD. Mackey.

DISCUSSION.

Mr. FRANK WOOD said that the great trouble in England was the shortage of labour: a long

* This Journal, April 30, 1915, pp. 424-5.

† This Journal, March 15, 1915, pp. 210-1.

training was necessary to produce an expert glassblower. He had been informed that if a glass contained arsenic, it became clouded with the repeated heating and cooling in working up in the blowpipe. He supposed arsenic was used because it cleared the molten glass of air bubbles and impurities, but this result could be obtained just as well by the use of ample time and heat. If sodium carbonate were used, the resulting glass was not so good as if the nitrate were used.

Mr. C. P. FINN asked whether there was any special process of annealing safety lamp glasses. He had seen glasses which fractured into pieces, only being held in place by the metal frame of the lamp. The nature of the fracture was similar to that of toughened glass or of a Rupert's drop.

The CHAIRMAN said that he supposed the glasses used in the electric lamps would have to be toughened.

Mr. Wood said that in the modern lamps the globe carrying the filament was surrounded by a separate globe of very thick glass. If that outer globe were broken, it automatically extinguished the light.

Mr. T. FAIRLEY said that he had found that the moment the surface of toughened glass was fractured, the glass flew to pieces. The same thing happened if the outer surface were dissolved away in hydrofluoric acid. It appeared therefore that only the outer surface was toughened.

Mr. FRANK WOOD said that in the case of a doubtful looking apparatus it was very useful to re-anneal it by placing in a cold oil bath, and gradually heating to as high a temperature as was safe, afterwards allowing it to cool slowly.

Mr. F. W. BRANSON agreed with Mr. Wood that the presence of arsenic was objectionable and unnecessary. He considered that the use of a certain proportion of sodium nitrate in the manufacture of glass was an advantage. Pure alumina was very low in price and worked well. Several firms in this country manufactured miner's lamp glasses, and since the war certain tests had been somewhat relaxed by the Board of Trade. Some of the glasses were toughened by dipping in oil.

An extensive collection of British-made chemical glass and porcelain ware, nickel crucibles, filter-papers, etc., was exhibited by the British Laboratory Ware Association, Ltd.

THE ANALYSIS OF TANNING MATERIALS.

BY ALEXANDER T. HOUGH.

It is a recognised fact that the official method of analysis of the International Association of Leather Trades Chemists, even in its present improved form, leaves much to be desired from the point of view of accuracy.

Mr. Bennett's recent suggestions (this J., 1914, 33, 1182, *seq.*), if finally adopted, will greatly enhance the value of the method, and it is to be regretted that the research work was not pushed to this point before the last change of method was made in 1907, as it was even then realised in which direction the present official method could be improved and made to give higher non-tannins.

The change which was then made reacted upon the trade inconveniently for some considerable time, owing to the apparent loss of tannin indicated by the new method; and at that time, if this loss had been still greater to the extent of the sugges-

tions now made by Mr. Bennett, the resistance of the trade would probably not have been stronger.

The friction caused by the previous change of method passed, in England, in about a year. But on the Continent of Europe it was so great that the trade actually proved stronger than the chemists, and to this day, although the "shake" method is the official method of the I.A.L.T.C., it is only used on the Continent rarely, and by special request of the client; ordinarily the old filter bell method obtains, using dry chromed hide-powder.

It will certainly be difficult to impose a second and still more sweeping change than the last on the English trade, and it seems rather futile to force more changes upon our own people when the continental and American trades will not fall into line as they ought to do, for the improvements suggested are equally applicable to all present methods of tannin analysis, and if adopted in England only will put English traders to a serious disadvantage.

In Mr. Bennett's first paper there is, however, one statement which appears to be misleading: he says that by increasing the dilution of the extract solution the non-tannins are increased, and he quotes figures showing that by adding 100 c.c. of water to each 100 c.c. of tannin solution shaken with 26.5 grms. of wet chromed hide-powder, an increase of non-tannins is obtained.

Now although the experimental work is correct and higher non-tannins are actually obtained under these conditions, the higher non-tannins are not due to dilution of the solution, but to the fact that 26.5 grms. of hide-powder is now being used to detannise 200 c.c., whereas before, the same quantity was used to detannise 100 c.c. The concentration of the hide-powder has been decreased, and it cannot therefore do as much work in a specified time. If the quantity of tannin per litre of solution is decreased by 50%, and 100 c.c. be shaken with 26.5 grms. of wet chromed hide-powder, the non-tannin will actually be lower than with a stronger solution, for obviously, there being less tannin in the solution, it is more quickly absorbed, and the hide-powder subsequently commences to absorb the non-tannins. That this is a fact may be proved by experiment. The difference is not great, but that only proves the efficacy of chroming the hide-powder, one object of which is to reduce the absorption of non-tanning matters. Thus, by dilution of the tannin solution, lower non-tannins are obtained unless larger quantities of solution be used, or smaller quantities of hide-powder, and the same result may be obtained by increasing the strength of the solution of tannin. Actually it would seem best to use tannin solutions of the present official strength and reduce the quantity of hide-powder employed to such a point that detannisation is just effected.

Then again Mr. Bennett suggests that the reduction of the quantity of hide-powder employed may "involve some extension in the time of shaking." This seems as undesirable as it is unnecessary, for if changes are to be made, they should be as few as are necessary to obtain the desired degree of accuracy. Now the concentration of the tannin solution being constant, smaller quantities of hide-powder take longer to detannise, and *vice versa*, since the present method uses a large excess of hide-powder, there is no need to alter both factors—hide-powder and time. The quantity of hide-powder should, as suggested, be reduced to such a point that it will do its work in the official $\frac{1}{4}$ hour. If the detannisation is not complete too little powder has been employed.

It thus appears that, so far as infusions of fresh tanning materials and solutions of tanning extracts are concerned, it is only desirable to change three factors, viz.:—(1) The acidity of the hide-powder before chroming, which should be reduced to *nil*

by extending the method suggested by Dr. Parker and myself (Collegium, 1908, No. 310; this J., 1908, 695). (2) The reduction of the quantity of hide-powder per "shake" to such a point that solutions of the present official strength are just detannised in $\frac{1}{4}$ hour. (3) The employment of a more basic chromic salt for chroming the hide-powder.

In regard to tannery liquors I can only endorse Mr. Bennett's statements and eulogise his suggestions, excepting that which mentions dilution of the solutions for the estimation of non-tannins, to which the arguments instanced above apply with even greater force, owing to the larger quantities of non-tannins and free organic acids contained in such solutions. Back tannery liquors are usually somewhere between $N/50$ to $N/20$ in volatile acids, and the tannin strength is often within the limits prescribed by Mr. Bennett, so that these liquors would seldom require dilution before analysis, and acid solutions of such a strength and in presence of so little tannin would certainly seriously influence results. It is certain that the hide-powder will primarily absorb the strong organic acids, thus automatically changing its condition and absorptive capacity before attacking the tannin.

I would suggest the possibility of reducing the acidity of all tannery liquors to some predetermined standard by first estimating the volatile acidity by the lime water method, or the concentration of the H-ions by means of the apparatus described by Wood, Sand, and Law (this J., 1911, 872), then adding sufficient standard soda to neutralise to a certain fixed point—such as will leave the solution slightly acid, in order to prevent oxidation—and afterwards detannising as suggested, but without further dilution. After detannisation one might add to the non-tannins sufficient tartaric acid to combine with the added soda, together with an excess of 25 mgrms., and correct for sodium tartrate and tartaric acid in the final result. This is in order to expel all volatile acids as suggested by Mr. Bennett.

The washing of the hide-powder has always been the *bête noire* of the "shake" method, and soon after the method was adopted in England it was suggested that this washing might be avoided by simply doing a blank test with distilled water and correcting the non-tannins by subtracting the residue thus found. A blank test with washed powder gives between 1 and 2 mgrms. of residue, mostly organic, per 50 c.c. evaporated. This residue precipitates tannin and is probably reduced to nil during shaking. The liquor squeezed from unwashed hide-powder, however, gives a flocculent precipitate with tannin, and 50 c.c. filtered and evaporated give a residue of about 223 mgrms., composed mostly of hydrolysed hide-substance or gelatones. In a blank test made with 26.5 grms. of wet, chromed, and unwashed hide-powder, shaken with 100 c.c. of distilled water, 50 c.c. of filtrate gave a residue of 32 mgrms.

On shaking this hide-powder with tan solutions, one would have expected these precipitable gelatones to have been thrown out of solution at first, and absorption of tannin by the hide-powder to have taken place secondarily. This, however, is not the case. By increasing the concentration of the tannin solutions shaken, the gelatones in the non-tannins decrease, as shown by the increasing feebleness of their reactions with tannin solutions and the decreasing differences between the residues yielded by washed and unwashed powders as the tannin strength advances (see table).

Eventually, by diminishing the hide-powder employed, or increasing the strength of tannin, one might arrive at a point where no further cloudiness would be shown by the non-tannins on addition of tannin, but as this point would be

always doubtful, and a correction therefore always variable, it would seem useless to attempt to do tannin analyses with unwashed hide-powder.

Concentration of tan solution.	Washed hide-powder.	Unwashed hide-powder.	Difference.
	grms.	grms.	mgrms.
0.37%	0.0480	0.0600	12
0.185%	0.0230	0.0390	16
0.074%	0.0060	0.0230	22
distilled water	0.0020	0.0320	30

In the experiments shown in the above table, 100 c.c. of tan solution was shaken for $\frac{1}{4}$ hour with 26.5 grms. of wet chromed hide-powder—representing 6.5 grms. of dry hide-powder—and the residues given are on 50 c.c. of the resulting non-tannin, evaporated and dried.

THE ANALYSIS OF TANNING MATERIALS: A REPLY.

BY H. G. BENNETT.

(I.) Some criticism is offered by Mr. Hough on the writer's suggestion to increase the dilution at which detannisation is effected. The facts are, that when the same weight of hide-powder is used to absorb the same weight of tannin, in the same manner, an increase in the dilution of the tannin infusion results in a smaller absorption of non-tanning matters. It seems legitimate to conclude that the change in the experimental results is the effect of the one deliberate change in the method of analysis. Other factors being constant, the dilution and the non-tannin percentage are concomitant variations, and are therefore causally connected. It is difficult to see how Mr. Hough can avoid that conclusion, but it is even more difficult to understand his positive statement to the contrary, viz., "the higher non-tans are not due to the dilution of the solution."

Mr. Hough has apparently not realised that in experimenting on the effect of dilution, the ratio of the weight of hide-powder used to the weight of tannin used was constant; and that in experimenting on the effect of a lower proportion of hide-powder the dilution was kept constant. These are two different lines of experiment; the factors changed are fundamentally different, the results are affected to a different extent and for different reasons.

(II.) Mr. Hough also says that any extension in the time of shaking is "as undesirable as it is unnecessary." With this the writer is in full agreement. The method of procedure suggested has been used for over two years, and no extension of the time of shaking has ever been found necessary. Mr. Hough's quotation referred not to the revised method suggested, but to possible future experiments, the object of which was to ascertain the *smallest possible proportion* of hide-powder which could be used for complete detannisation. In employing 5 grms. of hide-powder per shake 15 minutes shaking is sufficient; but if it be desired to reduce the proportion of hide-powder to the absolute minimum, the attainment of this minimum may involve an extension in the time of shaking. It may yet be found that the minimum amount of hide-powder necessary for 15 minutes' shaking does not give a sufficiently accurate result.

The writer is of the opinion that further experiments in this direction are very desirable, the attainment of this minimum being conducive both to truth and to concordance. The lower the proportion of hide-powder, the less the method is dependent upon variations in its quality.

Chemical Society.

THE POSITION OF THE ORGANIC CHEMICAL INDUSTRY.

Presidential Address delivered at the Annual General Meeting of the Chemical Society, March 25th, 1915. By William Henry Perkin, Ph.D., Sc.D., LL.D., F.R.S. Chem. Soc. Trans., 1915, 107, 557—578.

[ABSTRACT.]

THE critical condition of our textile and other industries as a result of the present lack of dyes is a vivid illustration of the fact that Germany has no competitor worth considering in the whole domain of organic chemical industry. That we should have allowed trades of such magnitude to pass almost completely into the hands of a foreign nation seems incredible, and we must take warning, and not allow, in the future, our industries to be controlled in this way by the foreigner, and to be in danger of being brought to a standstill.

The opportunity of establishing a great national industry, due to the discovery of the aniline dyes in this country, has been allowed to escape us, and various reasons have been put forward to explain the loss of the colour industry. One of the main reasons for our position is that we as a nation, and our manufacturers in particular, have failed to understand the extreme complexity of the scientific basis of organic chemical industry.

It has been urged repeatedly that our patent laws were greatly to blame, and that these laws were such that an English patent was no protection, and that so soon as anything new had been discovered in this country the Germans at once set to work to manufacture it. Even if this were true, and there may be some truth in it, it does not explain why the Germans were able to obtain their raw material as they did in this country, to transport it to Germany, and then to send the dye over here, and at the same time to make a handsome profit out of the transaction. Again, it has been urged that the obstacles to the use of pure alcohol which existed at the end of the last century played a great part in bringing about the decadence of the coal-tar colour industry in this country. Possibly there has been some hardship in special cases, but the assertion that the coal-tar industry has been lost to this country on account of these obstacles has been proved to be devoid of substantial foundation. Of late years the restrictions on the use of duty-free alcohol have been so relaxed and the denaturants which may be employed are of such a wide range, including as they do the actual articles to be manufactured, that there is probably at the present time less difficulty put in the way of the manufacturer here than is the case in Germany.

It is quite obvious that other reasons than those just mentioned must be found to account for the gradual transference of the coal-tar industry to Germany. The decadence of this industry and its gradual transference to Germany may be said to have begun during the period 1870-75. It was in 1874 that the works of Perkin and Sons at Greenford Green was sold to the firm of Brooke, Simpson, and Spiller, and these works were then in the most prosperous condition, and much in advance of anything that existed in Germany. One reason for the sale was my father's natural dislike to an industrial career, and his desire to devote himself entirely to pure chemistry. There was, however, a much more weighty consideration which played the really important part in his decision to dispose of the works. It was recognised that the works could not be carried on successfully in competition with the rising industry in Germany unless a number of first-rate chemists could be obtained and employed in developing the

existing processes, and more particularly in the all-important work of making new discoveries. Inquiries were made at many of the British universities in the hope of discovering young men trained in the methods of organic chemistry, but in vain. The manufacturer of organic colouring matters during the critical years 1870-80 was, owing to the neglect of organic chemistry by our universities, placed in a very difficult and practically impossible position. At that time organic chemistry was not recognised by the older universities, and the newer universities, which have since done so much for the progress of science, had not come into existence. It is surely remarkable that the study of so important a subject as organic chemistry should not only have been practically ignored by our universities in the past, but that even at the present day it does not flourish in the way it does in almost every university and technical school in Germany.

So soon as the importance of organic chemistry became apparent, great teachers, such as Liebig and Wöhler, Kekulé and Baeyer, founded schools in Germany specially devoted to the subject, and they and their pupils then began to publish that wonderful series of classical investigations which laid the foundations on which the superstructure has since been raised.

The value of the example of these great teachers and of the system of research which they had initiated soon became generally appreciated by the universities in Germany, and every effort was made, by the establishment of laboratories supported by adequate grants from the various States, to help forward the new movement. The step which, in my opinion, did more than anything else to bring about the wonderful development of organic chemistry in Germany was the provision that research must be an essential part in the training of every German student of chemistry. Every student is brought into contact with research as a matter of course, and it is made quite clear to him, directly and indirectly, that his future career as a teacher or as a works chemist depends mainly on his ability as an investigator.

Since the necessity for research as an essential part of the training of the science student in this country is not insisted on, it is not surprising that the output of original work has in the past been small compared with that of Germany, and that the supply of able research chemists is so limited. I suggest that the German system is, in this respect, worth copying, and that the B.Sc. degree of our universities, and certainly the B.Sc. with Honours, should not be conferred except on those who have gone through a course of research as an essential part of their training. A change in this direction would ensure that a supply of first-rate chemical ability was always available to assist in the development of the industries of the country. If the universities of our country had, at the time the Greenford Green works changed hands and for some years afterwards, trained able research chemists and placed them at the disposal of the manufacturer, there can be no doubt that these works, as well as others, would still be in existence and flourishing, and that we should have kept the coal-tar colour industry here, and it is precisely for this reason that I express the opinion that the universities, more perhaps than the manufacturers, were to blame for the loss of the industry.

In almost every direction, and to a far greater extent than has been the case in any other country, Germany has recognised the value of the closest possible contact between the industries and the universities. In Germany the majority of the professors and Privatdozenten are in close touch with the large factories, and spend part of their time in solving technical problems which they either devise themselves or which may be

submitted to them by the manufacturer. I have it on the authority of several of the best-known directors of German works that the atmosphere of the university laboratory is much more suitable for discovery than that of the works, and that, as a fact, many of the most valuable discoveries which subsequently proved to be of the highest technical importance have been made in university laboratories and transferred to the works. Close association of the universities with the industries does not exist to any extent in this country, and is one of the things we have to aim at in the future. It must be of great advantage to industry, and cannot fail to be of great value also to the university, for it must result in the manufacturer taking a keen interest in the welfare of the department with which he is associated. Contact with the research department of a large works must always be stimulating; problems are encountered, many of them of great scientific interest, which would never suggest themselves in strictly academic circumstances, and as one of the results, the tendency, which is always present under existing university conditions, for the professor to become an academic fossil and unproductive, is postponed. Again, contact with the research departments of a flourishing works cannot fail to suggest subjects for investigation which are eminently suitable to occupy the attention of research students, many of whom will ultimately take up technical work. I look forward to the time when the scientific staffs of our universities and technical schools will not only be available for industrial research, but will be encouraged by those in authority to undertake such work.

I am convinced that, when the new development has been given a fair trial, the difficulties which some are inclined to urge against it will be found to be more apparent than real. While, then, I have been pleading for closer contact between the universities and the industries, and have suggested that the existence of such an alliance has been an important factor in the development of the vast organic chemical industry in Germany, it must be remembered that many other influences have been at work to bring about this result.

It is because we have left the coal-tar colour industry to Germany, that we find ourselves in the present grave and serious position. If we accept the enormous technical importance of organic chemistry, and decide that we are not going to allow all this wealth and prosperity to pass entirely into the hands of a foreign country, our manufacturers must, in the first place, make up their minds so to conduct their works that research is going on unceasingly; no works can possibly flourish which is content to manufacture only well-known colours, and it is only by the discovery of new colours and other products that manufacturers can hope to get a satisfactory return on their capital. The manufacturer must therefore see that his laboratories are properly equipped, and well supplied with research chemists of ability who have had a sound scientific training, and also some experience in the methods of research. All this, however, will avail little unless he has a scientific leader in his works who is able to direct the investigations of his young staff in the right channels.

So far as I am aware, there is not a single colour works in this country which has a really brilliant scientific head; by which I mean a chemist of wide scientific experience, and with the knowledge and ability to direct research, and this is a very serious state of things, and quite incompatible with chemical efficiency.

I have long thought that the want of an able scientific head is one of the most obvious reasons

why our colour works are in such an unsatisfactory condition. The success of a business based on science must often be essentially the work of a single, brilliant, scientific man. If a works is fortunate enough to have the services of a distinguished scientific man, capable of initiating and carrying out original investigations, and who will not only be constantly making discoveries himself, but be able at the same time so to influence his young staff that they will follow in his footsteps, the success of such a works can never be in doubt. I am afraid, however, that it will be a long time before we can hope that our manufacturers will give up their old-fashioned rule of thumb methods and fully grasp the truth of this vital matter.

My experience of the manufacturer in this country is that he is usually merely a commercial person who does not like the expert, and especially the idea of giving the expert a prominent position in the control of his works. Possibly the reason in many cases is ignorance of the value of science, but more probably it is due to the fact that being ignorant of science himself, he feels that if the expert is given too much prominence he must either study himself in order to understand the expert or leave the essential control of the business in his hands. Both these courses are distasteful to the ordinary commercial member of a board of directors; the expert is therefore relegated to the background, and the business comes to grief.

It is scarcely necessary to point out that, if a chemical works is to be successful, the first essential is that it must be under chemical control, and that every department must be in the hands of an expert; the board of directors may then be a mixed board; provided that steps are taken to ensure that chemical opinion is largely represented on it. The recognition of the soundness of this principle is one of the main reasons for the success of the German works.

Let us assume that the necessity for the chemical control of a chemical works is conceded, and that it is clearly understood that the next step is the discovery of improvements in every direction, such as the invention of dyes better than those already known, and the economical development of essential existing processes, then the first thing to be done will be for our universities to set to work to educate a supply of organic research chemists who will be able to undertake this work. This will mean that organic chemistry will have to flourish to a much greater extent than it does now, because the supply of organic research chemists available under ordinary conditions is a very small one, and scarcely sufficient to meet even the moderate demand which exists at the present time. Those of our students who wish to become successful organic chemists must radically alter their methods, and devote more energy and concentration to the mastery of the literature of the subject, and particularly must spend much more time than they do now in the laboratory in order that they may acquire real skill, and get a thorough working knowledge of the essential processes connected with the complex and difficult technique of organic chemistry.

Probably, if there were a closer connection between the industries and the universities, students would more quickly appreciate the great amount of theoretical study, practical ability, and originality which is indispensable to the making of a successful research chemist for an organic chemical works, and recognise that the requisite technique can only be acquired as the result of long hours in the laboratory.

If the effort gradually to develop—it is not a question of immediately establishing—a thriving organic chemical industry in this country is to be

seriously taken in hand, and if the requisite capital is forthcoming, it is obvious that what will be required before everything else will be a really able chemical staff, and there should, therefore, be a great opening in the near future for young organic chemists of ability.

Soon after the outbreak of the war, a Board of Trade Committee was appointed, with instructions to consider the best means of obtaining for the use of British industry sufficient supplies of chemical products, and, after hearing the evidence of many of the more important producers and consumers, a small Committee was charged with the task of sifting the mass of evidence which had come forward. As the result of the report of this Sub-Committee to the larger body, a meeting of representatives of industrial firms and associations was held on December 10th at the Board of Trade, when a committee was appointed, and shortly afterwards recommended a scheme which involved the formation of a joint stock company, having for its object the manufacture and supply of synthetic colours. Subsequently, the Government announced that they were prepared to assist such an effort (see this J., 1915, 22). Neither the Board of Trade Committee nor the Sub-Committee had anything whatever to do with the preparation of the scheme, and it is certainly extraordinary that a Committee consisting entirely of business men, and which did not include a single chemical expert, should have been entrusted with the formulation of a scheme for the founding and developing of a chemical industry. Had a chemical expert been present I venture to think that such a scheme would never have been placed before the public. It is stated in the Memorandum of Agreement attached to the scheme that the Company has been incorporated for the purpose, among other things, of manufacturing and selling dyes, colours, and other chemical substances, which, previously to the war, were exclusively or principally manufactured in Germany, and no mention is made of what ought to be the main object of such a company, namely, the employment of a large staff of research chemists under leaders of ability for the purpose of making new discoveries in every possible direction.

It cannot be too strongly emphasised that it is not merely a question of producing the dyes which are required during the war; any company which is formed must be established in so strong a position that it can expect to deal successfully with the keen competition which will be waged with the greatest severity by the Germans after the war.

The promoters of the scheme do not appear to have appreciated the difficulties of the situation, and obviously think that the manufacture of dyes in this country which previous to the war had been invented and produced in Germany is a matter which can quite easily be managed. It seems to be imagined in many quarters that, in order to manufacture a dye which had previously been made in Germany, all that is necessary is to follow the directions given in the patent dealing with that particular dye. No greater mistake could possibly be made. It is common knowledge that German manufacturers have for many years devoted large sums to the establishment of an efficient staff of patent experts, whose business it is to word a patent that, whilst it satisfies the requirements of the patent laws of the various countries in which it is taken out, it only gives such information as is absolutely necessary, and contains no indication of the process which is used in the actual manufacture. In many cases patents are devised which are of no practical value, and are merely intended to mislead and

throw competitors on the wrong scent. The discovery of the most efficient method of working patented processes is therefore often a matter of great experimental difficulty, and may require many months of research. Any new company started with the object of manufacturing dyes which previously to the war had been made exclusively in Germany must therefore be prepared to employ a large staff of research chemists for a long period without any prospect of return in the way of dividends.

Further, it must always be remembered that the Germans have many years' start of the new Company, and have accumulated such vast experience of methods of manufacture, and more particularly of the recovery and economical use of by-products, that they are able to sell at a profit at very low prices. What the new Company has to face is, therefore, in the first place, the problem of working out methods of manufacture and the utilisation of by-products until they have arrived at the same state of efficiency as the Germans, and that may be a matter of years. While this is being done, the new Company must also be busily engaged in training a large body of research chemists under the supervision of capable scientific leaders, so that the works may develop in as many new directions as possible, because the Company can only hope for permanent success if it pursues a policy of discovery and invention. Another point has also to be borne in mind, and that is that the Germans supply dyes and other products, not only to this country, but to practically all the other nations, and, in the event of a new company being formed on such large lines that it might prove to be a serious competitor, a German works could well afford to sell at cost price or at a loss in this country and make its profits in other lands until the new company had been ruined. Lastly, if we are to be allowed to make dyes, etc., during the war according to patents belonging to the Germans, what is to happen after the war? Will the Company be still allowed to use these patented processes, or will the patents again become the sole property of the Germans, and be workable in this country only on the payment of royalties or licences?

Although it is a matter of so much congratulation that the Government, which in past years has paid practically no attention to science and the application of science to industry, should, at last, have recognised the necessity for intervening and in no uncertain fashion, I have been forced to the conclusion, largely for the reasons which I have just stated, that the Company founded on the lines of this first Government scheme could not be expected to be successful in achieving the object which we all have so much at heart, namely, the recovery and development of the organic chemical industry in this country. Since the application for shares in the proposed Company was quite insufficient, the Government withdrew the scheme, and substituted for it an amended proposal, which is certainly in some respects an improvement (see this J., 1915, 133).

The amended proposal is another proof of the determination of the Government to meet the criticisms which were raised against the first scheme in a generous spirit, and to do all it possibly can to assist the efforts of the manufacturers in this country to place the organic chemical industry on a firm basis.

The grant for scientific research may be welcomed as a satisfactory addition to the old proposal, mainly because it shows that the Committee of users of dyes have at last found out that research is necessary if the new Company is to be a success. My own feeling, however, is that the Company ought to provide for research out of its

ordinary capital as a matter of course, and should not require a special subsidy for this purpose.

A much better plan, I venture to think, would be to employ this grant to subsidise the research laboratories of those universities and technical schools which are willing to specialise in organic chemistry, and are prepared to train a certain number of research students with the definite view of their subsequently entering the service of the new company. Supposing the new company were to adopt the view that closer connection between the universities and the industries is most desirable, and were to work in conjunction with the staffs of some of the leading organic schools, it is quite obvious that the knowledge of the needs of the works which would result from this connection would enable the staff to supply research students of exactly the type required by the works. Such research students would have been trained under the best scientific supervision which the country can provide, and at the same time they would enter the works with a considerable knowledge of the application of organic chemistry to technical operations, and be in a position to tackle with success research problems connected with new discoveries and new developments in the works. The plan of training research students under these conditions is, as I have already pointed out, the one which has long been adopted with such extraordinary success in Germany, and the large subsidies which the various States place at the disposal of their universities allow of the purchase of expensive apparatus and appliances which are outside the inadequate resources of most of the university laboratories of this country.

With regard to the kind of works it is proposed to organise for the manufacture of dyestuffs, etc., it would be well carefully to consider the policy which the Germans have adopted with so much success in the matter of the construction and arrangement of their works. One of the things which must strike a visitor to a great German works more perhaps than any other is the order and cleanliness which reigns everywhere, and the obvious care which is taken that every manufacturing operation shall be efficient in every detail. This order and cleanliness is not confined to the section of the works which deals with organic products; the same state of things is to be observed in every part, as, for example, in the case of the large plants which deal with the manufacture of sulphuric acid, nitric acid, and other inorganic products. Perhaps the idea which is conveyed most vividly by works such as these, all of which are concerned with the manufacture of a very large number of products of widely different character, is that they are, after all, merely laboratories on a larger scale. A very different impression is got by an inspection of many of the colour works in this country, and it seems to me very doubtful policy to suggest the possibility of the acquisition of works of this kind, which are obviously not efficient, and could only be made so by pulling down and re-building. It may be said that the most efficient only will be taken over, but selection will be found most difficult, because, if the new company proves a success, great pressure will be exerted by existing works in order to enter the charmed circle, and the argument of unfair competition will be used for all it is worth, and will be very difficult to deal with. Again, the experience of the Germans is all in favour of building up very large works, and against spreading manufacturing operations

over small works situated in different parts of the country.

The reason for this is obvious. In the manufacture of any substance, by-products are almost always produced which must either be recovered or used in the manufacture of other saleable products; otherwise serious loss is inevitable. It is exactly in this respect that the Germans are so efficient, and the wonderful organisation which enables them to dovetail one process into another is one of the reasons why the comparatively small works in this country find it impossible to compete with them even in the manufacture of such simple substances as salicylic acid or β -naphthol. In order that by-products may be used to the best advantage it is obviously essential that all these dovetailing operations must be carried out on the same site, so that it may not be necessary to transport the by-products from one works to another, an operation which could not fail to entail loss. Probably the best course for the new company is either greatly to enlarge the works of Messrs. Read Holliday and Sons, or, if it is difficult to find space for this purpose in Huddersfield, to take steps to acquire a suitable site and erect and equip works thereon, a plan which is mentioned in the explanatory statement as one of the objects of the new company.

Let us suppose that, in the near future, a practically new works is built on a large scale, and with all the most modern appliances, and that the control of the whole works and of the different departments is placed in the hands of efficient chemical leaders with adequate staffs of chemists under their charge, and that the company has also large and well-equipped research laboratories busily engaged in discovering new developments and improvements on existing processes; what prospect has such a works of competing successfully with the existing German organisations and of obtaining a fair share of the organic chemical industry?

If we suppose that the German companies will continue to work with the same efficiency as before, or will rapidly regain that efficiency, I am inclined to think that we must be prepared to face the certainty that some years must elapse before we can compete successfully against organisations which have taken years to develop and bring to perfection. Many of us hold the view that, in order to prevent underselling and other unfair methods of competition, the Government ought to protect the new venture for ten years at least by placing an import duty of not less than 25 per cent. on all German dyes and other organic products. I hold the view that this, or prohibition for a time, is the only real solution of the difficulty, and if it should be found that this course leads to slackness and rule of thumb methods, and that the works, after their period of protection, have not developed on the lines of discovery and invention, then the Government will at least have the satisfaction of knowing that everything has been done on their part to establish the industry.

Failure to develop on research lines is scarcely conceivable if the works is in charge of a highly-trained chemical staff, but, on the other hand, if it gets into the power of the business man who wants an immediate return for his outlay, is not willing to wait for results, and fails to appreciate the importance of scientific control, then no tariff can avert disaster.

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I.—GENERAL PLANT; MACHINERY.

[Corrosion due to] occurrence of chlorine in coal. De Waele. *Sec. IIA.*

PATENTS.

Grinding or crushing machinery. A. H. Moss, Gainsborough. Eng. Pat. 3258, Feb. 7, 1914.

A HORIZONTAL grinding ring having a concave upper surface is supported on three or more rollers, and one or more grinding rollers on swivelling shafts are pressed into contact with the ring by means of a wire rope, which passes over the swivelling shafts, and has a weight attached to its free end. The machine is enclosed in a casing through which a current of air may be passed.—W. H. C.

Crushing, pulverising, and disintegrating apparatus. F. Mansfield, Liverpool. Eng. Pat. 7391, March 24, 1914.

To facilitate replacement of the hammers and grid bars of a disintegrator, the hammer shafts have a slight end play relatively to the discs in which they are mounted. An aperture is formed in the side wall of the machine at the end of the curved sweep of bars; the bars are introduced through this opening and moved round into position, and then a longer end bar is inserted and pressed against the other bars by means of bolts. At the base of the feed hopper is a dispersing rib to deflect the material away from the central zone into the grinding or pulverising zone.—W. H. C.

Pulverising machines; Laboratory —. F. C. W. Ingle, Johannesburg, Transvaal. Eng. Pat. 10,522, April 28, 1914.

THE interiors of the casing of the grinding chamber and of the feed and discharge chambers are constructed so as to have continuous curved surfaces, without any projections upon which dust can accumulate.—W. H. C.

Roll-mill for hard materials. H. Aldehoff, Berlin. U.S. Pat. 1,133,212, March 23, 1915. Date of appl., Jan. 19, 1914.

THREE grinding rolls are mounted in a triangular form within a grinding ring, which is supported by the upper grinding roll. A sloping guide plate between the lower rolls directs the material from the rolls towards sieve plates attached to the sides of the grinding ring.—W. H. C.

Pulveriser with rotary sieve. A. Weidknecht. Fr. Pat. 473,173, June 9, 1914.

THE material is fed into the upper of two superposed horizontal grinding chambers, and after receiving a preliminary grinding, passes into the larger, lower chamber. The ground material is discharged from the lower chamber into a cylindrical sieve rotating about a horizontal axis. The finer portion of the material passes through the sieve and is collected, whilst the coarser particles are carried by horizontal blades fixed at intervals round the inner periphery of the sieve to the highest point, and discharged into a shoot, from which they are carried back into the upper grinding chamber by a screw conveyor.—W. H. C.

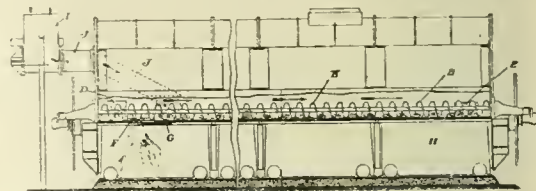
Pumps [for peat, sewage, etc.]. The International Nitrogen and Power Co., Ltd., and O. D. Lucas, London. Eng. Pat. 4950, Feb. 25, 1914.

THE pump is provided with independent suction and delivery piston valves. The suction valve is

operated mechanically and the delivery valve is opened by the pressure in the cylinder at the commencement of the stroke, being for this purpose connected with the cylinder by a by-pass.—W. H. C.

Drying machines. R. W. G., and F. R. Simon, Basford. Eng. Pat. 5647, March 5, 1914.

THE wet material is fed from the hopper, I, through the shoot, J, into a conduit parallel with the rotary dryer, H, and containing a rotary conveyor,



B, which conveys the material to the inlet opening, E, of the dryer. The dried material is discharged from the drying cylinder, partly through the opening, F, provided with a sieve with a sliding shutter, G, to regulate the proportion of dried material discharged, and partly through the opening, D, into the front end of the conveyor, whence it is carried forward and mixed with the wet material to facilitate drying.—W. H. C.

Drying apparatus. G. A. Mower, and Sturtevant Engineering Co., Ltd., London. Eng. Pat. 24,232, Dec. 17, 1914.

FANS are used in tunnel-drying apparatus between each stage to blow the air through a heater to the next stage. With this arrangement no baffles are required, thus leaving a clear passageway for the conveyors.—W. H. C.

Furnaces or kilns; Gas-fired —. L. F. Tooth, London. Eng. Pat. 7632, Sept. 26, 1914. Addition to Eng. Pat. 1772, Jan. 22, 1913 (this J., 1914, 240).

THE burners are arranged in the floors of the combustion chambers, and the secondary air is pre-heated by passing through passages in the furnace walls.—W. H. C.

Furnaces heated by gaseous or liquid fuel. L. F. Tooth, London. Eng. Pat. 8961, April 9, 1914.

THE horizontal furnace is of circular, square, or \square -section, and burners for gaseous or liquid fuel enter it tangentially at one end. The combustion products pass through a ring of openings at the closed rear end, into a series of horizontal regenerator flues leading to the main outlet at the front of the furnace. A second set of flues may be arranged between the first set, the gases passing through the two sets in series. In a modification, the furnace is open and provided with burners at both ends, the outlets to the flues being at the centre.—W.F.F.

Furnace; Rotary —. H. G. Akers, Toronto, Canada. U.S. Pat. 1,130,953, March 9, 1915. Date of appl., May 14, 1913.

THE furnace has a composite lining, the bottom part of one material and the top part of another, and has a flange at the discharge end to serve as a hearth. Means are provided for imparting an oscillating rotary movement to the furnace.—W. H. C.

Retort and furnace. G. Schwahn, St. Louis, Mo. U.S. Pat. 1,132,738, March 23, 1915. Date of appl., Aug. 27, 1914.

A RETORT having two vertical side-walls of large area, with a narrow intervening space, is enclosed within a furnace having double sets of flues for the combustible gases, one set on each side of the retort. The flues are preferably near the top or bottom of the retort, with outlet flues for the combustion products near the opposite extremity.

—P. SODN.

Kiln. J. N. Silva, Pueblo, Colo. U.S. Pat. 1,133,190, March 23, 1915. Date of appl., Nov. 13, 1912.

THE furnace grate is formed within the plane of the kiln wall and has an ash hopper below, from which the ashes are discharged through a valved shoot, into a pit formed on the ground outside the plane of the kiln wall. The valve is operated from above by means of a rod, and air is delivered below the grate from a main formed in the wall of the ash hopper.—W. H. C.

Metallic union. [Surface-combustion furnace.] W. McCa. Johnson, Assignor to The Continuous Zinc Furnace Co., Hartford, Conn. U.S. Pat. 1,133,245, March 23, 1915. Date of appl., Dec. 8, 1914.

A MIXING chamber for the combustible gas communicates with a superposed chamber containing a bed of refractory material, by a number of tubes of refractory material which are supported by a metallic partition, and extend into the combustion bed. The metal of the partition is "amalgamated" with a film of metal deposited in the pores of the lower ends of the tubes.—W. F. F.

Separators; Planetary, centrifugal —. W. Mauss, Johannesburg, Transvaal. Eng. Pat. 8767, April 7, 1914.

IN separators of the planetary type in which the separated solid matter is carried out of the separating zone by the slow rotation of the separating drums about their own axes, it has been found that as the deposit of solid matter approaches a position parallel with the direction of the centrifugal force, it tends to break up and roll back to the separating zone. To overcome this defect, a curved shield is fixed within each of the separating drums, so as to form, with the wall of the drum, an annular passage through which the separated solids pass to the point near the main axis, where they are removed by a plough and discharged through an opening in the bottom plate of the outer drum. "Adhesion rings" are provided on the inner side of the drums to assist in the transport of the separated solids to the separation zone. The drums are so disposed that they nearly touch the main axis.

—W. H. C.

Separator; Centrifugal —. D. B. Weston, Sharon, and M. H. Barker, Boston, Mass. U.S. Pat. 1,132,814, March 23, 1915. Date of appl., May 9, 1911.

A PRESSURE-TIGHT chamber formed of two cones attached to one another at their wider ends and provided with hollow shafts attached to their narrower ends, is supported and rotated in a vertical position. Liquid enters the separator through one of the hollow shafts and leaves by the other, the separated material being discharged through ports formed in the periphery and provided with valves opening inwards and actuated by weighted levers.—W. H. C.

Separating solid particles from liquids by the combination of a centrifugal and filtering action. K. and A. Ward. Fr. Pat. 472,701, May 26, 1914. Under Int. Conv., May 29, 1913.

LIQUID passes through a hollow shaft to a revolving

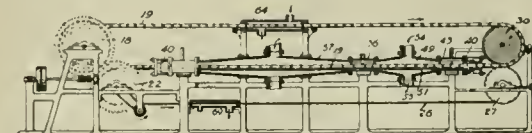
perforated drum, and the heavier solid particles are projected outwards through the wall of the drum into a surrounding stationary casing filled with liquid under pressure. The liquid, thus freed from heavier particles, passes inwards through the permeable wall of an inner concentric drum which retains the lighter particles, and is finally discharged through the hollow shaft. The filter may be cleaned by passing a current of clean liquid in the reverse direction.—W. F. F.

Lubricating packing; Process of making a —. A. Barberis, Mexico City. Eng. Pat. 14,433, June 16, 1914.

COTTON or other fibrous waste is rendered incombustible by soaking it in a 10% solution of alum or other suitable salt; it is then squeezed, soaked in a mixture of water, 1,000 grms.; boric acid, 20; gelatin, 30; glycerin, 40; 30% solution of formaldehyde, 4, and number 00 graphite, 100 grms., again squeezed, and treated with a suitable proportion of lubricating oil.—W. H. C.

Filter-press. F. J. Wagner, Santa Ana, Cal. U.S. Pat. 1,119,736, Dec. 1, 1914. Date of appl., May 9, 1913.

THE endless belt, 26, formed of filtering material, and the linked conveyor chain, 19, pass respectively over the drums, 22, 27, 18, 30, in the direction



shown by the arrows. On coming into contact, as they leave the drums, 27, 30, they form together a continuous series of filter-cells enclosed by the links of the chain. These pass through the stuffing-box, 40, and the pressure-box, 43, into the filter-chamber, 49, into which the material to be filtered is introduced through the pipe, 54. The liquid passes through the band of filter cloth and through the perforated supporting plate, 51, and is discharged through the pipe, 55. The residue is carried by the chain and belt through the pressure-box, 56, and the washing chamber, 57, and the solid residue is discharged as the band passes over the drum, 22, any remaining particles being removed by the brush, 13. The band and the conveyor chain are washed in the washing boxes, 69, 64, respectively, on their way back to the drums, 27, 30.—W. H. C.

Filters; Plate —. E. Simoneton. Fr. Pat. 473,187, Sept. 10, 1913.

A METALLIC ring fixed in the central aperture of the hollow disc or plate of porous material, is provided with openings for the filtrate having flanges which overlap the central portion of the disc. When the discs are mounted on a hollow central rod, all axial pressure is taken by the metal rings.—W. H. C.

Decolorising liquids; Method for —. F. R. Bachler, Assignor to Kieselguhr Co. of America, Los Angeles, Cal. U.S. Pat. 1,131,308, March 9, 1915. Date of appl., Sept. 20, 1913.

LIQUIDS containing oxidisable colouring matter are mixed with hydrogen peroxide absorbed in finely-divided kieselguhr, and the mixture is heated.

—W. H. C.

Evaporator. R. R. Row, Jersey City, N.J. U.S. Pat. 1,131,738, March 16, 1915. Date of appl., June 7, 1912.

THE vertical heating coils of the evaporator are

mounted on a frame supported on a door which closes an opening in the side of the vertical evaporating chamber. The door and frame are mounted on rollers, so that the coils can be easily withdrawn from or returned to the ebullition chamber.—W. H. C.

Cooling, washing, and mixing gases; Apparatus for —. H. E. Theisen, Munich, Germany. U.S. Pat. 1,131,966, March 16, 1915. Date of appl., June 16, 1914.

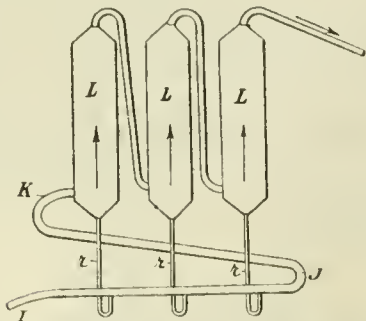
A SERIES of annular beaters, mounted on a central shaft, rotates within a casing, the upper part of which is concentric with the beaters, whilst the opposite walls of the lower portion gradually diverge. Washing liquid is supplied to the annular beaters, and the gas is introduced through the enlarged lower portion of the casing.—W. H. C.

Gas-currents; Trapping particles in suspension in —. T. E. Murray and C. B. Grady, New York. U.S. Pats. (A) 1,132,677, and (B) 1,132,678, March 23, 1915. Dates of appl., March 28 and May 15, 1914.

(A) THE gas is supplied to a rotary fan wheel which delivers it radially outwards on to liquid retained by flanges at the lower edges of a curved plate forming a volute chamber around the wheel. The liquid is carried round the inner circumference of the plate in a thin film by the gas current, and discharged into a receptacle below the chamber. (B) The gas passes over a film of liquid running over a wooden plate.—W. F. F.

Distillation; [Separation of vapours of —]. E. A. R. Chenard. Third Addition, dated March 31, 1914, to Fr. Pat. 443,499, May 7, 1912 (see this J., 1912, 971 and 1913, 184, 249).

To separate vapours of different densities, the mixture is passed through the pipe, I, J, K, and the vessels, L, L, L, connected as shown (see fig.).

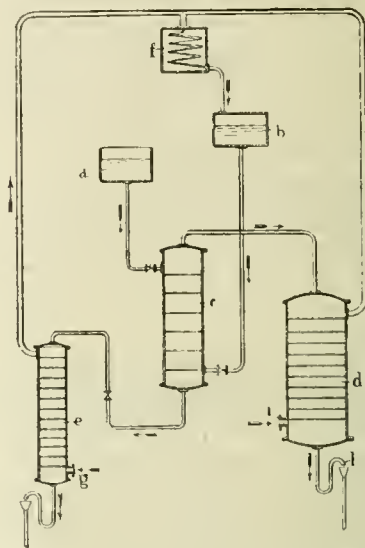


The heavier vapour sinks to the bottom of these vessels and that condensed returns by the pipes, *r*, to the pipe, I, J, where it is again vaporised. Alternatively the vessels, L, L, L, may be connected by pipes from the bottom of one to the top of the next.—W. F. F.

Mixtures of liquids; [Extraction] apparatus for the separation of — into two components. K. Kubierschky. Fr. Pat. 472,560, May 22, 1914.

THE mixture of liquids (e.g., a solution of aniline in water) flows from the tank, *a*, into the upper part of the column, *c*, and a solvent (e.g., benzol) flows from the tank, *b*, into the lower part of the column, *c*, the proportions being regulated by the cocks (see fig.). The solvent rises through the heavier solution, dissolves the desired constituent, and passes in the direction indicated by the arrow, into the top of the column, *d*. Steam

enters this column at *i*, and vaporises the benzol, which passes in the direction indicated by the arrow to the condenser, *f*. The aniline freed from benzol flows from the bottom of the column, *d*.



by the pipe, *l*. The exhausted liquid, which contains a little of the solvent, flows from the bottom of the column, *c*, into the column, *e*, where the benzol is distilled off by steam, which enters at *g*.—W. H. C.

Decantation; Apparatus for — [for bleaching liquor, etc.]. A. Champ, Craponne, France. Eng. Pat. 25,112, Nov. 4, 1913. Under Int. Conv., Feb. 24, 1913.

SEE Fr. Pat. 454,751 of 1913; this J., 1913, 910.

Sizing or classifying comminuted material; Process of, and apparatus for —. H. M. Sutton and W. L. and E. G. Steele, Dallas, Tex., U.S.A. Eng. Pat. 7225, March 21, 1914.

SEE U.S. Pat. 1,114,935 of 1914; this J., 1914, 1143.

Separation of particles from fluids; Centrifugal processes and apparatus for the —. K. and A. Ward, Stockholm. Eng. Pat. 13,074, May 27, 1914.

SEE Fr. Pat. 472,701 of 1914; preceding.

Hydrating, pulping, or reducing material in a wet or semi-liquid state; Apparatus for —. H. Jackson, Garstang. U.S. Pat. 1,133,968, March 30, 1915. Date of appl., May 14, 1912.

SEE Eng. Pat. 12,933 of 1911; this J., 1912, 636.

Crystals; Process and apparatus for obtaining large —. Elektrochem. Werke G. m. b. H. Fr. Pat. 472,604, May 23, 1914. Under Int. Conv., July 16, 1913.

SEE Ger. Pat. 273,929 of 1913; this J., 1914, 822.

Centrifugal separators. H. Edenborough. Fr. Pat. 472,625, Aug. 27, 1913. Under Int. Conv., Sept. 26, 1912.

SEE Eng. Pat. 21,947 of 1912; this J., 1913, 954.

Kilns for the preparation of chlorosulphonic acid and for similar purposes. Fr. Pat. 472,612. See VII.

IIA.—FUEL; GAS; MINERAL OILS AND WAXES.

Chlorine in coal; [Corrosion due to] occurrence of —. A. de Waele. *Analyst*, 1915, **40**, 146—150.

RAPID corrosion of the tubes of an economiser was found to be due to chlorine in the furnace gases, the tubes containing much ferric chloride. The coals used had been derived from the brine districts of the Midlands, and the whole of the chlorine (0.018 to 0.344% in six samples) was present as soluble chloride. In the case of another boiler-furnace in which nothing but Welsh coal had been used, there were no signs of pitting in the economiser tubes after three years. Eleven samples of the different coals used in this and neighbouring boilers contained 0.003 to 0.032% Cl. —C. A. M.

Cokes; Soluble chlorides and total chlorine in some English —. S. W. Bridge. *Analyst*, 1915, **40**, 143—146.

THIRTEEN samples of gas-coke contained from 0.013 to 0.262% of soluble chlorides and 0.039 to 0.199% of total chlorine (both as NaCl). A sample of metallurgical coke contained 0.007% of soluble chlorides and 0.071% of total chlorine, and a low-temperature cannel residue, 0.357 and 0.918% respectively. The variations of the chlorine in coke are thus similar to those found in coal. The average amounts in Derbyshire cokes were higher than in the case of cokes from Durham, Lancashire, and Yorkshire. The low ratio of soluble to total chlorine in the metallurgical coke indicated the larger amount of chlorine expelled on carbonising the coal under coke-oven conditions. Samples of coal and cannel rich in chlorine were carbonised in a fireclay crucible at about 400° to 500° C., and also in a platinum crucible for 15 hours over a Méker burner. The proportion of total chlorine expelled at the higher temperatures was much greater than at lower temperatures. For example, a cannel containing 0.987% Cl left a low-temperature residue with 0.918% and a high-temperature residue with 0.314% Cl. *Determination of soluble chlorides*:—From 15 to 30 grms., crushed to pass a 10-mesh sieve, is boiled with water for an hour beneath a reflux condenser, the liquid filtered, and the filtrate and washings acidified with nitric acid, permanganate added till the liquid is pink, and the chlorine determined volumetrically. *Total chlorine*:—From 2.5 to 5 grms. is ignited with 3 to 6 grms. of a mixture of sodium carbonate and lime (1:2) until the carbon is completely oxidised, the mass boiled with water containing a little lead carbonate to remove sulphides, and the chlorine in the aqueous decoction determined as above. No material loss of chlorine occurs in burning off the carbon. —C. A. M.

Coke-ovens; Application of by-product — to the gas industry. J. D. Forrest. *Indiana, U.S.A., Gas Assoc.*, March, 1915. *J. Gas Lighting*, 1915, **130**, 81—83.

THE advantages of the by-product coke-oven are that the cost of labour per ton of coal carbonised is lower; the quantity, quality, and value of the coke produced are higher; the fuel requirements for carbonisation are more economical, and the quantity and quality of the gas and by-products are better than those obtained with gas retorts. On the other hand there is the difficulty of securing a market for the coke produced, and the initial outlay for installing the plant is heavy. In addition, great care is necessary in the selection of the coal. Failure to maintain proper heat conditions in the operation of a by-product coke-oven may mean not only loss in gas and by-products, but the production of a large amount of unsaleable coke.

The author is of opinion that an ideal arrangement is one under which all the surplus gas from the coke-ovens is sold to a gas company. Where the consumption of gas was in excess of that supplied by the coke-ovens, the gas company would operate its own water-gas plant to make up the deficiency. —E. R. A.

Tar removal and recovery from carburetted water-gas.

S. Carter. *Manchester Junior Gas Assoc.*, April 10, 1915. *J. Gas Lighting*, 1915, **130**, 89—91.

CRUDE carburetted water-gas after ordinary condensation contains a considerable amount of light, persistent, greasy fog, which is eliminated in the first purifier, rendering the purifying material inactive. To remove tar fog, filtration under vacuum has been found to be more satisfactory than under pressure, as then the gas is not dried unduly. Fresh fog is developed, however, as soon as the gas passes the exhausters, and although of a light character, it is sufficient to render the purifying material inactive. It has been dealt with effectively by means of the "Hurricane" tar extractor or tar-trap (see Eng. Pat. 20,757 of 1911; this *J.*, 1912, 913). This apparatus has an efficiency of about 90%, whatever the nature of the gas dealt with. In a specific case 80% of the tar fog remaining in the gas after simple condensation, was removed by the filters on the exhauster inlet, and 90% of the remainder in the "Hurricane," the total efficiency of the combination being 98%. 70° F. (21° C.) appears to be a critical temperature in the process of filtering carburetted water-gas at pressures about —5 inches; at this temperature difficulties have been experienced, which have not been encountered at lower or higher temperatures. The persistence of water in the recovered tar, forming an obstinate emulsion, has been dealt with successfully by adding "primary" or dry tar, whereby the light tarry constituents of the emulsion are dissolved and the water globules liberated. The emulsion is discharged into a 12-inch vertical pipe, open at both ends, standing in the settling tank containing "primary" or dry tar. One end of the tube is above the surface of the water and the other within 10 ins. of the bottom or below the level of the tar suction. The amount of "primary" tar produced is generally more than sufficient to treat all the "secondary" tar. The tar as sold contains about 1—2% of water. —E. R. A.

Benzol and its recovery from coal gas. F. Pining. *Gas Record (Chicago)*, March 10, 1915. *J. Gas Lighting*, 1915, **130**, 81.

ACCORDING to various tests of American coals, the average benzol recovery would amount to 2 gallons per net ton. From 1000 cu. ft. of gas produced from an average coal, about 0.18 gallon of benzol can be recovered, showing a profit of 1.7 cents (0.85d.), the loss in volume being inappreciable. If the benzol were recovered from all the coal carbonised in the by-product coke-ovens of the United States, the annual production would be 29,600,000 gallons, valued at \$4,400,000 (nearly £920,000). The following calculation is given as an annual average based on 2000 net tons of dry coal per day.

Revenue		
	Per cent.	Gallons.
Benzol	67	978,000
Toluol	16	234,000
Xylol	8	117,000
Solvent naphtha	9	131,000
		1,460,000

1,460,000 gallons at 15 cents	\$219,000
Crude naphthalene, 330 net tons, at \$5	1650
Regenerated acid, 40° B. (sp. gr. 1.383) 360 net tons at \$6	2160
Total	\$222,810
<i>Expenditure.</i>	
Raw materials, as wash oil, sulphuric acid, caustic soda	\$15,000
Steam for the different distillations	15,000
Electric power for water, oil pumps, agitator, and illumination	6200
Wages of 3 distillers and 2 helpers	5000
Overhead expenses, fire insurance, maintenance and depreciation, assuming the cost of the complete plant to be about \$300,000	30,000
Calorific loss of the gases	13,000
Total	\$84,200

Profit, \$138,610 (about £28,877)=46% on the capital.
Cost to produce 1 gallon of benzol, 5.8 cents (2.9d.).

—E. R. A.

Gases; Firing of—by adiabatic compression.

III. *Ignition-points of mixtures of electrolytic gas with argon. Ratio of the specific heats for nitrogen and hydrogen.* IV. *Ignition-points of mixtures of electrolytic gas with carbon dioxide. Ratio of the specific heats for carbon dioxide.* J. M. Crofts. Chem. Soc. Trans., 1915, 107, 290—313. (See also this J., 1914, 909.)

THE addition of argon or carbon dioxide to electrolytic gas produced a rise in the ignition point proportional to the amount of gas added, as previously observed with nitrogen and hydrogen. Combustion caused no appreciable reduction of the carbon dioxide to carbon monoxide. It is considered that added nitrogen or excess of hydrogen behaves like argon, as an inert gas, and similarly constituted mixtures, such as $2\text{H}_2 + \text{O}_2 + \text{H}_2$ and $2\text{H}_2 + \text{O}_2 + \text{A}$, are assumed therefore to have the same ignition temperature. Calculations based on this supposition led to a corrected value for the ignition temperature of electrolytic gas itself, viz., 520°C . The ignition temperatures of $2\text{H}_2 + \text{O}_2 + x\text{A}$ were $(520 + 13x)^\circ\text{C}$. For temperature intervals $15^\circ\text{—}t^\circ$, the mean values of molecular heats at constant volume, under the conditions of experiment, were calculated as: nitrogen, $4.7 + 0.0004t$; hydrogen, $4.86 + 0.00064t$; and carbon dioxide, $6.6 + 0.0023t$.—F. SODN.

Flame in mixtures of methane and air; Velocities of—. II. A. Parker. Chem. Soc. Trans., 1915, 107, 328—337. (See this J., 1914, 1000, and compare R. V. Wheeler, this J., 1914, 1195.)

THE initial velocities of propagation of flame in mixtures of methane and air were measured in tubes varying in internal diameter from 1 to 17.5 cm. The velocities increased considerably with the diameter of the tube, up to about 15 cm., and then approached a limiting value of about 108 cm. per sec., which would be obtained with a tube of somewhat more than 20 cm. diam. The limiting value is, however, only about 1% greater than that obtained with a tube of 15 cm. diam., which may be regarded as the minimum diameter yielding true values. The velocity varied with the nature of the igniting spark, and there was evidence that the electric spark induced a sharper initial inflammation than other modes of ignition, such as adiabatic compression.—F. SODN.

PATENTS.

Peat; Drying—, and converting it into fuel. O. A. Ford and J. C. Long, Everett, Mass., U.S.A. Eng. Pat. 7593, March 25, 1914.

WET peat is fed into a long inclined rotating jacketed drum, provided with an internal helix, and hot gases from a boiler plant are passed through the drum in the reverse direction; the

temperature is controlled by diverting a portion of the gas through the jacket, the regulating dampers being moved by a thermostat. The dried peat passes into a grinder. By-products may be recovered from the peat gases and from the furnace gases by passing them through a water-cooled condenser.—W. F. F.

Fuel; Composite briquette—. E. Eaton, London. Eng. Pat. 11,345, May 8, 1914.

A MIXTURE of chalk 88% and solidified tar 12% is impregnated while in a mixing machine with 2—5% of petroleum or tar oils carried by a current of steam, and the mass is briquetted in the usual manner.—W. F. F.

Fuel; Artificial— and method of making the same. E. J. Babcock, Grand Forks, N.D. U.S. Pat. 1,130,564, March 2, 1915. Date of appl., March 5, 1912.

NON-COKING low-grade coal or lignite is carbonised, and the residue is ground, mixed with from 4 to 10% (preferably 7%) of finely-divided coking coal, and 4 to 8% (6%) of pitch, heated to the melting point of the pitch: 0.5 to 2% (1.25%) of glutinous matter (dry flour from ground grain or seeds) is then added, and the mass briquetted.—W. H. C.

Coke-oven. A. Roberts, Evanston, Ill. U.S. Pat. 1,132,685, March 23, 1915. Date of appl., Sept. 8, 1914.

THE heating walls are built of blocks having recesses of varying depths formed in them, and so arranged that zig-zag passages of varying cross section are formed throughout the height and length of the walls.—W. F. F.

Vertical retorts; Regenerator settings for—. S. Glover, St. Helens, and J. West, Southport. Eng. Pat. 7757, March 27, 1914.

THE combustion, heating, waste-gas circulating, and secondary air-preheating chambers are divided by vertical partitions so that the gases pass over the opposite sides of the retorts in two parallel streams, moving in the same direction. Supplementary combustion chambers are also provided.—W. H. C.

Retorts used in the manufacture of gas and for like purposes; Apparatus for charging—. Drakes, Ltd., and J. W. Drake, Halifax. Eng. Pat. 8091, March 31, 1914.

A ROTARY valve is mounted on a horizontal axis in a cylindrical casing fixed below the hopper, and having inlet and outlet openings, one or the other of which is closed by the valve. The valve is pressed against its seat by springs extending radially from the rotary shaft and adjustable in tension by screws. Openings are provided in the end walls of the casing for adjusting the screws. The movement of the valve is limited by stops.—W. F. F.

Gas furnaces; Heating— with producer gas or lighting gas. R. Geipert. First Addition, dated April 11, 1914, to Fr. Pat. 471,644, March 20, 1914 (see this J., 1915, 414). Under Int. Conv., March 10, 1914.

WHEN lighting gas is used for heating the furnace, it is passed through the producer and is partly or wholly burnt therein; or it may be burnt before passing to the producer. During observation of the furnace temperature, when using lighting gas which has been only partly burnt, and hence gives a luminous flame, the lighting gas is either burnt completely in the producer during this period, or the supply is throttled.—W. F. F.

Water-gas; Continuous production of—. Soc. Franc. d'Exploit. de Fours Spéciaux à Haute Température, and A. Verzier. Fr. Pat. 473,149, Sept. 8, 1913.

STEAM is generated from water contained in a pan which closes the bottom of the ashpit, and which is heated by the hot water-gas circulating through a collecting chamber to a space below the pan. Air for combustion is supplied through a super-heating tube traversing the gas-collecting chamber and terminating at the side of the fuel bed.

—W. F. F.

Illuminating gases, and Mond and other gases for heating or power purposes; Purification of— [from tar fog]. E. Howl, Dudley, and F. Perry, Tipton. Eng. Pat. 5051, Feb. 26, 1914.

THE gas is treated in a tower with a spray of water particles charged electrostatically. The suspended particles in the gas coalesce, and collect with the water in a tank at the bottom of the tower. Instead of a water spray, a stream of other electrified particles, e.g., metal dust, may be used.—W. H. C.

[Coal] gas; Apparatus for recovering sulphur and ammonia from— [by washing]. E. F. Lloyd, Detroit, Mich. U.S. Pat. 1,132,594, March 23, 1915. Date of appl., April 21, 1913.

THE washing liquor passes through a wash cooler to a scrubber, to which fresh water is also supplied, the mixed ammoniacal liquor passing thence to a still supplied with a current of steam. The liquor is tapped from the still at a point where it is free from sulphur, and returned to the scrubber. The cooling medium from the wash cooler is used to reduce the temperature of the tapped liquor and also that discharged from the still.—W. F. F.

Fuel for internal combustion engines. R. Wood, Durban, Natal. Eng. Pat. 24,262, Dec. 18, 1914.

A MIXTURE of alcohol (67° O.P.) 54.3, ether 45.0, ammonia (NH₃) 0.5, and white arsenic 0.2 parts by weight.—W. F. F.

Gasoline; Manufacture of—. R. F. Bacon, B. T. Brooks, and C. W. Clark, Assignors to Gulf Refining Co., Pittsburgh, Pa. U.S. Pat. 1,131,309, March 9, 1915. Date of appl., May 2, 1913.

PETROLEUM oils, which have a boiling point of 250° C. and upwards, are converted into a mixture of hydrocarbons, boiling below 200° C., by submitting them to a combined distilling and cracking operation in a vertical tubular retort at a temperature of 350°–500° C. and a pressure of 60–300 lb. per square inch. The particles of tar and coke produced sink to the bottom of the retort, and are removed.—W. H. C.

Lubricant. A. Warrell, Assignor to Continental Asbestos Corporation, Worcester, Mass. U.S. Pat. 1,133,204, March 23, 1915. Date of appl., June 6, 1914.

A PERMANENT putty-like magma formed by the prolonged agitation of chrysotile asbestos or asbestos tailings in hot lubricating oil.—W. F. F.

Liquid fuel suitable for combustion and lighting (internal combustion engines and motor vehicles); Manufacture of— from coal tar. M. Lorand. Fr. Pat. 472,860, June 2, 1914.

COAL tar is agitated for some hours with a 1% soda solution which is then decanted, and the tar is distilled, the light oil (b. pt. about 200°–280° C.) which distills after the water and the first oily portions being collected. The residue may be used in the manufacture of asphalt.—W. F. F.

Agglomerated combustibles; Manufacture of—. L. Martel, Gard, France. Eng. Pat. 7664, March 26, 1914. Under Int. Conv., March 27, 1913. SEE Fr. Pat. 456,061 of 1913; this J., 1913, 936.

Gas retorts; Vertical—. A. G. Glasgow, Richmond, Va., U.S.A. From J. H. Taussig, Philadelphia, U.S.A. Eng. Pat. 8829, April 7, 1914. SEE Fr. Pat. 471,142 of 1914; this J., 1915, 166.

Gas; Means for withdrawing— from retorts. D. D. Barnum, Worcester, Mass., H. A. Carpenter, Sewickley, Pa., and Riter-Conley Manufacturing Co., Pittsburgh, Pa., U.S.A. Eng. Pat. 5142, Feb. 27, 1914.

SEE U.S. Pat. 1,091,111 of 1914; this J., 1914, 471.

Gas; Apparatus for producing—. W. R. Degenhardt, Kalgoorlie, and W. Jordan, Youanme, W. Australia. U.S. Pat. 1,133,010, March 23, 1915. Date of appl., Nov. 14, 1913.

SEE Fr. Pat. 461,265 of 1913; this J., 1914, 472.

Gas-producer grates; Ash-discharging device for—. Q. Moore, Glasgow. U.S. Pat. 1,133,995, March 30, 1915. Date of appl., Jan. 26, 1915.

SEE Eng. Pat. 2619 of 1914; this J., 1915, 414.

Gas producers. The Power Gas Corporation, Ltd. Fr. Pat. 473,331, May 18, 1914. Under Int. Conv., Feb. 20, 1914.

SEE Eng. Pat. 4452 of 1914; this J., 1914, 636.

Gas; Purification of—. H. F. Smith, Lexington, Ohio, U.S.A. Eng. Pat. 11,216, May 6, 1914. SEE Fr. Pat. 472,306 of 1914; this J., 1915, 414.

Hydrocarbons; New product [liquefied gas] with a basis of—. F. P. Peterson. Fr. Pat. 472,848, May 30, 1914. Under Int. Conv., Jan. 5, 1914.

SEE U.S. Pat. 1,094,864 of 1914; this J., 1914, 585.

Motor spirit from peat tar; Manufacture of—. T. Franke. Fr. Pat. 473,035, June 4, 1914. Under Int. Conv., June 7 and July 4, 1913.

SEE Eng. Pats. 13,261 and 15,459 of 1913; this J., 1914, 782.

[Hydrocarbon] oils; Decomposition of— by heat, especially for the production of liquid fuels. C. E. C. Luck. Fr. Pat. 473,331, May 22, 1914. Under Int. Conv., May 23, 1913.

SEE Eng. Pat. 12,059 of 1913; this J., 1911, 685.

Precipitation tank [for oil]. U.S. Pat. 1,129,893. See XI1.

Application of naphthenic acids, their soaps, and solutions as insecticides, and process of making the solutions. Fr. Pat. 472,561. See XIXb.

Viscosimeter. U.S. Pat. 1,132,621. See XXIII.

II.B.—DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Nitrogen containing a small proportion of methane or carbon monoxide; Behaviour of half-watt lamps filled with—. L. Hamburger, Chem. Weekblad, 1915, 12, 62–73. J. Chem. Soc., 1915, 108, ii., 81–82.

THE presence of more than 0.05% CH₄ or 2% CO in the nitrogen employed rendered the filament brittle and shortened the life of the lamp.

—F. SONN.

Chemical reactions at very low pressures. Langmuir. See VII.

PATENTS.

Heat: Generating — by interaction between metals and metallic compounds. A. Lang and J. Schmitt. Fr. Pat. 473,995, June 5, 1914.

FINELY-DIVIDED metals having different heats of combination are mixed in equivalent proportions with metallic oxides or sulphides, and the mixture is compressed or mixed with a suitable binder and then granulated. A mixture of aluminium, iron, zinc, barium peroxide, and manganese dioxide is given as an example. The mixtures may be used as explosives.—W. F. F.

Incandescent gas mantles. I. More, Ashburton, New Zealand. Eng. Pat. 14,973, June 23, 1911. Under Int. Conv., March 13, 1914.

A MIXTURE of 100 parts by weight of refined white china clay and one of potassium permanganate with 7500 to 8000 of water, is applied to the finished unvarnished mantle.—B. N.

Rare earths for incandescence lighting by means of gas blowpipes: Composition of —. Soc. L'Oxylythe. Fr. Pat. 473,222, Sept. 13, 1913.

A MIXTURE of thorium oxide, 92%, cerium oxide, 2%, magnesia, 2%, lime, 1%, and a flux of an alkali polysilicate (powdered glass), 3%, is placed in a hollow muff of corundum, alundum, or other refractory material, provided with a circular groove on the inside to retain the mixture. The surface of the mixture, acted upon by the blow-pipe flame, is hardened by the flux, and may be regenerated by applying a small quantity of the dry or slightly wetted composition.—B. N.

Photometers. Eng. Pat. 776. See XXIII.

III.—TAR AND TAR PRODUCTS.

Unsaturated organic compounds: Addition products of — with nitric acid and picric acid. G. Redden. J. prakt. Chem., 1915, 91, 213—244.

NITRIC acid yields addition products with substances containing the groups C:O, C:N, or N:N. Nitrates of the following compounds are described: benzaldehyde, colourless oil; cinnamic aldehyde, white crystalline mass, m. pt. 60°—61° C.; acetophenone, colourless oil; benzophenone, yellowish prisms, m. pt. 30°—31° C.; fluorenone, orange-red needles, m. pt. 63°—64° C.; benzil, yellow needles; phenanthrenequinone, red needles, m. pt. 80°—83° C.; camphor, white crystals, m. pt. 10°—11° C.; benzophenoneanilide, light-yellow crystals, m. pt. 166°—167° C.; fluorenoneanilide, orange crystals, m. pt. 136°—137° C.; azobenzene, orange-red crystals. In each case one molecule of the substance combines with one molecule of nitric acid. Picric acid yields similar products with substances containing any one of the groups C:O, C:N, N:N, or C:C, but the last type of compound does not give addition products with nitric acid. Picrates of the following substances are described: benzaldehyde, light-yellow prisms, m. pt. 70°—72° C.; cinnamic aldehyde, light-yellow needles, m. pt. 66°—67° C.; acetophenone, yellow prisms, m. pt. 53° C.; dibenzalacetone, orange crystals, m. pt. 113°—114° C.; benzophenoneanilide, yellow crystals, m. pt. 188°—189° C.; fluorenoneanilide, red prisms, m. pt. 187°—188° C.; azobenzene, red crystals. The composition of the picrates is similar to that of the nitrates. All the derivatives are readily hydrolysed, so that in preparing the nitrates the strength of the acid has to be carefully regulated. The derivatives are also decomposed by solvents in which one component is easily and the other sparingly soluble. Addition

compounds are formed with increasing ease and possess increasing stability in the series, C:C, N:N, C:O, C:N. Benzaldehyde nitrate separates as an upper layer after shaking 2 grms. of the aldehyde at 0° C. with 19 c.c. of nitric acid of sp. gr. 1.371; the picrate crystallises when a melt of 6 grms. of the aldehyde and 4 grms. of the acid is allowed to cool. The constitution of these substances and the related question of the constitution of benzene are fully discussed.—J. R.

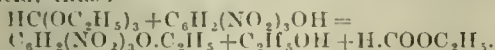
Aniline: Bromination of —. H. Franzen and A. Henglein. J. prakt. Chem., 1915, 91, 245—257.

Benzylideneaniline dibromide is obtained in 83% yield by slowly adding bromine (80 grms.) in chloroform (50 c.c.) to an ice-cooled solution of benzylideneaniline (90 grms.) in the same solvent (150 c.c.) and allowing to stand for an hour. The temperature must not rise above 25° C. *Benzylidene-p-bromoaniline hydrobromide*, Br.C₆H₄.NH.CHBr.C₆H₅, is prepared by slowly adding absolute alcohol (200 c.c.) to the thick yellow paste obtained in the foregoing operation. After standing for two hours the mixture is cooled in ice; the deposited pale yellow crystalline powder (52 grms.) is collected, washed with a little chloroform, and dried. *Benzylidene-p-bromoaniline*: a mixture of benzylideneaniline dibromide (170 grms.) and absolute alcohol (100 c.c.) is shaken with pyridine (50 grms.) and complete solution effected by heating on the water-bath. Upon pouring into an ice-cooled porcelain dish the mixture solidifies to an almost colourless mass; it is ground up with a little absolute alcohol, drained with the aid of the pump, washed sparingly with ice-cold alcohol, and dried. Yield, 90%; m. pt., after recrystallisation from methyl alcohol, 67° C. *p-Bromoaniline*: benzylideneaniline dibromide (170 grms.) is dissolved in absolute alcohol (200 c.c.) by warming, diluted (1:1) hydrochloric acid (500 c.c.) is added, and benzaldehyde completely removed by steaming. The residue when poured into several litres of dilute ammonia and allowed to stand for 24 hours yields a colourless crystalline mass of *p-bromoaniline*, which is freed from oil by pressure and crystallised from alcohol or petroleum ether. Yield, 65%; m. pt. 63° C. *Benzylidene-p-bromoaniline dibromide*, Br.C₆H₄.NBr.CHBr.C₆H₅: a solution of bromine (32 grms.) in chloroform (20 c.c.) is added slowly to an ice-cooled solution of benzylidene-p-bromoaniline (52 grms.) in chloroform (120 c.c.), the temperature being kept below 25° C. After two hours the thick paste is drained with the aid of the pump, washed with chloroform, and dried. Yield, 84%; m. pt., 182° C. *Benzylidene-2,4-dibromoaniline hydrobromide* Br₂.C₆H₃.NH.CHBr.C₆H₅: absolute alcohol (100 c.c.) is added to benzylidene-p-bromoaniline dibromide (70 grms.) and solution completed by warming on the waterbath. The yellow crystalline powder, which separates on cooling, is collected and washed with a little ice-cold absolute alcohol. A second fraction is obtained by adding dry ether (250 c.c.) to the mother-liquor. Yield, 30 grms. *2,4-Dibromoaniline*: benzylideneaniline (181 grms.) is brominated as above and pyridine (80 grms.) added slowly to the chloroform suspension of the product. Bromine (160 grms.) in chloroform (100 c.c.) is added slowly to the ice-cooled mixture; absolute alcohol (400 c.c.) is stirred into the resulting paste; the mixture is poured into 1.5 litres of sulphuric acid (1:10), and the whole is distilled with steam till benzaldehyde is completely expelled and colourless crystals appear in the condensing tube. The hot acid is decanted from the residual solid cake which forms after partial cooling, and the powdered solid is then boiled with dilute sulphuric acid (1.5 litres). The extract deposits colourless leaflets of 2,4-dibromoaniline sulphate upon cooling; the base is liberated with ammonia

and crystallised from alcohol. Yield, 18% ; m. pt., 80° C. The portion undissolved by the sulphuric acid consists of 2,4,6-tribromoaniline and is purified by crystallisation from alcohol. *Benzylidene-2,4-dibromoaniline*, Br₂ : C₆H₃N : CH.C₆H₅ : 2,4-dibromoaniline (90 grms.) is heated with absolute alcohol (100 c.c.) and benzaldehyde (40 grms.) for an hour upon the waterbath, after which the alcohol is distilled. The residual oil crystallises upon inoculation. The substance crystallises from alcohol, with which it readily forms supersaturated solutions, in pale yellow needles melting at 67° C. Yield, 83%. *Benzylidene-2,4-dibromoaniline dibromide*, Br₂ : C₆H₃NBr.CHBr.C₆H₅ : the preceding substance (60 grms.) when dissolved in ice-cooled chloroform (100 c.c.) and treated with bromine (28 grms.) in chloroform (20 c.c.) yields orange-yellow needles melting at 115°–120° C. Yield, 68%. *2,4,6-Tribromoaniline* : the preceding substance (27 grms.) upon warming on the waterbath with absolute alcohol (20 c.c.) yields a crystalline mass of 2,4,6-tribromoaniline hydrobromide, which when crystallised from alcohol gives 2,4,6-tribromoaniline, melting at 120° C. ; if pyridine (6 grms.) is added to the original mixture the pure free base crystallises out directly.—J. R.

Orthoformic ester : Use of — as an alkylating agent. R. von Walther. J. prakt. Chem., 1915, 91, 258–260.

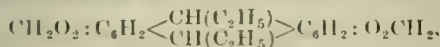
ORTHOFORMIC ester is hydrolysed by aqueous picric acid, but when a mixture of equal weights of the two substances is heated slowly to 170° C. in an oil-bath, 2,4,6-trinitrophenol is produced in good yield, thus :



A similar reaction occurs to a lesser extent when 2,4-dinitrophenol is heated over a naked flame with an equal weight of orthoformic ester.—J. R.

Homopiperonyl and homoveratryl alcohols : Reaction of —. G. M. Robinson. Chem. Soc. Trans., 1915, 107, 267–276.

HOMOPIPERONYL alcohol and homoveratryl alcohol undergo condensation to anthracene derivatives under the influence of mineral acids. The condensed homoveratryl alcohol is 2,3,6,7-tetramethoxy-9,10-dihydroanthracene, m. pt. 227° C. On nitration this yields 6,6'-dinitro-3,4,3',4'-tetramethoxydiphenylmethane, m. pt. 138° C. the constitution of which was proved by its synthesis from tetramethoxybenzophenone. The reactivity of homopiperonyl alcohol suggests that the polymerisation of *iso*-safrole is due to a similar underlying condensation. The formula :—



derived in this way for di-*iso*safrole explains its *cis-trans* isomerism.—G. F. M.

Coumarin derivatives : Formation of — and preparation of stable coumarinic acids. L. A. Jordan and J. P. Thorpe. Chem. Soc. Trans., 1915, 107, 387–406.

COLD alcoholic sodium ethoxide converts ethyl isodehydracetate into a mixture of the labile modification of ethyl β -methylglutaconate (Chem. Soc. Trans., 1912, 101, 1557) and a neutral substance, m. pt. 135° C., which is now shown to be ethyl 3-acetyl-4,5,7-trimethylcoumarin-6,8-dicarboxylate. This substance dissolves in alkali hydroxides, and on acidifying, the corresponding coumarinic acid is precipitated. Other coumarin derivatives were prepared by hydrolysing in stages the acetyl and the two carbo-ethoxy groups, complete hydrolysis yielding 4,5,7-trimethylcoumarin. The 3-acetyl group and the 6-carbo-ethoxy group

are very stable to alkalis but can be hydrolysed by sulphuric acid, the corresponding coumarinic acids being formed. These are relatively stable, the most stable being that containing a carboxy group in position 8. Phosphorus pentachloride and phosphoryl chloride produce an intense purple coloration destroyed by alcohol, with all coumarins substituted in position 4. The substances to which the colour is due can be isolated as dark blue powders with a coppery reflex. They contain phosphorus and are rapidly acted on by moist air. Water converts them into the coumarin or coumarinic acid. All the coumarins described, absorbed bromine to give a 3-bromocoumarin. Some nitrocoumarins were also prepared : the 6-position is readily substituted by the nitro group, whilst the 3-position is only substituted with difficulty. All the 4-substituted coumarins dissolve in alkali, yielding colourless solutions of the salt of the corresponding coumarinic acid. It is suggested that the yellow salts of coumarinic acids are *o*-quinone derivatives, whilst the colourless salts of 4-substituted coumarinic acids have the normal coumarinic acid structure.—T. C.

Tar removal and recovery from carburetted water-gas [and toluene recovery from gas]. Carter. See 11A.

Benzol and its recovery from coal gas. Puming. See 11A.

PATENTS.

Benzol from heavy oils : Apparatus for the direct extraction of — [in one distillation]. E. Barbet et Fils et Cie. Fr. Pat. 473,082, Sept. 5, 1913.

HEAVY oils, containing 2% of benzol, are separated into various fractions in two successive operations carried out in a column distilling apparatus. The oil is first distilled by heating coils supplied with high-pressure steam, and the naphthalene then separated by the injection of low-pressure superheated steam.—F. W. A.

Benzol, especially heavy benzol : Process for deodorising — and rendering it non-explosive and non-inflammable. I. I. Lipszyc. Fr. Pat. 473,309, Sept. 15, 1913.

BENZOL is deodorised by treatment with an oxidising agent, such as potassium or calcium permanganate in neutral or sulphuric acid solution, and subsequently washing with water and caustic soda. It is rendered non-explosive and non-inflammable by mixing it with 10 to 25% of trichloro-ethylene or with other chloro-hydrocarbons.—F. W. A.

Diarylated chloro-urcides : Production of —. Badische Anilin und Soda Fabrik. Fr. Pat. 472,941, May 13, 1914. Under Int. Conv., Aug. 4, 1913.

SEE Eng. Pat. 20,107 of 1913 ; this J., 1914, 825.

[Extraction] apparatus for the separation of mixtures of liquids into two components. Fr. Pat. 472,560. See I.

Manufacture of a liquid fuel suitable for combustion and lighting (internal combustion engines and motor vehicles) from coal tar. Fr. Pat. 472,860. See 11A.

IV.—COLOURING MATTERS AND DYES.

Indigo : Natural v. synthetic —. J. P. Srivastava and W. Cole. J. Soc. Dyers and Col., 1915, 31, 100–102.

BERGTHEIL and Briggs (see this J., 1907, 314 ; J. Soc. Dyers and Col., 1907, 146) stated that

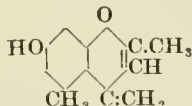
natural indigo dyes a deeper and fuller shade than synthetic indigo. The Badische Company explained this result by stating that the brand of the synthetic product used was unsuitable for dyeing wool in a hydrosulphite vat. Pastes of a fine Bengal indigo and a synthetic indigo were analysed by the authors, by Bergtheil, and by the Badische Company, and for each paste a number of indigotin units was agreed upon to represent the relative strengths. On dyeing wool to a standard shade in vats prepared from the two pastes, the amounts of wool dyed by the same number of indigotin units were practically identical. Samples of cloth obtained from the dyed materials could not be distinguished by two independent judges. Natural indigo dyed a slightly darker shade, whereas the dyeings obtained from synthetic indigo were of a more "bloomy" shade; both these advantages were destroyed on scouring and milling. The amount of reducing agent required was appreciably less in the case of the synthetic product, the uniformity of which is also an advantage.—F. W. A.

Indigo; Exportation of natural —. Board of Trade Announcement, April 30, 1915.

THE reservation of the stock of natural indigo primarily for dye users in the United Kingdom (see this J., 1915, 348), will be maintained only until Saturday, May 8th, 1915. After that date the Government Brokers, Messrs. Lewis and Peat, 6, Mincing Lane, London, E.C., will accordingly be prepared to entertain applications from buyers desirous of exporting natural indigo from this country.

Benzopyranol derivatives. J. N. Collie and G. N. White. Chem. Soc. Trans., 1915, 107, 369—376.

UNDER the influence of concentrated mineral acids orcinol condenses with acetylacetone to give a mixture of the salts of two benzopyranols, which can be separated by fractional crystallisation from aqueous hydrochloric or hydrobromic acids. The 7-hydroxy-2,5-dimethyl-4-methylene- γ -benzopyranol.



is an orange substance, giving a lemon yellow hydrochloride, a platinum double chloride, and a greenish yellow hydrobromide; it dissolves in sodium hydroxide to give a feebly yellow solution. 5-Hydroxy-2,7-dimethyl-4-methylene- γ -benzopyranol, is a violet substance, giving an orange hydrochloride; it dissolves in sodium hydroxide to an almost colourless solution. Both substances can be acetylated, but do not yield condensation products with hydroxylamine, semicarbazide, etc., nor are they readily reduced. These facts are in agreement with the above constitution rather than the alternative quinonoid form. Prolonged boiling with concentrated hydrochloric acid and tin converts them into dihydro-compounds. Both these and the acetyl-compounds are colourless, and are remarkable in not forming salts with acids. It is suggested that the bases and their salts are quinonoid; the acetyl derivative, on the other hand, is benzenoid and therefore colourless. These benzopyranols are related to the natural dyes, apigenin and luteolin, and also to the anthocyanin colours found in flowers.—G. F. M.

PATENTS.

Chrome-mordant dyestuffs; Manufacture of —. Farb. vorm. Meister, Lucius, und Brüning. Fr. Pat., 472,737, May 27, 1914. Under Int. Conv., Nov. 5, 1913, and May 6, 1914.

YELLOW chrome mordant dyestuffs are obtained

by combining diazotised anthranilic acid, or a substitution product, with pyrazolonesulphonic acids or their derivatives. The dyestuffs may be dyed direct in presence of bichromate, or the wool treated with bichromate before dyeing; in the latter case it is necessary to chrome the dyeings subsequently with bichromate to render them fast to milling. When dyed on wool in the usual way and after-treated with bichromate, the shades produced are fast to alkalis and to milling, and remarkably fast to carbonising, stoving, and to light.—F. W. A.

Azo dyestuffs; Manufacture of insoluble —. Chem. Fabr. Griesheim-Elektron. Fr. Pat. 472,889, June 2, 1914. Under Int. Conv., Dec. 4, 1913.

Azo dyestuffs, which are insoluble in water and possess remarkable properties of fastness, are obtained by combining diazo- or tetrazo-compounds of the aromatic series, which do not contain a sulphonic or carboxylic group, with 2-acylamino-3-naphthols. The dyestuffs obtained are faster to chlorine than those from 1-acylamino-4-naphthols (Witt, this J., 1896, 134). They may be used in the manufacture of lakes, or produced or the fibre as usual for ice colours.—F. W. A.

Azo dyestuffs and products used in producing them. Badische Anilin und Soda Fabrik. Fr. Pat. 472,893, June 2, 1914. Under Int. Conv., Feb. 6 and April 3, 1914.

DIAZO-, diazotised azo-, or tetrazo-compounds which do not contain a sulphonic group are combined with derivatives of 1,7-aminonaphthol of the general formula $(7)HO.C_{10}H_6.NHR(1)$, in which R is derived from an aromatic acid or from an arylsulphonic acid. The dyestuffs obtained are insoluble in water, and are best produced on the fibre. The dyeings are characterised by brightness in shade and fastness to washing, to chlorine, and to light. In presence of a suitable substratum, pigments are obtained. The derivatives of 1,7-aminonaphthol required are obtained by the method of Sachs (this J., 1906, 1036), or by treating 1,7-aminonaphthol in solution or suspension in an indifferent medium with the equivalent amount of the acid chloride, in presence or in absence of neutralising agents. Benzoyl-, *o*-chlorobenzoyl-, *p*-chlorobenzoyl-, 2,4-dichlorobenzoyl-, 2,6-dichlorobenzoyl-, *m*-nitrobenzoyl-, *p*-toluenesulphonyl-, and *p*-chlorobenzenesulphonyl-1,7-aminonaphthol are especially claimed.—F. W. A.

Sulphur colours. J. Flachslander, K. P. Gralert, and M. Buff, Elberfeld, Germany. Assignors to Synthetic Patents Co., New York. U.S. Pat. 1,132,922, March 23, 1915. Date of appl., Sept. 16, 1913.

SEE Fr. Pat. 449,983 of 1912; this J., 1913, 480.

Indigoid dyes; Treating insoluble —. R. Hutzler, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen, Germany. U.S. Pat. 1,133,031, March 23, 1915. Date of appl., Sept. 26, 1913.

SEE Ger. Pat. 265,536 of 1912; this J., 1913, 1101.

Colouring matters of the anthraquinone series; Production of —. H. Wolff, Mannheim, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen, Germany. U.S. Pat. 1,133,081, March 23, 1915. Date of appl., Sept. 26, 1913.

SEE Fr. Pat. 459,105 of 1913; this J., 1913, 1101.

Vat dyestuffs; Production of red —. Badische Anilin und Soda Fabrik. Seventh Addition, dated May 4, 1914, to Fr. Pat. 365,920, May 4, 1906. Under Int. Conv., July 31, 1913.

SEE Eng. Pat. 21,133 of 1913; this J., 1914, 855.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Cotton; Microscopical studies on—A. Herzog. Chem.-Zeit., 1914, 38, 1089—1091, 1097—1100.

In the trade, the abnormal thin-walled fibres known as "dead" and "unripe" are not particularly differentiated; in woven goods they roll up into small knots which appear as light-coloured spots in dyed fabrics. These two types are, however, not identical either in character or origin. Dead fibres are most frequent in degenerated plants and those which have run wild, but are also met with to some extent in good sorts. They appear under the microscope as broad tubular ribbons, without cell-contents, the upper and lower walls being in close contact except where longitudinal folds are caused by a slight sliding movement. The thickness of the walls is only 0.5—0.6 μ and the breadth of the flattened ribbon exceeds that of the normal fibre by 31—65%. The walls of many of the fibres show striations at an angle of 45° to the axis. The cuticular layer is very slightly developed and does not produce the usual globular swellings under the action of cuprammonium. Comparative dyeings with Methylene Blue showed no appreciable difference in intensity between the dead and the normal fibres; the apparent resistance of the former is therefore probably an optical effect due to the extreme thinness of the fibre-wall. The dead fibres are doubly refractive, showing colours under the polarising microscope; the insertion of a mica plate of 1.8 λ affords a ready means for their differentiation among the normal fibres. The latter remain bright in all positions, while the broad, flat, dead fibres show black and white portions according to their relative position in the field. In the case of unripe fibres the thickness of wall is at least 1 μ ; the cuticle is only weakly developed, and the action of cuprammonium is similar to that with the dead fibres. The interior of the fibre is, however, very rich in protoplasmic residues; no differentiation of the cellulose walls can be detected, and striations are absent. The protein contents cause the fibre to absorb substantive dyestuffs more intensely than the normal fibre, but the cellulose absorbs but little. Basic dyestuffs on mordants, however, give only pale shades owing to the thinness of the walls. The fibre is of about normal breadth, but it is not twisted. Under the polarising microscope with mica plate, the contrasts of light and dark portions are less marked than in the case of the dead fibres.

"Beard" fibres, short, coarse, very stiff and distinctly coloured fibres, occur at the pointed end of the cotton seed and are collected along with the down in the treatment of the hull-residues. Their dimensions vary within wide limits; average values recorded are: breadth, 45.1 μ ; length, 2.4 mm. The author recognises three types. Type 1, the most common, is very irregular in breadth and structure; the walls are fairly thick but less so than those of the textile fibre. The interior and even the walls are highly charged with coloured protein matters, beard fibres from Egyptian seeds showing 1.86—2.46% N. against 0.49—0.51% for the textile fibres; the lumen is often filled with protoplasm. The cuticle is not strongly developed but the fibres are charged with an excess of fatty matters in a similar degree to the protein. They swell rather slowly in cuprammonium and the cell wall is thereby stratified into a large number of well differentiated layers, while the protoplasm remains insoluble. Type 2 is exceptional, very rarely met with; the fibres are flat, ribbon-like, very broad, often folded or twisted. They are gradually dissolved by cuprammonium, without stratification. The protoplasmic contents are deep brown in colour and

present in very large quantities (e.g., 23.1% of protein), especially near the base. Type 3 occurs particularly in wild or degenerated plants; the fibres are similar in breadth to the textile fibres, with spiral structural markings at an angle of 50°—63°. They are poor in protein, only slightly coloured, with cuticle only slightly developed; they dissolve in cuprammonium without special characteristics. The interior of the fibres is often penetrated by fungus mycelium, which is stained by aniline blue-glycerin.

Testing the mercerising capacity of cotton yarns. Lack of lustre on mercerisation may generally be traced to the presence of incompletely ripened or otherwise abnormal fibres. In order to test the mercerising capacity, sections of the raw yarn about 0.5 mm. long (e.g., 10 separate sections) are mounted in a mixture of potassium hydroxide and glycerin on slides ruled with fine lines to facilitate counting. In each mount 100 fragments are counted without selection, those which fail to show a perfectly cylindrical form being reckoned as non-mercerised. The proportion of cylindrical fragments is in direct relation to the lustre obtainable, e.g., very high lustre, 93—98%; satisfactory, 83—87%; inferior, 68—75%.—J. F. B.

Parchment paper; Tests for distinguishing—from pergamin paper. G. Annoni and G. Rodano. Ann. Lab. Chim. delle Gabelle, 1914, 7, 19. L'Ind. Chim., 1915, 2, 129.

PARCHMENT paper, prepared by the action of sulphuric acid on rag paper, is resistant to boiling water and to a boiling 2% solution of potassium carbonate, whereas the imitation pergamin papers, prepared by mechanical treatment of wood pulp, are much less resistant to water and are immediately disintegrated by a boiling 2% solution of potassium carbonate. On treatment with a drop of zinc chloride-iodine solution, a violet stain is produced on both kinds of paper, though more slowly on the pergamin, but on subsequent treatment with water, the violet changes to an intense blue—due to hydrocellulose—in the case of parchment paper, whilst only a faint violet coloration is left on pergamin paper. Pergamin papers invariably contain resin, whilst this is absent from parchment papers; hence the production of a reddish violet coloration on applying Morawski's reaction—treatment with acetic anhydride and sulphuric acid in succession—is a proof that the sample is a pergamin paper.—A. S.

Sulphite-cellulose manufacture; Utilisation of volatile waste products of—H. Bergström. Papierfabr., 1914, 12, 1010—1012. Z. angew. Chem., 1915, 28, Ref., 17.

If the vapours "blown off" from sulphite pulp boilers be condensed, sulphurous acid, methyl alcohol, cymene, and small quantities of furfural and of a solid terpene alcohol can be recovered from the condensed liquid, which contains 100 grms. of sulphurous acid and 5—5.5 grms. of methyl alcohol per litre, and 1—1.5 kilos. of oil, furfural, etc., per ton of cellulose. Moreover the quality of the cellulose would be improved by removing these products from the condensed liquid before using it again in the boiling process. Considerable quantities of methyl alcohol, and possibly also some acetic acid, could be recovered by evaporating the spent lyes from the boilers. (See also this J., 1912, 381, 711; 1913, 358.)—A. S.

Cellulose manufacture; Terpene substances as by-products of—A. Hellström. Papierfabr., 1914, 12, 1025. Z. angew. Chem., 1915, 28, Ref., 47. (See also this J., 1914, 745.)

THE turpentine oil and methyl alcohol can be freed from methyl sulphide by fractionation in a column still. Oils which have been freed from

resinified constituents by distillation can be easily refined by treatment with sulphuric acid. The liquid resin obtained as a by-product in the manufacture of soda-cellulose is used for sizing paper and for the manufacture of rosin oil and lubricating greases. The oil may be hardened by hydrogenation, and the pitch obtained from it may be used for insulating electric cables.—A. S.

PATENTS.

Fabrics; Machines for drying——. W. Mycock, Salford. Eng. Pat. 7054, March 20, 1914.

IN machines consisting of stacks of steam-heated drying cylinders, the framework is constructed entirely or almost entirely of the "doll-heads" in which the trunnions of the cylinders are mounted. The doll-heads are bolted together by means of flanges, forming a columnar frame, each column being attached to the steam-main at the bottom and supported at the top by screwed rods depending from a fixed girder.—J. F. B.

Cellulose; Process for obtaining lustrous threads of a basis of——. P. Joliot. First Addition, dated Aug. 4, 1913, to Fr. Pat. 468,380, April 22, 1913 (this J., 1914, 958).

IT is sufficient to apply tension to the threads either before or during the reconversion to cellulose, *i.e.*, after the treatment with alkali and carbon bisulphide described in the principal patent. The process may be applied to cellulose fabrics, and the elasticity of the final product may be varied by altering the degree of tension applied before the reconversion to cellulose.—F. Sr.

Cellulose esters; Manufacture of——. Soc. Chim. des Usines du Rhône. Fr. Pat. 473,399, June 12, 1914. Under Int. Conv., June 25, 1913.

THE esterification of cellulose is preceded by a preliminary treatment in presence of small quantities of acetic anhydride. *Example*: 10 parts of cellulose is kept for several hours at 30° C. in a mixture of 60 parts of glacial acetic acid, 1 part of acetic anhydride, and 0.5 part of 100% sulphuric acid, and 21 parts of acetic anhydride is then added, whereupon the cellulose is rapidly acetylated and dissolved. Precipitation with water yields a product soluble in chloroform, very slightly soluble in alcohol, and insoluble in nitrobenzene, acetone, or ether. Partial saponification produces esters, some of which are soluble in acetone.—F. SP.

Celluloid substitute from gelatin and casein; Preparation of a——. F. von Kageneck. Ger. Pat. 281,541, Nov. 12, 1913.

A MIXTURE of gelatin and casein is treated with sodium silicate solution and then with a hardening agent such as alum.—A. S.

Paper pulp; Apparatus for use in the squeezing and washing of——. S. Milne, Edinburgh. Eng. Pat. 6948, Mar. 19, 1914.

THE apparatus comprises two horizontal endless wire cloths, the lower wire passing round a perforated drum and the upper wire round a roller which presses against the perforated drum. The pulp is fed into a hopper in close contact with the lower wire on the perforated drum and, after squeezing, passes on as a layer between the two wires. Press rolls or vacuum boxes are arranged at intervals along the path of the wires, and troughs are placed beneath each set of press rolls or vacuum boxes. Fresh water is added to the pulp in front of the last set of press rolls, and the washings collected in the trough are delivered in front of the preceding set of rolls, and so on in the reverse direction to the travel of the pulp, and are drawn off in a concentrated form at the first set of rolls.—J. F. B.

Wood pulp, especially brown pulp; Manufacture of——. A. Zacharias. Ger. Pat. 280,476, Jan. 10, 1914.

THE wood, without removing the bark, is subjected to a boiling and steaming process, with addition of caustic soda lye, and afterwards is barked and cleaned by means of brushes.—A. S.

Sulphite-cellulose waste lyes; Process for utilising the fermentable and reducing carbohydrates in——for obtaining alcohol or a reducing agent. H. B. Landmark. First Addition, dated May 20, 1914, to Fr. Pat. 456,871, April 19, 1913 (this J., 1913, 1063). Under Int. Conv., Sept. 25, 1913.

THE liquors are concentrated to at least seven-eighths of their original volume before neutralisation and fermentation, whereby much sulphurous acid is removed and a better fermentation attained.—J. H. L.

Wood fibre; Process of and apparatus for obtaining——. W. K. Freeman, Oswawa, N.Y. Eng. Pat. 28,929, Dec. 15, 1913.

SEE Fr. Pat. 471,620 of 1913; this J., 1915, 419.

Acetyl-cellulose composition; Non-inflammable——. W. G. Lindsay, New York, Assignor to The Celluloid Co. U.S. Pat. 1,133,385, March 30, 1915. Date of appl., May 5, 1909.

SEE Fr. Pat. 415,517 of 1910; this J., 1910, 1299.

Nitrocellulose solutions; Preparation of threads from——. E. Berl and M. Isler. Fr. Pat. 473,446, June 12, 1914. Under Int. Conv., June 16, 1913.

SEE Ger Pat. 273,936 of 1913; this J., 1914, 746.

Binding and impregnating materials made from waste sulphite liquors. E. Pollacsek, Spezia, Italy. U.S. Pat. 1,133,499, March 30, 1915. Date of appl., Sept. 10, 1913.

SEE Fr. Pat. 462,429 of 1913; this J., 1914, 248.

Paper; Product for sizing——. J. A. de Cew. Fr. Pat. 472,662, May 26, 1914.

SEE U.S. Pat. 1,099,168 of 1914; this J., 1914, 785.

Solvents with a basis of furfural. Fr. Pat. 472,423. See XIII.

Preparation of lacquers from nitrocellulose or resins. Ger. Pat. 280,376. See XIII.

Preparation of lacquers from cellulose derivatives. Ger. Pat. 281,265. See XIII.

Material similar to leather. Fr. Pat. 472,852. See XV.

A special leather and process of making it. Fr. Pat. 473,380. See XV.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Acid dyebath; Mechanism of the——. III. *Experiments with Crystal Scarlet*. M. Fort and P. Anderson. J. Soc. Dyers and Col., 1915, 31, 96—100.

IN continuation of previous work (see this J., 1913, 907; 1915, 349), quantitative experiments were made with pure Crystal Scarlet and sulphuric acid, using two qualities of wool, *viz.*, a dry-combed merino-silver, scoured with neutral soap, and a thick fingering yarn made from a coarse long-stapled, cross-bred wool. In similar experiments, the cross-bred yarn took up more acid and more Crystal Scarlet from a neutral bath, than the

merino sliver. The interchange of acid and dye-stuff was found to take place in approximately equimolecular proportions in the case of the sliver, but the results were not so satisfactory in the case of yarn. It is not to be implied that the free colour acid is not formed in any acid dyebath, but such action is not an essential part of the dyeing process, which proceeds as follows: wool basic hydrate, $H_2SO_4 + C_{25}H_{12}N_2S_2O_2Na_2 \rightleftharpoons$ wool basic hydrate, $C_{25}H_{12}N_2S_2O_2H_2 + Na_2SO_4$. The different factors in the equilibrium may be varied, e.g., dyeing may be retarded by increasing the amount of sodium sulphate, stripping with which, however, only takes place to an equilibrium (Knecht: J. Soc. Dyers and Col., 1905, 250). The common assumption that sulphuric acid in the dyebath first liberates the free colour acid from an acid dyestuff, is not supported by the authors' results.—F. W. A.

Microscopical studies on cotton. Herzog. See V.

PATENTS.

Dyeing artificial silk. S. Heap and Son, Ltd., and W. Marshall, Rochdale, Eng. Pat. 15,820, July 2, 1914.

In dyeing fabrics containing artificial silk, either in hanks or in the piece, with basic dyestuffs, better results are obtained by first treating with a tannin bath, and then with the dyestuff before the treatment with tartar emetic or other metallic salt.

—F. W. A.

Dyeing fur and hair; Process for —. Akt.-Ges. für Anilin-Fabrikation. Fr. Pat. 472,702, May 26, 1914. Under Int. Conv., Dec. 20, 1913.

DERIVATIVES of dialkylaminodiphenylamine of the general formula (alkyl) $N.C_6H_4.NH.C_6H_4.R'(3)$ are used, in which R' is NH_2 , $N(CH_3)_2$, $N(C_2H_5)_2$, OH , etc. The dyeing process is carried out as usual, in presence of an oxidising agent, for example, hydrogen peroxide, but alkali is not added to the dye-bath; the skin may or may not be mordanted. The grey dyeings obtained are very fast to light.—F. W. A.

Dyes on the fibre; Production of —. Akt.-Ges. für Anilin-Fabrikation. Fr. Pat. 473,141, June 13, 1914. Under Int. Conv., Dec. 31, 1913.

DYESTUFFS are produced on the fibre by combining 1-nitroaryl-3-methyl-5-pyrazolone with a diazotised aromatic amine. Very bright yellow shades are obtained with diazo-compounds of the benzene series. White discharges may be obtained with rongalite, whereas this is not possible, even in presence of anthraquinone as catalyst, with 1-phenyl-3-methyl-5-pyrazolone.—F. W. A.

Textile fabrics; Treatment [waterproofing] of open-mesh —. M. Ratignier, Lyon, France. U.S. Pat. 1,133,062, Mar. 23, 1915. Date of appl., April 21, 1913.

OPEN-MESH fabrics are waterproofed by impregnating with an alcoholic solution containing gum lac, amyl acetate, and collodion, and allowing the treated fabric to dry slowly.—F. W. A.

Impregnation of fibrous material and textiles [with rubber solutions, &c.]; Process for the —. J. D. Tew. Fr. Pat. 472,814, May 30, 1914.

In impregnating textile materials with rubber solutions, better results are obtained by distributing the solution on one side of the material and applying a greater pressure to this side than to the other side of the material. The material is wound on a drum with a hollow, perforated core from which the solution is forced through the successive layers of material. The impregnated material is then dried by hot air distributed in the same manner as the solution.—F. W. A.

Bleaching purposes; Treatment of textile fibres for —. E. T. J. Watreniez, Brussels. U.S. Pat. 1,133,769, March 30, 1915. Date of appl., Feb. 6, 1911.

See Fr. Pat. 467,887 of 1911; this J., 1914, 959.

Bleaching, dyeing, and the like; Apparatus for —. O. and E. H. Sumner, St. Margarets-on-Thames. U.S. Pat. 1,133,759, March 30, 1915. Date of appl., Oct. 7, 1913.

See Eng. Pat. 18,817 of 1913; this J., 1914, 959.

Manufacture of insoluble azo dyestuffs. Fr. Pat. 472,889. See IV.

Azo dyestuffs and products used in producing them. Fr. Pat. 472,893. See IV.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Sodium hypochlorite from caustic soda and chlorine; Manufacture of —. U. Cattania and C. Ranucci. Annali Chim. Appl., 1915, 3, 161—161.

SODIUM hypochlorite solution (28° B., sp. gr. 1.241) made by the interaction of chlorine and caustic soda solution in an absorption tower, usually contains 8—9% of available chlorine, rarely 10%. The author prepared solutions containing up to 17.7% by bubbling chlorine into caustic soda solution of 28° B. contained in a stoneware vessel provided with an agitator and placed in a tank of cold water. When the concentration of available chlorine reached 7.7%, separation of sodium chloride commenced, and the hypochlorite then gradually decomposed on allowing the solution to stand, but the solutions maintained their strength when the sodium chloride was removed as soon as it separated.—A. S.

Nitriles; Analysis of —. N. Busvold. Chem.-Zeit., 1915, 39, 211.

In determining nitrite by the silver bromate method (see this J., 1914, 104) if the amount of sulphuric acid (1:4) used exceeds 50 c.c. to about 500 c.c. of liquid, marked reduction of the bromate is effected by the acid. Similarly, the acetic acid concentration should fall between 50 c.c. and 100 c.c. of 2-N acid to 1 gm. of silver bromate and 100 c.c. of water (500 c.c. total volume). The best temperature for the addition of the nitrite solution is about 90° C. Acetic acid may be replaced by succinic and similar acids, but not by oxalic acid. During the reduction it should not be possible to detect oxides of nitrogen by potassium iodide and starch test paper; hence in the final warming with sulphuric acid (1:4) it is advisable to add not more than 30 c.c. in the first instance, out of the 50 c.c. permissible. In the presence of air, acetic acid vapour causes a slow development of blue colour in the test paper.—J. R.

Nitrogen; Fixation of atmospheric —. The cyanamide process. W. S. Landis. Amer. Chem. Soc., Mar., 1915. Met. and Chem. Eng., 1915, 13, 213—220.

THE history of the cyanamide process is briefly outlined and a description given of the plant of the American Cyanamid Co. at Niagara Falls. The process depends on the reversible reaction: $CaC_2 + N_2 \rightleftharpoons CaCN_2 + C$, the equilibrium constants of which are not yet definitely established. High-grade materials are necessary for successful operation; ordinary "lighting" carbide is unsuitable; the nitrogen employed is obtained from liquid air. The calcium carbide, crushed to pass a 100-mesh sieve, is treated in small ovens ($\frac{1}{2}$ —2½ tons capacity), special precautions being necessary to avoid a reversal of the reaction. The product

from the ovens, called "lime nitrogen" and containing about 22% N and 1% of carbide, is finely ground (great care being required to avoid explosion) and stored in silos. For agricultural purposes the finely divided product is partly hydrated to decompose the contained carbide and then "oiled" to render it dustless for storage; this partial hydration requires special attention since, particularly at temperatures above normal, calcium cyanamide tends to become transformed (by the action of water) into a variety of organic compounds of inferior manurial value. Calcium cyanamide is also employed for the manufacture of ammonia, by subjecting a mixture of the material and water to the action of heat and high pressure; for the preparation of powders for case-hardening iron and steel, and for the production of crude sodium cyanide (containing the equivalent of 25% KCN), by melting a special grade of cyanamide with sodium chloride: solutions prepared from this low-grade cyanide have proved to be as efficient for metallurgical purposes as solutions of equivalent strength prepared from higher grade products. A process is now being developed for converting the ammonia obtained from calcium cyanamide into a fertiliser consisting largely of ammonium phosphate. This product, "ammophos," contains over 13% NH_3 and 45–50% P_2O_5 , and when mixed with high-grade potash salts will make a complete fertiliser about six times as concentrated as the average grades now available. The world's production of cyanamide (from 14 factories) during 1914 was about 300,000 tons, the present annual output of the Niagara Falls plant being 64,000 tons.—W. E. F. P.

Radium: The industrial uses of—T. Thorne Baker, *J. Roy. Soc. Arts*, 1915, 63, 490–498. (See also this J., 1914, 35.)

TESTS with mustard seed indicated that germination and growth are promoted by the α rays of the radium emanation, especially when supplied in the form of emanation water; that the β and γ rays are injurious to plant life; and that germination is adversely affected or prevented by the presence of uranium. Radio-active ore residues for agricultural purposes should therefore be purified and standardised as regards radium content before use. An aqueous solution of the product obtained by dissolving radium barium sulphate in molten sodium chloride was found to be superior to ordinary emanation water for external medical use. Photographic emulsions were found to yield much denser and more vigorous results when containing radium chloride or bromide than without this addition. Mention is also made of the use of radium for eradicating fungi on dried fish, in fermentation industries, as a bactericide, and for rendering the hands of clocks, etc., luminescent in the dark. The author advocates the use of radio-active ore residues for many of the purposes for which pure radium salts are at present employed.—W. E. F. P.

Chemical reactions at low pressures. 4. Langmuir, *J. Ind. Eng. Chem.*, 1915, 7, 349–351.

IF a small quantity of gas be introduced into an exhausted bulb containing a highly heated tungsten filament, in almost all cases the gas gradually disappears. At the very low pressures used, viz., 0.0001 to 0.05 mm. of mercury, the temperature of the gas is determined by that of the bulb, and there is no temperature gradient in the gas, in the ordinary sense, even close to the filament, so that it is possible to have the filament reacting with a gas at an entirely different temperature. The experimental results obtained are not in accord with Bodenstein and Fink's theory of heterogeneous reactions (compare this J., 1908, 120), in which it is assumed that the reaction velocity is limited by the

rate of diffusion of the gas molecules through an adsorption layer of highly compressed gas on the surface of the solid. A "molecular film theory" has been developed which is in good quantitative agreement with the experimental results. It is assumed that most of the gas molecules striking the bare surface of a filament are held by cohesive force as an adsorption film—usually only one molecule deep—until they evaporate from the surface: a condition of equilibrium is attained when the rates of adsorption and of evaporation are equal. The reaction velocity depends upon the rate at which the gas molecules can come in contact with the active portion of the surface, which may be either the uncovered portion or the adsorption film. It is probable that even at higher pressures than those mentioned above, e.g., at atmospheric pressure, the mechanism of a heterogeneous reaction can be explained better by the "molecular film theory" than by that of Bodenstein and Fink.

The reactions studied may be divided into four classes:—(A) The filament is attacked by the gas. (B) The gas reacts with vapour given off by the filament. (C) The filament acts as a catalyst, producing a chemical change in the gas without itself being permanently altered. (D) The gas is changed chemically, or reacts with the filament, as a result of electrical discharges. The following examples of the first three classes are given:—

(A) *Tungsten filament and oxygen.* Oxygen is adsorbed by the bare filament, forming a layer composed of two modifications in chemical equilibrium with each other. One modification is active and reacts immediately with oxygen to form tungsten trioxide, which distils off, leaving the surface of the filament bright, whilst the other modification is inactive. The rate at which the adsorption film volatilises, is low compared with that at which it is removed by combining with more oxygen. *Carbon filament and oxygen.* Oxygen in contact with a carbon filament heated to 1200° absolute, in part reacts with the carbon to form carbon dioxide, and in part gradually forms an extremely stable adsorption film, which greatly retards the formation of carbon dioxide. The adsorption film decomposes slowly when the filament is heated to 1700° abs. and rapidly at 2100°, in a vacuum, with evolution of carbon monoxide. The adsorption film is also formed when the filament is heated in carbon dioxide, a volume of carbon monoxide equal to that of the carbon dioxide consumed being produced. Carbon monoxide is not adsorbed by carbon at any temperature.

(B) *Tungsten and nitrogen.* Nitrogen does not combine with solid tungsten, but forms a nitride, WN_2 , with tungsten vapour; the velocity of the reaction is not affected by the temperature of the bulb. (See also this J., 1914, 245.) *Molybdenum and nitrogen.* Nitrogen combines with molybdenum vapour to form either a stable nitride, MoN_2 , or an unstable adsorption compound which decomposes on striking the bulb: the lower the temperature of the reacting gases, the greater the proportion of the stable nitride. *Tungsten and carbon monoxide.* With the bulb at the ordinary temperature carbon monoxide combines with tungsten vapour to form WCO , but if the bulb be cooled below -70°C , the carbon monoxide attacks the solid filament, forming an adsorption film of WCO . The reaction of the gas with the filament has a negative temperature coefficient; its velocity is independent of the pressure of the carbon monoxide and of the temperature of the bulb below -70°C , but is limited by the rate at which the compound can distil off. *Platinum and oxygen.* Analogous to molybdenum and nitrogen, but at higher pressures, i.e., above 1 mm., oxygen attacks solid platinum at a rate increasing with the pressure

(c) *Dissociation of hydrogen into atoms* (see this J., 1914, 919). *Dissociation of chlorine into atoms*. If two tungsten filaments be mounted side by side in a bulb containing chlorine at low pressure, and one of the filaments be highly heated, the cold filament gradually becomes thinner and may finally disappear, whilst the heated filament may become thicker. The chlorine is dissociated into atoms by the heated filament and the atomic chlorine attacks the cold filament, producing tungsten hexachloride, the vapour of which decomposes in contact with the heated filament and deposits tungsten on it. *Oxygen and carbon monoxide in contact with platinum*. The carbon monoxide reacts only with oxygen present as an adsorption film on the surface of the platinum. At low temperatures carbon monoxide is adsorbed preferentially and prevents adsorption of oxygen. As the temperature is raised the adsorbed carbon monoxide evaporates with increasing rapidity and the proportion of oxygen adsorbed, and hence capable of reacting, increases. Eventually a point is reached beyond which the velocity of the reaction diminishes as the temperature is increased, because the adsorbed oxygen distils off before the molecules of carbon monoxide can come in contact with it. *Hydrogen and oxygen in contact with platinum*. Similar to the reaction between carbon monoxide and oxygen.—A. S.

PATENTS.

Nitric acid; Preparation of highly concentrated —. Farb. vorm. Meister, Lucius, und Brüning. Fr. Pat. 472,775, May 28, 1914. Under Int. Conv., June 21, 1913.

NITRIC acid of the highest concentration may be prepared by the distillation of acid of lower concentration, provided that the latter is stronger than the acid of minimum vapour pressure. The process may be carried out in a still provided with a dephlegmating column, kept at a suitable temperature either by means of a jacket or by means of the nitric acid vapour produced in the still. The vapour of the concentrated acid rises through the column and is condensed and collected. The acid to be distilled may be introduced into the dephlegmating column, and the residual acid of minimum vapour pressure removed from the still continuously.—F. SP.

Nitric acid; Manufacture of —. Oesterr. Verein für Chem. und Metall. Produktion. Ger. Pat. 280,967, Jan. 27, 1914. Under Int. Conv., Nov. 5, 1913.

AMMONIUM nitrate is heated with a quantity of sulphuric acid at least sufficient to form acid ammonium sulphate.—A. S.

Acetic acid; Process for manufacturing — from acetylene. Chem. Fabr. Griesheim-Elektron. Fr. Pat. 473,158, June 8, 1914. Under Int. Conv., June 24, 1913.

ACETIC acid may be prepared from acetylene, without isolating the acetaldehyde formed as an intermediate product, by the interaction of acetylene, oxygen, and the requisite amount of water in the presence of mercury compounds, e.g., acetate, sulphate, or phosphate. The reaction is carried out in acetic acid, or in any appropriate organic acid (e.g., chloroacetic or lactic acid) which can be easily separated from the acetic acid formed. Contact substances such as iron oxides or vanadium pentoxide, and accelerating agents such as phosphoric acid, sulphuric acid, or bisulphates, may be employed in addition to the mercury compounds. The best results are obtained by introducing the acetylene and oxygen alternately in small quantities into the acid medium containing the contact substances. If glacial acetic acid is employed, ethylidene diacetate is formed as an intermediate product.—F. SP.

Phosphoric acid; Purification of commercial —. M. Melamid and L. Grötzinger. Ger. Pat. 280,969, April 17, 1914.

COMMERCIAL phosphoric acid is diluted with water, heated and agitated with tar or tar oils or derivatives in presence of an inert gas or vapour for 2–4 hours, and allowed to settle. The phosphoric acid is drawn off, filtered, and decolorised by filtering through bone charcoal.—A. S.

Kilns for the preparation of chlorosulphonic acid and for similar purposes. Wülding, Dahl u. Co. Fr. Pat. 472,612, May 23, 1914. Under Int. Conv., May 24, 1913.

THE cast iron parts of kilns subjected to the corrosive action of acid vapours and hot salt particles are protected by a lining of wrought iron.—W. H. H. N.

Washing compounds. J. T. Freestone, and W. F. Walker, Ltd., Liverpool. Eng. Pat. 19,229, Aug. 29, 1914.

A MIXTURE of 150 to 300 parts of sodium perborate and 200–100 parts of soda ash, with or without 75–125 parts of borax, with 20–10 parts of petroleum of flash point over 73° F. (23° C.), is pressed into a block and coated with paraffin wax to protect the ingredients from external moisture and decomposition.—W. H. H. N.

Silicate of soda or the like; Process of clarifying liquid —. J. G. Vail, Chester, and J. D. Carter, Lansdowne, Pa. U.S. Pat. 1,132,640, March 23, 1915. Date of appl., May 1, 1914.

THE liquid is heated, without agitation, and preferably under pressure, in a closed vessel from which it may be withdrawn through a cooling coil.—F. SODN.

Gases; Neutralising corrosive [sulphuric acid] fumes in —. T. E. Murray and E. B. Ricketts, New York. U.S. Pat. 1,132,679, March 23, 1915. Date of appl., Oct. 14, 1914.

AIR containing sulphuric acid fumes is passed through a thin sheet of sodium carbonate solution, then with the entrained liquid through an adjacent parallel foraminous screen, and finally through a second parallel sheet of sodium carbonate solution.—W. F. F.

Aluminium oxide from sulphate of alumina; Production of —. G. Schwahn, Belleville, Ill. U.S. Pats. (A) 1,132,736, and (B) 1,132,737, March 23, 1915. Dates of appl., Dec. 12, 1908, and Jan. 15, 1912.

(A) POROUS anhydrous aluminium sulphate is heated in the presence of steam, at a uniform temperature above the dissociating point of sulphuric acid. The sulphate may be heated in one part of a retort or furnace, and steam, generated or superheated in another part, conveyed through the incandescent material until pure alumina remains. (B) A relatively thin moving mass of porous aluminium sulphate, exposing a large heating area, is rapidly and uniformly heated to incandescence in the presence of air, and steam is then passed through the mass until all sulphuric acid is removed.—F. SODN.

Nitrogen compounds; Process for making —. G. Coutagne. Fr. Pat. 472,465, Aug. 5, 1913.

NITROGEN and air mixed with hydrogen or hydrocarbons are passed beneath the surface of a mixture of bauxite and carbon in powdered or granular form, raised to the necessary temperature by an electric current passing through the walls of the containing crucible. The heat produced by burning excess carbon and the combustible gas constituent, maintains the mass at the reaction

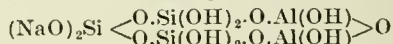
temperature, and the gases pass up through the heated crust where aluminium nitride is formed.
—W. H. H. N.

Potash; Extraction of— from saline deposits containing small quantities. M. E. Pichard. Fr. Pat. 472,503, Aug. 6, 1913.

THE salt is treated with a cold saturated solution of sodium chloride containing sufficient sodium nitrate to convert the potassium into nitrate. The solution is concentrated, and potassium nitrate containing sodium chloride separates on cooling. The former is recovered by leaching with hot water.—W. H. H. N.

Substances capable of exchanging their bases; Manufacture of—. Water Softeners (France). Ltd. Fr. Pat. 472,533, May 20, 1914.

THE substances contain groups of the type,



in which the alumina may be replaced by other isomorphous oxides and the silicon by titanium, thus producing bodies not containing aluminium and silicon. The kaolin portion of the complex may be replaced by other silicates, or by titanates, etc. Such substances may be obtained, for example, by heating aluminium silicates with alkalis and treating the product with water.
—J. H. J.

Oxides of nitrogen; Catalytic oxidation of ammonia to—. Verein Chem. Fabriken in Mannheim. Fr. Pat. 492,567, May 22, 1914. Under Int. Conv., May 28, 1913.

AIR and ammonia are forced through the catalyst so that the pressure of the products as they leave is greater than that of the atmosphere. This may be attained, for instance, by placing a perforated plate after the catalyst.—W. H. H. N.

Oxides of nitrogen; Preparation of— by oxidation of ammonia in presence of catalysts. Badische Anilin und Soda Fabrik. Ger. Pat. 280,499, Jan. 31, 1913.

THE reacting gases, if they have been in contact with material capable of yielding dust-like particles, are purified thoroughly immediately before coming in contact with the catalyst; or the purified gases on their way to the catalyst are brought in contact only with materials, e.g., nickel or high-grade nickel alloys, not capable of yielding dust-like particles.—A. S.

Colloidal hydroxides of osmium and ruthenium; Preparation of— and of the colloidal metals. Kalle und Co. A.-G. Ger. Pat. 280,365, July 30, 1913. Addition to Ger. Pat. 248,525 (this J., 1912, 952).

THE tetroxide of osmium or of ruthenium is mixed with a protective colloid, such as sodium protalbate or lysalbate, and with alcohol, and the mixture evaporated carefully to dryness. The solid colloidal hydroxide thus obtained may be reduced to the colloidal metal by means of hydrogen at a low temperature.—A. S.

Magnesium carbonate from calcareous magnesium carbonates and magnesium silicates; Manufacture of—. A. Hambloch and S. Gelleri. Ger. Pat. 280,738, Dec. 25, 1913.

THE raw or calcined mineral is ground, mixed with alkali carbonate or bicarbonate, treated with water saturated with carbon dioxide, and then heated to 60°–70° C. The precipitated calcium carbonate and other insoluble matter is separated, and the solution, containing the magnesium in the form of a double carbonate,

is heated, whereupon magnesium carbonate is precipitated, leaving a solution of alkali carbonate.—A. S.

Hydrogen; Manufacture of— in iron and steel works. H. Dicke. Ger. Pat. 280,964, Aug. 14, 1913.

HYDROGEN is produced by the action of steam on scrap from the various departments of an iron and steel works, and the resulting iron oxide is utilised in the blast-furnace or open-hearth furnace.—A. S.

Alkalis and an aluminium silicate suitable for cement manufacture; Process for obtaining— from natural double silicates. R. van der Leeden. Ger. Pat. 281,006, March 5, 1914.

NATURAL double silicates are heated with a quantity of calcium chloride approximately equivalent to their alkali content, or an equivalent quantity of a waste product containing calcium chloride, and with a small quantity of a reducing agent, e.g., carbon.—A. S.

Nitric acid; Process for concentrating dilute—. E. Collett, Assignor to Norsk Hydro-Elektrisk Kvælstofaktieselskab, Christiania, Norway. U.S. Pat. 1,133,840, March 30, 1915. Date of appl., Oct. 13, 1913.

SEE Eng. Pat. 22,746 of 1913; this J., 1914, 482.

Salt; Process and apparatus for converting rock— into table salt. L. W. Damman, Zvolle, Netherlands. Eng. Pat. 10,304, April 25, 1914. Under Int. Conv., Sept. 17, 1913.

SEE Ger. Pat. 276,344 of 1913; this J., 1915, 138.

Ammonium sulphate; Production of—. C. Bosch, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen, Germany. U.S. Pat. 1,133,086, March 23, 1915. Date of appl., Jan. 21, 1913.

SEE Eng. Pats. 12,845 and 14,114 of 1912; this J., 1913, 363.

Hydrogen; Purification of—. C. Bosch and W. Wild, Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen, Germany. U.S. Pat. 1,133,087, March 23, 1915. Date of appl., Dec. 4, 1913.

SEE Eng. Pat. 14,509 of 1913; this J., 1914, 256.

Sulphur from pyrites and other metallic sulphides; Production of—. W. A. Hall, New York. U.S. Pat. 1,133,636, March 30, 1915. Date of appl., June 25, 1913.

SEE Eng. Pat. 8279 of 1913; this J., 1914, 485.

Boron; Manufacture of—. Comp. Franç. pour l'Exploit. des Proc. Thomson-Houston. Eighth Addition, dated April 30, 1914, to Fr. Pat. 377,683, May 8, 1907. Under Int. Conv., May 2, 1913.

SEE Eng. Pat. 15,757 of 1913; this J., 1914, 692.

Hydrosulphites; Direct preparation of anhydrous— from aqueous solutions. Chem. Fabr. Griesheim-Elektron. First Addition, dated May 9, 1914, to Fr. Pat. 460,610, June 23, 1913. Under Int. Conv., Sept. 27, 1913.

SEE Ger. Pat. 279,389 of 1913; this J., 1915, 355.

Alkali compounds; Manufacture of soluble— from alkali-bearing rocks or products of devitrification. P. and M. Radmann. Fr. Pat. 472,722, May 27, 1914. Under Int. Conv., May 31, 1913.

SEE Eng. Pat. 12,136 of 1914; this J., 1915, 138.

Gases rich in sulphur dioxide; Process and apparatus for the purification of—. L. P. Basset. Fr. Pat. 472,956, Aug. 27, 1913.

SEE Eng. Pat. 20,667 of 1913; this J., 1915, 28.

Sulphur from gases rich in sulphur dioxide; Process and apparatus for the extraction of—. L. P. Basset. Fr. Pat. 472,957, Aug. 27, 1913.

SEE Eng. Pat. 20,716 of 1913; this J., 1915, 28.

Seaweeds; Preparation of products from—, and their application to the treatment of paper, textiles, leather, etc. T. Ingham. Fr. Pat. 473,373, June 12, 1914. Under Int. Conv., June 14, 1913.

SEE Eng. Pat. 13,777 of 1913; this J., 1914, 689.

VIII.—GLASS; CERAMICS.

Zirconia; Refractory properties of—. H. C. Meyer. Met. and Chem. Eng., 1915, 13, 263—266.

NATURAL zirconia (100-mesh) containing ZrO_2 81.1, SiO_2 7.71, Fe_2O_3 3.10, TiO_2 1.21, and Al_2O_3 0.66% (the remainder being mainly "loss on ignition")—was only slightly vitrified at about $1830^\circ C$. and had a small shrinkage. At $1427^\circ C$., the linear shrinkages of pure zirconium oxide (99% ZrO_2), wet-ground natural zirconia, and purified natural zirconia (95% ZrO_2) were each 9%; a mixture of 60 parts of 80-mesh zirconia with 40 of wet-ground zirconia, had a linear shrinkage of 3%; and a mixture of 93 parts of purified zirconia with 7 of very refractory kaolin a shrinkage of 12%. Of various binding agents tested, wet-ground zirconia was the most satisfactory. A mixture of 80-mesh zirconia with 5% of good fireclay ("Warrior Ridge") as bonding material withstood a temperature of $1800^\circ C$; tested in the form of standard bricks under furnace conditions, this mixture was superior to magnesite, but inferior to carborundum, as regards shrinking, cracking, and behaviour in contact with carbon. Owing to the low thermal conductivity of zirconia (much less than that of magnesite), crucibles, etc., made of this material require to be considerably thinner than when made of clay, but the danger of breakage through handling is minimised by the high tensile strength of zirconia when properly bonded and fired.—W. E. F. P.

Glazes; Coefficients of expansion of—. R. Rieke and W. Steger. Sprechsaal, 1914, 47, 577, 585, 593, 601. Z. angew. Chem., 1915, 28, Ref., 22—23.

THE effects of varying the proportions of alumina, silica, and boric acid whilst keeping the RO-content constant were studied, using as a basis a glaze of the composition $(0.3CaO, 0.7PbO) \cdot 0.2Al_2O_3 \cdot (2.1SiO_2, 0.1B_2O_3)$. The coefficient of expansion between the ordinary temperature and $100^\circ C$. was diminished by increasing the content of silica, by substituting silica for an equivalent quantity of boric acid, and by alumina up to a content of 0.3 mol. It was increased by increasing the content of boric acid and, in the case of borate glasses free from silica, by proportions of alumina exceeding 0.2 mol. The coefficient of expansion of borate glasses containing very little or no silica, was diminished by increasing the content of boric acid. There was no direct relation between the coefficients of expansion of the glazes and their behaviour when applied to pottery bodies.—A. S.

PATENTS.

Lenses, plates, prisms, and the like; Manufacture of—. A. J. Davis, Birmingham. Eng. Pat. 10,188, April 28, 1914.

ONE side of a sheet of ordinary coloured sheet glass

is coated with a thin layer of a silicious cement to which clear lead or other glass, applied subsequently in a molten or plastic condition, will adhere.—W. C. H.

Argillaceous ceramic pastes; Process of treating—in the dry way. E. Tuschhoff. Fr. Pat. 473,001, Aug. 30, 1913.

VERY finely ground ceramic materials to which a small quantity of water, oil, or other liquid is added, are kneaded, in a machine capable of exerting a pressing action, into lumps which are then sifted and granulated and can be moulded into tiles, etc., in presses.—W. C. H.

Enamels free from boric acid and composed of silicates of alumina, soda, and lime, containing fluorine; Process of enamelling cast- and sheet-iron articles by means of—. C. Musiol. Fr. Pat. 473,395, June 12, 1914.

THE enamels, used like ordinary bright and coloured glazes, are free from boric acid and consist of a vehicle of silicate of alumina, soda, and lime mixed with fluorides; the usual colouring and clouding materials are added as required.—W. C. H.

IX.—BUILDING MATERIALS.

Puzzuolana mortars in sea water; Change of composition of—. G. Giorgis and G. Cenni. Annali Chim. Appl., 1915, 3, 168—181.

SAMPLES of puzzuolana mortars which had been immersed in sea water—one from about 60 A.D. and five others from 1886, 1888, 1888, 1893, and 1897 respectively—were analysed. Comparison of the results with the probable composition of the original mortars showed that in all cases a portion of the lime had been removed from the mortar by the action of sea water, but that after some time this action had ceased, for the percentage of lime remaining was of the same order in the sample dating from 60 A.D. as in the others. The quantity of alkalis had diminished in all cases, whilst that of magnesia showed no appreciable change in four samples and an increase and decrease respectively in the two others.—A. S.

PATENTS

Artificial stones; Furnaces for use in the manufacture of—. J. W. Hughes, Narberth, Pa., U.S.A. Eng. Pat. 14,458, June 16, 1914.

THE furnace consists of an annular tunnel kiln with a travelling hearth on to which the articles are delivered by means of an endless chain conveyor moving transversely. The burned articles are removed in a similar manner by the returning half of the same conveyor.—A. B. S.

Bricks from sand; Manufacture of—. J. F. Léger. Fr. Pat. 472,532, May 20, 1914. Under Int. Conv., May 24, 1913.

BRICKS are made by pressing a mixture of 8 parts of sand, 1 part of barium sulphate, and 1 part of calcined magnesia, together with sufficient magnesium chloride solution to form a bond. The bricks may be used after drying for 24 hours in the open air and are quite dry after a week's exposure; they are impervious, and are not affected by water. Argillaceous sand must not be used.—A. B. S.

Bricks, tiles and slabs with a cork basis; Manufacture of—. J. F. Léger. Fr. Pat. 472,639, May 25, 1914. Under Int. Conv., May 28, 1913.

BRICKS and other articles made of cork compositions usually deteriorate rapidly by absorption of

moisture. This is avoided by pressing the articles from a mixture of granulated cork and calcined magnesia to which is added a solution of magnesium chloride. Articles so made are fireproof and as resilient as other cork mixtures.—A. B. S.

Bricks: Manufacture of refractory—. J. F. Léger. Fr. Pat. 472,640, May 25, 1914. Under Int. Conv., May 28, 1913.

A MIXTURE of granulated and powdered silica and calcined magnesia with a solution of magnesium chloride is used for making refractory bricks infusible at the temperature of the blast-furnace.—A. B. S.

Cement; Process of manufacture of a special—*not decomposed by sea water or by sulphate or magnesian waters.* A. Klein. Fr. Pat. 472,619, May 23, 1914.

THE clinker before being ground is mixed with from 5 to 20% of an anhydrous oxide of magnesium. copper, iron, tin, aluminium, lead, nickel, or zinc, preferably with 10% of iron oxide.—W. C. H.

Wood; Drying—*by means of smoke.* H. J. B. Teillard, jun. Fr. Pat. 473,192, March 9, 1914.

THE wood is placed on racks in a closed chamber into which smoke is delivered from an external stove by means of an inclined pipe. An exit flue is provided near the floor in the opposite wall of the drying chamber, this flue being connected to a vertical pipe extending above the top of the chamber. The action of the smoke does not depend on its heat, but on its chemical properties. The wood can be dried by means of smoke in from 1 to 2 months, as compared with 6–8 months for drying with steam, and 1–1½ years for drying in the open air. Fumigation is also the cheapest method, and it destroys larvæ, etc.—A. B. S.

Wood; Method of dyeing, impregnating, or softening—*at high temperature, and preventing the destruction of the wood during such process.* L. Petersen-Hviid, Kastrup, Denmark. Eng. Pat. 29,614, Dec. 23, 1913. Under Int. Conv., Dec. 30, 1912.

SEE Fr. Pat. 466,768 of 1913; this J., 1914, 965.

Process for obtaining alkalis and an aluminium silicate suitable for cement manufacture from natural double silicates. Ger. Pat. 281,006, Sec VII.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

[Steel.] *Comparative study of single-impact, repeated-impact, rotatory-bending and alternating-bending tests.* M. Nusbaumer. Rev. Mét., 1914, 11, 1133–1190.

SPECIMENS of a series of industrial steels, after different thermal treatments, were tested in a Stanton-Baird repeated-impact testing machine, in a modified Wöhler machine, and in a machine devised to bend backwards and forwards in the same plane a test-piece secured at one end (vibration tests). The machines used are described in detail. *Normalised steels.* The endurance of the normalised steels was proportional to the carbon content for the Wöhler (rotary-bending) and vibration tests. Under repeated-impact tests the same relation held for carbon values below 0.25–0.30%, but was reversed for higher carbon values. The low-nickel steels possessed greater endurance than the iron-carbon steels under repeated-impact and vibration tests; no Wöhler

tests were made. The high-nickel steels were not superior to the iron-carbon steels of moderate hardness; no Wöhler or vibration tests were made. The nickel-chrome steels showed even greater endurance under repeated-impact and vibration tests than the nickel steels, and of the nickel-chrome series the softest steel always gave the best results; no Wöhler tests were made. *Quenching followed by annealing* increased the endurance of the iron-carbon and the low-nickel steels under repeated-impact and vibration tests, but tended to diminish that of the nickel-chrome steels; no Wöhler tests were made, nor were the high-nickel steels tested. *Quenching without subsequent annealing* increased the endurance of the mild iron-carbon steels, and particularly that of the low-nickel steels under repeated-impact tests. The nickel-chrome steels were also improved, particularly the cemented nickel-chrome steels. The endurance of the high-carbon iron-carbon steels and of the high-nickel steels was diminished. Quenching decreased considerably the endurance under vibration tests of the iron-carbon and the low-nickel steels. It improved, on the contrary, the nickel-chrome steels. No Wöhler tests were made, nor were the high-nickel steels tested. The results showed that the endurance of a given steel under any form of repeated-stress is in accordance with the resistance under the single-impact (Frémont) test: that under any form of repeated-stress a steel may be fractured when working below the elastic limit, if the test is continued for a sufficient time; and that under all forms of repeated-stress, fracture is produced by progressive cracking.—T. St.

Steel; Brittleness of mild—*produced by working it at "blue" heat.* E. Preuss. Stahl u. Eisen, 1914, 34, 1370–1374. Z. angew. Chem., 1915, 28, Ref., 40.

THE brittleness of mild steel was found to be increased to a remarkable degree by small tensile stresses (elongations of 1.7, 4.2, or 8.3% respectively) at 250° and, especially, at 300° C. The brittleness increased rapidly with the stress applied, and was not accompanied by any perceptible change in the microstructure of the metal.—A. S.

Chromium and vanadium in steel; Determination of—. C. H. Rich and G. C. Whittam. Met. and Chem. Eng., 1915, 13, 238–239.

DUPLICATE determinations of chromium and vanadium may be completed in less than an hour by the following combination of the methods of Walters and Kent Smith (Met. and Chem. Eng., 1911, 12, [5]; see also this J., 1906, 138):—1–2 grms. of the steel is dissolved in 40–60 c.c. of sulphuric acid, 2–3 c.c. of nitric acid added, and the solution boiled and diluted to 170–180 c.c.; 20 c.c. of silver nitrate solution (1.33 grms. per litre) is then added, and the liquid boiled during the addition of successive small portions of moist ammonium persulphate until the chromium is completely oxidised, as indicated by the precipitation of manganese dioxide or the persistence of a pink tint in the liquid. After further boiling to decompose the excess of persulphate, about 2 c.c. of hydrochloric acid is added, the liquid boiled until chlorine is completely expelled, cooled, and diluted to 400 c.c. A measured volume of N/10 ferrous sulphate is then added, the excess of the latter titrated with N/10 permanganate (standardised against sodium oxalate), and the percentage of chromium calculated. The titrated solution is prepared for the determination of vanadium by discharging the pink colour with ferrous sulphate, adding 1 or 2 drops of permanganate, and then exactly discharging the pink tint by the addition of N/20 ferrous sulphate. A measured

volume of the latter is then added and the excess titrated with standard potassium bichromate, the end point being the first appearance of the momentary flush produced in a small drop of potassium ferricyanide solution by a drop of the assay liquid. The relative values of the solutions employed in each determination are found by control determinations on 2 grms. of plain carbon steel under the conditions of assay; but it is usually more convenient to ascertain these relations in acidified water solutions and then make allowance in the analysis for "blanks" determined in solutions of plain carbon steel, the latter being consistent and only requiring verification at intervals. Accurate results were obtained in determinations made on synthetic and standard steels containing up to 0.22% Cr and 0.25% V.—W. E. F. P.

Manganese in the blast-furnace; Reduction of —. H. Thaler. *Stahl u. Eisen*, 1914, **34**, 1481—1481. *Z. angew. Chem.*, 1915, **28**, Ref., 39.

AN experimental investigation of the manufacture of spiegel with 6.02, 10.83, 12.90, and 20.32% Mn respectively, led to the following conclusions:—Manganese is reduced both directly by carbon, and indirectly, and the fuel consumption increases with the amount of manganese reduced. Reduction is promoted by a high temperature and by slow passage of the charge through the furnace. The proportion of manganese recovered in the spiegel, expressed as a percentage of the amount in the charge, increases with the purity of the manganese ore and the manganese content of the spiegel. The slag should have a basicity corresponding to a 0.8 to 1.0-silicate. Under normal conditions the loss of manganese in the slag is a function of the quantity of slag; it diminishes as the manganese content of the spiegel increases. Loss of manganese by volatilisation is small in the case of low-grade spiegel, but rises rapidly with increasing reduction of manganese, amounting to 7–8% for 20% spiegel. The loss of manganese in the flue dust does not, as a rule, exceed 1%.—A. S.

[*Gold.*] *Cyanide plants; The effect of mineralised waters in* —. T. B. Stevens and W. S. Bradley. *Inst. Min. and Met.*, April 15, 1915. [Advance proof.] 14 pages.

AT the Sons of Gwalia mine (W. Australia), the best practical conditions for using the local water supply were ascertained. The "fresh water" was obtained from shallow wells and the "salt water" from the drainage of underground workings. The salt water contained CaSO_4 3.584, MgCl_2 6.317, MgSO_4 2.760, and NaCl 42.972 grms. per litre. Until recently salt water only was used in the plant, the sand from the battery being treated with 0.3 and the slime with 0.07% cyanide solution. The use of protective alkali was not economically possible, as 12 lb. of pure lime was required per ton of salt water; but by adding 2 lb. per ton of ore the cyanide consumption was reduced owing to the protective action of magnesium hydroxide. The addition of a small quantity of fresh water caused the deposition of considerable magnesium hydroxide and calcium sulphate on the zinc shavings, due to the dilution of the sodium chloride. Experiments made with fresh water proved that it was far more satisfactory, and that the bicarbonates consumed more cyanide than the other cyanicides present; this was counteracted by adding a sufficiency of lime.—W. R. S.

Cyanide solutions; The precipitating action of carbon in contact with auriferous —. W. R. Feldtmann. *Inst. Min. and Met.*, April 15, 1915. [Advance proof.] 15 pages. (See also this J., 1913, 1014.)

THE graphitic schists of West Africa are known to precipitate gold from cyanide solutions. The

results of experiments are given showing that this precipitating action is closely analogous to that of wood charcoal: in both cases there is no visible coating on the precipitant, and the precipitated gold is insoluble in cyanide, but soluble to a large extent (about 75%) in sodium sulphide solution, with simultaneous formation of sodium thiocyanate in molecular excess of the precipitated gold. From gold chloride solution, on the other hand, gold is precipitated as a visible metallic coating, soluble in cyanide. After treatment with alkali sulphide, the precipitating power of both schist and charcoal is renewed practically in its entirety. It is suggested that the gold is precipitated in combination with cyanogen, possibly as a "carbonyl aurocyanide." It may be possible to recover gold from graphitic cyanide tailings by sodium sulphide, using copper as a precipitant.—W. R. S.

Gold bullion; Refining —. T. K. Rose. Presidential Address. *Inst. Min. and Met.*, Feb. 18, 1915. 21 pages.

THREE processes for refining gold bullion are at present in use on a large scale: (1) boiling with sulphuric acid, (2) treatment of the molten metal with chlorine gas, (3) electrolytic refining. Two modifications of the electrolytic process are used: the silver nitrate process for alloys rich in silver, and the gold chloride process for alloys rich in gold. In the latter, or Wohlwill, process the electrolyte contains gold chloride and free hydrochloric acid; the anode consists of the impure bullion, the silver of which is converted into chloride which deposits as slime and coats the anode. If more than 6% of silver is present in the latter, it becomes necessary to remove the coating of chloride: by superposing on the direct current an alternating current of greater voltage (pulsating current), the coating is stripped off and falls to the bottom. The gold dissolves in the form of auric and aurous chlorides, the latter being decomposed by water with formation of finely divided gold: $3\text{HAuCl}_2 = 2\text{Au} + \text{HAuCl}_4 + 2\text{HCl}$. The anode sludge therefore contains gold in amounts increasing with the temperature of the bath. At the Denver mint, with a temperature of 65° C., the amount of gold found in the slime was 11.37% of that deposited on the cathode; with a cold bath it is less than 1%. A cascade system of mixing is to be adopted in the New York refinery for maintaining uniform concentration; the use of a propeller reduces the fineness of the deposit, as it drives particles of silver chloride against the cathode, where they adhere. Platinum is not dissolved unless alloyed, when it passes into the solution and remains there; palladium behaves similarly. The current density used in practice is 400–500 amp. in Germany, and 700–1000 amp. per sq. metre in the United States, the amount of free hydrochloric acid varying between 5 and 10%. The author's experiments go to prove that with 20–30% of acid a current density of 3000–5000 amp. may be maintained, practically no gold passing into the slime. The amount of gold present as chloride is 3–7%; if increased to 20% a higher current density may be used, and the metal forms a yellow coherent sheet. The electrolytic method yields the purest product at low working cost, but the time of treatment is much longer than in the other processes, and 50% of the gold undergoing treatment is locked up in the plant.—W. R. S.

Platinum plating. G. Nikolaus. *Elektrochem. Zeits.*, 1914, **21**, 193–195. *Z. angew. Chem.*, 1915, **28**, Ref., 37.

A PURE, white deposit can be obtained by using a boiling bath composed of 4 grms. of platinum chloride, 20 grms. of ammonium phosphate, 90 grms. of sodium phosphate, and 5 grms. of sodium chloride to 1 litre of water. The article

to be plated should be suspended between two anodes and kept in motion. The potential difference should be 6—8 volts.—A. S.

Copper cyanide plating solutions. M. C. Weber. Lewis Inst., Chicago. Met. and Chem. Eng., 1915, 13, 255—256.

By the use of cuprous cyanide for the preparation of plating solutions, the presence of inert salts in the latter is avoided and the efficiency of the baths increased, since solutions highly concentrated in copper can be worked at a relatively low specific gravity. As prepared from cuprous cyanide and the copper salts ordinarily employed, the cost of a plating bath of a given concentration in copper varied as follows:—

<i>Copper cyanide (70% Cu)—</i>		
100 lb. copper cyanide	\$42.00	
100 lb. sodium cyanide	22.00	\$64.00 (£13 6s. 8d.)
<i>Copper carbonate (50% Cu)—</i>		
140 lb. copper carbonate	\$19.60	
239 lb. sodium cyanide	52.58	\$72.18 (£15 0s. 9d.)
<i>Cupri-cupro sulphite ("red copper compound"—40% Cu)—</i>		
175 lb. red copper compound	\$52.50	
160 lb. sodium cyanide	35.20	\$87.70 (£18 5s. 5d.)
<i>Copper acetate (31% Cu)—</i>		
220 lb. copper acetate	\$44.00	
193 lb. sodium cyanide	42.46	\$86.46 (£18 0s. 3d.)

After continuous use for 2 hours, the first solution was practically unchanged, whereas each of the others required an addition of sodium cyanide to prevent coating of the anode.—W. E. F. P.

Brass; Analysis of—B. Koch. Chem.-Zeit., 1915, 39, 215.

ONE gram of brass turnings is treated with 15 c.c. of sulphuric acid (1:1) and 10 c.c. of nitric acid of sp. gr. 1.20, in the order named, and the solution is boiled until nitrous fumes are completely expelled and crystals of zinc sulphate begin to separate. Distilled water is added to the partly cooled liquid to a total volume of 150 c.c., and the copper is determined as described previously (Chem.-Zeit., 1913, 37, 873). Solid sodium hydroxide (18 grms.) is stirred into the copper-free solution cooled to about 30° C., potassium cyanide (5 grms.) is added, and the zinc is determined by electrolytic deposition upon the platinum electrode already employed in the copper determination. Concordant results are obtained under any of the following sets of conditions:—

Temp.		Current.		Time.
Start.	End.	Amps.	Volts.	Hours.
70° C.	95° C.	5	6	1
70° C.	85° C.	3	5.5	1½
50° C.	70° C.	1	5	5
50° C.	ord. temp.	0.4	4	left overnight

In the last case the liquid is kept at 50° to 60° C. for about 2 hours before allowing to cool. It is sufficient to wash the deposited zinc with cold water. The electrode holders are coated with asphaltum lacquer.—J. R.

Alloys rich in lead (white metal, type metal, solders, etc.). Electrolytic analysis of—I. Compagno. Annali Chim. Appl., 1915, 3, 164—168.

ONE grm. of the alloy is treated with 4 c.c. of concentrated hydrochloric acid and 4 c.c. of nitric acid (sp. gr. 1.2), and after a few hours the mixture is heated to expel nitrous fumes. The liquid is poured off and the residual lead chloride is washed by decantation two or three times with cold water acidulated with a few drops of hydrochloric acid. The solution and washings are made alkaline with sodium hydroxide,

treated with 30 c.c. of sodium monosulphide solution (sp. gr. 1.225), and with 0.4 grm. of potassium cyanide to retain copper in solution, then boiled, allowed to settle, the solution poured off, and the precipitated sulphides washed by decantation two or three times with hot water to which a few drops of sodium sulphide solution have been added. The lead chloride is dissolved in the smallest possible quantity of hot sodium hydroxide solution, the solution diluted with 15—20 c.c. of hot water, treated with 20 c.c. of sodium sulphide solution and 0.1 grm. of potassium cyanide, and the precipitate washed by decantation as described above. The two sulphide precipitates are collected on the same filter and washed with hot water containing sodium sulphide: the total quantity of sodium sulphide solution used for precipitation and washing is 80 c.c. The solution and washings are concentrated to 130 c.c., and antimony, copper, and tin determined as described previously (this J., 1913, 979). The precipitate, together with the filter paper, is boiled with 25 c.c. of dilute nitric acid (sp. gr. 1.2), diluted with water, the solution decanted, and the residue boiled successively with 25 c.c. of dilute and 20 c.c. of concentrated nitric acid, then collected on a filter, and washed with cold water. In the solution the lead is determined electrolytically as dioxide in the usual way, and iron, zinc, etc., by known methods. Some results obtained by this method with alloys of known composition are tabulated.—A. S.

Zinc smelting: Action of slags and vapours on the muffles (retorts) in—, and absorption of zinc oxide by clay. O. Proske. Metall u. Erz., 1914, 11, 333—339, 377—385, 412—418, 553—562. Z. angew. Chem., 1915, 28, Ref., 36.

THE formation of zinc-spinel occurs to a larger extent in hand-made than in machine-made retorts; it is diminished greatly by addition of coke to the mass used for making the retorts. During smelting the slag takes up considerable quantities of silica and alumina from the retorts, and a viscous layer, intermediate in composition between the slag and the retort, is formed, which tends to prevent rapid destruction of the latter. It is only at the higher temperatures prevailing towards the end of the distillation that there is any pronounced destructive action of the slag on the retorts. The absorption of zinc oxide by the clay used for making the retorts, and its fixation as aluminates, increases with the pressure, temperature, and time.—A. S.

Tin smelting in Bolivia. R. Pezet. Min. and Eng. World, 1915, 42, 643.

PRACTICALLY the whole of the tin ore mined in Bolivia is exported to Europe for smelting. Experiments have recently been made with a Wile electric furnace in smelting Bolivian "barilla" or concentrates producing tin of 98½% purity directly from the furnace without any refining. The balance was composed of 0.69% antimony and 0.56% iron. The loss of tin in the slag was 1.89%, which represented about 5—10% of the tin charged. The power expended was about 450 kw.-hrs. per ton. The analysis of the concentrates was as follows: Tin, 66.96; iron, 0.92; sulphur, 1.14; silica, 5.24; lime, nil; antimony, 0.42%.

Sulphates; Formation and decomposition of—during roasting. B. Dudley, jun. Met. and Chem. Eng., 1915, 13, 221—226.

FIGURES and curves (based on the results of other investigators) are given showing the composition of equilibrium mixtures resulting from dissociation of sulphur trioxide at atmospheric pressure; the total equilibrium pressures of sulphur trioxide, sulphur dioxide, and oxygen formed above

various heated sulphates; and the dissociation tensions, up to 800° C., of certain sulphates with respect to sulphur trioxide. The concentrations of the sulphur oxides in the gas in immediate contact with the ore and in the interstices of the ore bed are greater than is shown by the analysis of the furnace gas as a whole, and the composition of the gas in the interstices approaches that of the furnace gas as the depth of ore bed decreases and the rapidity of rabbling increases. Consequently the formation of sulphates in the roasting furnace is promoted by low temperature, thick beds of ore, and slow rabbling, and prevented (or their decomposition assisted) by the opposite conditions.—W. E. F. P.

Monazite and wolframite: Concentration of —. F. Freise. *Metall u. Erz*, 1914, 11, 573—578, 587—594. *Z. angew. Chem.*, 1915, 28, Ref., 37.

MONAZITE concentrates may be divided into three groups according to the ease with which the monazite may be separated from accompanying minerals by magnetic treatment: those containing garnets, with the exception of iron-alumina garnets, are the most, and those containing tourmaline, olivine, hornblende, and augites are the least refractory, whilst those containing zircon occupy an intermediate position. Iron minerals are best separated by a preliminary magnetic treatment. Roasting increases the magnetic susceptibility of monazite about four-fold and also increases that of most of the coloured accompanying minerals. The magnetic susceptibility of monazite increases with the cerium content but appears to be independent of the thorium content.—A. S.

PATENTS.

Iron for castings; Method of preparing —. W. G. Kranz. Sharon, Pa., Assignor to The National Malleable Castings Co., Cleveland, Ohio. U.S. Pat. 1,132,661, March 23, 1915. Date of appl., April 17, 1911.

IRON rich in carbon and sulphur is heated in an electric furnace with lime to eliminate the sulphur. The treatment may be continued until calcium carbide forms, by which oxides are removed from the metal, and carbon may also be added.—W. R. S.

Iron or steel from galvanised scrap; Production of —. K. Albert and O. Schleimer. *Ger. Pat.* 280,414, Dec. 2, 1913.

THE scrap is melted by adding it to a highly heated bath of molten iron, e.g., in an open-hearth or electric furnace. The zinc is volatilised as metal or as oxide and is recovered as oxide from the furnace gases.—A. S.

[Zinc and lead] sulphide ores; Separation of —. Amalgamated Zinc (De Bavay's), Ltd., Melbourne, Australia. *Eng. Pat.* 9049, April 9, 1914. Under Int. Conv., April 11, 1913.

THE ore is submitted to a flotation process, and the concentrate of mixed lead and zinc sulphides is then agitated and aerated in a solution of sodium carbonate (0.2—3%) to obtain a float concentrate rich in zinc and a residue rich in lead. When a frothing agent, such as eucalyptus oil, is used in the preliminary concentration, the mixed sulphides are treated with a solution of sodium sulphide or hydrogen sulphide previous to separation.—W. R. S.

Zinc; Process and electric furnace permitting the extraction, in a state of purity, of — from its ores. E. F. Côte and P. R. Pierron, Lyons, France. *Eng. Pat.* 14,192, June 12, 1914. Under Int. Conv., Nov. 19, 1913.

THE ore is reduced in an "arc and resistance" furnace connected to an "indirect resistance"

furnace; the zinc vapour passes into the latter, condensing in its upper part in the form of drops and powder on the surface of an electrically heated column of coarse carbon, while the furnace gases, which are the cause of the formation of zinc powder, escape upwards through a stack filled with carbon pieces on which the remainder of the zinc condenses. The lower layer of the carbon column is withdrawn from time to time and replaced at the top by carbon from the stack; the condensed zinc descends with, and is re-distilled by, the heated carbon which retains impurities, the zinc vapour passing laterally through pipes leading into a condenser below, where the pure metal collects in the liquid state.—W. R. S.

Zinc; Production of — by electrolysis. Apparatus for producing zinc, copper, or other metals by electrolysis. M. Perreux-Lloyd. *Fr. Pats.* (A) 472,763 and (B) 472,764, May 28, 1911.

(A) FOREIGN metals are separated from the zinc solution by passing it through vessels containing waste zinc to precipitate copper, and afterwards over ore rich in zinc oxide, to precipitate iron. Or the zinc only may be dissolved from the ore by sulphurous acid, obtained by roasting zinc blende, the solution containing sulphite or bisulphite being then oxidised to sulphate by air. Bubbles of hydrogen are removed from the deposited zinc by means of rubbing pads having a reciprocating motion. (B) The rotary cathode cylinder is supported between two end discs, in which are adjusted and fixed the ends of the shafts, which turn in stuffing-boxes fixed in the walls of the outer vessel. The anode completely envelops the periphery of the cathode, with the exception of a longitudinal upper space, in which rubbing pads, acting on the outer surface of the deposited metal, are disposed. The longitudinal rod, carrying the rubbing pads, is given a reciprocating motion by means of a bent lever and cam mechanism driven by the cathode shaft, the variation of the pivot of the lever varying constantly the position of the rubbing pads and preventing the formation of striae on the metal. The anode, consisting of end supports carrying several concentric groups of lead rods, is made in two parts, and the upper portion, together with the longitudinal bar carrying the rubbing pads, may be removed for the withdrawal of the deposited metal on the cathode.—B. N.

[Silver-cadmium] alloys; Process of making —. E. D. Gleason, Flatbush, N.Y., Assignor to R. H. King, Brooklyn, N.Y. U.S. Pat. 1,133,019, March 23, 1915. Date of appl., July 18, 1911. Renewed May 13, 1912.

A DUCTILE alloy (Ag 55, Cd 45%) is made by heating silver to approximately its boiling point under a layer of flux, adding cadmium, and agitating the molten mass.—W. R. S.

Roasting furnace; Rotary muffle —. Bunzlauer Werke Lengersdorf und Co. *Ger. Pat.* 280,428, June 8, 1913.

THE long rotary roasting chamber, mounted at an inclination to the horizontal, is elliptical in cross-section. Along the wide sides of the chamber are two flat roasting hearths, the spaces between the hearths and the wall of the chamber serving as heating flues. Manholes and openings for viewing the interior, fitted with covers, are provided in the narrow sides of the roasting chamber, which are not heated. The material is introduced at one end into, and discharged at the other end from the roasting chamber through fixed cylindrical chambers, the internal diameter of which is shorter than the major axis of the roasting chamber. By varying the diameter of the outlet chamber the

depth of the charge in the roasting chamber, and hence the amount of material passing through in a given time, can be regulated without altering the slope of the furnace.—A. S.

Furnace for obtaining easily oxidisable metals. A. Zavelberg. Ger. Pats. (A) 276,364, Aug. 6, 1913, and (B) 280,524, April 2, 1914. Additions to Ger. Pat. 226,257 (this J., 1910, 1460).

(A) THE furnace is composed of a number of independent reaction chambers or shafts, and tight joints between the walls of adjacent chambers are obtained by means of packing layers of finely ground quartz, asbestos, or the like. (B) A packing layer of finely ground pure silica, *e.g.*, washed sea sand, is used.—A. S.

Furnaces; Electro-metallurgical — more especially suitable for the manufacture of aluminium and its alloys. Comp. des Prod. Chim. d'Alais et de la Camargue. Fr. Pat. 473,043, Sept. 3, 1913.

THE molten metal in the bottom of the furnace is connected to the negative terminal by a mass of aluminium, of cross-section gradually increasing towards the outside of the furnace, and passing through the base. The heat is thus conducted away sufficiently rapidly, or the mass of aluminium may be cooled by circulation of water, to prevent fusion.—B. N.

Briquettes of fine ores, flux dust, etc.; Manufacture of —. B. Müller-Tromp. Ger. Pat. 278,105, Dec. 12, 1909.

THE material is mixed with calcined phosphatic chalk and briquetted in a moderately moist condition, with or without addition of quicklime.—A. S.

Oil used for hardening [metals]; Process and apparatus for cooling —. Dittmann-Nenhaus und Gabriel-Bergenthal A.-G. Ger. Pat. 280,512, May 29, 1914.

WATER is delivered on to the surface of the oil and sinks through it, thereby cooling it. The water flows from the lower part of the hardening tank into a settling vessel to recover the oil.—A. S.

Phosphor-copper; Process for the production of —. E. Schulte. Ger. Pat. 281,293, March 11, 1913.

MOLTEN phosphorus in measured quantities is forced into a bath of molten copper by hydraulic pressure, with exclusion of air.—A. S.

Alloys of iron. J. R. Speer, Trappe, Md., and W. L. Forster, Rochester, Pa., U.S.A. Eng. Pat. 29,634, Dec. 23, 1913. Under Int. Conv., March 18, 1913.

SEE U.S. Pat. 1,071,364 of 1913; this J., 1913, 947.

Steel; Manufacture of —. W. G. Nicholls. Fr. Pat. 473,105, June 5, 1914.

SEE U.S. Pat. 1,100,905 of 1914; this J., 1914, 792.

Slags in steel works; Use of collecting vessels for —. F. Dahl. Fr. Pat. 472,738, May 27, 1914. Under Int. Conv., Jan. 9, 1914.

SEE Ger. Pat. 279,542 of 1914; this J., 1915, 233.

Furnaces; Ore-roasting —. E. Bracq, Lens, France. Eng. Pat. 11,743, May 12, 1914. Under Int. Conv., May 13, 1913. Addition to Eng. Pat. 20,108 of 1912.

SEE Addition of May 13, 1913, to Fr. Pat. 434,494 of 1911; this J., 1914, 88.

Zinc; Roasting of compounds or ores containing —. A. L. J. Queneau, Philadelphia, Pa. U.S. Pat. 1,132,684, March 23, 1915. Date of appl., July 19, 1911.

SEE Fr. Pat. 445,233 of 1912; this J., 1912, 1186.

Galvanising-bath. N. K. Turnbull, Manchester. U.S. Pat. 1,132,889, March 23, 1915. Date of appl., Nov. 13, 1913.

SEE Eng. Pat. 9815 of 1913; this J., 1914, 489.

Galvanising wire, hoops, sheets, and the like. H. H. Field, Grappenhall, M. Howarth, Latchford, and E. A. Atkins, Liverpool. U.S. Pat. 1,133,628, March 30, 1915. Date of appl., Feb. 11, 1913.

SEE Eng. Pat. 27,611 of 1912; this J., 1914, 425.

Copper; Electrolytic process of producing —. M. Perreur-Lloyd, Boulogne, France. U.S. Pat. 1,133,059, March 23, 1915. Date of appl., March 28, 1912.

SEE Fr. Pat. 441,614 of 1912; this J., 1912, 932.

Ores; Process for reducing —. H. C. Alford. Fr. Pat. 471,898, May 7, 1914.

SEE U.S. Pat. 1,097,156 of 1914; this J., 1914, 698.

Neutralising corrosive [sulphuric acid] fumes in gases. U.S. Pat. 1,132,679. See VII.

Preparation of colloidal hydroxides of osmium and ruthenium and of the colloidal metals. Ger. Pat. 280,365. See VII.

Manufacture of hydrogen in iron and steel works. Ger. Pat. 280,964. See VII.

XI.—ELECTRO-CHEMISTRY.

PATENTS.

Furnaces; Electric resistance —. G. Gmür-Zehnder, Aarau, Switzerland. Eng. Pat. 23,495, Dec. 3, 1914.

THE refractory material under treatment is placed in a central tube clear of the current circuit, and enclosed within two concentric heating tubes mounted between top and bottom conducting blocks. The concentric tubes may be raised vertically to open the furnace, and a cooling air blast is simultaneously brought into action upon the tube containing the heated material.—B. N.

Furnace; Electric — with several fusion hearths, and electrodes of different polarity vertically above the hearths. Helfenstein Elektro-Ofen-G. m. b. H. Fr. Pat. 473,416, June 13, 1914. Under Int. Conv., June 14, 1913.

THE furnace vessel, comprising several chambers containing electrodes, is surmounted by a common charging vessel, formed in a single piece by prolonging the furnace walls. The escaping gases are withdrawn from the charging vessel through tubes passing laterally through the walls or down into the interior, the material above the mouths of the tubes preventing the entry of air. The electrodes are separated in the charging vessel by partitions, which prevent the lateral passage of the current between the electrodes, and permit the replacement of electrodes of one phase without interrupting the working, and without entry of air into the other chambers. Each electrode, together with its mounting, is completely surrounded by an insulating sleeve.—B. N.

Plate for electrical or secondary batteries or accumulators. E. Hancock and D. David, Cardiff. U.S. Pat. 1,133,641, March 30, 1915. Date of appl., Aug. 25, 1914.

SEE Eng. Pat. 19,109 of 1913; this J., 1914, 1096.

Ozoniser, and sterilisation of water by ozone. Fr. Pat. 473,184. See XIXB.

XII.—FATS; OILS; WAXES.

Oil-seed; A new—from *S. America*. E. M. Jesson. Bull. Miscell. Inform., Roy. Botan. Gard., Kew, 1914, No. 9, 333–331. Bull. Bureau Agric. Intell., 1915, 6, 75.

A SHIPMENT of the seeds of *Osteophloeum platyspermum*, Warb. (*Myristica platysperma*, Spruce), a tree indigenous to N.W. Brazil, was recently received at Liverpool. On extracting with petroleum spirit, a white, crystalline fat with very little smell, was obtained. The kernels of one sample gave 55.2% of fat, with m. pt. 43° C., and solidified at 39° C., iodine value (Wijs) 6.3%, saponification value 210.2, refractometer reading at 40° C., 36.9. The oil contained 5.3% of free fatty acids (as oleic acid). The inner shell of the fruit is brittle and easily crushed.—E. H. T.

PATENTS.

Oil and the like; Detouricating—[previous to hydrogenation]. C. Ellis, Montclair, N.J. U.S. Pat. 1,132,710, March 23, 1915. Date of appl., Aug. 15, 1913.

THE oil or fat is exposed, in the absence of hydrogen, to the action of a spent catalyst, which will absorb or combine with substances injurious to the catalytic action, and is then hydrogenated in the presence of an active catalyst.—C. A. M.

Precipitation tank [for oil]. W. L. Morris, Assignor to S. F. Bowser and Co., Fort Wayne, Ind. U.S. Pat. 1,129,893, March 2, 1915. Date of appl., Feb. 16, 1912.

A VERTICAL cylindrical tank for clarifying oil has a conical bottom with a sediment-discharge pipe, and a number of inlet pipes around the circumference near the bottom, each provided with a deflector to direct the liquid upwards against the wall of the tank. The clarified oil flows into a discharge funnel in the upper part of the tank; the funnel is adjustable vertically from outside, and its stem slides in a discharge pipe which extends downwards within the tank and passes out through the side near the bottom. A heating coil is arranged above the surface of the liquid to assist its flow into the discharge funnel.—W. F. F.

Hydrogenation of fats and oils. J. Dewar and A. Liebmann. Fr. Pat. 472,888, June 2, 1914. Under Int. Conv., June 4, 1913.

SEE Eng. Pat. 12,982 of 1913; this J., 1911, 797.

Method for decolorising liquids. U.S. Pat. 1,131,308. See 1.

Lubricant. U.S. Pat. 1,133,201. See 11A.

Washing compounds. Eng. Pat. 19,229. See VII.

Viscosimeter. U.S. Pat. 1,132,624. See XXIII.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

White lead specification. Oil, Paint, and Drug Rep., April 12, 1915.

THE U.S. Navy Department issued on March 1st specification No. 5211b, for white lead, as follows:—*White lead, dry*. The pigment shall be pure hydrated carbonate of lead, free from all adulterants. The total acetate shall not be in excess of the equivalent of 0.15% of absolute acetic acid. *White lead, in oil*. To be of the same quality as white lead dry, and be finely ground in at least 85.0%, by weight, of pure raw linseed oil in accordance with the latest issue of

Navy Department specifications for raw linseed oil. The material shall not contain more than 0.50% of moisture. *Comparison with standard sample*. White lead, dry and in oil, shall be free from crystalline structure and be equal in whiteness, fineness, opacity or body, tinting strength, and covering qualities to the standard sample of white lead, samples of which may be obtained by application to the construction officer, navy yard, New York. *Tinting test*. The tinting strength will be compared with the standard sample of dry white lead as follows:—10 grms. of dry white lead will be thoroughly ground with 10 mgrms. of dry lampblack and a sufficient weight of raw linseed oil to reduce the lead to a paste form, and compared with equal amount of standard white lead, dry lampblack, and linseed oil ground in the same manner. When placed alongside the standard sample on a glass slide, the tint of the lead under test shall not be darker than that of the standard sample. In case of samples of white lead in oil, the oil will be extracted with gasoline or some equally suitable solvent, so that the tinting test can be made on the dry pigments.

Chrome yellows and greens; Analysis of—A. Given. J. Ind. Eng. Chem., 1915, 7, 321.

Moisture and lead carbonate. Moisture is determined by drying 1 gm. of the pigment for 4 hours at 105°–110° C. in a small beaker. The residue is mixed well with 50 c.c. of 50% acetic acid, allowed to stand over night, then filtered through a Gooch crucible, and the residue washed, dried, and weighed; the loss in weight is reckoned as lead carbonate. *Lead sulphate and chromate*. 1 gm. of pigment is boiled for 5–10 mins. with 50 c.c. of water and 50 c.c. of 25% caustic soda solution, filtered through a Gooch crucible, the residue (a) washed, and the filtrate diluted to 250 c.c. In 50 c.c. of this solution the sulphate is determined by adding excess of hydrochloric acid and 5 c.c. of alcohol, boiling until the chromate is reduced to chromic chloride, and precipitating with barium chloride. In another 50 c.c. the total lead is determined as chromate by adding excess of nitric acid, heating to boiling, and precipitating with 25 c.c. of a boiling saturated solution of potassium chromate. The difference between the total lead and that present as carbonate and sulphate gives the lead as chromate. *Barytes or china clay*. The residue (a) (see above) is treated for 10 mins. with hot hydrochloric acid (1:1), filtered, and the residue washed. This treatment is repeated twice again, and the final residue is reckoned as barytes or china clay, according to the base of the pigment.—A. S.

Oleoresin of the sand pine. A. W. Schorger. J. Ind. Eng. Chem., 1915, 7, 321–322.

THE sand pine (*P. clausa*, Sarg.) is practically confined in its range to the State of Florida. Its oleoresin contained 6.1% of water and 2.67% of "trash," and yielded 18.93% of volatile oil and 72.30% of resin (grade G.). The resin had the saponification value 178.7 and acid value 172.5. It consisted mainly of abietic acid, but contained 4% of resene soluble in light petroleum spirit. The volatile oil had sp. gr. 0.8723–0.8725 at 15°/15° C., n_D^{20} = 1.4767–1.4768, and α_D^{20} = –22.49° to –22.80°. It contained about 75% of *l*- β -pinene and 10% each of *l*- α -pinene and *l*-camphene.—A. S.

Toxic jaundice due to tetrachloroethane poisoning. Willcox. See XIXB.

PATENTS.

Paint; Manufacture of metallic—The British Patent Surbrite Co., and E. G. Meadway, London. Eng. Pat. 7087, March 20, 1914.

METALLIC powder (2 lb.) is incorporated with

320 grains of gum mastic dissolved in 2 fl. oz. of a solution of 2½ oz. of rubber in 160 fl. oz. of naphtha or other solvent, and with 113 fl. oz. of a solution of celluloid in amyl acetate or other solvent, and the paint is thinned with the celluloid solvent (15 fl. oz.).—C. A. M.

Solvents with a basis of furfural. G. Meunier. Fr. Pat. 472,423, Aug. 4, 1913.

FURFURAL is claimed as a solvent for nitrocellulose, particularly for pyroxylin containing 11.5% N, also for celluloid, for gums and resins used in varnishes, and for linseed oil varnish. Mixtures of furfural with one or more of the following substances may also be employed:—ethyl, methyl, or amyl alcohol, acetate, or formate; ketones, oil of turpentine, benzene, toluene, acetic or formic acid. The hardest copals can be gelatinised and to a large extent dissolved without discoloration by digestion with a mixture of equal volumes of oil of turpentine, acetone, and furfural at 40°–50° C., and a mixture of 77 vol. of ethyl alcohol (95° Gay-Lussac) and 23 vols. of furfural can frequently be employed as a substitute for acetone, amyl alcohol, or amyl acetate.—F. Sp.

Lacquers from nitrocellulose or resins: Preparation of——. Chem. Fabr. Buckau, Abteilung Dubois und Kaufmann. Ger. Pat. 280,376, July 31, 1913.

NEUTRAL esters of alkylcarbonic acids are used as solvents.—A. S.

Resinous products: Preparation of——. Badische Anilin und Soda Fabrik. Ger. Pat. 280,595, Jan. 25, 1913.

COMPOUNDS of the general formula, $R.CH_2.X$, where R is an aromatic residue and X is a halogen, e.g., benzyl chloride or bromide, *o*-chlorobenzyl chloride, or *o*-chloro-*o*- or *β*-methylnaphthalene, are treated with metallic halides, e.g., with ferric chloride at the ordinary temperature, or with aluminium chloride or zinc chloride at a higher temperature, in absence of diluents. The resinous products so obtained are soluble in benzene, carbon tetrachloride, and other organic solvents.—A. S.

Resin lacquers. Badische Anilin und Soda Fabrik. Ger. Pat. 280,377, Jan. 25, 1913.

LACQUERS are prepared by dissolving in volatile solvents the resinous products obtained by treating benzyl halides or their derivatives with metallic halides (see preceding abstract) or with metals (Zincke, Ber., 2, 739).—A. S.

Lacquers from cellulose derivatives: Preparation of——. Zapon-Lack-Ges. Ger. Pat. 281,265, April 22, 1913.

CELLULOSE derivatives are dissolved in the usual solvents, e.g., acetone oil, methyl alcohol, ketones, or the like, in which the polymerisation products of conmarone and indene have been previously dissolved, and the products are diluted with alcohol, petroleum spirit, benzene, or the like.—A. S.

Manufacture of insoluble azo dyestuffs. Fr. Pat. 472,889. See IV.

Azo dyestuffs and products used in producing them. Fr. Pat. 472,893. See IV.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Rubber; Isolation of the insoluble constituent of——. G. Bernstein. Kolloid-Zeits., 1914, 15, 49–50. Z. angew. Chem., 1915, 28, Ref., 24.

A TWO per cent. solution of the rubber in petroleum spirit is exposed to ultra-violet light from a

Westinghouse lamp, with exclusion of air: complete depolymerisation of the rubber is effected in less than 3 minutes, the viscosity of the solution falling until it is not much greater than that of the solvent, and the liquid can then easily be separated from the insoluble matter by decanting or filtering.—A. S.

Caoutchouc; Regeneration of——*from its tetrabromide.* F. Kirchhof. Kolloid-Zeits., 1914, 15, 126–131. Z. angew. Chem., 1915, 28, Ref., 24–25.

ABOUT one-half of the combined bromine in caoutchouc tetrabromide is removed by heating with alcoholic potash at about 100° C. The remaining bromine is removed completely only at a much higher temperature. The bromine-free product is isomeric, but not identical with normal caoutchouc. It was found, contrary to the statements of Ostromisslensky, that from the tetrabromide from raw rubber an inelastic product is obtained by regeneration with metallic calcium and an elastic product by regeneration with aniline. The author considers that the processes of Ostromisslensky (this J., 1912, 348) and of Harries (this J., 1913, 372; 1914, 93, 269) are not likely to acquire importance technically in the near future on account of their costliness, the inferior value of the products in comparison with those obtained by other regeneration processes, and the low price of raw rubber.—A. S.

PATENTS.

India-rubber; Treatment of fabrics used in conjunction with——. W. E. Muntz, London. Eng. Pat. 4910, Feb. 26, 1913.

SEE Fr. Pat. 468,493 of 1914; this J., 1914, 974. Reference is directed in pursuance of Sect. 7, Sub-sect. 4, of the Patents and Designs Act, 1907, to Eng. Pats. 2224 of 1867, 8963 of 1885, 11,299 of 1898, and 23,873 of 1910.

India-rubber; Process of reclaiming old or waste vulcanised——. T. Gare, New Brighton. U.S. Pat. 1,133,952, March 30, 1915. Date of appl., Sept. 17, 1906.

SEE Eng. Pat. 19,894 of 1906; this J., 1907, 1288.

Impregnation of fibrous materials and textiles [with rubber solutions]. Fr. Pat. 472,844. See VI.

XV.—LEATHER; BONE; HORN; GLUE.

Tannin analysis; High results in——. H. G. Bennett. Collegium (London), 1915, 97–102.

EXPLANATIONS are advanced for the variations of 1–2% tannin in the results obtained by different chemists for the same materials. Weighing residues once only, except those of tan liquors or when dried for 15–16 hours, is inadmissible. Residues of soluble solids, particularly in the case of quebracho, gambier, myrobalans, or sumach, still lose after the non-tannins have been dried to constant weight, and if they are not dried further, may cause an error corresponding to more than 0.5% tannin. The author recommends the use of well-ventilated ovens at a temperature as near 100° C. as possible for the drying of organic residues. The variation from 0.35 to 0.45% tannin officially allowed in the concentration of infusions for analysis gives rise to errors. If infusions containing as nearly as possible 0.45% tannin are used, the residues are greater and not so easily dried, and the relative absorption by the hide powder is greater. All the above errors give a higher tannin result. Experiments are cited to show that basins should

be allowed to cool for one hour before weighing. The suggested remedies for the above errors are the evaporation of half quantities of infusion in the case of total and soluble solids, a uniform time of not less than one hour for cooling basins, and a narrower range of concentration of tannin infusions.—F. C. T.

Quebracho extract; Suspected adulteration of— with sulphite-cellulose. H. Becker and J. Gross. *Ledertech. Rundschau*, Oct. 22, 1911. *Collegium* (London), 1915, 106—108.

AN extract described as pure quebracho showed about 15% sulphite-cellulose according to the Procter-Hirst reaction, high alcohol figure, low gallic acid value, and high non-tannin content. Other results, particularly the large amount of sulphates in the ash, confirmed this. Becker is of the opinion that quebracho extract might give the above results if made from partly rotten wood, owing to the solution of a larger amount of non-tannin substances. A sample of unsound wood was extracted, and the analytical results indicated 20% sulphite cellulose. Gross points out that only 2% of rotten wood is allowed in commercial quebracho wood, and that attempts to make from quebracho wood alone an extract showing figures like those of Becker's extract, did not succeed. From experience he finds that a quebracho extract, even if prepared under pressure and highly sulphited, cannot be regarded as pure if it contains more than 6% of non-tannins.—F. C. T.

Moellon analysis; Report of committee on—. T. A. Faust. *J. Amer. Leather Chem. Assoc.*, 1915, 10, 174—178. (See also this J., 1915, 41.)

THE method previously proposed for the determination of unsaponifiable matter is quite reliable, if the petroleum ether solution is washed with 25% alcohol. The results in the determination of oxidised fatty acids led to the following revised method:—The soap solution from the determination of unsaponifiable matter is boiled till all the alcohol is expelled, and is then dissolved in hot water. The solution is transferred to a separating funnel, made up to about 300 c.c., and a slight excess of concentrated hydrochloric acid added. A large excess of acid causes low results. The contents of the funnel are vigorously rotated and extracted with petroleum spirit. The aqueous layer is run off, and the petroleum layer poured out, avoiding loss of oxidised acids. These acids are washed twice with small quantities of petroleum spirit and hot water to ensure complete removal of oil and salt. The oxidised acids are then dissolved in warm 95% alcohol, and the solution filtered and evaporated, the evaporation and drying occupying 16 hours. The whole operation should be carried out without delay.

—F. C. T.

Sulphite-cellulose in leather; Cinchonine for the detection of—. W. Appellius. *Ledertech. Rundschau*, 1915, 17. *J. Amer. Leather Chem. Assoc.*, 1915, 10, 202—203. (See also this J., 1915, 189.)

THE cinchonine test is uncertain with leather extracts unless carried out according to the following method:—5—10 grms. of leather, cut into small cubes (not finely ground), is extracted by heating to boiling with 100 c.c. of water. After filtration 5 c.c. of 25% hydrochloric acid is added to the filtrate, which is heated to boiling and again filtered; 20 c.c. of cinchonine solution is then added to 50 c.c. of the filtrate, together with a very little tannin solution, and the mixture heated to boiling without moving the flask. A lumpy, brown-black precipitate appears in the presence of even small amounts of sulphite-cellulose.—F. C. T.

Sulphited tanning extracts; Analysis of—, and determination of free sulphuric acid in leather. L. Dufour. *Collegium*, 1911, 613—617. *Z. angew. Chem.*, 1915, 28, Ref., 31.

IN the determination of free sulphuric acid by Balland and Maljean's method (this J., 1895, 496) sulphur in organic combination is also determined, and this may lead to serious errors, especially in the case of sulphited extracts. The organic sulphur in catechol-tannins may be determined by precipitating with formaldehyde in presence of hydrochloric acid, incinerating the precipitate after addition of sodium carbonate, dissolving the residue in water acidified with nitric acid, and precipitating with barium chloride. Extracts of sulphite-cellulose or Neradol are precipitated with cinchonine hydrochloride instead of with formaldehyde.

The content of free sulphuric acid in leather tanned with sulphited extracts can be determined more accurately by the method of Procter and Searle (this J., 1901, 287) than by Balland and Maljean's method (*loc. cit.*), especially if incineration is effected without the use of a coal gas flame.—A. S.

Sulphuric acid in leather; Determination of—. L. Jablonski. *Ledertech. Rundschau*, 1914, 6, 281. *Z. angew. Chem.*, 1915, 28, Ref., 31.

THE leather is boiled with a mixture of glacial acetic acid and a chloro-derivative of acetic acid for 1—3 hours under a reflux condenser, the mixture is diluted with water and filtered, the residue washed, and the sulphuric acid in an aliquot part of the filtrate determined as barium sulphate. The method, in conjunction with an analysis of the ash, allows of the differentiation of free sulphuric acid and sulphates.—A. S.

Corrigendum. This J., April 15th, 1915, p. 368, col. 2, abstract on "Artificial bates." In line 14 of abstract, for "a bate" read "an enzyme bate."

PATENTS.

Hides and skins; Treatment [depilation] of—. W. Owen, Warrington. *Eng. Pat.* 1375, Jan. 28, 1915.

THE hides are treated with "solcite" (a mixture of common salt, sodium carbonate, and tannic acid) either dry or in solution, allowed to stand for four days, then hung exposed to the atmosphere for two days, soaked, and subsequently unhaired as usual. A saving of time and complete avoidance of stains on the skins are claimed for this process.

—F. C. T.

Skins; Treatment of—. R. Vidal. First Addition, dated Aug. 21, 1913, to *Fr. Pat.* 435,917, Sept. 23, 1911 (this J., 1912, 349).

THE application of alkali sulphites, thiosulphates, or polysulphides to the skins, described in the chief patent, is best effected in the presence of alkali hydroxide, carbonate, or sulphide. A further drumming with hydrogen peroxide gives the skins still more stretch, and bleaches and brightens the hair. This operation is followed by tannage.—F. C. T.

Leather; Material similar to—. R. Miller. *Fr. Pat.* 472,852, May 30, 1914.

MATERIAL suitable as a substitute for leather or cardboard, is formed by treating a mixture of vegetable or other fibres and gelatin or glue, with chrome alum, and subjecting to pressure.—F. C. T.

Leather; A special— and process of making it. Soc. Anon. Nouvelle L'Oyonnithé. *Fr. Pat.* 473,380, Sept. 19, 1913.

A NEW product called "Norman leather" is made

by compressing a sheet of celluloid (coated with celluloid solution or glue) with a prepared sheet of ordinary leather of any desired thickness, or between two such sheets. The celluloid matches the leather in colour.—E. C. T.

Tanning agents; Process of producing soluble——. E. Dehnelt. Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen, Germany. U.S. Pat. 1,133,108, March 23, 1915. Date of appl., June 30, 1913.

SEE Eng. Pat. 24,982 of 1912; this J., 1913, 919.

Tanning preparations; Soluble——. Badische Anilin und Soda Fabrik. First Addition, dated Aug. 5, 1913, to Fr. Pat. 461,746, Nov. 5, 1912.

SEE Eng. Pat. 18,259 of 1913; this J., 1911, 877.

XVI.—SOILS; FERTILISERS.

Soils; Variation of the fertility of———*under the influence of natural conditions and dry air storage.* K. Ghedroiz. Selskoje Khosiasstro i Lessovodstvo, 1914, 47, 630—633. Bull. Bureau Agric. Intell., 1915, 6, 37—39.

CULTURES of oats and flax were grown in zinc pots containing soil which had been stored in dry air for periods of 1 to 6 years. Some of the pots were treated with a complete manure, containing calcium nitrate, mono-sodium phosphate, and potassium sulphate; others with the same less the nitrate, phosphate, and potassium sulphate respectively, and there were the usual control pots. A gradual increase was observed in the crops with the length of time the soil had been stored in all cases, except in that of oats with the complete manure, where the greatest yield was obtained with the soil which had been stored for one year. These and other experiments showed that when a soil is stored in dry air, its productivity increases in proportion to the length of storage; the phosphoric acid and nitrogen contents of the plants, and the citric-soluble P_2O_5 of the soil, vary in a like manner.—E. H. T.

Soil; Nitrogen metabolism in the——. H. H. Green. Centralbl. Bakt., Abt. II., 1914, 41, 577—608. Bull. Bureau Agric. Intell., 1915, 6, 39—40.

SAMPLES of soil from field plots manured respectively with sodium nitrate, ammonium sulphate, and blood, flesh, and horn meals, were taken at monthly intervals from Aug. 1912 to Aug. 1913, and were tested as to the ammonification of the nitrogen in the organic fertilisers, the nitrification in the ammonium sulphate, and the fixation of atmospheric nitrogen. The ammonification curve rose from Aug. to Oct., remained level or fell slightly during Nov., rose to a maximum in Dec., fell to a minimum in Feb., and attained a lower maximum in April; thenceforward there was a slight fall until the summer minimum in August was reached. The nitrification curve was similar, except that the spring maximum was in March and the summer decline began in April. The smallness of the actual variations and the unexpected maxima in Dec. were held to be due to the exceptionally mild winter. The seasonal variation is considered to be related to the activity of the soil protozoa. Nitrogen fixation through *Azotobacter* was observed in July and Aug., 1913, though no perceptible growth of these organisms in mannitol solution inoculated with soil had been remarked in any of the preceding ten summers. A comparison of the crop returns with the laboratory tests of the bacterial activity, showed that the latter were a very fair index of

the former; but there was no bacteriological evidence to account for the better crops obtained on soil which had been cultivated in autumn compared with those grown on land which was left untouched till spring.—E. H. T.

Nitrogen; Direct assimilation of atmospheric——*by plants.* M. Molliard. Comptes rend., 1915, 160, 310—313. (See also Mameli and Pollacci, this J., 1915, 293.)

RADISHES were cultivated from seed under strictly aseptic conditions in tubes containing powdered pumice impregnated with a solution containing mineral salts, dextrose, and ammonium chloride. After seven weeks, the total nitrogen of the tube-contents was determined and compared with that originally present in the seeds and in the liquid. The gain or loss of nitrogen was in every case less than the experimental error involved. When the plants were grown to their full extent with the roots in the aseptic solution but the stems in the free air, a very slight gain (1.32 mgrm.) of nitrogen was observed, much less than that found by Mameli and Pollacci (7.9 mgrm.). The gain was due to assimilation of combined nitrogen present in the air.—E. H. T.

Chlorides and nitrates of potassium and sodium; Influence of——*on germination [of wheat].* H. Mischeels. Intern. Zeits. phys.-chem. Biol., 1914, 1, 412—419. J. Chem. Soc. 1915, 103, i, 110.

WHEAT grains previously soaked in water were allowed to germinate in dilute solutions of the chlorides and nitrates of sodium and potassium. The Cl-ion had a more injurious effect than the NO_3 -ion, and the Na-ion than the K-ion. The NO_3 -ion exerted a beneficial action, especially in relation to the length of the leaves and the weight of the plantlet, and it also caused a lengthening of the root hairs. In presence of Na-ions a longer root appeared to be produced than in presence of K-ions. Similar results were obtained by passing an electric current through the solutions and observing the germination of the grains in the neighbourhood of the cathode and anode respectively.—G. F. M.

Phosphates; Production of available——*by furnace treatment.* J. H. Payne. Amer. Fertiliser, 1914, 16, 41—46. Bull. Bureau Agric. Intell., 1915, 6, 51—53.

WHEN a mineral phosphate is sufficiently heated in an electric furnace with a non-volatile acid, such as silicic acid, and a reducing agent, such as carbon, the whole of the phosphoric acid is volatilised and may be absorbed in an alkaline liquid. The soluble phosphate produced should contain not less than 30—50% of water-soluble P_2O_5 . Plant for carrying out this process has been installed recently near Charlotte, N.C. U.S.A. There are various methods of converting the phosphorus of tricalcium phosphate into a citric-soluble form by calcining with alkaline or acid reagents. That of Wiborgh (Eng. Pat. 2678 of 1896; this J., 1897, 250) consists in heating apatite to a red or yellow heat with from 6—10% of an alkaline sodium or potassium compound, and yields a tetra-calcium sodium or potassium phosphate ($10CaO, 2Na_2O, 3P_2O_5$), soluble in Wagner's reagent but insoluble in water. In Connor's process (U.S. Pat. 931,846; this J., 1909, 1054) of heating 5 parts of phosphate with 1 pt. NaOH and 2 pts. CaO, a similar product is obtained, and that of Newberry (U.S. Pat. 978,193; this J., 1911, 101) gives the same result with but half the amounts of the alkalis. The calculated cost of production of the Wiborgh product, containing 30% available P_2O_5 , will eventually be \$7.13 (about 29s. 8d.) per ton, or 1s. per unit, assuming that the phosphatic

rock contains 70% phosphate and there are no transport charges.—E. H. T.

Kainit; Use of—in the destruction of weeds. J. Vasters and T. Remy. Landwirt. Jahrb., 1914, 46, 627—657. Bull. Bureau Agric. Intell., 1915, 6, 151—156.

FINELY ground kainit is very useful for destroying certain weeds, particularly when they are young. Charlock, runc, black bindweed, chickweed, nettle, groundsel, and cornflower are very sensitive to it; redshank and spurrey are moderately susceptible; sowthistle and fumitory only slightly so. The kainit should be distributed uniformly on the plants, in amounts varying from 10—11 cwt. to a maximum of 16 cwt. per acre. The best results can only be obtained when the weeds are very wet with dew or rain, and the effect is enhanced if the soil is dry or lightly frozen. Any clogging effect upon the surface soil can be rectified with lime. Cereals stand such a top-dressing of kainit very well, and subsequently benefit from its application to the soil. Kainit made from carnallite is better than that from sylvine. In the Rhine province the cost of fine grinding is 2½d. per cwt., and that of application 3s. per acre for a dressing of 11 cwt. Although inferior to hoeing, kainit is in many respects superior to other weed-killers; it has no permanent injurious effects when used in large quantities, it is hygroscopic and readily soluble.—E. H. T.

Industrial uses of radium. Baker. See VII.

PATENT.

Calcium phosphates; Process of dry concentration of —. J. Parent. Fr. Pat. 472,709, Aug. 13, 1913.

MINERAL phosphates are calcined at a sufficiently high temperature to eliminate water and organic matter, including bitumen, and to convert practically all the calcium carbonate into calcium oxide, which combines to a slight extent with the silica present to form a silicate not absorbing sulphuric acid. The free lime and other impurities are separated mechanically by fine sieves, the residue constituting the concentrated phosphate.—J. P. O.

XVII.—SUGARS ; STARCHES ; GUMS.

Bagasse; Rational maceration of — in the cane sugar factory. L. Pellet. Intern. Sugar J., 1915, 17, 20—26, 74—79, 123—127 and 175—178.

CONTRARY to the opinion generally accepted, the author considers that the maceration water should not be applied just as the bagasse leaves the mill, since then the bagasse adheres to the top roller, diminishing considerably the efficiency of the operation. Preferably the water should be delivered when the bagasse has passed on to the exit platform, which serves as a scraper of the lower rear roller. To effect the maximum sugar extraction and to prevent "swamping," the total water used should be distributed over the bagasse at a number of different points variable with the volume used; preferably it should be sprayed on the bagasse from below as well as from above, and the surface of the bagasse should be renewed frequently by the use of stirrers or overlapping carriers. The modern system of grouping the mill units closely together (so as to be driven by a central engine) has the disadvantage of not permitting the application of the water at a multiplicity of points, which demands considerable distance. In a 4-unit installation with crusher, for example, there should be at least 32—38 ft. between the second and the third units, since it is

there the greatest amount of water is delivered. Special atomisers which water the bagasse evenly in a very fine spray should be employed, a number of these being mounted on a horizontal distributing pipe fed from water tanks. Preferably the water used should be that condensed in the evaporators and pans from the exhaust or live steam used for heating these apparatus, and not filter-press washings, nor the water condensed from juice or syrup vapours, and it should be applied at 80°—85° C. under a pressure of about 23 ft., either from a tank or by a pump after careful filtration. In discussing the amount and place of maceration, the author discusses mills of different capacities with and without crushers of the Krajewski type. For example, with a 3-unit installation with a crusher, the amount of water would be about 20% of the weight of cane, one-third being delivered immediately after the first mill, one-third immediately after the second distributor, and the remaining third a few yards after the second mill; while with a 4-unit mill also using a crusher, 20—25% of water and more may be used if applied with four distributors each taking one-quarter, the first immediately after the first mill, the second immediately after the second mill, the third a few yards after the second distributor, and the fourth immediately after the third mill. Steam may be used, replacing water in the last distributor; and the juices from the last mill (which are very weak) may be returned and applied between the first and second mills. To ascertain the amount of water passing into the distributing pipes at any moment, gauges should be used, and it is convenient to unite all these, together with the regulating cocks, on a platform in the centre of the mills, so that the operator may survey the whole process of milling, and especially note what is taking place on the several carriers.—J. P. O.

Sucrose; Determination of — by double polarisation, employing a new method of clarification. N. Deerr. Intern. Sugar J., 1915, 17, 179—182.

To eliminate the error caused by the direct reading being taken in an alkaline solution (due to basic lead acetate) and the inversion reading in a strongly acid medium (due to hydrochloric acid), the author takes the two readings in solutions having the same composition so far as non-sugars are concerned. Clarification of both solutions is effected by adding successively baryta and a mixture of aluminium sulphate and sulphuric acid, the small amount of sulphuric acid remaining in solution after the separation of the aluminium hydroxide and barium sulphate being insufficient to induce appreciable hydrolysis while taking the direct reading, but being sufficient to invert all the sucrose present at a high temperature, aided by the hydrolysing action of the excess of aluminium sulphate remaining in solution. The solutions required are: (A) a 0.52 N solution of baryta; (B) a solution of 165 grms. of crystallised aluminium sulphate and 135 c.c. of N/1 sulphuric acid per litre; the titre of (B) is adjusted so that 25 c.c. of (A) is equivalent to 15 c.c. of (B). For the direct reading 50 c.c. of the material under examination (containing 3.25 grms. in the case of cane molasses) is mixed with 25 c.c. of (A) and next with 15 c.c. of (B), the volume being completed to 100 c.c., and about 0.1 gm. of sodium hydro-sulphite added. After filtering, the solution is polarised, the reading being increased by 0.7% to compensate for the volume of precipitate formed, or the volume may be completed to 100.7 c.c., instead of 100 c.c. For the inversion reading 50 c.c. of the same solution of the material used for the direct reading is treated in a 100 c.c. flask with 15 c.c. of (B), and inversion effected at 95°—97° C. during 20 minutes. After cooling, 25 c.c. of (A) is added, the volume made up to

100 c.c., the liquid filtered, and the saccharimeter reading ascertained, while from the direct and inversion readings is calculated the percentage of sucrose from the usual formula, a special constant, however, being used. This constant varies with dilution and temperature: the following values were found at 26° C.:—Inversion reading (200 mm. tube), —25° V., constant 142.2; —20° V., 141.8; —15° V., 141.3; —10° V., 140.7; —5° V., 139.8; —1° V., 138.4. Advantages of the proposed process, in addition to both readings being made under identical conditions, are that the influence of the lead salts is eliminated, and that the filtrate may be used for the determination of the reducing sugars. On the other hand, in comparison with the ordinary procedure its disadvantages are that the decolorisation is less intense (though reasonably efficient), and that the time required is somewhat greater.—J. P. O.

Sucrose: Oxidation of—by potassium permanganate. C. W. R. Powell. J. Roy. Soc. New South Wales, 1914, 48, 223—241. J. Chem. Soc., 1915, 108, ii, 91—92.

MEASUREMENTS of the rate at which potassium permanganate oxidises sucrose in acid, neutral, and alkaline solution, showed that the velocity of the reaction is least in neutral solution, and that higher oxides of manganese are precipitated during the course of the oxidation unless a certain quantity of acid is present at the beginning. The results obtained in acid solution indicate a bimolecular reaction, although the velocity-coefficient increases during the course of the change; this increase is attributed to the influence of manganese sulphate formed during the reaction. Within certain limits the nature of the reaction does not seem to be affected by the concentration of the acid, but the initial velocity is approximately proportional to the hydrogen-ion concentration. The velocity is increased in the ratio 3:1 for a rise of 10° C. Permanganate oxidises dextrose more rapidly than sucrose, but the quantity of the former sugar produced during the time required for the experiments was too small to affect the results.—W. P. S.

Penloses and hexoses: Mutarotation of the phenylosazones of—. P. A. Levene and F. B. La Forge. J. Biol. Chem., 1915, 20, 429—431.

THE initial rotation of an osazone in Neuberg's pyridine-alcohol solution is subject to small variations, dependent on traces of impurities, but the direction of the mutarotation and the equilibrium rotation remain constant. The authors determined the character of the mutarotation of the phenylosazones of the normal pentoses and hexoses with the following results:—

Osazone.	Rotation, [α] _D .		M. pt., ° C.
	Soon after preparing solution.	After 24 hours.	
<i>l</i> -Arabinose	+0.55	+0.30	166
<i>d</i> -Xylose	—0.09	—0.43	164
<i>d</i> -Altrose	—0.40	—0.29	178
<i>d</i> -Gulose	+0.07	+0.40	168
<i>d</i> -Galactose	+0.80	+0.34	201
Dextrose	—0.62	—0.35	208

The determinations were made in a 0.5 dm. tube with D-light, using 0.1 grm. of the substance in 5 c.c. of pyridine-alcohol mixture.—W. P. S.

Temperature coefficient of photochemical reactions. Berthelot. See XXIV.

PATENTS.

Cane sugar: Process of refining raw—. F. Murke, Fort Collins, Colo. U.S. Pat. 1,132,868, March 23, 1915. Date of appl., June 20, 1914.

IMPURITIES adhering to the sugar crystals are removed by mechanical means, e.g., by washing, and a solution of the cleansed crystals is treated at about the boiling point with lime or its equivalent and then recrystallised.—J. F. B.

Liquids [sugar solutions]; Purification [decolorising] of—. R. H. McKee, Orono, Me. U.S. Pat. 1,133,049, March 23, 1915. Date of appl., March 27, 1912. Renewed Aug. 15, 1914.

LIQUIDS, particularly sugar solutions, are treated with black ash residues, which may previously have been treated with acids or heated to redness.—J. F. B.

Beetroot juice: Rapid and continuous process of cold extraction of—applicable in sugar factories and distilleries. V. Petrucci. Fr. Pat. 472,598, May 22, 1914.

BEETROOT slices contained between two perforated plates in a series of cylindrical vessels, are treated with a current of cold water passing upwards, which at first displaces pure juice (not a mixture of juice and water), though later the liquid becomes dilute. In this way, using a battery of 7 or 8 vessels, slices may be exhausted rapidly and continuously.—J. P. O.

Starch: Process of extracting—from manioc and other roots. F. Strumberg. Fr. Pat. 472,772, May 28, 1914.

THE starch is separated from the root fibres by grinding in a mill consisting of two moderately hard stones, the bottom one of which is fixed.—J. P. O.

XVIII.—FERMENTATION INDUSTRIES.

Malt, wort, beer, and yeast: Determination of mineral constituents in—. F. Schönfeld and S. Sokolowski. Woch. Brau. 1915, 31 [52]. Brewers' J., 1915, 51, 225—226.

TEN grms. of finely ground barley or malt, or the evaporated residue from 100 c.c. of wort or beer, is carefully charred in a platinum or asbestos crucible and the cake of charcoal is rubbed down and the crucible heated in the direct flame, combustion of the last traces being assisted by treatment with ammonium nitrate. In the case of pressed yeast the sample is passed through a mincing machine, made up into small rolls, one of which is treated for the determination of dry substance and then powdered, 5 grms. of the powder being taken for incineration. Silica is determined in the ash in the usual manner, phosphoric acid by Woy's method; lime and magnesia are determined after precipitation of the phosphoric acid by ferric chloride.

Beer: Study of the foam-keeping capacity of—. T. Ihnen. Paper read before the Soc. of Graduates, U.S. Brewers' Academy. Brewers' J., 1915, 51, 221—223.

THE foam-retaining capacity of beer is tested by cooling the sample in bottle to 5° C., pouring the contents into a glass of 500 c.c. capacity and noting the time required for the foam to disappear; good beers will retain the foam for over 30 mins. The foam-retaining qualities are favourably influenced by a high percentage of carbon dioxide; the danger of over-bunging or over-carbonating bottled beer has been considerably over-rated and

an increase in the quantity of dissolved gas will materially improve the foam-retaining quality, even if the other factors remain unchanged. One of the best samples examined had a foam-retaining capacity of over 30 mins. and contained carbon dioxide 0.59, total proteins 0.27, coagulable proteins 0.01, non-coagulable 0.26, dextrin 2.23, extract 4.45, alcohol 4.07% by weight. This beer, on standing in open bottle for 30 mins., lost 0.06% CO_2 and still had a foam-retaining capacity of over 20 mins. Another beer, originally containing 0.49% CO_2 and 0.37% of total proteins, had almost as good a foam-retaining capacity as the first, but after standing in open bottle for 30 mins., with loss of 0.06% CO_2 , the foam-retaining capacity fell to 9½ mins. Thus the view that a high percentage of protein is a necessary condition for good foam-retention is not upheld. The influence of proteins appears to depend rather on the quality of the proteolytic products than on the quantity of total protein. Beers practically identical as regards percentages of carbon dioxide, total protein, and dextrin may be quite different in foam-retaining quality. The percentage of dextrin plays an important part. Although no fixed rule can be laid down, owing to the variable factor of the qualitative value of the proteins, it is generally the case that, under similar conditions as regards carbon dioxide and protein-contents, those beers which are rich in dextrin retain the foam better than those poor in dextrin.—J. F. B.

Rum; Study of the ferments of —. E. Kayser. *Comptes rend.*, 1915, 160, 408—411.

THE composition of rum depends on the nature of the original sugar solution (molasses) and the method of fermentation and distillation, but principally on the kind of micro-organism used to ferment the sugar. The addition of ammonium sulphate or asparagine to the molasses has a favourable effect on the action of *Schizosaccharomyces*, the quantity of alcohol produced being increased whilst the volatile acids are diminished; the opposite effect is, however, noticed in the case of bottom-fermentation yeast. Yeasts acting in the presence of bacteria isolated from molasses produce, from sterile molasses, about nine times as much volatile acids and less aldehyde than does the yeast acting alone. It is suggested that by the use of selected pure or mixed cultures of yeasts, rums of any desired composition or quality could be prepared.—W. P. S.

Cider vinegar manufacture; Utility of sulphurous acid and pure yeast in —. W. V. Cruess, J. R. Zion, and A. V. Sifredi. *J. Ind. Eng. Chem.*, 1915, 7, 321—325.

IN the manufacture of cider vinegar in California, the alcoholic fermentation is effected with compressed yeast or is allowed to take place spontaneously. Large quantities of lactic bacteria and *Mycoderma vini* develop, resulting in the loss of alcohol and, frequently, production of an unpleasant flavour. In some small scale tests in barrels, the apple juice was treated with potassium metabisulphite at the rate of 12 oz. per 200 gallons, and after standing for 24 hours was pitched with pure "Burgundy" wine yeast. As compared with natural fermentation this treatment resulted in an increase of 1.8% of alcohol, more complete fermentation of the sugar, elimination of wild yeasts and lactic bacteria, more rapid clearing of both the cider and the vinegar, improved flavour, and more rapid acetification. Analogous results were obtained in large scale tests in which a quantity of metabisulphite equivalent to 8 oz. per 200 gallons was used.—A. S.

Utilisation of volatile waste products of sulphite-cellulose manufacture. Bergström. See V.

Terpene substances as by-products of cellulose manufacture. Hellström. See V.

Dried yeast as food for farm stock. Crowther. See XIXA.

PATENTS.

Breweries and similar works; Method of heating liquor and the like in —. H. Boot and R. J. S. Spencer-Phillips, London. Eng. Pat. 6160, Mar. 14, 1914.

IN industries where a large supply of hot water is required, the exhaust steam from a steam turbine may be conducted to an injection condenser discharging into the hot water storage tank. The water is circulated by means of a pump from the tank through the condenser, which is also partly supplied with fresh cold water, the amount of which is regulated by a valve automatically controlled by a float in the tank. When the demand for hot water is small, the tank fills up and the cold-water valve is closed by the float; the rise of pressure in the exhaust main then causes the steam to blow directly into the tank through a non-return valve, or through a safety valve into the atmosphere.—J. F. B.

Mash filters; Process for filling — with mash of constant and homogeneous composition. P. Reichardt. Fr. Pat. 473,131, June 6, 1914.

IN a mash filter fed by a pump, a return pipe fitted with a valve operated by a hand wheel connects the main pipe carrying the mash to the pump with that conveying it from the latter to the filter. As the resistance of the filter increases in the course of filtration, this valve is opened by degrees and allows some of the mash to return from the pressure to the exhaust side of the pump. The amount of mash supplied to the filter, and the pressure within the latter, can thus be regulated without any throttling of the main mash pipe or any alteration of the speed of the pump. The tendency towards a partial separation of solids from liquid in the pipes is thereby minimised.—J. H. L.

Hops; Apparatus for economising — used in the manufacture of ale, beer, stout, and the like. T. R. Shercliff, Burton-on-Trent. Eng. Pat. 19,380, Sept. 3, 1914.

THE apparatus is a modification of that described in Eng. Pat. 18,270 of 1912 (this J., 1913, 804). It is provided with a steam jacket, apertures for pressure gauges and thermometers, an inlet pipe for the wort delivering into the upper part of the funnel-shaped sieve, an overflow pipe, a draw-off tap, and a sluice or watertight door at the bottom for discharging the hops. Around the outlet for the wort the floor is lower than elsewhere and the recess thus formed is covered by a sieve to keep back the hops.—J. H. L.

Carbon dioxide or other gases [fermentation gases]; Apparatus for cooling — during the compression thereof. H. Müry, Zürich, Switzerland. Eng. Pat. 13,530, June 3, 1914. Under Int. Conv., June 4, 1913.

THE gas enters the compressing cylinder together with the cooling water, and both pass out directly into a receptacle mounted on the outlet from the cylinder and containing a temperature regulator which controls the feed of the cooling water. The gas and water then pass down an inclined pipe of larger diameter than the receptacle, the lower end terminating in a ball in which separation of the cooling water is completed.—J. F. B.

Yoghourt beer; Manufacture of —. Versuchs- und Lehranstalt für Branerei in Berlin. Fr. Pat. 472,483, April 28, 1914. Under Int. Conv., April, 30, June 29, July 10, and Dec. 6, 1913.

THE following processes are claimed:—Fermenta-

tion of wort by mixtures of yeast and *B. bulgaricus*, the action of the latter being strengthened, if necessary, by employing higher temperatures than usual or by adding fresh cultures during fermentation. Fermentation by yeast alone, and addition of a culture of the bacillus in wort before the secondary fermentation. Acidification of mashies by means of the bacillus, the wort being so drawn off as to carry with it most of the organisms, which remain active during the subsequent fermentation. Fermentation at blood temperature by pure culture yeasts adapted to work thereat, in presence of the bacillus. Addition of small quantities of lactose or albuminoid substances, or both, to Yoghurt beer to prolong the life of the *B. bulgaricus* present.—J. H. L.

Fermented beverages; Treatment of— with a view to their conservation. A. P. Bouland. Fr. Pat. 472,666, Aug. 12, 1913.

THE secondary fermentation of wines and similar beverages is carried out in a closed vessel capable of withstanding pressure and provided with the usual fittings. The lower part is funnel-shaped and terminates in a valve which communicates with a small chamber closed below by a cock. From time to time the yeast which has subsided is allowed to fall into the lower chamber and afterwards drawn off, in order to obviate its deleterious influence on the bouquet of the wine. —J. H. L.

Hops; Process and apparatus for the production of extracts of—. L. A. von Horst. Fr. Pat. 473,409, June 12, 1914. Under Int. Conv., Oct. 31, 1913.

SEE Eng. Pat. 24,813 of 1913; this J., 1914, 659.

Beer or other liquids; Process and apparatus for the clarification of—. E. R. Curtis and J. W. Huxley. Fr. Pat. 473,335, June 11, 1914. Under Int. Conv., June 12, 1913.

SEE Eng. Pat. 13,619 of 1913; this J., 1914, 707.

Utilising the fermentable and reducing carbohydrates in sulphite-cellulose waste lyes for obtaining alcohol or a reducing agent. Addition to Fr. Pat. 456,871. See V.

XIXA.—FOODS.

Wheat; The organic phosphoric acid of—. G. Clarke. Chem. Soc. Trans., 1915, 107, 360.

By extracting ground wheat with 0.2% hydrochloric acid and treating the pale brown extract as described for the preparation of phytin from mustard (see this J., 1914, 436), a white amorphous substance was obtained which resembled phytin in its properties; the yield was 0.14%. The substance thus obtained was a mixture of complex calcium and magnesium salts of the type, $C_{12}H_{22}O_{44}P_{10}Ca_2Mg$. When heated under pressure at 130° C. with 30% sulphuric acid it was decomposed into inositol, m.pt. 211°–212° C., and phosphoric acid. Its composition differed from that of the calcium magnesium salt extracted from mustard (*loc. cit.*). The free acid, obtained from the calcium magnesium salt described above by preparing the lead salt and decomposing the latter with hydrogen sulphide, consisted of a mixture of phosphoric acid in organic combination and phosphoric acid. The strychnine salt of the former acid was sparingly soluble in water, from which it crystallised in needles, m.pt. 218°–219° C.; the strychnine salt of the inositol-phosphoric acid obtained from phytin extracted from mustard melted at 203°–204° C.—W. P. S.

Sulphates in flour; Determination of—. G. D. Elsdon. Analyst, 1915, 40, 142–143.

TEN grms. of the flour is heated gently with 25 c.c. of hydrochloric acid, with frequent shaking, until the liquid is deep purple, and the beaker is then left on the cover of the water-bath for about an hour. The liquid is diluted with about 100 c.c. of water and filtered, the filter washed once with cold water, the filtrate and washings heated to boiling, and the sulphuric acid precipitated with barium chloride. The average amount of SO_3 thus found in samples of plain and self-raising flour was 0.012%. In determining the sulphate in phosphatic self-raising flour an allowance of 0.025% of calcium sulphate (the maximum amount likely to be present normally in the flour) should be made.—C. A. M.

Milks; Capillary behaviour of—. E. Lenk. Die Naturwissenschaften, 1914, 2, 813–816. Bull. Bureau Agric. Intell., 1915, 6, 140–142.

KREIDL and Lenk found that if drops of milk fall upon thick blotting paper with a high content of mineral matter, three concentric rings are formed. The inner circle contains the fat, the middle ring contains the casein, the outer ring the water and dissolved matter. The two inner rings remain visible for hours but the outer one gradually becomes indistinct. The casein and water contents of milk can be estimated roughly by observing the sharpness of the boundary of the two outer rings—the more water the less clear the delimitation—and their ratio to each other. The milk of animals, e.g., goats, mares, rabbits and rats, which resembles cow's milk when examined with the ultramicroscope, gives the three-ring formation, but the middle ring is lacking if the casein be coagulated, or if the fat content be high (up to 30%). Human milk gives only two rings because its casein is in solution, not being visible with the ultramicroscope. As the rate of diffusion of a drop of milk on absorbent paper depends chiefly upon the amount of fat, the latter can be determined quantitatively from the former. The rates of diffusion for milk with 10% fat, for whole milk, for milk watered at 50%, and for skimmed milk are, respectively, 0.47, 0.71, 1.22, 2.36 inches per minute. The milk of various mammals has been studied with reference to the height to which it ascends by capillarity in strips of filter paper. The differences observed are due to the different concentration of casein. Watered and skimmed milk both rise higher than pure milk, but no reliable inference can be drawn that any given sample has been tampered with. —E. H. T.

Lactose in milk; Use of colloidal iron [hydroxide] in the determination of—. R. L. Hill. J. Biol. Chem., 1915, 20, 175–177.

A TEN per cent. solution of colloidal iron (dialysed ferric hydroxide) may be used for precipitating proteins from milk previous to the determination of the lactose. Ten grms. of the milk is diluted with water to 25 c.c., and about 3 c.c. of the solution of colloidal iron hydroxide is added; the actual quantity of the latter required depends on the composition of the milk and can be ascertained by adding the last portion drop by drop. When too little has been added, the mixture remains turbid, but when precipitation is complete a clear supernatant liquid separates from the flocculent precipitate; the liquid will have a reddish tinge if too much iron has been added. The mixture is filtered, the precipitate washed with water, the filtrate diluted to 100 c.c., and the lactose determined by titration with Benedict's solution (see this J., 1911, 439).—W. P. S.

Boric acid in butter: Routine detection and determination of—. H. Hawley. Analyst, 1915, 40, 150—152.

TWENTY grms. of each sample of butter is melted, the aqueous layers stirred with 18 c.c. of dilute hydrochloric acid (20 c.c. per litre), and 10 c.c. of fat-free liquid pipetted from each beaker. After cooling, 5 c.c. of turmeric reagent is added to each. This is prepared by digesting 5 grms. of turmeric root and 5 grms. of tartaric acid with three successive portions of alcohol or methylated spirit for not less than an hour each time, and diluting the extract to 500 c.c. with alcohol. It should be kept in the dark. The colours obtained in the tests are compared with those given by standard dilute hydrochloric acid solutions containing 0.1 to 0.5% of boric acid and 0.5 c.c. of milk to match the opalescence of the samples. The results are accurate within 0.1%. Samples containing above 0.5% of boric acid should be analysed by the usual method of extraction and titration.—(C. A. M.)

Yeast; Dried—as food for farm stock. C. Crowther. J. Board Agric., 1915, 22, 1—10.

DRIED brewers' yeast is extensively employed in Germany for cattle-feeding, and there are now in England several drying plants producing 2000—3000 tons annually, mainly for export. Its average composition is:—moisture 4.3%, proteins 48.5%, oil 0.5%, fibre 0.5%, ash 10.7%, soluble carbohydrates (by difference) 35.5%. Even when mixed with other foods and water, it may be kept for several days without objectionable fermentation taking place. Feeding experiments in Yorkshire showed it to be a safe food for cows, calves, and pigs, though cows show an aversion to it on account of its bitter flavour. When given to pigs it produced better results than "sharps," weight for weight, used as a partial substitute for the latter.—J. H. L.

Colorimetric determination of α -amino-acid nitrogen. Harding and MacLean. See XXIII.

PATENTS.

Milk and cream; Process of sterilising—. A. Rutter, Mentone, Australia. Eng. Pat. 216, Jan. 3, 1914. Under Int. Conv., May 29, 1913.

MILK or cream is treated with from 0.05 to 0.15% of its weight of an alkali peroxide, e.g., sodium peroxide, a quantity of citric acid sufficient to neutralise the alkalinity due to the peroxide is added, and the whole is then heated to 30°—52° C. for 30 minutes or more.—W. P. S.

Foods with a lecithin basis; Preparation of—. A. Szűcs, and F. Neumann's Nachfolger. Fr. Pat. 472,826, May 30, 1914. Under Int. Conv., June 23, 1913.

FINELY powdered lecithin is emulsified with a small quantity of milk, and the emulsion is added to milk for immediate consumption or to sterilised milk for the manufacture of cheese or other dairy products.—J. H. J.

Milk; Production of a nutritive beverage from skimmed—. R. Eichloff. Ger. Pat. 280,446, June 14, 1913.

THE milk is heated with an acid, e.g., hydrochloric acid, to sterilise it and invert the lactose, and is then submitted to the simultaneous action of peptonising enzymes and fermentation organisms, for example trypsin and yeast. The fermented liquid is sterilised by heat, filtered, and evaporated to the desired consistence.—A. S.

Fruit juice from the residuum of the manufacture of cider or of perry and process for preparing the same. A. Cordier, Paris. Eng. Pat. 20,143, Sept. 24, 1914. Under Int. Conv., June 27, 1914.

THE pressed residue of fruit pulp obtained in the manufacture of cider or perry is boiled with water and the aqueous extract is evaporated to dryness. The dry product is dissolved in water for use as a flavouring material.—W. P. S.

Pectic substances for confectionery; Extraction of—. H. A. Derooy and J. Rennotte. Fr. Pat. 473,316, May 9, 1914.

PECTIC substances are extracted from fruits or vegetables by hot lixiviation and maceration, and the extract is concentrated in air or *in vacuo*.—J. H. J.

Coffee substitutes; Method of manufacturing—. J. H. Kellogg, Battle Creek, Mich. U.S. Pat. 1,133,037, March 23, 1915. Date of appl., May 12, 1913.

A MOIST mixture including sugar-containing materials, is heated under pressure until the sugar is caramelised, and the insoluble substances are then removed.—W. P. S.

Desiccating [liquids]; Method of—. I. S. Merrell, Syracuse, N.Y. U.S. Pat. 1,133,051, March 23, 1915. Date of appl., Dec. 8, 1913.

LIQUIDS containing organic substances are sprayed into a chamber in which a very low pressure is maintained; superheated steam is also introduced into the chamber, which is surrounded by a heating jacket to prevent condensation.—W. P. S.

Cocoa and chocolate pastes; Roasting of—. F. E. F. Neumann. Fr. Pat. 472,834, May 30, 1914.

THE paste is spread out in a thin layer and left for a short time upon flat moving surfaces of metal or porcelain heated to the roasting temperature.—J. H. J.

Milk; Centrifugal clarification of—. B. R. Wright, Poughkeepsie, N.Y., U.S.A. Eng. Pat. 7814, March 27, 1914. Under Int. Conv., July 21, 1913.

SEE U.S. Pat. 1,122,457 of 1914; this J., 1915, 196. Reference is directed in pursuance of Sect. 7, Sub-sect. 4, of the Patents and Designs Act, 1907, to Eng. Pat. 323 of 1913.

Milk; Preparation of an alimentary product from—. R. Eichloff. Fr. Pat. 473,439, June 13, 1914. Under Int. Conv., June 13, 1913.

SEE Ger. Pat. 280,446 of 1913; preceding.

Foodstuff; Manufacture of an easily digestible—from whole wheat grains. C. Mauterer. Fr. Pat. 472,790, Aug. 19, 1913.

SEE Eng. Pat. 18,837 of 1913; this J., 1914, 803

XIXB.—WATER PURIFICATION; SANITATION.

Sewage; Treating and disposing of—. Roy. Com. on Sewage Disposal. Final Rept., Feb. 11, 1915. [Cd. 7821.]

THIS report is a general summary of the conclusions and recommendations contained in the nine reports already issued. Of these reports, four dealt mainly with the purification of domestic sewage discharging into streams, two with the discharge of sewage into tidal waters, and three with the discharge of manufacturing effluents. Following on the recommendations of the Commission, shell fish owners agreed to close sewage-polluted layings, and oysters

are in consequence far safer articles of diet now than formerly. As the result of the Commission's experimental work, a plant was erected for the purification of distillery waste, which has proved capable of producing at a reasonable cost an effluent which is not injurious to fish; other similar plants are in process of erection.

The ninth and latest report dealt with two subjects, the discharge of manufacturing wastes which cannot be taken into sewers, and the disposal of domestic refuse in rural areas. Manufacturing wastes can be divided into two classes, those for which efficient purification is practicable, and those for which it is not. In certain cases in the first class, adequate reduction of the solids in suspension by settlement may be regarded as efficient purification. In coal washing and in paper mills, the effluents should not contain more than 4 parts per 100,000 of suspended solids. In tin, lead, and zinc mines, china clay works, and stone quarries, a standard of 6 parts of suspended solids is suggested provisionally. This should obviate danger to cattle or fish from poisoning by lead, tin, antimony, or arsenic. In other cases, a reduction of dissolved solids as well as suspended solids is necessary. For breweries and maltings, shale oil distillation, tanneries, fellmongers' waste, and dairies, the suspended solids should not exceed 4 parts and the amount of dissolved oxygen absorbed in five days should not exceed 4 parts. For distilleries the standard should be 3 parts suspended solids and 2 parts dissolved oxygen; for woolscouring, tin plating, and galvanising, 6 parts suspended solids, no standard for dissolved solids being fixed at present. In the second class of wastes, in which efficient purification is not practicable, there are certain cases in which clarification would effect considerable improvement, and a standard of 6 parts suspended solids should be attainable for bleach works, paper works, and cotton printing effluents, and a standard of 4 parts for cotton and woollen dyeing effluents. For sulphite cellulose liquors and gas liquors no standards are suggested, but in neither case should the crude waste be turned into a stream. Certain alterations in the existing law with regard to rivers boards and the pollution of streams are recommended.

On the subject of disposal in rural areas, the Commission says that the water carriage system of sewerage is the most satisfactory provided an abundant water supply is available. Where the water supply is inadequate, dry earth closets are open to little objection, the domestic waste water being distributed over gardens or conveyed to cesspools.—J. H. J.

Sewage; Purification of — by aeration in the presence of activated sludge. E. Bartow and F. W. Mohlman. *J. Ind. Eng. Chem.*, 1915, 7, 318—320.

EXPERIMENTS were made with a fairly strong domestic sewage free from trade wastes on the lines described by Arden and Lockett (this J., 1914, 523, 1122). The sewage was placed in a tank, 9 ins. square and 5 ft. deep, having a porous plate 4 ins. above the bottom, and compressed air was introduced below the porous plate. Complete nitrification was effected in 15 days with the use of 4830 cb. ft. of air: the "free ammonia" was first converted almost quantitatively into nitrite, and then the nitrite almost quantitatively into nitrate. The supernatant liquid was siphoned off, a fresh charge of sewage introduced, and the treatment repeated in presence of the residual sludge. In the second treatment nitrification was complete in 4 days with 1270 cb. ft. of air; in the third in 2 days with 720 cb. ft.; in the twelfth in less than 8 hours with less than 128 cb. ft., and in the thirty-first, with sludge and sewage in the proportion of 1:5, in less than 5 hours with 85 cb. ft. of air,

equivalent to 0.2 cb. ft. per sq. ft. of surface area per minute, or about 3 cb. ft. per gallon of sewage. In presence of the activated sludge nitrate was formed simultaneously with nitrite. The activated sludge contained many *Vorticella* and *Rotifera*, but the predominant organism was an annelid worm, *Aelosoma hemprichi*, 2—5 mm. long, which multiplies rapidly by fission, and feeds on small organic particles, destroying at least its own weight of organic matter and probably more every day. The sludge lost 95.54% of its weight when dried on the water-bath and then for 3 hours in an oven at 100° C.; the residue contained 6.3% nitrogen, 4% fat, and 1.44% phosphorus, and the loss on ignition was 75%. In pot cultures the dried sludge gave better results as a fertiliser than a quantity of dried blood containing the same amount of nitrogen.—A. S.

Bacteria; Behaviour of — towards purified animal and vegetable proteins. J. A. Sperry and L. F. Rettger. *J. Biol. Chem.*, 1915, 20, 445—459.

AEROBES and facultative anaerobes, and even extremely active putrefactive anaerobes, were found to be incapable of attacking and decomposing pure proteins. Solutions of the proteins, however, were decomposed when they contained peptone or other nitrogenous food which furnished the nitrogen necessary for bacterial development. In such cases, the proteolysis of the protein resulted from the action of an enzyme produced by the bacteria during the process of rapid multiplication.—W. P. S.

Tetrachloro-ethane poisoning; Toxic jaundice due to —. W. H. Willcox. *Lancet*, 1915, 188, 544—547.

CELLULOSE varnish, consisting of a solution of cellulose acetate in a mixture of benzene, acetone, methylated spirit, and tetrachloro-ethane, is used in aeroplane factories to coat the calico stretched over the framework of the wings of the machines. The vapour evolved during evaporation of the varnish has a specific gravity of 1.91. Workers using the varnish in several factories were affected with acute jaundice, some cases ending fatally. The symptoms were drowsiness, sickness, jaundice, and mental confusion, sometimes leading to coma and death. Autopsies showed that the most marked change in the organs was the shrunken and bile-stained liver. Experiments on animals, made with the varnish and its volatile constituents, showed that tetrachloro-ethane is a powerful liver poison, and that the poisonous effects of the varnish vapour were due to the tetrachloro-ethane contained in it. In works where the varnish is used, the heavy vapours should be removed by powerful extraction fans placed at a low level.—J. H. J.

PATENTS.

Liquids; Sterilisation, filtration, and similar treatment of —. L. Linden, Brussels. Eng. Pat. 6855, March 18, 1914.

THE liquid is passed successively, from a main settling tank, through a settling tank, a filter chamber filled with spherical iron, terra-cotta, or marble balls, a chamber divided by a vertical partition and having a horizontal screen near the top, and a second filter chamber filled with spongy iron. It is collected in one compartment of a chamber divided into two parts by a vertical partition reaching nearly to the top, and having discharge openings at the top. The second compartment serves to collect the liquid from a series of settling and filter chambers similar to the first series. The filters in either series may be cleansed by closing the outlets in the central chamber and opening a cock at the bottom of one of the settling

tanks, whereupon the filtered liquid flows through the series in the reverse direction.—W. P. S.

Ultra-violet rays produced by electric sparks, and used for sterilisation; Reflector for —. J. von Kowalski. Fr. Pat. 473,030, June 4, 1914. Under Int. Conv., May 26, 1914.

THE source of light is placed in the focus of the reflector, which consists of one or more hollow mirrors of glazed porcelain, placed above the light so as to reflect all the energy on to the liquid to be sterilised.—J. H. J.

Ozonisers, and sterilisation of water by ozone. H. Gruner. Fr. Pat. 473,184, Sept. 9, 1913.

THE ozoniser consists of a number of glass tubes, containing metallic threads, arranged concentrically within a glass cylinder, around the outside of which a metallic spiral is wound. The inner threads are connected to a source of high-tension current and the outer spiral to earth. At the top and bottom are an inlet and an exit for air. In using the ozoniser as a water steriliser, the exit tube is connected to the side tube of a water pump, containing a mixing chamber for securing intimate mixing of the current of ozonised air and water, which then flows to a sterilising chamber of such shape that intimate and prolonged contact between the water and the ozonised air is obtained.—J. H. J.

Sterilising water; Method of —. M. Riegel. Ger. Pat. 280,998, Oct. 28, 1913.

STERILISATION is effected by treating the water, at the ordinary temperature or at 40° C., with a small quantity of hydrochloric acid and of hydrogen peroxide. The excess of free acid is subsequently neutralised.—A. S.

Water; Purification of [removing dissolved oxygen from] — to render it suitable for technical application. R. von Walther. Fr. Pat. 473,092, June 5, 1914.

THE water is passed through shallow beds of an easily oxidisable metal, such as manganese, zinc, aluminium, copper, or especially iron, which removes the dissolved oxygen quickly and completely. After treatment the precipitated oxides are removed by filtration.—J. H. J.

Naphthenic acids, their soaps, and solutions; Application of — as insecticides, and process of making the solutions. Soc. La Littorale. Fr. Pat. 472,561, May 22, 1914.

THE alkaline liquor resulting from the purification of crude petroleum is treated with 10% by weight of quinoline, and the layer of quinoline saturated with naphthenates is separated by decantation or centrifuging; or the naphthenic acids or naphthenates obtained by neutralising with sulphuric acid the alkaline liquor from the purification of crude petroleum, are mixed with an equal weight of quinoline, separation being effected as before. The resulting solution of naphthenic acids or naphthenates in quinoline may be used as an insecticide, either alone or mixed with a copper or other preparation.—J. P. O.

Nutrient medium for pure cultures of tissues. R. Odier. Ger. Pat. 280,462, May 21, 1913.

CLAIM is made for nutrient media containing glycogen, which promotes the activity and development of the cells. Specially good results are said to be obtained with a solution containing 8.25 grms. of sea salt, 0.2 gm. each of sodium bicarbonate, potassium chloride, and calcium chloride, and 0.75 gm. of dextrose to 1 litre of water, and saturated with glycogen.—A. S.

Waste water; Process for manufacturing a substance for purifying — and for draining sludge. F. Richter, Frankfort, Germany. U.S. Pat. 1,133,446, March 30, 1915. Date of appl., June 3, 1912.

SEE Fr. Pat. 443,789 of 1912; this J., 1912, 1005.

Pumps [for sewage, etc.]. Eng. Pat. 4950. See I.

Manufacture of substances capable of exchanging their bases. Fr. Pat. 472,533. See VII.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Alkaloids of the morphine series; Action of acetic anhydride on —. M. Tiffeneau. Bull. Soc. Chim., 1915, 17, 67—77.

THE extra-phenanthrene chain, $\text{CH}_2\text{CH}_2\text{N}(\text{CH}_3)$, of alkaloids of the morphine group may be attacked by acetic anhydride with rupture, at both ends, of the carbon and the nitrogen bonds or, at one end, of the nitrogen bond only. The two types of rupture are independent of each other, and the latter type has been studied in the case of benzylamine derivatives of simple constitution. To determine rupture of the chain at the nitrogen bond, the nitrogen atom must be tertiary and must be united to a benzene nucleus by an intermediate carbon atom (benzyl type). The alkaloids of the morphine group vary in their behaviour on treatment with acetic anhydride; this variation depends on the character of the nucleus III of the phenanthrene structure. When this is a true aromatic ring, as in the case of morphothebaine, apocodeine, or apomorphine and its derivatives (see Pschorr's formula, this J., 1907, 634), the conditions mentioned above are exactly fulfilled, carbon atom 9 being the connecting link characterising the benzylamine type; in such cases acetic anhydride always causes rupture. When the ring III is of tetrahydro-aromatic type, rupture is never produced by the action of acetic anhydride alone; either there is no reaction (e.g., phenyldihydrothebaine) or simple acetylation without rupture takes place (e.g., morphine and its derivatives, codeine and thebaine). When the ring is of dihydro-aromatic type (e.g., thebaine) or is capable of becoming so by enolisation (e.g., codeinone and pseudocodeinone) the aromatic character may predominate and a double rupture at both nitrogen and carbon bonds may be produced. In these cases, however, the dihydro-aromatic ring is not in itself sufficient to determine rupture and the additional presence of the neutral oxygen (oxide) linkage between carbon atoms 4 and 5 appears to be necessary. As regards the mechanism of the reaction, the acetic anhydride apparently combines first with the trivalent nitrogen, and the instability of the quinquivalent system determines the rupture. The two stages can be sharply differentiated in the case of thebaine by following the reaction with the polarimeter, and the fact that if the tertiary base be previously converted into the corresponding quaternary methiodide, no rupture takes place, affords an additional support to the hypothesis.—J. F. B.

Alkaloids; Colloidal state of —. Relations between surface tension, size of particle, and toxicity. I. Traube and N. Onodera. Intern. Zeits. phys.-chem. Biol., 1914, 1, 35—59. J. Chem. Soc., 1915, 108, i, 105. (See also this J., 1912, 839.)

ALKALOIDS such as atropine and quinine, the molecular weight of which exceeds a definite limit, are present in solution in a colloidal state, whilst the corresponding salts form true solutions. The

surface tension of water is hardly affected when alkaloidal salts are dissolved in it, but is diminished on adding subsequently a small quantity of alkali owing to liberation of free alkaloid which assumes a colloidal condition; at the same time the toxicity of the solution increases. Many free alkaloids are unstable in solution, the small particles aggregating in a few hours into large masses, with consequent increase of surface tension and decrease of toxicity. On adding a little alkali to such an attenuated alkaloid solution the aggregates disperse, the surface tension diminishes, and the toxicity reaches or even surpasses its former intensity. The localisation of action of the various alkaloids may be partly due to the variation in the alkalinity of the different organs of the body. The toxicity of solutions of some alkaloids, including quinine, is increased by boiling and subsequently cooling, with corresponding alterations in the size of the colloidal particles and the surface tension. The antagonistic action of pilocarpine on atropine is accompanied by similar changes. With all alkaloids the alteration in surface tension is the chief factor in determining the toxicity. It is suggested that any alteration in the surface tension disturbs the equilibrium or affects the normal velocity of the reactions taking place in the organism, this becoming apparent as a toxic effect, the toxicity of alkaloids being thus due chiefly to the physical instead of to the chemical changes produced. When an electric current is passed through a solution of an alkaloid, the smaller particles wander towards the cathode, whilst the larger aggregates accumulate at the anode.—T. C.

Drugs and poisons; Synergism and antagonism of — I. Traube and N. Onodera. Intern. Zeits. phys.-chem. Biol., 1914, 1, 133—147. J. Chem. Soc., 1915, 108, i, 105—106.

If an alkaloid is added to the solution of the salt of another alkaloid, the extent of alteration of the surface tension depends on the relative basicity of the two alkaloids. The relative toxicity of some alkaloids is given by the following descending series of basicities: nicotine, pilocarpine, atropine, physostigmine, quinine, aconitine, veratrine. The surface tension of quinine solutions is increased by the addition of atropine, aconitine, veratrine, and nicotine. The synergetic or antagonistic influence of two substances (drugs, narcotics, etc.) on each other in the body may be due to an indirect action on the velocity of the protoplasmic reactions instead of to the direct action on the surface tension.—T. C.

Alkaloids; Catalytic action of — on precipitation, oxidation and saponification processes. I. Traube and N. Onodera. Inter. Zeits. phys.-chem. Biol., 1914, 1, 148—157. J. Chem. Soc., 1915, 108, ii, 92.

ALKALOIDS, although univalent, greatly accelerate the precipitation of arsenious sulphide from its colloidal solution and also the oxidation of oxalic acid by permanganate. A few alkaloids inhibit the saponification of ethyl acetate by potassium hydroxide, whilst the majority accelerate it. Pilocarpine has a strong accelerating action, whilst atropine has an inhibitory action on the saponification process, though both alkaloids act similarly with respect to precipitation and oxidation processes. It is suggested that the antagonistic physiological action of these two alkaloids is possibly correlated with their action on hydrolytic processes.—T. C.

Hydroxymethylanthraquinones; Separation and identification of — [in chrysarobin, buckthorn, rhubarb, senna, and aloes] E. M. Bailey. Amer. J. Pharm., 1915, 87, 148—154. (See also this J., 1914, 501, 1071.)

THE fluid extract of the drug (25 grms.) is

evaporated to remove alcohol, diluted with water, precipitated with a solution of normal lead acetate, the precipitate digested with 10% sulphuric acid on the water-bath, and the hot acid solution extracted with hot benzene. In the case of powdered drugs 3 grms. is boiled for one hour with alcoholic potash, the alcohol removed, the residue treated with dilute sulphuric acid, and the acid liquid extracted with hot benzene. On shaking the benzene solution with 5% ammonium carbonate solution, followed by 5% sodium carbonate solution and by 5% sodium hydroxide, there are extracted successively an unidentified hydroxymethylanthraquinone or mixture of hydroxymethylanthraquinones (in the case of senna and aloes only), emodin, and chrysophanic acid. These substances give characteristic colour reactions when a trace is added to 4 or 5 drops of concentrated sulphuric acid, and a further colour change when 1 to 2 drops of concentrated nitric acid followed by 1 c.c. of water are added. The unidentified substance gives a purple or violet colour with sulphuric acid, becoming yellow with nitric acid and water; emodin gives a pink colour not affected by nitric acid and water, whilst chrysophanic acid gives an orange-red colour with sulphuric acid, becoming yellow with nitric acid and water with simultaneous precipitation of chrysophanic acid. The emodin obtained from both Socotrine and Barbados aloes gave anomalous colour reactions.—T. C.

Anæsthetics; Residual valency of —, and its importance in anæsthesia. Chemical theory of anæsthesia. A. P. Mathews. Intern. Zeits. phys. chem. Biol., 1914, 1, 433—449. J. Chem. Soc. 1915, 108, i, 106.

THE average amount of residual valency per molecule possessed by various anæsthetics was computed from the cohesion, and a general, but not complete parallelism was found to exist between anæsthetic power and amount of residual valency. Lack of complete parallelism may be due to the fact that the spacial relation of the valencies must also be an important determining factor. The theory of anæsthesia put forward is that the irritable substance in protoplasm is a molecular oxygen-protoplasmic union or a peroxide union which, on stimulation, passes by molecular rearrangement into a stable form, oxidation taking place and carbon dioxide being produced. Anæsthesia is produced by the anæsthetic, by virtue of its residual valency, occupying the oxygen receptors of the cell, forming a non-irritable, dissociable, anæsthetic-protoplasm compound.—G. F. M.

Phospholipins; Method for the determination of certain groups in —. M. L. Foster. J. Biol. Chem., 1915, 20, 403—412.

IT was found possible, by a modification of the Herzig and Meyer method (heating with ammonium iodide and hydriodic acid; see this J., 1895, 688), to obtain a sharp separation of the glycerol and alkyl groups in certain phospholipins (lecithin and cephalin), the former group reacting at 112° C. and the latter at 180°—190° C. A paraffin bath was used for controlling the temperature. Whilst the glycerol could be determined accurately, the separation of the methyl and ethyl groups was not so satisfactory. One preparation of lecithin showed the three methyl groups commonly attributed to this substance, but others showed less; methyl and ethyl groups were not found to be present in cephalin. Experiments with synthetic choline chloride showed that hydriodic acid does not split off the methyl groups completely.—W. P. S.

Glycerophosphoric acid of lecithin; Constitution of the —. O. Bailly. *Comptes rend.*, 1915, 160, 395—398.

CALCIUM glycerophosphate, prepared from egg-lecithin by alkaline hydrolysis, has a solubility in water (2.88% at 12.5° C.) intermediate between that of calcium β -glycerophosphate (1.78%) and calcium α -glycerophosphate (4.5%). When the calcium salt is converted into the sodium salt and the latter crystallised, the mother liquor gives the characteristic reaction of the α -salt, viz., formation of dihydroxyacetone-phosphoric acid when oxidised by bromine, but the crystals do not. Further, when the calcium salt itself is crystallised from water, the crystals do not yield dihydroxyacetone-phosphoric acid, although this may be obtained from the original calcium salt. It is concluded that egg-lecithin consists of a mixture of at least two isomerides of glycerophosphoric acid; the β -compound predominates. (See also this J., 1914, 665.)—W. P. S.

Kaempferia Ethelæ; Volatile oil from tubers of —. E. Goulding and O. D. Roberts. *Chem. Soc. Trans.*, 1915, 107, 314—319.

TUBERS of *Kaempferia Ethelæ*, J. M. Wood, ("Sherungulu" tubers) from the Transvaal, containing 25% of moisture, when distilled in steam yielded 1.5% of volatile oil having approximately the following composition: terpenes, including dipentene and probably pinene, 21.8%; cineol, 17.2%; a new ketone, $C_{24}H_{40}O$, m. pt. 102° C., $[\alpha]_D^{20} = +198.20'$ in chloroform, 13%; alcohols, including linalool, 11.2%; esters, chiefly or entirely methylanthranilic acid methyl ester, 1.3%; phenols, 0.5%; acids, chiefly or entirely acetic acid, 0.1%; residue, probably chiefly sesquiterpenes, 34.0%. 93% of the oil consisted of a light oil of sp. gr. 0.9137 at 15° C.; n_D^{20} in 100 mm. tube = +19.47; acid value, 2.3; ester value, 5.0; ester value after acetylation, 47.6; whilst the remaining 7% formed a heavy, dark brown, viscous liquid, with an odour resembling crushed ivy leaves, which gradually became semi-solid owing to separation of the ketone of m. pt. 102° C. The ketone gave a hydroxylamino-oxime of m. pt. 134° C., an oxime, m. pt. 166°, and a benzoyl derivative, m. pt. above 260° C.—T. C.

Acidity [in physiological fluids]; Determination of —. I. Traube and R. Somogyi. *Intern. Zeits. phys.-chem. Biol.*, 1914, 1, 479—484. *J. Chem. Soc.*, 1915, 108, ii, 101—102.

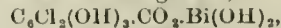
FIVE c.c. of a 2% solution of sodium isovalerate, a capillary-inactive salt, is mixed with 0.2 c.c. of serum or other tissue fluid, and the lowering of surface tension due to the liberation of the capillary-active isovaleric acid by the free acid present in the liquid under examination is measured by the viscostagonometer at 23° C.—T. C.

Salicylic acid; A new colour reaction of —. P. A. W. Self. *Pharm. J.*, 1915, 94, 521.

WHEN a trace of salicylic acid or a salicylate is added to a few drops of a cooled mixture of equal parts by volume of concentrated sulphuric acid and 40% formaldehyde, and a trace of ammonium vanadate is added, an immediate Prussian blue coloration, rapidly changing to green, is obtained. Salicylaldehyde gives a pale yellow coloration before the addition of ammonium vanadate, but otherwise reacts like salicylic acid. All other monophenols, polyphenols, or phenolic substances either give no coloration (except that given by the reagents alone, an orange coloration changing to green), or give various shades of red, brown, or green, usually changing to brown.—T. C.

Gallic acid; Bismuth salts of halogenated derivatives of —. P. Lami. *Boll. Chim. Farm.*, 1914, 54, 2—5. *J. Chem. Soc.*, 1915, 108, i, 80.

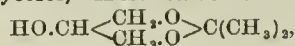
BASIC bismuth dichlorogallate,



prepared from dichlorogallic acid, m. pt. 155° C., is lemon yellow; the analogous basic bismuth dibromogallate from dibromogallic acid, m. pt. about 150° C., is olive green, and the di-iodogallate dark yellow. The two latter are of value as local astringents in dermatology. They are soluble in concentrated sulphuric acid with formation of a red and then a black coloration and evolution of vapours of the halogen.—G. F. M.

Glycerol; Condensation of acetone and benzaldehyde with —. Preparation of glycerol- α -methyl ether. J. C. Irvine, J. L. A. Macdonald, and C. W. Soutar. *Chem. Soc. Trans.*, 1915, 107, 337—351.

THE products obtained by condensing glycerol with acetone or benzaldehyde were methylated, and the methyl derivatives hydrolysed with 0.5% hydrochloric acid. Glycerol- α -methyl ether was obtained, and hence isopropylidene-glycerol (acetone-glycerol) must have the constitution



and benzylidene-glycerol an analogous formula.

Isopropylidene-glycerol was obtained by dissolving dry glycerol in a 1% solution of hydrogen chloride in acetone. It boils at 86.5° C. at 13 mm.; $n_D^{20} = 1.4383$; sp. gr. at 18°/4° C., 1.0727. Glycerol- α -methyl ether is a colourless neutral liquid, soluble in water and organic solvents, b. pt. 110° C. at 13 mm.; $n_D^{20} = 1.4463$; sp. gr. at 17°/4° C., 1.1197. Benzylidene-glycerol forms prismatic crystals of m. pt. 65° C.—G. F. M.

Allyl alcohol; Preparation of —. F. D. Chattaway. *Chem. Soc. Trans.*, 1915, 107, 407—410. (See also this J., 1914, 218.)

ANHYDROUS oxalic acid (500 grms.) is added to an equal weight of glycerol in a 1.5 litre flask, which is then connected with a water pump and heated continuously on a water-bath for 4 or 5 hours until formic acid ceases to distil over. The residue is distilled very slowly, preferably using a short fractionating column, and all distillate below 210° C. is rejected. A mixture of allyl alcohol and allyl formate begins to distil at 220°—225° C., the reaction being practically complete at 230° C. No acrolein is formed unless the temperature rises above 240° C. The residue can be made up to 500 grms. by the addition of more glycerol, a further 500 grms. of oxalic acid added, and the process repeated four or five times. 50 grms. of sodium hydroxide in a litre of water is added to the mixture of allyl alcohol and allyl formate, and after hydrolysis of the ester is complete, the liquid is fractionated, allyl alcohol being obtained as a mixture of constant boiling point, 87°—88° C., containing 27—28% of water. Anhydrous allyl alcohol is obtained by treating this mixture repeatedly with anhydrous potassium carbonate and again fractionating. 500 grms. of glycerol and 500 grms. of oxalic acid give about 200 to 210 grms. of the constant boiling mixture or about 150 grms. of the pure alcohol in one operation. If all residues are worked up the yield is practically theoretical. Allyl formate can be obtained by direct fractionation of the crude allyl alcohol-allyl formate mixture. The addition of ammonium chloride to the reaction mixture offers no advantage.—T. C.

Selenioaldehydes. L. Vanino and A. Schinner. *J. prakt. Chem.*, 1915, 91, 116—127.

THE selenium analogues of certain thioaldehydes were prepared by the action of hydrogen selenide

upon aqueous or alcoholic solutions of aldehydes sometimes] in the presence of hydrogen chloride which appeared to have a determining effect upon what particular modification of selenioaldehyde was produced. The hydrogen selenide was generated by the action of water on aluminium selenide. Selenioformaldehyde, H.CSeO , a crystalline substance, m. pt. 215°C ., was obtained by passing hydrogen selenide into an 18% formaldehyde solution to which had been added three times its volume of concentrated hydrochloric acid. It becomes bright green by exposure to light, and is only slightly soluble in most ordinary solvents. Selenioacetaldehyde, CH_3CSeO , was obtained by the action of hydrogen selenide on acetaldehyde dissolved in three times its volume of alcoholic hydrogen chloride; it crystallised from alcohol in fine needles, m. pt. 139°C . Seleniobenzaldehyde, $\text{C}_6\text{H}_5\text{CSeO}$, was obtained in three different modifications. Treatment of an alcoholic solution of benzaldehyde with hydrogen selenide in the absence of hydrogen chloride gave a blood red oil, and from the alcoholic liquid yellow crystals, m. pt. $83^{\circ}\text{--}84^{\circ}\text{C}$., were obtained. The action of hydrogen selenide on benzaldehyde in solution in alcoholic hydrogen chloride resulted in the formation after three hours of a thick mass of crystals, which when recrystallised from benzene formed odourless golden yellow needles, containing a molecule of benzene of crystallisation, m. pt. 205°C . From the mother liquors a third or γ -seleniobenzaldehyde was isolated. It formed pale yellow needles, m. pt. 166°C . On heating the β -seleniobenzaldehyde (m. p. 205°C .) with copper powder, stilbene distilled over, a reaction similar to that given by α -thiobenzaldehyde.—G. F. M.

Gold salts and colloidal gold; Comparative pharmacological action of—. H. Busquet. *Comptes rend.*, 1915, 160, 404–406.

WHEN a Ringer-Locke solution containing 0.01 grm. of colloidal gold per litre was passed through the isolated heart of a rabbit, the action of the heart was stimulated, whilst a similar dose of gold chloride arrested the coronary circulation and interfered with the cardiac action. Experiments *in vivo* showed that doses of colloidal gold diminished the frequency of the heart beats, increased their amplitude, and raised the arterial pressure of the blood; gold chloride accelerated the action of the heart, diminished the amplitude of the beats, and decreased the arterial pressure to such an extent as to cause death.—W. P. S.

Urotropine; Avoidance of the Trade-mark—. THE Trade-mark "Urotropine" (No. 215,652), registered by the Chem. Fabr. auf Actien, vorm. E. Schering, has been avoided by the Board of Trade. The application for avoidance or suspension was made on Sept. 18th last, but was adjourned for six months, on the ground that there were ample stocks of the substance in this country. At the adjourned hearing on March 3rd it was shown that the stocks had become exhausted.

Addition products of unsaturated organic compounds with nitric acid and picric acid. Reddelien. See III.

Use of orthoformic ester as an alkylating agent. Von Walther. See III.

Use of hydrochloric acid in the determination of certain forms of organic nitrogen. Drushel and Brandegge. See XXIII.

PATENTS.

Ethylene; Manufacture of—. W. K. Freeman, Oswawa, N.Y., U.S.A. Eng. Pat. 24,019, Dec. 15, 1913.

IF the reaction between hydrogen and the carbon

arc is sufficiently prolonged, the product is almost pure ethylene. Hydrogen is prepared electrolytically and passed under pressure, by means of a motor-driven pump, into two parallel tubes on either side of a series of arcs, enclosed in a practically gas-tight chamber. The hydrogen leaves the pipes by a series of platinum nozzles, one on either side of each arc, so that a lens-shaped mass of hydrogen is formed in the centre of each arc by the impinging streams; concave deflectors assist in retaining the hydrogen in the centre of the arc. A safety pressure valve is provided at one end of the chamber. The ethylene is led out by a tube which may be cooled if necessary. The motor for working the pressure pump, and the electrolytic chamber for generating the hydrogen are on parallel branches of the same electric circuit, the strength of which is regulated by a solenoid controlled by the current passing through the arcs; in this way the supply of hydrogen is varied, roughly, in accordance with the consumption of energy by the arcs. In an alternative apparatus, a number of arcs are produced by passing a suitable current through a mass of loosely packed lumps of carbon, contained in a chamber through which a slow current of hydrogen is passed.—B. V. S.

Diethylbromo-acetylurea; Manufacture of—. Farb-fabr. vorm. F. Bayer und Co. Third Addition, dated April 29, 1914, to Fr. Pat. 417,803, July 2, 1910. Under Int. Conv., May 17, 1913. (See Eng. Pat. 2888 of 1910; this J., 1910, 1332.)

DIETHYLBROMO-ACETYLUREA,



may be prepared by treating with ammonia the product of the action of bromine on diethylacetyl isocyanate, $(\text{C}_2\text{H}_5)_2\text{CH.CO.NCO}$, a colourless liquid boiling at 55°C . (23 mm.), obtained by heating diethylacetyl chloride with mercuric cyanate.—F. Sp.

Aluminium acetate compounds; Manufacture of—. G. Eichelbaum, Berlin, Assignor to Kalle und Co., A.-G., Biebrich, Germany. U.S. Pat. 1,132,709, March 23, 1915. Date of appl., June 25, 1913.

SEE Ger. Pat. 272,516 of 1912; this J., 1914, 568.

Hexamethylenetetramine; Compounds of—. F. Boedecker, Assignor to J. D. Riedel A.-G., Berlin. U.S. Pat. 1,133,916, March 30, 1915. Date of appl., Sept. 19, 1913.

SEE Ger. Pat. 266,123 of 1913; this J., 1913, 1129.

Orthovanadic acid esters and their solutions. L. Hess, Berlin. U.S. Pat. 1,133,961, March 30, 1915. Date of appl., Feb. 6, 1914.

SEE Ger. Pat. 273,220 of 1913; this J., 1914, 712.

Dihalogen-paraffins; Manufacture of—. F. E. Matthews and H. J. W. Bliss. Fr. Pat. 472,642, May 25, 1914. Under Int. Conv., June 30, 1913.

SEE Eng. Pat. 15,048 of 1913; this J., 1914, 806.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Photographic goods. Board of Trade Bulletin, No. 41

THE following figures show the value of certain descriptions of photographic goods exported from Germany and Austria-Hungary to all destinations, in a recent year:—

Exports from Germany (1912): Silver bromide, silver nitrate, and other silver salts and compounds, £60,900; collodion and celloidin, £7750;

chemical products, not specially mentioned, for photographic, cleaning, and other purposes, £369,350; photographic paper sensitised (ready for use), £233,100; dry plates for photographic purposes, £123,400; optical glass, crude, rough pressed optical glass, £58,250; spectacle glasses and other eye-glasses, stereoscope glasses, not ground nor mounted, £6150; other optical glasses, ground and mounted; stereoscopes; microscopes, unmounted lenses for optical purposes, £232,950; photographic lenses, ground and mounted; unmounted lenses for photographic purposes; photographic objects and apparatus of all kinds, £375,150; films, exposed or unexposed, of celluloid or similar materials, £376,600; total, £1,843,000. *Exports from Austria-Hungary* (1913): Paper prepared for photographic purposes, sensitised or not, £26,590; dry plates for photographic purposes, sensitised, £1500; optical glasses, other than spectacle glasses and watch glasses, polished, £11,300; total, £12,390.

The above particulars for Austria-Hungary are incomplete owing to the fact that many descriptions of photographic goods are not separately recorded in the Austrian official trade returns. The exports of photographic goods from the United Kingdom are not separately distinguished in our trade returns.

Germany's principal markets for photographic chemicals are the United States, Russia, United Kingdom, France, Switzerland, Italy, Denmark, Scandinavia, and Japan. There are a number of smaller markets also which would repay attention. For photographic paper and dry plates Germany's principal markets were Russia, United Kingdom (mainly sensitised paper), Switzerland, Western Europe, and South America, particularly Brazil and Argentina. The United States is relatively a small market for these goods. Films, exposed or unexposed, were sent chiefly to the United Kingdom, France, Italy and the United States, in which four countries the moving picture business has attained its greatest development. The principal markets for optical glass, photographic and other lenses, mounted and unmounted, and photographic apparatus of all kinds are the United Kingdom, Russia, France, Switzerland, Italy, United States, Japan, and Belgium, but there are quite a number of smaller markets to which the attention of British manufacturers of such goods might be turned.

Article.	In the United Kingdom Market.	In Colonial and Neutral Markets.
(A) <i>German Trade</i> (1912).	£	£
Bromide and nitrate of silver, other silver salts and compounds	1,850	39,300
Collodion and collodion	500	5,950
Other chemical products for photographic and other purposes	43,300	280,200
Photographic paper (sensitised) ready for use	39,700	154,050
Dry plates for photographic purposes	2,550	78,400
Optical glass, crude: rough-pressed optical glass	5,550	51,650
Spectacle glasses and other eye-glasses, stereoscopic glasses, not ground nor mounted	300	5,300
Other optical glasses, ground and mounted; stereoscopes; microscopes; unmounted lenses for optical purposes	31,900	177,150
Photographic lenses, ground, etc., mounted or unmounted; photographic objects and apparatus of all kinds	66,150	249,700
Films, exposed or unexposed, of celluloid or similar materials	40,350	294,150
(B) <i>Austro-Hungarian Trade</i> (1913).		
Sensitised paper for photographic purposes	370	13,990
Total	232,520	1,349,840

The principal markets for Austrian-made sensitised paper are Russia (European), Sweden, Switzerland, Italy, and Roumania. The trade at best is a small one. The exports of other descriptions of photographic goods for which particulars are available go mainly to Germany.

The figures in the accompanying Table serve to indicate the volume of the trade in photographic goods which might conceivably be diverted to British manufacturers, thus making a grand total of £1,582,360.

Temperature coefficient of photochemical reactions.
Berthelot. See XXIV.

Industrial uses of radium. Baker. See VII.

PATENTS.

Colour photography and colour printing. J. and E. Rheinberg, London. Eng. Pat. 22,764, Nov. 19, 1914. Addition to Eng. Pat. 22,938, Oct. 10, 1913 (this J., 1914, 1116).

THE transfusion of colours need not be complete, as stated in the chief patent, a satisfactory picture being obtained with only partial transfusion.

—B. V. S.

Celluloid varnishes; Process for applying adherent
— to viscose or similar cellulose films. Balland et Cie. Fr. Pat. 473,189, Sept. 11, 1913.

VISCOSE films can be coated with an adherent film of celluloid, and thus rendered impermeable to water, by interposing between the viscose and the celluloid a layer of glue or gelatin containing a considerable proportion of a resin soluble in solvents of celluloid. *Example*:—A solution of 200 grms. of glue in 300 c.c. of water is mixed with a solution of 100 grms. of shellac in 200 c.c. of alcohol and 10 c.c. of ammonia, and the product is diluted with 300 c.c. of water. The viscose film is coated with this solution, dried, and treated with dilute formaldehyde to render the glue insoluble and to destroy traces of ammonia. Celluloid solution is then applied, a firmly adherent film being obtained.—F. Sp.

XXII.—EXPLOSIVES; MATCHES.

Explosion which occurred at the factory of the Schultze Co., Ltd., at Eyeworth, near Lyndhurst, Hants, on March 1, 1915; Report on the circumstances attending an —. A. Desborough. No. CCXII.

Two men were killed and one severely injured as a result of an explosion which occurred during the dismantling of three old boiler shells. The boilers had been used formerly for boiling nitro lignin, and the explosion was due to the ignition of an accumulation of nitro lignin below the wooden false bottom, possibly by a spark produced by an iron tool or a nail in the boot of the workman. It would not have taken place had the interiors of the boilers been thoroughly wetted before dismantling was commenced.—A. S.

PATENTS.

Explosive. J. F. O'Brien, Chicago, Ill. U.S. Pat. 1,132,873, March 23, 1915. Date of appl., Oct. 14, 1913.

THE explosive contains ammonium perchlorate (20 to 65 parts by weight), sodium nitrate (not more than 55), liquid dinitrotoluene (10 to 15), sawdust (14 to 23), and free carbon (1 to 3½ parts).
—C. A. M.

Hexanitrodiphenyloxide (2.4.6.3'.4'.6'); *Preparation of* —. Westfälisch-Anhaltische Sprengstoff-A.-G. Ger. Pat. 281,053, Nov. 23, 1913.

A di-, tri-, tetra-, or penta-nitro derivative of

diphenyl ether having at least one nitro-group in a meta position to the oxygen atom, is nitrated with mixed acid. The nitro derivatives mentioned may be prepared by condensing an alkali salt of *m*-nitrophenol with 2,4-dinitro- or 2,4,6-trinitrochlorobenzene, or by condensing a nitro derivative of chlorobenzene, containing at least one nitro group in a meta position to the chlorine atom, with an alkali salt of phenol or of *o*- or *p*-nitrophenol or 2,4-dinitrophenol. Hexanitrodiphenyloxide, m.pt. 269° C. (uncorr.), is insoluble in water, sparingly soluble in alcohol and ether, easily soluble in nitrobenzene. It is stable and relatively insensitive to percussion, but considerably superior to picric acid in explosive power (compare Fr. Pat. 460,571; this J., 1914, 44.)—A. S.

Generating heat by interaction between metals and metallic compounds. Fr. Pat. 473,095. See IIB.

XXIII.—ANALYTICAL PROCESSES.

List of reagents for analytical purposes, with notes indicating the standards of purity regarded as necessary for analytical work.

THE Councils of the Institute of Chemistry and the Society of Public Analysts have appointed a Committee to consider the recovery of that portion of the trade in fine chemicals for analytical purposes, which has been attracted away from this country. This Committee has prepared a list of reagents for analytical purposes, in which are indicated the standards of purity regarded as necessary for analytical work. The standards and tests are in the main those adopted by a Committee appointed by the Eighth International Congress of Applied Chemistry. The list has been brought to the notice of manufacturers, with the recommendation that the labels on the bottles containing materials complying with these tests should bear the letters, A.R.—signifying Analytical Reagent. Copies of the list may be obtained on application to the Registrar of the Institute of Chemistry, 30, Russell Square, London, W.C.

Sulphuric acid, calcium chloride, and aluminium trioxide; Comparison of the relative drying powers of—when used in ordinary Scheibler desiccating jars. J. W. Marden and V. Elliott. J. Ind. Eng. Chem., 1915, 7, 320—321.

EXPERIMENTS are described showing the variable results obtained according to the conditions of working in the determination of moisture by drying over sulphuric acid. When weighed dishes of alumina and sulphuric acid were placed together in a desiccator, the alumina increased in weight faster than the sulphuric acid. In comparative tests with flour, crystallised copper sulphate, coffee, tea, etc., alumina gave somewhat better results than 95% sulphuric acid for small amounts of moisture and was equal to the acid for larger quantities; calcium chloride gave inferior results in all cases. The alumina was prepared by igniting the washed precipitated hydroxide in the glass tube of a combustion furnace, using a smoky flame.—A. S.

Potassium; Determination of—by the perchlorate method. R. G. Thin and A. C. Cumming. Chem. Soc. Trans., 1915, 107, 361—366.

EXPERIMENTS were made to elucidate the causes and extent of possible errors in the perchlorate method for the estimation of potassium. Davis (this J., 1912, 1045) suggested washing the precipitate with 95% alcohol containing 0.2% of perchloric acid, but solubility determinations indicate that potassium perchlorate is distinctly soluble in alcohol (0.051 grm. in 100 grms. of 93.5% alcohol at 25.2° C.), and that the water

added with the perchloric acid more or less counterbalances the slight decrease in solubility caused by the addition of the acid. Another source of error is the presence of traces of potassium perchlorate in the "pure" perchloric acid of commerce, which should therefore be redistilled *in vacuo* before use. Accurate results may be obtained if the following conditions are complied with. Ammonium salts must not be present in any quantity. Evaporation with the perchloric acid must be carried far enough to ensure complete conversion of chlorides into perchlorates. A freshly prepared saturated alcoholic solution of potassium perchlorate must be used as the washing liquid, instead of alcohol and perchloric acid. Since the presence of other salts, even up to 2 grms. of various chlorides, has no effect on the accuracy of the determination, the perchlorate method seems to be superior to the platinichloride method.—G. F. M.

Nitrogen; Use of hydrochloric acid in the determination of certain forms of organic—. W. A. Drushel and M. M. Brandegee. Amer. J. Sci., 1915, 39, 398—404.

THE following method is proposed for the determination of nitrogen in aliphatic nitriles, cyanogen-substituted esters, amides, and imides:—0.1—0.3 grm. of the substance is heated with 3 c.c. of hydrochloric acid of sp. gr. about 1.2, for 2 hours at about 200° C. in a sealed tube. A considerable pressure of carbon dioxide is developed in some cases. The product is rinsed out into a basin, evaporated to dryness, further heated for 15 mins. on a water bath and afterwards for 5 mins. in an oven at about 110° C. By this means all free hydrochloric acid is eliminated without any appreciable loss of ammonium chloride, and the latter is then determined by titration with silver nitrate solution in presence of potassium chromate. The presence of acetic acid or its homologues does not affect the action of the chromate indicator, but if stronger acids, such as succinic acid, are present it is advisable to add a very small quantity of sodium acetate, preferably before the addition of the indicator. Tested on acetonitrile, propionitrile, propionamide, succinimide, and the ethyl esters of α -cyano-acetic, -propionic, and -butyric acids, and *n*-dipropylcyanoacetic acid, the method gave exact results, except with cyanoacetic acid, which was probably not pure. Accurate results were also obtained with glycine, but only after heating for 3—4 hours at about 200° C.

—J. H. L.

α -Amino-acid nitrogen; Colorimetric method for the determination of—. V. J. Harding and R. M. MacLean. J. Biol. Chem., 1915, 20, 217—230.

THE method depends on a reaction discovered by Ruhemann (Chem. Soc., Trans., 1910, 97, 2025) who found that all acids containing a free amino group in the α position gave an intense blue coloration with triketohydrindene hydrate; β -, γ -, and δ -amino acids gave only slight colorations, whilst α -amino-acids substituted in the amino or carboxyl group did not react at all. One c.c. of the solution under examination, containing not more than 0.05 mgrm. of α -amino-acid nitrogen and having a neutral reaction towards phenolphthalein, is mixed with 1 c.c. of a 10% aqueous solution of pure pyridine and 1 c.c. of a freshly prepared 2% solution of triketohydrindene hydrate, the mixture is heated for 20 minutes on a boiling water-bath, then diluted and the coloration compared with a standard prepared under similar conditions from 1 c.c. of a solution containing 0.3178 grm. of alanine per litre (each c.c. of this solution will contain 0.05 mgrm. of nitrogen). The method may be applied to the determination

of the α -amino-acid nitrogen set free in the hydrolysis of proteins, but is untrustworthy in the case of cystine.—W. P. S.

[Determination of] soluble chlorides and total chlorine in some English coles. Bridge. See IIA.

Tests for distinguishing parchment paper from pergamyn paper. Annoni and Rodano. See V.

Analysis of nitrites. Busvold. See VII.

Determination of chromium and vanadium in steel. Rich and Whittam. See X.

Analysis of brass. Koch. See X.

Electrolytic analysis of alloys rich in lead (white metal, type metal, solders, etc.). Compagno. See X.

Analysis of chrome yellows and greens. Given. See XIII.

Isolation of the insoluble constituent of rubber. Bernstein. See XIV.

High results in tannin analysis. Bennett. See XV.

Report on moellon analysis. Faust. See XV.

Cinchonine for the detection of sulphite-cellulose in leather. Appellius. See XV.

Analysis of sulphited tanning extracts, and determination of free sulphuric acid in leather. Dufour. See XV.

Determination of sulphuric acid in leather. Jablonski. See XV.

Determination of sucrose by double polarisation, employing a new method of clarification. Deerr. See XVII.

Determination of the mineral constituents in malt, wort, beer, and yeast. Schönfeld and Sokolowski. See XVIII.

Determination of sulphates in flour. Elsdon. See XIXA.

Capillary behaviour of milks. Lenk. See XIXA.

Use of colloidal iron [hydroxide] in the determination of lactose in milk. Hill. See XIXA.

Routine detection and determination of boric acid in butter. Hawley. See XIXA.

Determination of certain groups in phospholipins. Foster. See XX.

Determination of acidity [in physiological liquids]. Traube and Somogyi. See XX.

Separation and identification of hydroxymethyl-anthraquinones [in chrysarobin, buckthorn, rhubarb, senna, and aloes]. Bailey. See XX.

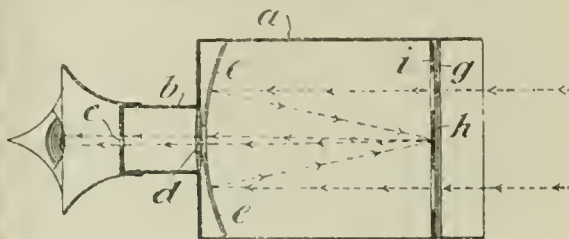
A new colour reaction of salicylic acid. Self. See XX.

PATENTS.

Photometers. South Metropolitan Gas Co., and J. S. G. Thomas, London. Eng. Pat. 776, Jan. 18, 1915.

A PHOTOMETER for determining, by direct viewing, the suitability of a given strength of illumination for a particular purpose, comprises an opaque tube, *a* (see fig.), closed at one end except for an eye-piece, *b*, containing a lens, *d*, and stop, *c*, and provided at that end with an annular concave reflector, *e*. At the other end of the tube is a transparent screen, *g*, and a circular, central,

opaque disc, *h*, having a mark, *e.g.*, a black cross on a white ground, on its inner face. The amount of light entering the tube can be controlled



by an adjustable stop or diaphragm, *i*. The diaphragm, *i*, is set to give a certain visibility of the mark on *h*, with the required degree of luminosity; an excess of visibility then indicates too much light and *vice-versa*.—B. V. S.

Viscosimeter. G. M. Saybolt, Jersey City, N.J. U.S. Pat. 1,132,621, March 23, 1915. Date of appl., Feb. 2, 1914.

THE liquid to be tested is contained in a tube provided with means for ensuring uniform filling, and surrounded by a constant-temperature bath which has an oscillating cover carrying agitating-paddles and a thermometer. The capillary nozzle at the lower end of the tube is surrounded by a larger tube which may be closed to form an air seal.—W. F. F.

Gas mixtures of known constituents; Method of quantitatively analysing—and apparatus therefor. H. Gerdien, Assignor to Siemens and Halske A.-G., Berlin. U.S. Pat. 1,133,556, March 30, 1915. Date of appl., July 18, 1913.

See Fr. Pat. 458,916 of 1913; this J., 1913, 1171.

XXIV.—MISCELLANEOUS ABSTRACTS.

Photochemical reactions; Temperature coefficient of —. D Berthelot. Comptes rend., 1915, 160, 440—443.

THE decomposition of ketoses, such as dihydroxy-acetone and laevulose, by light into carbon dioxide and lower alcohols may be used as a basis of actinometric measurements, *e.g.*, for comparing the efficacy of different sources of ultra-violet light for the sterilisation of water, etc.; the amount of gas formed in a given time is a function of the vibration frequency of the ultra-violet light. Such actions are but very slightly influenced by temperature changes. The temperature coefficient of the laevulose reaction between 40° and 70° C. was found to be 1.035. When oxalic acid and ferric chloride interact in sunlight, the ferric salt is reduced and carbon dioxide is liberated. The temperature coefficient of this reaction between 21° and 61° C. was 1.01, the same figure found by Lemoine for the temperature-interval, 3°—35° C. The vibration frequency is the intensity factor of light energy, just as temperature is that of heat energy.—E. H. T.

Nitric oxide; Behaviour of different substances towards —. T. Panzer. Z. physiol. Chem., 1915, 93, 378—395.

It has been shown previously (see this J., 1913, 707) that after treatment with nitric oxide, diastase gives several reactions of nitroso-compounds. For purposes of comparison the author exposed weighed quantities of more than fifty compounds of various types (unsaturated compounds, non-volatile alcohols, phenols, aldehydes, carbohydrates, primary amines, proteins, amino-acids;

acid amides, and other nitrogenous substances) to a current of dry nitric oxide for 24 hours, and afterwards to a current of carbon dioxide. The increase in weight produced did not exceed 5% in most cases; the most conspicuous exceptions were turpentine oil, glycerol, phenol, *m*-cresol, β -naphthol, *p*-toluidine, β -naphthylamine, acetanilide, and antipyrin, which showed increases up to 22%, but in all cases very variable. Most of the products showed some, but none of them all, of the reactions given by diastase after similar treatment, and it is concluded that the active groups of diastase which are attacked by nitric oxide differ from any of those present in the compounds investigated.

—J. H. L.

Trade Report.

Prohibited exports.

ORDERS in Council, dated April 15th and 26th, amend the Proclamation of Feb. 3rd and the Orders in Council of March 2nd and 18th (see this J., 1915, 154, 381, 455) as follows:—

The headings "Oil, mineral lubricating (including mineral lubricating grease and lubricating oil composed of mineral and other oils)" and "Oil, whale, namely train, blubber, sperm or head matter, and seal oil, shark oil and Japan fish oil," in the list of goods the exportation of which is prohibited to all destinations abroad other than British Possessions and Protectorates, are deleted, and there are substituted the headings "Lubricants" and "Oil, whale (train, blubber, sperm), seal oil, shark oil, fish oil generally, and mixtures or compounds of any of the foregoing," respectively.

Alunite is added to the list of goods the exportation of which is prohibited to all destinations abroad other than British Possessions and Protectorates.

The following are added to the list of goods the exportation of which is prohibited to all foreign ports in Europe and on the Mediterranean and Black Seas, other than those of France, Russia (except Baltic ports), Spain and Portugal:—Anthracite. Lacs of all kinds, including shellac, gum lac, seed lac, stick lac, and other forms of lac, but not including lac dye.

The exportation of toluol and mixtures containing toluol is prohibited to all destinations.

German chemical companies; Dividends of—

THE financial results of the great German chemical companies, which have just been published for the past year, are considered in that country as very satisfactory. After setting aside £450,000 for depreciation, as against £412,000 in 1913, the Badische Anilin und Soda Fabrik reports net profits, including £111,000 brought forward, of £789,000 as contrasted with £858,000 in 1913, when the carry forward was £99,000. It is proposed to allocate £150,000 to a war risks fund as compared with a similar amount for doubtful debts in the previous year, and to pay a dividend of 19% on ordinary share capital of £1,800,000, as against 28%, and 9½% on new capital of £700,000. The Farbenfabr. vorm. F. Bayer und Co. records net profits of £774,000, including the balance of £98,000 from 1913, as against £838,000 in 1913, and the directors recommend the payment of 19% on the ordinary share capital of £1,800,000, as compared with 28%, and 9½% on new shares of £900,000. In the case of the Farbwerke vorm. Meister, Lucius, und Brüning, the accounts show net profits and balance forward, after apportioning £284,000 to depreciation as contrasted with

£272,000, in 1913, amounting to £630,000 as against £819,000. It is intended to distribute 20% on ordinary share capital of £1,800,000 as compared with 30%, and 10% on new capital of £700,000. The A.-G. f. Anilin-Fabrikation contemplates the payment of 16% on capital of £700,000 as against 23%, and 8% on the new issue of capital. The following dividend announcements have also been made for 1914, the figures in parentheses being those for the previous year:—Chemische Fabrik vorm. E. Schering, 11% (15); Chemische Fabrik vorm. Hell und Sthamer, of Billward, 10% (14); Chemische Düngefabrik, Rendsburg, 10% (10); Chemische Fabrik E. Matthes und Weber, 10% (10); A.-G. Silesia Verein Chemischer Fabriken, 8% (12); Rütgerswerke A.-G., of Rulin, 10% (12); Akt.-Färberei Munchberg, vorm. Knab und Linhardt, 6% (8); and the Lübeck Schwefelsäure und Superphosphat A.-G., 7% (7) (see also this J., 1915, 455).

* New Books.

[The Roman numerals in thick type refer to the similar classification of abstracts under "Journal and Patent Literature" and in the "List of Patent Applications."]

IIA. *Castellani, L. e. Romanelli, U.:* L'acetilene e le sue pratiche applicazioni. 3a. ediz. Milano, Hoepli. 16°, p. XX, 335. 1915. Lire 4.

Brewer, R. W. A.: Carburation in theory and practice; including a criticism of carburettor development; a manual of reference for automobile engineers and owners. N.Y., Appleton. 253 p. il. diagrs. tab. 8vo. 1915. \$1.50 n.

Kohlen-Jahrbuch 1915. Ratgeber f. Gewinnng., Handel u. Konsum v. Kohle, Koks, Briquets u. anderen Heizmaterialien. Mit umfass. Kalendarium u. Notizbuch. 15 Jahrg. 1915. 2 Tle. in 1 Bde. (XII, 296; IV, 54 S., Schreibkalender u. 8 S. m. Fig. u. 1 Karte.) 18°. Leipzig, Degener. 1915. Cloth M. 3.

VII. *Strickland, Sir W. W.:* Notes and observations on forms of sand. Illustrated. Cr. 8vo. swd. Smithson and Blanchard, London. 1915. 1s. 6d.

VIII. *Stull, R. T., and others:* Deformation temperatures of some porcelain glazes. Urbana, Ill., Univ. of Ill. 14 p. diagrs. tabs. 8vo. (Ceramics bull.) pap. 1915. 10 c.

Williams, A. E.: Notes on the development of the ruby color in glass. Urbana, Ill. Univ. of Ill. 23 p. tabs. 8vo. (Ceramics bull.) pap. 1915. 15 c.

X. *Heat-treatment of steel.* 8vo. Spon, London. 1915. Net 10s. 6d.

White, C. H.: Methods in metallurgical analysis. 106 illustrations. N.Y., Van Nostrand. c. 9 + 356 p. (3½ p. bibl.) 1915. D. \$2.50 n.

Swingle, C. F.: Oxy-acetylene welding and cutting; including the operation and care of acetylene generating plants; and the oxygen process for removal of carbon. Chic., Drake. c. 190 p. il. figs. 1915. S. \$1.

XIV. *Lock, R. H.:* Rubber and rubber planting. N.Y., Putnam. 1914. 11 + 245 p. il. pls. 1915. \$1.50 n.

Rubber Recueil: A series of papers about rubber: its botany, culture, preparation and commerce. 4to. Unwin. London. 1915. Net 21s.

* Compiled by H. Grevel and Co., 33, King Street, Covent Garden, London, W.C., from whom all the works in the preceding lists can be obtained.

Journal of the Society of Chemical Industry.

No. 10, Vol. XXXIV.

MAY 31, 1915.

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Official Notice.

ANNUAL GENERAL MEETING, 1915.

In accordance with the provisions of By-law 64, notice is hereby given that the Annual General Meeting will be held at the Municipal School of Technology, Manchester, commencing at 10.30 a.m. on Wednesday, July 14th, 1915.

PROVISIONAL ARRANGEMENTS.

Wednesday, July 14th, 1915.

Morning: Annual General Meeting and Address from the President, Prof. G. G. Henderson, D.Sc.
Afternoon: "Co-partnership in Chemical Works." Sir Wm. H. Lever, Bart.

Evening: Annual Dinner.

Thursday, July 15, 1915.

Morning: "Research and Chemical Industry." Dr. M. O. Forster, F.R.S., and Dr. Chas. C. Carpenter. "Legislation and its Effect on Chemical Industry." Prof. H. E. Armstrong, F.R.S.

Afternoon: "Chemical Engineering." Dr. G. T. Beilby, F.R.S.

Evening: Visit to the University Laboratories. Demonstrations by Sir Ernest Rutherford, F.R.S., Prof. W. J. Pope, F.R.S., and Prof. Harold Dixon, F.R.S.

Friday, July 16th, 1915.

Morning: "Economic Utilisation of Coal and the Production of Cheap Power." Mr. Walter F. Reid.

Afternoon: Visit to Works (Trafford Park Estates).

Evening: Social Meeting.

In accordance with the provisions of By-law 24, those members whose names are printed in *italics* in the List of Council will retire from their respective offices at the forthcoming Annual Meeting.

Dr. C. C. Carpenter has been nominated to the office of President under By-law 20; Prof. G. G. Henderson has been nominated a Vice-President under By-law 20; Prof. E. C. C. Baly, F.R.S., Mr. R. H. Clayton, and Mr. Julius Hübner have been nominated Vice-Presidents under By-law 21, and Mr. Thos. Tyrer and Dr. R. Messel, F.R.S., have been re-appointed Hon. Treasurer and Hon. Foreign Secretary respectively.

Dr. E. F. Armstrong, Prof. H. E. Armstrong, F.R.S., Prof. W. R. E. Hodgkinson, and Mr. Walter F. Reid have been nominated under By-law 25 to fill four vacancies among the Ordinary Members of Council. No ballot will be required.

CHARLES G. CRESSWELL,

Secretary.

London Section.

Meeting held at Burlington House on Monday, June 8th, 1914.

PROF. W. R. HODGKINSON IN THE CHAIR.

THE DICKSON CENTRIFUGE SYSTEM OF SEWAGE TREATMENT.

BY E. HOWARD TRIPP, PH.D.

The subject of sewage disposal is of such great importance that no apology is needed in describing an original and ingenious system which promises to be more efficient and at least as economical as any at present in

vogue. Even if the ultimate results do not correspond fully with the hopes and anticipations which are now entertained in influential quarters, few will deny, when they have studied the process, that it affords the elements of a real advance on existing methods and incidentally presents some novel points of scientific interest. The scheme has been successfully translated into practice at Dublin and at Winnipeg. The corporation of the former city has entered into a 25-year contract for the treatment of the whole of its sludge by the Dickson process, and at Winnipeg a small complete plant has been in operation for some time past.

The Dickson process.

Some years ago Mr. Alexander Dickson, of Dublin, noticed that solid matter could frequently be seen floating on the Liffey below the point where the effluent from Messrs. Guinness' brewery enters it, but above that spot no such floating matter was visible. He framed the hypothesis that the flotation might in some way be causally connected with the yeast present in the effluent. This idea was tested by treating sewage and sewage sludge with live brewer's yeast in an experimental plant, and the results confirmed the hypothesis. It was further established that the most favourable temperature was between 90° and 96° F., and also that only a very small proportion of yeast was needed. The separated sludge was found to contain about 80% of water, against 90% normally present in the raw material. A typical analysis of the materials would show:—

	Raw sludge.	Top fermented layer.	Effluent.
Total solids	9—11	18—22	6—7
Organic and volatile	5—6	10—12	3—4
Ash	4—5	8—10	2—3
Nitrogen	0.3—0.4	0.6—0.8	0.01—0.02
Nitrogen of dry material	3—4	3—4	

Thus by treating with yeast, about one-half of the water present in the raw sludge is eliminated, and this fraction is found to be approximately constant, whatever the original water-content of the sludge may be.

The removal of the rest of the water proved to be the most formidable of all the obstacles. Sewage sludges that are sold, or given away, for manurial purposes either contain such a large percentage of moisture that the cost of transport is prohibitive, or they have been dried in such a manner that much, if not most, of the original nitrogenous content has been burnt out. Prolonged air-drying is resorted to in some places, but this involves a large storage space, and also a loss of nitrogen. After many vain efforts, success was attained by the ingenious modification of a plant that is used in France for pulverising and drying coal in the manufacture of briquettes. With the aid of this apparatus, practically all the moisture present can be removed, although in practice this is unnecessary and inadvisable.

The maximum temperature to which the treated sludge is exposed is 450° F., and analyses made before and after drying show that not more than 0.2% of nitrogen is lost in the operation.

The Dublin sewage plant.

The Dublin sewage, amounting to a daily average of 13 million gallons, is conveyed through an 8 ft. main sewer for a length of two miles to the pumping station where, after passing through a screen chamber, it is raised 23 ft., and is then allowed to flow into the sedimentation tanks. There are eighteen of these, each measuring 94 ft. square, and their cost was no less than £300,000, exclusive of the value of the land. The total cost of all the works was £508,000. No chemicals are used, and after the

sedimentation has taken place, the effluent flows over concrete sills into a channel, from which it is discharged into the estuary of the Liffey. The effluent is not a good one; it will support fish life for a very short time, but its discharge into the estuary is unattended by any apparent harm owing to the great degree of dilution it undergoes. The sludge is swept into a second culvert, thence into a sump, pumped to a high-level tank, and finally flows into a sludge steamer, which cost some £12,000 to build and entails a further £3000 per annum for upkeep. It makes on the average about three voyages a week and dumps some 1200 tons of sludge into the bay in the same period.

A pipe from the high-level tank takes the sludge into the new works which, although occupying less than one acre of ground, are built on such a scale as to cope with the whole of the Dublin sludge. At the present time a portion only of the sludge is being treated, owing to delay in delivery of some additional drying plant. The process has been worked intermittently for several years, and in November, 1913, on the initiative of Mr. J. D. Watson, the Birmingham Drainage Board sent Mr. I. F. Mountfort, A.M.I.C.E., to make a thorough investigation and a continuous, night and day, test for 14 days. The result of this examination was to substantiate fully the claims made by the management, both as regards efficiency and costs.

The Dickson plant.

The sludge is conveyed along an open trough to a small screen where solid matter, which might block the pumps, is removed. About 0.5% of yeast, mixed with water, and about 3% of already fermented sludge are added, and the mixture is pumped into a "heater," consisting of a number of pipes heated by hot air, so that it attains a temperature of 94° F. From this point it flows into a distributing trough which feeds the fermenting troughs. These are eleven in number, each measures 50 by 4 ft. and has a capacity of 3000 gallons or 15 tons.* They are made of concrete, and beneath them are hot-air ducts which maintain the contents of the troughs at about 94° F.

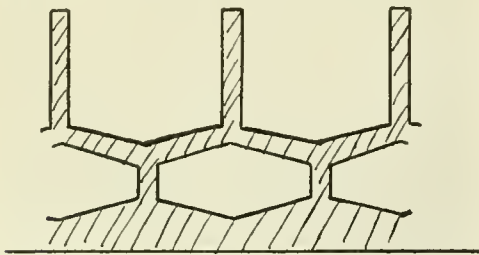


FIG. 1A.—Section of fermentation troughs showing hot-air ducts.

In 24 hours or less the action is completed, the solids have separated out and come to the surface, leaving the more liquid portion beneath. The former are run off through sluice valves into a receiving trough, which, like the distributing trough at the other end, is placed at right angles to the fermentation troughs. The effluent passes out of the troughs through vertical perforated pipes, the perforations being of such a size that no solid matter can get through. The amount of suspended matter in this effluent is small, but, in the case of inland towns, it would have to be further purified by the centrifuge process before final discharge.

From the receiver-trough the separated sludge is pumped through a pipe (*k*) into a patent distributor (*u*) at the top of the "dryer." (Fig. 1.) This consists of a vertical, cylindrical tower fitted together in sections, and containing a number of horizontal perforated platforms (*g*, *f*) which are alternately fixed and rotating upon a central shaft (*d*). On the under-side of each rotating platform is a scraper (*h*) which moves over the surface of the fixed platform below it, and acts as a rake to subdivide the sludge before it falls through the perforations (*e*). At the

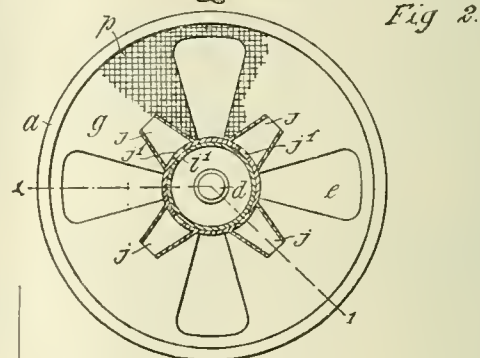
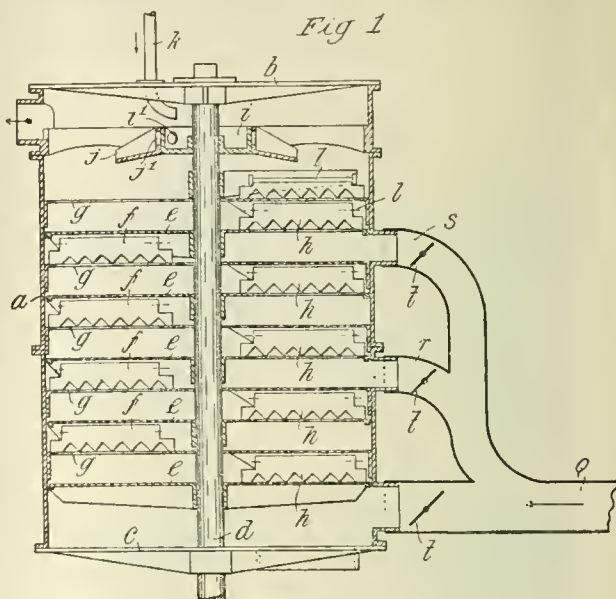


Fig 3

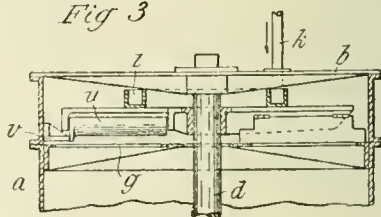
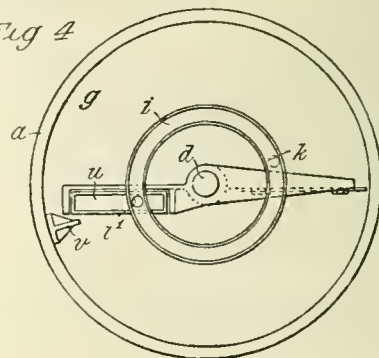


Fig 4



same time hot air, at about 450° F., is admitted at the bottom (and only at the bottom, in the latest type of the machine), and passes upwards through the apparatus,

After emerging at the top, it is further utilised for maintaining the temperature of the heater and of the fermentation troughs, and it finally passes back into the combustion chamber of the furnace from which it originally

Fig. 5

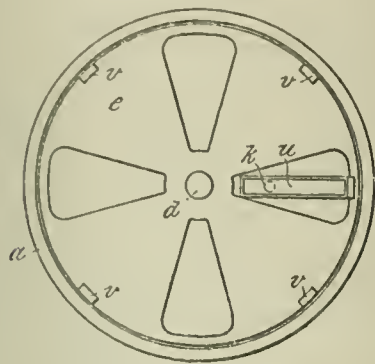
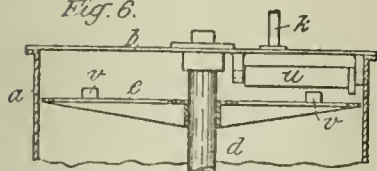


Fig. 6



issued. It is found that 1 lb. of average coal is required for every lb. of dried sludge produced, but it is anticipated that the most recent improvements will increase this ratio by 20–25%. The dried sludge falls out at the base of the apparatus into a patent disintegrator, consisting of revolving paddles working in a draft of hot air. In this way the process of desiccation and pulverisation is completed.

Theory of the action of the yeast.

By the expression "yeast fermentation" it might be implied that the flotation of the solids in the sludge is due to the action of yeast as a fermentative agent, but investigation has shown that:—

- (1) Killed yeast is just as effective as live yeast.
- (2) After introduction into the sludge, the yeast cells rapidly degenerate and before long completely disappear.
- (3) The action does not take place if the sludge be previously sterilised.

The conclusions from these observations are: that the action is due to the anaerobic micro-organisms which feed on the yeast; and that the levitation of the solids is caused by the escaping gases. These gases have not been analysed, but there is no reason to doubt that they contain carbon dioxide, methane, and hydrogen, the normal gaseous products of the anaerobic fermentation of cellulose, as the bacteria found in the troughs have been identified as cellulose and sugar fermenting organisms. Not only dead yeast, but such substances as starch and dextrose produce the same result, but more slowly. The best and quickest agent is brewer's yeast at 95° F. This is all that has been ascertained so far as regards the action of the yeast. It is, however, quite within the bounds of probability that the enzymes in the yeast may exert their specific functions, as they would withstand the temperature of the sludge. The differences between the Dickson product and ordinary septic tank sludges seem to point to the existence of some action or actions above and beyond those involved in ordinary anaerobic fermentation.

The fertiliser.

As the commercial success of the Dickson process will depend to a considerable extent upon the value of the

recovered sludge, it is interesting to inquire how its composition and properties bear resemblance to those of ordinary sewage sludges. The findings of the Royal Commission on sewage disposal on the question of the manurial value of sewage sludge were none too optimistic. It is admitted on all hands that the potential value of the constituents is great, and when we consider the enormous quantity of material that would be available, very great, yet although their application to the soil has been attended with some benefit, the results have been much less favourable than *a priori* judgments would indicate. It was unfortunate that so many of the sludges investigated by the Royal Commission contained trade waste of various kinds. The effects of small amounts of certain mineral salts, etc., upon plant life have been shown in some cases to be very great, hence in an investigation of such a nature, it would have been better to have confined the preliminary work to the examination of the manurial effects of plain domestic sludge and so in the first instance to have reduced the problem to its simplest form: for even the simplest form in this case is a very complicated one.

At the present time two fertilisers are being produced and marketed in Dublin: the plain dried sludge, called "Manurito," and the same material mixed with phosphates and kainit, termed "Compound Manurito." Owing to the exposure to heat in the "dryer," the product is entirely free from live seeds, which are usually present in other dried sludges and which, when put on to the soil, germinate and produce an undesirable flora. For the same reason it is practically free from microbial life, bacteriological examination having disclosed merely the presence of one or two heat-resisting micro-organisms. "Manurito" is in such a fine state of division that it readily mixes with the soil and it could be applied with the seeds in the drill. When moist the smell may be described as acute, but when dry it is nearly odourless. It is highly probable that the knowledge of the chemical composition of such a natural fertiliser at the best only affords a very rough indication of its manurial value; yet such knowledge is an indispensable condition of subsequent exact investigation.

Analysis of "Dickson" sludge. Dry basis.

	Sample A. 1912.	Sample B. 1914.	Winnipeg, 1914.
Organic * and volatile	46.79	47.85	47.28
Sand and matter insol. in HCl	28.13	23.03	
Phosphoric acid	2.64	4.04	
Lime	4.87	11.10	
Potash	0.26	—	
Magnesia	—	0.51	
Iron oxide and alumina	—	7.22	
*Containing nitrogen..	2.51	2.26	
Nitrogen = ammonia ..	3.05	2.74	
Moisture	23.06	21.00	3.31

A comparison of the above with the Leeds septic tank sludge analysed by the Royal Commission (April, 1905. Fifth Report, App. 8) shows that the former is considerably richer in organic matter and in nitrogen, and there is also much more lime and phosphoric acid in it. In fact the high content in the latter constituents seemed to suggest that some addition had been made, and an inquiry at once elicited the reply that a little superphosphate had been added in order to fix the nitrogen. The moisture content was also high, but this is due to the fact that the standard permissible amount of water in a manure is 18%, and the product was consequently not dried below this point. There is no doubt that complete desiccation can be effected if desired. The presence of a considerable quantity of seed-husks caused some trouble in sampling for analysis, each piece of husk or straw having to be cut up as finely as possible with a small pair of nail scissors. The moisture was determined by heating, by drying *in vacuo* over sulphuric acid, and *in vacuo* over phosphoric oxide. These estimations showed that a not inappreciable evolution of ammonia takes place on warming and on standing in

vacuo over an acid drying agent. A sample containing 20% of moisture began to evolve an alkaline gas at 40° C., another containing less than 1%, the same gas at 65° C. Some 13 grams were dried over P_2O_5 in a vacuum of 1–3 mm. of mercury for 14 days. After losing 20.4% in the first 24 hours, it lost almost regularly about 5 mg. per day. After 14 days, nitrogen determinations by the Dumas combustion method gave 2.062 and 2.047, or an average of 2.055%, whereas the original sample before drying gave 2.225% (dry basis) by the same method. The figure obtained for total nitrogen, viz., 21% was the average of nine closely agreeing results by two different methods. It was considerably lower than was expected, but the sample was not a fresh one and also contained added superphosphate. From the results of analyses made in Dublin on fresh material, there is little doubt that an average sample would contain about 3% of nitrogen.

Availability of the nitrogen.

To ascertain the proportion of nitrogen which might, from a chemical point of view, be termed readily available for plant life, the amount which went into solution on digesting the sludge with distilled water for 24 hours at the room-temperature was determined. This was found to be 0.33%, the mean of four results in close agreement. The amount of nitrogen liberated by distilling with an excess of magnesia was 0.4%, and the quantity set free by the same oxide after previous boiling for one hour with 5% sulphuric acid was 0.5%. Exactly the same figure, 0.5% was obtained by determining the nitrogen evolved as ammonia on boiling for 2 hours with 0.5% potash solution. Considering that the sample analysed was not a fresh one, the above figures indicate that the percentage of available nitrogen was not less than 0.5%, and the ratio of available to total nitrogen was between $\frac{1}{4}$ and $\frac{1}{3}$. These results compare very favourably with those obtained for the sludges investigated by the Royal Commission. The average ratio found in these cases was between $\frac{1}{8}$ and $\frac{1}{5}$. The relatively high proportion of available nitrogen in Manurite is in keeping with the results of the analyses of Leeds septic tank sludge for the Royal Commission, for in both cases the sewage is subjected to anaerobic fermentation.

Ratio of available to total nitrogen in sewage sludges.

Date.	Leeds septic tank sludge.	Leeds settled sludge.	Date.	Dickson sludge.
April 11th, 1905	1:3.6	1:7	1912	1:5
Oct. 29th, 1906	1:5.5	1:11.8	1914	1:4.5

As to the availability of the residual nitrogen, agricultural experience of ordinary sewage sludges would indicate that it is of little importance. Dr. Voelcker, in his report to the Sewage Commission, stated that "nitrogenous organic matter is not the determining factor in the value of sewage sludge." Some laboratory experiments have recently been undertaken to ascertain the extent of nitrification which takes place when Manurite is added to a poor, uncultivated field soil. Although it is yet too soon to draw any valid conclusions, there are distinct indications that considerable nitrification does take place. At first sight it would appear probable that the Dickson material would be very similar to septic tank sludge, since both are products of anaerobic fermentation of sewage, but further consideration leads to the conclusion that there are important points of difference in their mode of origin which might well account for any difference in their fertilising value.

Septic Tank Sludge.

Obtained by anaerobic fermentation of crude sewage.

Fermentation takes place at the ordinary temperature and without additions.

The drying process is usually an extremely slow one, and then only very partial.

Dickson Fertiliser.

Obtained by anaerobic fermentation of previously settled sewage sludge.

Fermentation proceeds for a strictly limited time, at a definite temperature, and in presence of yeast.

The desiccation is very rapid and effective.

The organic matter.

It is quite possible that the manurial value of sewage sludge may be due to the organic matter as such, irrespective of the nitrogen content. There is little doubt that sludge is particularly valuable for consolidating a light soil, and if the analogy holds, since the organic constituents of stable and farmyard manure effect the retention of nitrifying organisms in the soil (see Russell, *Journ. Agric. Sci.* 6., i., pp. 49, 50), it is very possible that the organic constituents of sewage sludge may play a similar rôle. To ascertain if there is any "superior goodness" in the organic matter of the Dickson fertiliser, some preliminary experiments have been performed of a similar nature to those described by F. K. Cameron ("The Soil Solution") with stable manure. Briefly, these experiments consisted in separating and making aqueous solutions of different soluble constituents of the manure, and using these liquids to water young wheat plants. But whereas Cameron's experiments were performed with water-cultures and observations were apparently confined to tracing the effects on aerial and root development, in this case sand-cultures were used and the change in weight of the plants, as well as the growth of the leaves, was investigated.

Thirty grams of the fertiliser were digested with 100 c.c. of distilled water at the room-temperature. The liquid was then filtered and one-third of it diluted so that the amount of dissolved solids in it did not exceed 0.1 gm. per 100 c.c. [solution F]. The remainder was treated with an excess of 90% alcohol. The nearly white flocculent precipitate of organic matter was filtered, washed with alcohol and dried near an oven. It was then dissolved in water and the solution so diluted that it contained the same proportion of organic matter as was present in solution F [solution O]. As the earlier experiments were performed with "Manurite" to which a little superphosphate had been added (see above), the precipitated organic matter was contaminated with phosphate and sulphate; but the same general results were obtained later when a sample free from added superphosphate was employed. The organic matter was of a colloidal nature and was found to evolve ammonia on heating with soda-lime, showing the presence of nitrogen.

The filtrate from the alcoholic precipitation was boiled until all the alcohol was expelled and was then diluted to the same degree [solution M]. This liquid therefore contained the soluble mineral constituents of the fertiliser and organic matter which was not precipitated by alcohol. In some cases a solution of the mixed organic [O] and mineral [M] portions was also used. The sand used was coarse and very carefully purified by twice boiling either with hydrochloric or with nitrohydrochloric acid and thoroughly washing with tap- and distilled water. Finally it was baked on a hot-plate. The wheat plants were germinated in garden soil which had not been under cultivation for at least three years. Incidentally it was observed that the germinating power of the seeds diminished considerably as the soil was used over and over again, even after thorough aeration. The plants were removed from the soil when from 10–20 days old, their roots were carefully freed from adhering soil and then washed in running tap-water for about 1 hour. After drying for about the same period on filter paper they were weighed. At the end of the experiment they were air-dried for 24 hours before weighing. In nearly every case, similar plants watered with distilled water were grown as control. All the solutions used were previously passed through a Berkefeld filter. It was not considered necessary to attempt to sterilise the plants because, *inter alia*, the control experiments with distilled water would eliminate the bacteriological factor.

The aerial growth was determined by measuring the length of the leaves. A leaf was considered to be alive if blanched, but dead if brown or red in colour.

The appended table gives the comparative results of the action of the different solutions upon initially similar young wheat plants, which are denoted by the same letters as the solutions used to water them. The best developed plant is given first.

	Period of growth.	Aerial development.	Increase in organic matter.
A.	12 days	O {M F}	—
B.	12 days	O M	—
C.	28 days	F {M+O O} M W	M+O F O M W
D.	28 days	F O W M+O M	W O M+O F M
E.	20 days	F O M	{F O} M
F.	20 days	{M W} {F O}	M {O F W}
G.	20 days	O F W M	{O F} {M W}
H.	18 days	O M F W	F {O M} W
I.	18 days	F O W M	O F W M

In addition to showing that the aqueous extract of Manurito had a very marked beneficial action upon the plant development, these experiments also indicated that the soluble organic constituent produces an effect equal in intensity to that of the fertiliser itself.

It is probably illegitimate to draw any conclusion about the relative inferiority of the solution M, since its contents may have been profoundly altered when they were boiled to distil off the alcohol. This inferiority was in nearly every case very marked, in fact the plants watered with it usually did less well than the control plants with distilled water. This may be due to the presence of a toxin or toxins undestroyed by heat. In one or two cases, when the period of growth was prolonged, the M plants, after doing badly at first, seemed to recover their vitality. In all such experiments the factor of intrinsic vitality comes into play, and it is necessary that more of them should be undertaken before any stringent conclusion can be drawn. The results given above, however, afford distinct indications, and agree with those performed by F. K. Cameron with aqueous extracts of stable manure and water cultures. A few similar experiments have also been done with septic tank sludge and with the same results. The amount of soluble matter in the Dickson fertiliser (without additions) was, however, found to be about double that in the specimen of tank sludge investigated. The precipitated organic matter from the latter was also relatively smaller in amount, had a most unpleasant smell, and was of a darker colour.

As to the *modus operandi* of the fertilising action of the organic matter, there appear to be three probabilities. It may serve directly as a plant food, it may act indirectly by improving the moisture-retaining property of the sand, and it may provide nutriment for beneficial bacteria. That the second mode was operative appears very probable from the observation that the sand of the F and O plants retained its moisture much longer than that of the other plants; and the indication of nitrification referred to above constitutes evidence in favour of the third.

All the evidence so far obtained confirms the opinion that a commercial valuation of a natural fertiliser such as "Manurito," based solely upon the chemical analysis, is of little or no value. Both the plain and compound "Manurito" have been extensively tried by farmers and nurserymen in England and Ireland, and the results indicate that the intrinsic value is certainly not less than the market prices of £2 10s. and £3 13s. 6d. per ton respectively. At these prices the manures command a very ready sale.

Costs.

The cost of treating sewage sludge by the Dickson process depends upon various factors, of which the price of energy for the production of heat is by far the most important. At Dublin the coal employed is both inferior and expensive, so that the total costs, exclusive of those for interest and administration, work out to 25s. per ton of fertiliser produced. This sum is accounted for as follows:—

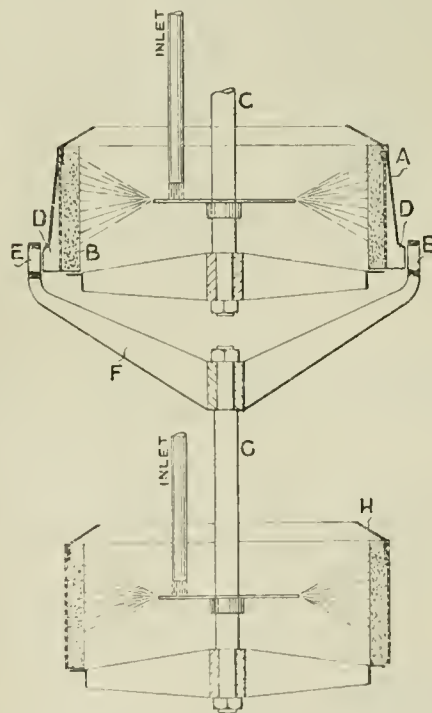
Labour	s.	d.
Fuel	2	2
Power	15	0
Stores	4	7
.....	3	3
Total	25	0

The conditions at Dublin have been by no means ideal for cheap working, and it is very probable that a considerable reduction in working costs may be effected. Were the heat from a refuse destructor available, costs would be very greatly reduced; and it is also possible that money might be saved by utilising the gases evolved in the fermentation troughs for the production of heat. As the process is continuous and automatic, the labour required at Dublin is small, viz., three workmen and one engineer to each shift. There is but little smell noticeable, and that is confined to the trough house, whilst the health of those who carry out and supervise the operations is good.

The centrifuge system of effluent purification.

Probably the greatest drawbacks of effluent treatment in percolating filters are high initial cost and the absolute necessity of expert management. Both of these disadvantages are obviated by the centrifuge system, which at the

Fig. 7.



same time yields an effluent superior to any other as regards suspended solids and dissolved oxygen. The apparatus is remarkably simple in construction (see Fig. 7). It is merely a centrifugal machine of which the cage or basket, A, H, is provided with an annulus of a filtering medium, e.g., sand, B. The speed of rotation, normally about 400 per minute, keeps the sand adhering to the metal basket as a compact mass. This centrifuge, or hydro-extractor, is supplied with a patented device for scraping and removing the inner portion of the sand without interrupting the process of filtration. The spindle, C, G, carries a horizontal disc which rotates with it and serves to distribute the liquid as it falls upon it. The energy contained in the outflowing liquid is trapped by making it drive a turbine, the power thus recovered helping to reduce the small amount required for rotation. In its passage through the

interstices of the annulus, the effluent is not only thoroughly aerated and deprived of its suspended matter, but colloidal matter is apparently broken down, precipitated and removed. The aeration is to a large extent independent of the nature of the filtering medium, for even very coarse material effects saturation. A bad sewage effluent is found to be practically saturated with dissolved oxygen after one passage through the apparatus. The degree of removal of the suspended solids varies directly with the fineness of the medium and the speed of rotation. Such solids can be entirely eliminated if necessary, but there is naturally an economic limit beyond which it is inadvisable to work. The reduction in the quantity of dissolved solids in the effluent from the hydro-extractor supports the conclusion that nitrogenous organic matter undergoes decomposition and oxidation in its passage through the machine. As regards the effects of this process on bacterial life, recent tests have shown remarkable results, and indicate the total elimination of *Bacillus coli*.

A plant for both Dickson and centrifuge processes has been in operation at Winnipeg for some time past. To ascertain the capabilities of the last-named process, some tests were recently carried out by the City Analyst on raw sewage, *i.e.*, there had been no preliminary sludge separation or treatment of any kind. The sewage was passed through a centrifuge, then given a half-hour treatment in a very small contact-bed, and finally passed through a second centrifuge.

Preliminary examination on Sewage from Aubrey Street Sewer, Winnipeg. Samples Collected February 17th, 1914.

Results stated in parts per million.

Free oxygen—	
1st Hydro-extractor	10
2nd Hydro-extractor	13

	Solids.					Oxygen consumed from permanganate.	
	Total.	Volatile.	Fixed.	Solids in solution.	Solids in suspension.	Three-minute period.	Four-hour period.
Raw sewage.....	2758	1129	1629	2155	603	152	360
1st Hydro	2328	628	1700	2086	242	92	222
2nd Hydro	1486	306	1180	1468*	18	26	58

* Domestic Water Supply, 1100.

The following table gives the average of eight analyses, taken at random, of the Winnipeg effluent after treatment, the sludge having previously been precipitated. April and May, 1914. Parts per million.

	Sewage.	Effluent.	Reduction.
Free ammonia	14	11	3
Albuminoid ammonia..	14	3	11
Oxygen consumed from permanganate	85	9	77
Free oxygen	2	14	12
Total solids	1970	1020	(increase) 950

The remarkable nature of these results may in part be due to the fact that the sewage at Aubrey Street is in a fairly fresh condition. The dissolved oxygen absorption test appears not to have been carried out, but the number of bacteria per c.c. were counted.

Sewage	81,500,000 bacilli per c.c.	Many <i>B. coli</i> .
Effluent after treatment	1,150,000 bacilli per c.c.	No <i>B. coli</i> .
Reduction per c.c.	80,350,000	

These figures were considered so remarkable that the examination was repeated. The second test confirmed the first.

The aeration and purification of polluted waters by the centrifuge process is well illustrated by the following experiments on fish life. It is well known that salmon alevins are exceedingly sensitive to a diminished oxygen supply. Six of these, about $\frac{3}{4}$ inch long and with their yolk sacs attached, were placed in the Dublin city effluent in a small vessel which was completely filled with the liquid and then hermetically covered. Four fish became "as if dead" within five minutes, and within another two minutes the remaining two followed suit. The motionless fish were then placed, under precisely the same conditions, into some of the effluent which had been passed through a hydro-extractor. In a few minutes they revived and were soon seen swimming about full of life, in fact they seemed to be just as healthy as some of their brethren who had been confined in tap-water as control. It was also found that minnow, a hardier fish, will live in unchanged hydro-effluent for five days, whereas control specimens in tap-water sometimes died within a shorter period. Some minnow were placed in water containing free sulphuretted hydrogen. After ten minutes they were all floating near the surface in an unconscious condition. They were then removed and put into some of the same contaminated liquid, but which had been once passed through the centrifuge. In about fifteen minutes they had to all appearances completely recovered. The centrifuged liquid had no smell, and lead acetate solution failed to show any signs of hydrogen sulphide—it had been oxidised to sulphuric acid. In a similar manner, it is found that ammonium sulphide undergoes oxidation to ammonium sulphate, a fact which may be utilised in the purification of, and recovery of ammonia from, the effluent from coke oven processes. Such a rapid and inexpensive method of effecting oxidation should be of considerable service in chemical investigation and routine

work. However that may be, the above experimental results leave no doubt that the centrifuge system would be of very great utility for the purification of effluents which are discharged into fish rivers. The cost of the process amounts to one-third of a penny per 1000 gallons for one treatment, and three farthings for a double treatment. There is no nuisance from smell during operation, the power required is small, as are also the space needed and the wear and tear. The use of the apparatus is independent of the size and position of the locality, and small communities can be served as efficiently as large. It might with advantage be used for disposing of the sewage of country houses. One treatment would separate the solids, which could be dug into trenches, and the effluent could be run directly on to the land.

Further applications.

Not only ordinary sewage effluents, but liquid trade waste of nearly all descriptions could be cheaply and effectively treated in the centrifuge. It has already been in service for some time at a big co-operative creamery near Limerick Junction, Co. Tipperary. The waste liquor is treated with mineral phosphate in small sedimentation tanks, the effluent passing first to a catchment tank containing sand and stones to trap the solids, and then through the centrifuge. The recovered solids contain 44.41% of total phosphates, of which 43.01% is soluble in 2% citric acid; and 0.42% of nitrogen; they are sold as a fertiliser at 36 shillings per ton.

The unpleasant smell of swimming baths is probably connected with the lack of dissolved oxygen in the water, and a simple passage through the centrifuge would doubtless restore to the water its natural freshness. There seems to be no reason, apart possibly from that of expense, why it should not be used for filtering the water supply of towns, and for ocean-going vessels and military purposes its possible application should not be overlooked. It would be interesting to find out if it could be used for softening water. If the filtering medium were composed of zeolites, or of sand and zeolites, or other precipitants, it is possible that the dissolved solids which cause the hardness might be precipitated and caught.

Costs.

The capital outlay required to instal a complete Dickson-Centrifuge installation would naturally vary with the local conditions. For a town of 100,000 inhabitants, the approximate cost would be £80,000, which would include sedimentation tanks but not sewers or land. The figure would be proportionately smaller for larger towns, but greater for smaller communities. For a town of 1000 inhabitants the capital cost would be about £5000. As regards working costs and upkeep, the proceeds of the sale of the fertiliser would probably go a long way to meet these, as the Dickson process is a remunerative one. The net total cost (all in) is expected to work out to approximately 2s. per head per annum.

The credit of having solved the practical difficulties connected with the yeast-separation and the drying of the sludge, is due to Mr. T. W. Barber, M.I.M.E., and he alone is responsible for the centrifuge method of treating effluents.

Whether the Dickson Centrifuge process of sewage treatment and disposal eventually comes into general use or not, few will deny that it presents some novel and interesting points of scientific and utilitarian import.

The author wishes to express his thanks to the proprietors of the Dickson Centrifuge patents for their kindness and courtesy in allowing him to inspect the works at Dublin, and in providing him with information; and also to Mr. H. M. Freear, of the Woburn Pot Culture Station, for much valuable advice on the agricultural experiments.

DISCUSSION.

Dr. S. RIDEAL said he could not quite understand why the first operation was necessary, if the hydro-extractors did all the work. How was it that a contact bed was necessary between the first and second hydro? One would have thought that some continuous process, by which the sewage passed from one hydro to a second one, would have saved intermediate contact beds. There was no evidence given of the chemical and bacterial changes which took place during that intermediate stage in the process. The sludge seemed to be very similar to any other sludge, with 9 to 11% of solid matter and 80–90% of water. Thus there was about 90% of water to be eliminated from that raw sludge, and even the top sludge in this process might contain 80%. To eliminate the 80% of water remaining in the yeast-fermented sludge, 1 lb. of coal was necessary for distilling off 4 lb. of water which was associated with every pound of organic matter. That was not a very good efficiency for the coal used. It meant that the principal portion of the process was the expensive operation of removing the water from the yeast-fermented sludge, and that was the difficulty in any process of sludge disposal. He had seen the Ter Meer process at work at Hanover, at Frankfurt,

and also at Harburg; it consisted in centrifuging the sludge removed from the bottom of sediment tanks. No yeast was used, but the sludge rose from the bottom of the tanks automatically by gravity pressure direct into the centrifuge, where water was separated. The sludge, passing away out from the centrifuge, contained about 70% of water and was sufficiently solid to be handled. The amounts of nitrogen and phosphorus in all these sludges were practically the same and all were of very little value. The increase in the nitrogen did not mean that that sludge could be valued at 50 shillings a ton. It was a really fictitious price for sludge. Some time ago he had collected the products from Dublin sewage which was being discharged untreated near the Pigeon Hole Fort, and had found the majority of the solids were not nitrogenous and would have practically no manurial value even if they were separated by the yeast process. It was unfortunate that inventors of new processes for utilising sewage tried to improve the sludge by adding phosphates and nitrogen so as to increase its manurial value. If the sludge had any value *per se*, it ought to be sold as such without addition.

The discussion was then adjourned, and was resumed on April 12th, 1915.

Dr. E. HOWARD TRIPP said that the drying of septic-tank sludge was a very slow process, and it was quite common to find about 60% of water even in pressed cake. In the case of the Dickson fertiliser, the desiccation was very rapid and very effective. The Dickson fertiliser again was absolutely sterile after it had been made, whereas that was not the case with the septic tank sludge. Preliminary experiments with the fertiliser had given very favourable results, and it had now been arranged that systematic plot tests should be carried out at one of the foremost agricultural institutions in this country.

They did not centrifuge the raw sludge, because about 50% of the nitrogen, normally present in the sludge, was lost when the effluent was centrifuged. The nitrogenous matter was broken down, and went into solution. It was believed that the changes induced by the yeast were beneficial, and produced a fertiliser which was not to be obtained by other means.

The Ter Meer centrifuges referred to by Dr. Rideal only reduced the water content to 70%, which could not be called drying sludge. They could with a Dickson centrifuge get down to 20% of moisture, or less if necessary. The amount of desiccation effected would depend upon the fineness of the medium and the speed of rotation, but there was naturally an economical limit, beyond which it was not feasible to go. He understood that the Ter Meer centrifuges had not found application anywhere outside Germany, and that the residual sludge was about as difficult to deal with as the original sewage, and the effluent from such machines constituted a problem in itself.

A contact bed was not absolutely necessary, but advisable, as it enabled the work of the first hydro, namely, super-saturation of the effluent with oxygen, to be utilised. The oxygen of super-saturation in the effluent acted very rapidly indeed in the contact bed, and the rate of flow through the contact bed was about 500 times the normal rate of flow for a normal contact bed. Hence only a very small bed was necessary.

Mr. F. R. O'SHAUGNESSY said he had made some experiments with a moderately strong sewage, and the results obtained on passing this sewage through the "Hydro-centrifugal machine" were as follows:—

(Results in parts per 100,000.)

	Suspended Solids.	Colloidal Solids.	Fec. Amm.	Albd. Amm.	Oxygen Absorbed.		
					Unset.	Set.	Clarified.
Sewage before treatment	6.5	10.5	4.02	1.12	20.45	15.65	14.31
Effluent from "Hydro"	1.5	5.5	3.95	0.96	19.45	15.65	14.42
Eff. 12 ins. sand after "Hydro"	2.0	5.5	3.85	0.70	18.14	15.13	13.83

The three-minutes oxygen absorbed figures corresponded with the above results, and showed conclusively that the purification in the machine was almost negligible. The behaviour of the machine and the appearance of the sand in the "Hydro" indicated that a portion of the solids was retained on the sand, which quickly choked up. Further experiments with the two principal constituents of sewage, viz., urine and faecal matter, made into aqueous mixtures corresponding to those found in sewage, showed that little oxidation (if any) had taken place in the machine. In passing the faecal emulsion through the machine, the sand very quickly choked up and rendered the machine useless. The apparent purification was due to the abstraction of solid matter by the sand, which became covered with sticky colloidal matter.

This operation, which produced such a negligible purification, appeared to cost about as much as the whole of the operations needed to purify the sewage completely by one of the well-known and well-tried methods at present in general use, together with the cost of sludge disposal.

The utilisation of sludge as a manure was an economic question. It was generally admitted now, that to attempt to recover the manurial elements of the soluble portions of sewage on a large scale in this country on land directly was impossible. That ruled out more than 50% of the manurial elements present in sewage, and, of course, by far the most easily available. The remainder, i.e., the sludge, had been washed most thoroughly by its long contact with water, and therefore anything that was immediately available was carried away. In his own experiments in the fermentation of sewage sludge, he had found that something like 25% of the organic nitrogen in the sewage sludge—and this was true of the organic matter generally—was broken down by biological action. The other nitrogenous elements were extremely stable, and would last for an indefinite time without any very apparent diminution. The net result was that sewage sludge as a manure could only be considered in the nature of a filler, when mixed with really valuable fertilisers, such as phosphates and potash salts. All the experimental evidence which had been produced up to date showed that the nitrogen of sewage sludge could only be recovered in one way, namely, by destructive distillation. At Birmingham the preliminary treatment consisted in digesting the sludge in order to destroy its objectionable characteristics (see this J., 1914, p. 3). That process was going on at the present time on an enormous scale, and was treating successfully the sludge of one million people. The final product resembled peat, and had given satisfactory results in producer-plant. By means of that process, they could get substantial nitrogen recovery in the shape of ammonium sulphate, together with tar, producer gas, and other products.

Dr. TRIPP, in reply, said with regard to the working of the hydro-extractor, it was very obvious that the figures that Mr. O'Shaughnessy had put forward were in marked and violent contrast to such figures as were obtained in Winnipeg. He did not think it was quite right to take a solution of urine in doing experiments of this kind. Sewage as obtained at the outfall and at the sewage works was very different in composition to that which originally went into the drains, e.g., there would be no urine left as such, owing to the enormous amount of change it would have undergone in the sewers. He had heard very little about the centrifuge tests at Birmingham. He understood that the centrifuge was the first one of a new type and did not do its work completely, because it was enclosed in an encasement which had not been provided with perforations, so that the air which came through with the water could not escape; hence a back pressure resulted, and clogging took place. Further, it was not intended that a raw sewage, especially of the character of the Birmingham sewage, should be passed into such a machine without preliminary precipitation. A centrifuge had been in use at Dublin for some time past, and another in Yorkshire, and in every case the information had been that they had worked successfully. In the residual nitrogen of ordinary sewage sludge the agricultural chemist was up against a tough proposition. He agreed with Mr. O'Shaughnessy as to the value of

ordinary sewage sludge; but he did not see what bearing that had upon the fertiliser produced by the Dickson process. The argument from analogy was always a dangerous one, and in the present case there was no degree of similarity between the two products.

Meeting held at Burlington House on Monday April 12th, 1915.

PROFESSOR W. R. HODGKINSON IN THE CHAIR.

Further exhibits were shown by the Worcester Porcelain Company of crucibles, etc.

Mr. MORSON produced samples of kapok (*Bombax malabaricum*), of which the best quality, from Java, was used in life-saving jackets, having a sustaining power much higher than that of the inferior qualities. Other kinds came from Ceylon, Calcutta, and Bombay. The prices varied from about 1½d. to 8d. per lb. The inferior qualities were apt to be adulterated with waste cotton, and so on; cotton was stained more deeply by iodine than kapok, and in that way it could be differentiated. Kapok was also beginning to take the place of eiderdown. Vermin would not go near it. It was of no use for weaving or spinning. It was often adulterated with *Culotropis procera*, which had been proved to be quite useless.

Dr. R. ROBERTSON said that one way of distinguishing between kapok and cotton was to submit it to such a process as that of Messrs. Cross and Bevan for estimating resistant cellulose. Cotton, after having been subjected to this process, would have somewhere about 95%, but the kapok only about 50% of resistant cellulose.

Mr. W. F. REID said he had made a great many tests of kapok. He had nitrated and made guncotton of it, and had found that the nitro-cellulose was probably not stable, but cellulose could be obtained from it in very large quantities. The bulk of it came from Java originally; but in West Africa there was an inferior kind produced from a creeper. The pods were nearly the size of a cocoa pod, and each contained a large quantity of fibre. The vine yielded a little rubber. When he was technical expert to the Royal Aero Club, he had suggested that the cars of the balloons should be lined with the material. The water-repellent power was in inverse proportion to the quality of the fibre as indicated by its market price. The yellowest varieties were the best for the purpose. It could be immersed in water for a week or two, and the water would not penetrate it. The fibre was also very brittle. If it were grown in large quantities, it might be used as a source of cellulose for paper, and similar purposes, as it was cheaper to grow than cotton; but it would first be necessary to extract the resinous matter in it, which repelled water: it was a kind of wax which could be extracted very easily, and might even be used commercially.

Meeting held at Burlington House, on Monday, May 3rd, 1915.

PROF. W. R. HODGKINSON IN THE CHAIR.

THE FUNCTION OF LITHARGE IN THE VULCANISATION PROCESS.

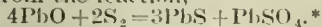
BY HENRY P. STEVENS, M.A., PH.D., F.I.C.

LITHARGE is an ingredient of a large class of rubber goods, of which boot, shoe, and golosh compounds are of especial interest. In the manufacture of

these goods the proportion of sulphur is kept very low in order to prevent sulphuring of the articles after vulcanisation, and the proportion of litharge is frequently very high.

It is well known that certain minerals, such as magnesia, antimony sulphide, etc., as well as litharge, promote vulcanisation when incorporated in the rubber mixing. Technically the result obtained is a correctly vulcanised product in a shorter time or at a lower temperature than would have otherwise been necessary. The state of vulcanisation is judged by the ageing qualities and the physical qualities generally. It is known that these are correlated with the coefficient of vulcanisation, that is the percentage of "combined" sulphur when calculated on the rubber in the product. Too high a coefficient of vulcanisation points to an overcured product, and too low a coefficient to an undercured one. The correct coefficient would probably vary with the raw rubber and possibly also with the type of mixing. I have usually found that for soft rubber mixings a figure of about 2.5 to 3 corresponds with the optimum physical condition of the freshly vulcanised rubber. This figure should be borne in mind when interpreting the results in the following tables.

The effect of litharge in promoting vulcanisation is usually attributed to the rise in temperature resulting from the reaction,



The investigation of this subject presented various difficulties, especially in the way of analysis, and it became necessary to work out a method for determining the sulphide and sulphate sulphur in the vulcanised product.† It was found that, after the rubber had been thoroughly swollen in a solvent such as ether, it was possible to decompose the sulphide completely by warming with acid and to collect and estimate the hydrogen sulphide evolved, whereas the sulphate formed was removed by extraction with strong hydrochloric acid in the presence of the solvent. The amount of sulphate obtained was invariably less than would have been expected from the above equation, and it is possible that part of the rubber was oxidised and a smaller proportion of sulphate to sulphide produced.

This new method for the analysis of vulcanised litharge mixings was applied to a series containing the same amounts of raw rubber (100 parts) and sulphur (5 parts), with increasing proportions of litharge. One part of sulphur is almost exactly the amount required for the conversion of 7 parts of litharge to lead sulphide (or sulphate). Taking the figure 2.5 as the coefficient of vulcanisation of the rubber, it follows that a mixing with the above proportions of rubber and sulphur, together with $17\frac{1}{2}$ parts of litharge, will contain sufficient sulphur to vulcanise correctly the rubber, and at the same time to convert the whole of the litharge into lead sulphide. When the mixing contains a larger proportion of litharge than this, there will be insufficient sulphur to vulcanise fully the rubber and to convert the whole of the litharge to lead sulphide. Under these latter conditions one would expect the rubber and litharge to compete for the sulphur present, and the distribution of the sulphur between them should throw much light on the changes taking place during vulcanisation. If rubber and litharge should be more or less equal in their avidity for sulphur, this will allow the employment in practice of a very large proportion of litharge without danger of over-curing the goods, provided that the amount of sulphur is restricted. The figures in the following tables bear out this view and show that the coefficient of vulcanisation falls when the proportion of sulphur

is insufficient to convert the whole of the litharge to lead sulphide, and at the same time leave sufficient to cure the rubber fully.

The list of the mixings employed is given in the first table. The table also shows the amount of sulphur required to convert the whole of the litharge present to lead sulphide, and the percentage of sulphur as calculated on the whole mixing. The rubber employed was an air-dried plantation sheet rubber of good quality.

TABLE I.

No.	Rubber.	Sulphur.	Litharge.	Sulphur required to convert litharge to PbS or PbSO ₄ .	S in mixing
1	100	5	nil	nil	% 4.76
2	100	5	7	1	4.46
3	100	5	14	2	4.20
4	100	5	17.5	2.5	4.08
5	100	5	21	3	3.97
6	100	5	28	4	3.76
7	100	5	35	5	3.57
8	100	5	42	6	3.40
9	100	5	56	8	3.11
10	100	5	70	10	2.86

Tables 2 and 3 give the figures obtained on analysis of the vulcanised mixings. Two cures were made, one for 2 hours and one for 3 hours, at 132° C. The mixings were vulcanised in moulds between thin sheets of tin plates.

TABLE II.
Specimens cured for 2 hours.

No. of sample.	Percentage of sulphur found (calculated on whole mixing).				Percentage of sulphur calculated on raw rubber used.			
	Free sulphur.	Sulphur present as lead sulphide.	Sulphur present as lead sulphate.	Combined sulphur by difference.	Free sulphur.	Sulphur present as lead sulphide.	Sulphur present as lead sulphate.	Combined sulphur by difference.
1	3.84	nil	nil	0.92	4.04	nil	nil	0.96
2	2.43	0.61	0.10	1.32	2.74	0.68	0.11	1.47
3	2.00	0.73	trace	1.47	2.38	0.87	trace	1.75
4	0.77	1.17	trace	2.14	0.94	1.41	trace	2.62
5	0.87	1.25	0.17	1.68	1.10	1.58	0.21	2.11
6	0.53	1.31	0.22	1.70	0.70	1.74	0.29	2.27
7	0.18	1.46	0.35	1.58	0.25	2.04	0.49	2.22
8	0.07	1.62	0.41	1.30	0.10	2.38	0.60	1.92
9	0.07	1.73	0.40	0.91	0.11	2.78	0.64	1.47
10	0.07	1.47	0.30	1.02	0.12	2.57	0.53	1.78

TABLE III.
Specimens cured for 3 hours.

No. of sample.	Percentage of sulphur found (calculated on whole mixing).				Percentage of sulphur calculated on raw rubber used.			
	Free sulphur.	Sulphur present as lead sulphide.	Sulphur present as lead sulphate.	Combined sulphur by difference.	Free sulphur.	Sulphur present as lead sulphide.	Sulphur present as lead sulphate.	Combined sulphur by difference.
1	3.00	nil	nil	1.76	3.14	nil	nil	1.86
2	1.88	0.53	trace	2.05	2.11	0.59	trace	2.30
3	1.21	0.69	0.10	2.20	1.44	0.82	0.12	2.62
4	0.27	0.86	0.20	2.75	0.33	1.05	0.25	3.37
5	0.48	1.00	0.13	2.36	0.61	1.20	0.16	2.97
6	0.39	1.13	0.23	2.01	0.52	1.50	0.30	2.68
7	0.22	1.43	0.28	1.64	0.31	2.00	0.39	2.30
8	0.06	1.70	0.37	1.27	0.09	2.50	0.54	1.87
9	0.04	1.86	0.34	0.87	0.06	3.00	0.55	1.39
10	0.07	1.74	0.30	0.75	0.12	3.04	0.53	1.31

* Esch and Anerbach, Ueber die Wirkung des Bleioxyds bei der Heissvulkanisation des Kautschuks, Gummi-Markt, 1911, p. 123. Also Seidl, Gummi-Zeitung, 15, 710 and 748.

† Stevens. Paper read before the Society of Public Analysts.

Sample 1, containing no litharge, was inserted for purposes of comparison, although it was undercured in both instances. The combined sulphur was checked by a determination on a separate portion of the specimen in some instances. The effect of treating the rubber with solvent and acid to liberate the sulphide sulphur causes a part of the vulcanised rubber to undergo decomposition, so that a portion of it and of the sulphur with which it is combined passes into solution. It is therefore necessary, in determining the combined sulphur directly, to include not only the sulphur retained by the residual rubber, but also any recovered from the solution in the solvent. The figures obtained with the first 5 specimens, Nos. 2—6 in Table III, were as follows:—

No. of sample.	%Sulphur in rubber residue.	%Sulphur in ether extract.	Sum of the foregoing being % of combined sulphur.	%Combined sulphur calculated on the raw rubber.
2	1.88	0.16	2.04	2.28
3	1.92	0.19	2.11	2.51
4	2.41	0.19	2.60	3.19
5	2.11	0.22	2.33	2.94
6	1.93	0.20	2.13	2.83

These figures agree sufficiently closely with those determined indirectly. Although the percentage of sulphur is calculated to the second place of decimals, it is not intended to imply that the figures are correct to more than one place of decimals. Where, however, it becomes a matter of adding together determinations of a number of constituents, the second figure has some significance. The last four columns in Tables II. and III. give the results as coefficients of vulcanisation, the corresponding percentage of total sulphur being 5 in all cases. The following conclusions may be drawn:—

(A) That the addition of litharge in moderate quantities increases the coefficient of vulcanisation as may be seen from comparing mixings 2, 3, and 4 with 1.

(B) That the maximum coefficient of vulcanisation for both cures is obtained with mixing No. 4, in which there is just sufficient sulphur to cure the rubber fully and to convert the whole of the litharge to lead sulphide and sulphate.

(C) That increasing proportions of litharge cause a progressive reduction in the coefficient of vulcanisation, a larger percentage of lead sulphide and sulphate being formed.

(D) That the percentage of free sulphur drops suddenly at the point where the rubber is fully cured. This corresponds with the appearance of the vulcanised specimens. Samples 1, 2, and 3 in both cures sulphured up in the ordinary manner. Samples 4—10 showed no sign of sulphuring up even after keeping for months. In both cures the free sulphur is lower in mixing No. 4 than in No. 5. This sudden break in the regular decrease in the figures for free sulphur was so remarkable that repeat tests were made by re-extracting fresh portions of the vulcanised rubbers. The figures given above are the mean of two results, *e.g.*, Mixing No. 4: percentage of free sulphur 0.30 and 0.25; mean, 0.27%. Mixing No. 5: percentage of free sulphur, 0.44 and 0.51; mean, 0.48%.

(E) That even with large proportions of litharge a little free sulphur always remains. The figures show some irregularity for mixings 9 and 10 in Table II. and mixing 10 in Table III. There is a tendency to an increase in the proportion of free sulphur and a reduction in the proportion of sulphur present as lead sulphide and lead sulphate. In Table II. the sulphur as lead sulphide shows a marked fall, and in Table III. the figure is practically stationary. Further experiments with

larger proportions of litharge are necessary to ascertain whether at this point a change takes place in the relative distribution of the sulphur, or whether the irregularities in the figures are purely accidental.

Newcastle Section.

Meeting held at Bolbec Hall on Wednesday, April 21st, 1915.

PROF. H. LOUIS IN THE CHAIR.

THE INTER-RELATIONSHIPS BETWEEN THE CONSTITUENTS OF BASIC SLAG.

BY S. H. COLLINS AND A. A. HALL.

The constituents of basic slag other than phosphorus have barely received due recognition. To a certain extent the value of the lime has been acknowledged and of recent years much has been made of the citric solubility test, but otherwise little attention has been paid to the other constituents.

Analytical methods.—For the general analysis about two or three grams was treated with about 40 c.c. of strong hydrochloric acid and a few drops of nitric acid in a wide, flat-bottomed dish and evaporated to dryness. When dry the mass was again treated with a smaller quantity of hydrochloric acid and evaporated a second time, after which the residue was dissolved in hydrochloric acid and water, filtered, and washed into a half-litre flask and made up to that volume. The phosphates were precipitated from 25 c.c. or 50 c.c. of the above solution by the molybdate method and weighed as the blue compound obtained on heating the yellow precipitate. The weight multiplied by 0.01 gives the weight of P_2O_5 . A separate amount of 100 c.c. of the solution of slag was treated with citric acid, ammonia, acetic acid, and ammonium oxalate to precipitate calcium, and the filtrate treated with much ammonia to precipitate magnesium as magnesium ammonium phosphate. For estimating manganese a separate quantity of the slag solution was treated with much barium carbonate, filtered from the precipitate of ferric phosphate, etc., and the manganese titrated at the boiling point with permanganate solution. The iron was determined by titration with titanous chloride using thiocyanate as indicator. The vanadium was determined in a special sulphuric acid solution by first oxidising with permanganate and then titrating with ferrous sulphate, using potassium ferrocyanide as external indicator.

The citric-soluble constituents were determined by Wagner's method. The fineness is the percentage passed by a standard sieve containing 10,000 meshes to the square inch.

The available lime is the lime soluble in citric acid which exceeds the amount of lime necessary to combine with the phosphoric acid soluble in citric acid to form $Ca_3P_2O_8$. That is, the citric-soluble lime and phosphoric acid are redistributed so as to be represented by the citric-soluble tricalcium phosphate and available lime. The sum of the first pair equals the sum of the second pair.

The correlation amongst the constituents.—The results of analysis shown in Table I exhibit certain relationships. The most interesting point is to consider the relationships occurring between the citric solubility and the general composition. As it is desirable to obtain as many data as possible

when working out coefficients of correlation, we have included many results from partial analyses not in the table now published. Since the coefficients thus calculated will differ in reliability according to the number of figures used, the probable errors of these coefficients have also been determined.

The coefficient of correlation is determined from the formula:—

$$r = \frac{\sum xy}{\sqrt{\sum x^2 \sum y^2}}$$

where x is the departure from the mean of the citric solubility and y is the departure from the mean of the fineness or other property supposed to be correlated.

When correlation is perfect the formula works out to be equal to unity, when there is no correlation the result is zero, and when the quantities move in opposite directions the result has a minus sign.

The probable error of the coefficient is calculated from the formula:—

$$\mu = \frac{0.674 (1 - r^2)}{\sqrt{n}}$$

in which r is the coefficient and n is the number of pairs which are correlated.

The correlations may also be represented by a graph, as has been done in the accompanying diagram for the case of the correlations between the citric solubility and the lime or magnesia. When the single tests are plotted, the resulting form is too scattered to admit of any clear interpretation. If, however, the results of the analyses are placed in the order of citric solubility and then averages taken of each consecutive ten analyses and the averages plotted, as in Graph 1, then a definite figure shows. The curves are only very rough, but show that there is a strong correlation between the citric solubility and the lime or magnesia. The coefficients of correlation corresponding to this graph are +0.52 for the lime and -0.31 for the magnesia.

The correlation between the citric solubility (see Table 3 and Graph 1) and the lime is very striking and shows that a high lime content and a high citric solubility are very intimately connected. This remark evidently applies only to slag, since Robertson has shown* that in other cases the opposite holds true. The correlation between citric solubility and fineness is to be expected, but that the lime content has more influence on citric solubility than has the fineness is hardly a foreseen result. The evil influence of silica is strikingly represented by the substantial figure -0.35, a result that has certainly surprised the authors. Magnesia appears to hinder the solution of a slag in citric acid, but unfortunately the importance of magnesia was not recognised when these investigations started ten years ago, with the result that fewer analyses are available and the probable error is in consequence larger. Manganese, iron, and vanadium may be dismissed as having no important influence on the citric solubility. That there is a correlation between the citric solubility and the total phosphates may be explained in many ways. High grade phosphates fetching a high price per ton are likely to receive more attention from the manufacturer than those slags which fetch a lower price per ton, the correlation may be the result of finer grinding of the richer slags and, of course, if there is more phosphate there is less of the other constituents and therefore less matter to obstruct the action of the citric acid.

The correlation between the hay crop and the constituents of the basic slag.—During the ten years

from 1904 to 1913, fifteen plots of land have been experimented with, the records of which have been published in the Cockle Park Guides, compiled by Professor Gilchrist for the Northumberland Education Committee. On these plots eleven different slags have been used, the analyses of which may be found in Tables 1 and 2. The analyses of the soils of the plots are given in Table 5 and the abstract of the crop of hay yielded in Table 6, fuller details of which are published in the Cockle Park Guides alluded to above.

The soils in these experiments varied from a fairly heavy Boulder Clay to a medium loam, but were uniformly poor in phosphates, not too well supplied with lime, and rich in humus. The crop was in most cases a permanent pasture manured at the rate of 50 lb. of phosphoric anhydride (P_2O_5) per acre per annum, and in the other cases was a three years seeds hay manured at the rate of 200 lb. of phosphoric anhydride per acre per three years.

For the purpose of calculating the coefficients of correlation, the departure from the mean weight of crop in any one year from two or three different slags was taken as " x " and the departure from the mean amount of any one constituent of two or three slags used to produce the above crop was taken as " y " in the formula given above.

The results so obtained are given in Table 4, where may be found not only the correlations of the constituents of the slags shown in Tables 1 and 2, but also the correlations of certain ratios calculated from the constituents. It will be at once seen that the coefficients of correlation are far less striking than those given in Table 3. The best are the ratios at the foot of the table. If, however, we consider, not the individual coefficients, but the general tendency of the coefficients, we shall obtain an accumulation of evidence. Percentage of phosphates, total, soluble, or insoluble, all show positive correlations, whilst the ratio, anything to phosphates, shows a minus coefficient. Generally speaking there is a uniform result, that is, eight for and none against, that a high percentage of phosphates is a good thing to have in a slag. The results for lime are not quite uniform. The actual "citric solubility" of the slag shows only trifling positive results, though the percentage of citric soluble phosphates shows a better figure. If, however, we group results we find that all the four "constituents" depending upon extraction of slag by a 2% solution of citric acid agree in giving positive correlation, and thus we have cumulative evidence that the "citric solubility" methods of analysis have a general value, though we do not feel inclined on present evidence to consider any particular test as having a proved value.

As the actual returns of hay are expressed in terms of pounds per acre, it is desirable to know the results of the constituents of the slags also in terms of pounds per acre. Since the slags were applied in amounts such as were necessary to supply the same amount of phosphoric acid per acre, the actual weights of lime, etc., applied per acre will be in strict proportion to the ratios, lime, etc., to phosphoric acid; therefore the coefficients of correlation between the yield of hay and the pounds of lime, etc., applied per acre will be exactly the same as the coefficients of correlation between the yield of hay and the ratio $CaO : P_2O_5$, etc., as already given. Since, however, the percentage of phosphates in the slags has a positive correlation, any ratio which includes the reciprocal of the percentage of phosphoric acid is bound to be depressed and may very easily be actually minus, as occurs in the present case. These field trials were originally constructed to test whether slags with a high percentage of phosphates were better or worse

* This Journal, 1914, 33, 9.

TABLE 1.
Analysis of Basic Slag.

No.	1602.	1603.	2289.	2290.	2291.	2688.	3044.	3045.	3046.	3047.
Total P_2O_5	12.60	20.49	18.03	9.09	12.55	19.58	17.63	17.57	19.34	19.35
$Ca_3P_2O_8$	27.50	44.92	39.32	19.82	27.39	42.70	38.46	38.34	42.21	42.24
SiO_2	17.69	10.12	10.12	13.49	14.51	13.75	7.85	7.77	12.18	12.12
CaO	38.02	46.81	43.04	40.43	46.58	46.63	52.00	52.22	45.51	44.75
MgO	4.24	2.92	3.56	5.01	2.47	2.21	1.88	1.94	0.16	0.11
MnO	7.39	4.38	4.54	5.41	3.61	5.70	9.37	9.37	4.26	4.68
Fe	12.89	9.98	12.97	13.83	10.19	8.88	8.13	8.13	9.03	9.10
V	0.48	0.66	0.45	0.23	0.24	0.33	0.32	0.38	0.34	0.30
Citric soluble P_2O_5	10.04	14.39	13.36	6.01	11.67	14.58	15.58	15.78	15.42	15.54
$Ca_3P_2O_8$	21.91	31.45	29.16	13.11	25.50	31.84	33.95	34.39	33.61	33.86
CaO	32.50	31.68	30.84	28.69	33.80	32.53	39.97	40.14	33.48	32.96
Available lime	20.63	14.62	15.04	21.59	19.97	15.27	21.60	21.53	15.29	14.64
Citric solubility	89	70	74	66	93	75	88	90	80	80
Fineness	85	88	90	95	90	90	78	77	82	82
Reducing power (FeO)	13.63	7.31	12.40	13.24	5.78	11.40	8.20	8.10	10.80	10.70

than slags with a low percentage of phosphates, when applied so as to give the same amount of phosphates per acre. The examination of these results shows clearly that the high percentage phosphates give the better results. When, however, we attempt to extract further information from these field trials so as to find out the values of lime, etc., we are met with the difficulty that the success of the experiment, from the point of view taken when the trials were designed, hides the effects of the other constituents of the slags and renders interpretation difficult.

The balance between the constituents of slags.—If the results just given are plotted, the data are too scattered to show much relationship, but curves may be drawn by arranging the data in order of the percentage of constituent below or above the mean and then averaging ten consecutive results. In most cases, such as those in Graphs 2 and 3, where any clear figure results, an optimum point is shown, and as a rule this optimum is not very far removed from the mean composition of slags as here published. It is hardly likely that the exact composition suitable for Cockle Park is also the best elsewhere, but the almost regular recurrence of an optimum point in the curves suggests that there is a certain balance needed in a slag. Probably a slag of medium composition is better than a slag of abnormal proportions.

Recent bacteriological research has shown that the balance of ions in solution is important in bacterial growth, and it seems not improbable that the rate of nitrification or some other bacterial process may be influenced by the balance of constituents in the slags. So far as we can judge at present, the average slag seems fairly well balanced. There is, however, no evidence that there is any particular constituent or property of slag, excepting of course the total amount of phosphates, that can be set apart as having an importance much greater than any other such constituent or property. Indeed, the evidence is all the other way. Very many of the constituents, such as magnesia, manganese, and iron, appear to have an influence and not merely a direct influence on crop production, but that the balance of these constituents is also important. Such a problem needs far more data than was anticipated when these investigations were commenced, but

TABLE 2.
Composition of Slags.

	2684.	2716.	x.
Total phosphate	35.89	39.97	41.3
Total lime	50.01	50.60	43.0
Citric solubility	95	89	89
Fineness	88	70	90

TABLE 3.

Coefficients of correlation between citric solubility and the constituents of slags.

Constituent.	Coefficient of correlation.	Probable error \pm .
Phosphates	+0.26	0.09
Silica	-0.35	0.10
Lime	+0.54	0.07
Magnesia	-0.31	0.12
Manganese	+0.17	0.14
Iron	+0.17	0.14
Fineness	+0.36	0.08

TABLE 4.

Coefficients of correlation between the yield of hay and the properties of slags.

Property of slag.	Coefficient of correlation.	Probable error \pm .
Phosphates	+0.13	0.09
Silica	-0.05	0.09
Lime	-0.06	0.09
Magnesia	-0.15	0.10
Manganese	0.00	0.10
Iron	+0.02	0.10
Citric soluble phosphates	+0.11	0.09
Citric soluble lime	+0.15	0.09
Available lime	-0.19	0.09
Citric solubility	+0.03	0.09
Citric insoluble phosphates	+0.10	0.09
Fineness	+0.06	0.09
Ratio CaO : P_2O_5	-0.20	0.08
MgO : P_2O_5	-0.26	0.10
MnO : P_2O_5	-0.20	0.10
Fe : P_2O_5	-0.25	0.10
SiO_2 : P_2O_5	-0.21	0.09
CaO : MgO	+0.06	0.10

TABLE 5.

Composition of soils.

	Maximum.	Minimum.	Mean.
Stones	% 7	% 0	% 2
Organic matter	11	6	8
Silica and silicates insoluble in hydrochloric acid	85	75	80
Soluble in hydrochloric acid:—			
Iron oxide and alumina ..	10	8	9
Lime	1.0	0.3	0.5
Potash	0.4	0.2	0.3
Phosphoric acid	0.12	0.04	0.07
Soluble in citric acid:—			
Lime	0.84	0.16	0.35
Potash	0.026	0.007	0.010
Phosphoric acid	0.013	0.002	0.006
Nitrogen	0.23	0.13	0.16
Calcium carbonate	0.42	0.003	0.01

TABLE 6.
Crops of hay obtained by manuring with different slags.

Experiment A.		
Slag.	1602.	1603.
Year.	Cwt. of hay.	
1904	20.0	19.5
1905	15.8	14.5
1906	29.5	28.2
1907	36.2	32.2

Experiment B.		
Slag.	2290.	2289.
Year.	Cwt. of hay.	
1908	22.8	20.2
1909	26.5	25.2
1910	25.0	22.5
1911	14.0	14.0

Experiment C.		
Slag.	2290.	2291.
Year.	Cwt. of hay.	
1912	20.2	28.8
1913	21.5	24.0

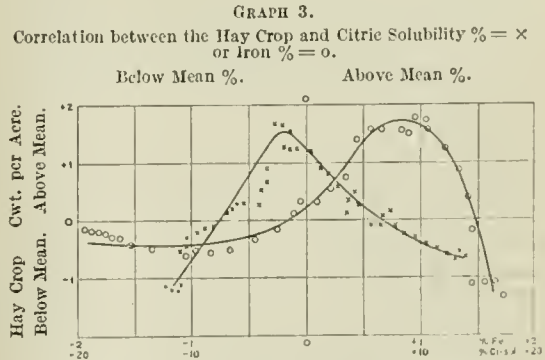
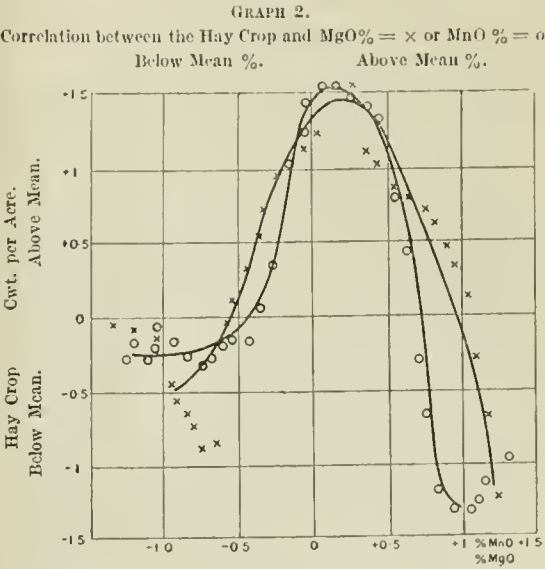
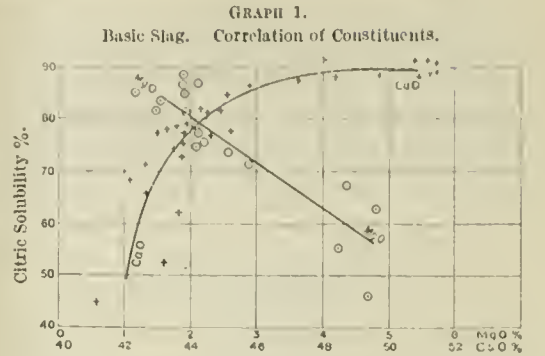
Experiment D.			
Slag.	2289.	2291.	2290.
Year.	Cwt. of hay.		
1908	9.1	8.0	7.1
1909	35.9	35.4	31.8
1910	18.5	18.9	15.0
1911	19.2	17.0	17.0
1912	41.2	33.2	30.0
1913	19.5	18.0	15.8

Experiment E.			
Slag.	2688.	2716.	2689.
Year.	Cwt. of hay.		
1911	25.5	26.5	24.0
1912	42.0	40.0	41.2
1913	50.5	52.5	49.8

Experiment F.		
Slag.	x.	2290.
Year.	Cwt. of hay.	
1912	35.2	39.2
1913	48.2	50.0

Experiment G.			
Slag.	3044-5.	3046-7.	2290.
Year.	Cwt. of hay.		
1913	43.5	44.2	43.5

the authors think that this knowledge is well worth having, even if incomplete. Experiments are still in progress, and as evidence accumulates it will be possible to discover more exactly what is the proper balance between the constituents of slags.



Conclusion.—It is quite well known that such substances as magnesia and manganese influence the cropping power of a soil, and it is known, though perhaps not appreciated, that these constituents vary considerably in slag. The most important constituent of slag is undoubtedly the phosphate, but in attempting to discover the constituents of secondary importance, the authors believe that no general investigation has been attempted, research having been restricted to one or two points. The wide attempt here made to find out the most likely ingredient to rank in the second place of importance, shows that even if these be all taken into account something more will be needed to give a fair presentation of the facts of the case. Not merely do many other

constituents appear to have a value, but there seems much reason for supposing that a balance of the secondary constituents is needed. In other words, medium proportions of magnesia, manganese, and iron are all useful, but extra large proportions harmful. The citric solubility of slags is correlated with the constituents of slags in such a manner that it may form a useful test, provided that its arbitrary and conventional character is recognised.

New England Section.

Meeting held at Boston, Mass., on Friday, March 19th, 1915.

MR. C. L. GAGNEBIN IN THE CHAIR.

FACTORS INFLUENCING THE STABILITY OF HYPOCHLORITE SOLUTIONS.

BY MARTIN L. GRIFFIN AND JOHN HEDALLEN.

The experiments recorded in this paper were carried out to determine the influence of various factors on the stability of solutions of calcium hypochlorite. For this study it is important to use exact methods for determining chlorine in its various forms. We have, therefore, reviewed and tested in this connection the most approved methods for doing this, which we believe will bring some fresh knowledge to this subject.

Bunsen's method.—A definite volume of bleach liquor is delivered into an excess of potassium iodide, acetic acid is added, and the liberated iodine titrated with sodium thiosulphate. This method gives the most accurate results and is a very rapid one. The only objection to it lies in the cost of potassium iodide and the somewhat unstable nature of the thiosulphate solution.

Penot's method consists in titrating a known volume of the bleach with an alkali arsenite solution, using iodide and starch as indicator. This method is not very well adapted to a plant where a number of titrations have to be carried out in a short time. Since the end-point is unknown it is necessary to take out a number of samples before the titration is completed, and finally, a check test has to be made in order to get an accurate result.

A modification of this method, by Mohr, consists in adding an excess of arsenious acid and titrating the excess with standard iodine. It has been claimed that these two methods work very well with solutions of chloride of lime, but that much trouble has been experienced in titrating the available chlorine in bleach made by passing chlorine gas into an excess of milk of lime, owing to the presence of free hydroxide, which would produce sodium carbonate when titrated with arsenious acid made alkaline with sodium bicarbonate. Further, it is claimed that the time factor will influence the titration results. We have not been able to verify any of these statements.

To examine the different methods mentioned for the determination of the available chlorine, a number of tests were made of electrolytic bleach liquor and of that made from bleaching powder with carefully standardised normal solutions. The comparative tests on the same sample were carried out at practically the same time, care being taken that conditions in each case remained the same. The same pipette was used in the same manner and the normal solutions were delivered into the sample to be tested at the same rate as when standardised.

To ascertain whether the amount of iodine used in Mohr's process had any influence upon the titration, the same sample was tested with 2, 5 and 10 c.c. excess arsenious acid.

The titration results with Penot's and Mohr's methods were in every case about 0.6% lower than those with the Bunsen method, and there was no indication that the electrolytic bleach liquor behaved differently from bleach liquor made from the powder.

The methods of Penot and Mohr in each case gave reasonably concordant results, and the amount of iodine introduced in Mohr's process was without influence upon the results.

We have further ascertained that the length of time used in titrating the samples is without influence, provided proper correction is made for the adhesion of the normal solution to the burette.

The method used for the analysis of a mixture of hypochlorite, chloride, and chlorate is that described in Sutton's "Volumetric Analysis" (10th ed., p. 178). The process is at once expeditious and accurate. All the determinations are performed successively upon the same solution.

In the daily bleach plant analysis, it is hardly necessary to determine the chloride and chlorate separately, since it is only necessary to know the availability of the liquor or the relation between the available and total chlorine. The method can therefore be shortened as follows:—Pipette 5 c.c. of the liquor to be tested into a pressure flask and add about 25 c.c. of a solution containing 40 grms. per litre of ferrous ammonium sulphate and 40 c.c. of sulphuric acid. Heat to about 100° C., cool slightly, and then add the silver, filter, wash the precipitate, and titrate the excess silver with thiocyanate as in the original process. The available chlorine is determined in a separate sample by the Bunsen method.

In the manufacture of calcium hypochlorite a certain excess of base must be present, otherwise the bleach liquor will chlorinate at once, producing a colourless or pink liquid according to the degree of chlorination, the pink colour being due to manganese.

In laboratory experiments 5% excess base will, as a rule, give a perfectly stable liquor with an availability of about 98% even after three days standing. In practice a larger surplus is required because, on a large scale, it is difficult to keep the concentration of the base and the volume of the feed regular, and as much as from 25 to 30% excess is ordinarily used. This excess of lime separates from the liquor upon standing, and is called sludge. In the following tests, approximately 10% excess base has been used, calculated on the total chlorine in the liquor. The availability obtained with lime alone as a base is taken as a standard in comparing the results.

Lime sludge.

The considerable excess of lime used in the manufacture of calcium hypochlorite can be used over again to advantage under certain conditions. It differs from fresh lime in that it does not possess the same ability to form a stable hypochlorite, though the excess of calcium hydroxide be the same. This is mainly due to the impurities.

The following analysis gives the relative composition of lime and its corresponding sludge.

	Lime.	Sludge.
	%	%
CaO	96.5	81.0
MgO	1.0	5.5
Fe ₂ O ₃ , Al ₂ O ₃ , SiO ₂	2.5	13.5

To determine the effect of sludge upon the availability when used over again for the manufacture of hypochlorite several tests were carried out with varying amounts of sludge and fresh lime as a base. The free calcium hydroxide in the sludge used was determined gravimetrically. The results are given in the following table, from which it may be seen that in the first four tests respectively 100, 75, 50, and 25 % sludge was used in conjunction with 25, 50, and 75 % fresh lime.

Availability of bleach liquor solution with varying amounts of sludge and fresh lime milk.

Base.				Available chlorine (grms. per litre.)				Total chlorine (grms. per litre)
% Sludge.	% Lime.	Total Ca(OH) ₂ (grms. per litre)	% Excess.	Time made.	After 1 day.	After 2 days.	After 3 days.	
100	—	33.0	10.7	20.20	2.72	2.06	1.65	28.60
75	25	32.9	11.1	22.45	2.97	2.31	1.98	28.39
50	50	32.5	12.4	24.22	4.75	2.56	2.14	27.70
25	75	32.0	13.5	26.61	26.35	26.35	26.22	27.08
100	—	52.2	81	26.45	26.40	26.35	26.22	27.72
83	17	47.2	63	27.00	26.85	26.56	26.50	27.44
62	38	42.1	47	26.95	26.95	26.95	26.85	27.55
62	38	42.1	30	30.50	30.45	30.40	30.00	31.10
35	65	37.2	23.6	28.18	28.15	28.12	27.95	28.80

It will be seen from the table that the bleach liquor is unstable with sludge alone and with 75 and 50 % sludge when the excess base is only about 10 %. All of these samples turned pinkish shortly after being made, and after three days standing 16.5 % of the total chlorine had been converted into chlorate. The fourth sample with 25 % sludge and 75 % new lime gave a stable liquor of 96.8 % availability after three days standing. These results correspond to what we have found in practice.

These tests were repeated with the same amount of new lime but with a more concentrated sludge. In this case we found, as shown in the table, that sludge alone, as well as 75 and 50 % sludge, will give a bleach liquor of a fairly high availability when well protected by an excess of calcium hydroxide, even in the form of sludge.

Influence of aluminium, magnesium, and iron hydroxides.

The impurities occurring in ordinary lime are aluminium, magnesium, and iron oxides; silica may be left out of consideration in this connection. To determine to what extent these impurities affect the availability of hypochlorite solutions, varying amounts of each were added, as freshly precipitated hydroxide, to the lime milk and the results noted on each of three succeeding days. The impurities added in each case were 2, 5, and 10 grms. of hydroxide per litre, the calcium base used being equivalent to 32.1 grms. per litre of Ca(OH)₂. Chlorine was led into these mixtures until the excess of calcium hydroxide remaining was approximately 10 %.

Considering first the influence of aluminium hydroxide, we find that as much as 2.0 grms. per litre is without influence upon the stability of the liquor in the presence of 10 % excess calcium hydroxide. Neither will an amount of 5 grms. per litre affect the availability, provided about 10 % excess base is left; however, in the case of 5 % excess calcium hydroxide, the availability drops rapidly, leaving only about 18 % of the chlorine as hypochlorite after three days standing. The solution is stable with as little as 5 % excess base in the absence of impurities.

In the case of 10 grms. per litre of aluminium hydroxide the availability is noticeably affected. Thus with 13 % excess base, the availability was

95.4 % after three days, and with 8.5 % excess, the available chlorine was reduced to about 20 % after three days. These experiments go to show that the influence of aluminium hydroxide largely depends upon how well the liquor is protected by the alkaline calcium base. Further, when as much as 10 grms. per litre of this impurity is added it will depress the availability of the hypochlorite solution even in the presence of a large excess of calcium base.

The magnesium hydroxide was added as Phillips' milk of magnesia. It has no influence upon the stability of calcium hypochlorite solutions in the presence of about 10 % excess calcium hydroxide. On the other hand it does not replace the calcium as a base; thus in the presence of 10 grms. of magnesium hydroxide per litre with an excess of calcium of only 0.5 %, the availability dropped to 37.6 % after 3 days.

Ferric hydroxide, on the other hand, even in small quantities, rapidly reduces the availability of the calcium hypochlorite solution, leaving a pinkish liquor; its influence is proportional to the amount added.

Stability of hypochlorite solutions with alkaline earths, alkali metals, and magnesium hydroxide as a base.—The bleach liquor samples in these cases were made in the same way as the previous ones. The temperature of the base, the concentration of the liquor, and the excess alkalinity were the same for each test. Both the alkaline earths and the alkali metals gave practically equally stable hypochlorite solutions, with an availability above 98 % after three days' standing.

The stability of the liquor obtained by leading chlorine into magnesium hydroxide (Phillips' milk of magnesia) is quite dependent upon the excess of free alkalinity. Thus, in the first test, where only half of the alkalinity was used up, 75.5 % of the total chlorine was present as hypochlorite after three days, while in the second test, where only 26.5 % of the total base was left as free alkali, the availability dropped rapidly to 7.9 %.

As a rule, it can be said that in leading chlorine into magnesium hydroxide under the same conditions as in the case of calcium hydroxide, the hypochlorite at first formed will change rapidly to chloride and chlorate with about 16 % of the total chlorine present as chlorate.

Bleach liquor made with magnesian lime as a base.—To show further the effect of magnesium hydroxide upon the stability of calcium hypochlorite solutions, a number of tests were repeated with ordinary magnesian lime containing calcium and magnesium in the proportion of 60 to 40, besides impurities to about the same extent as in the calcium lime used in these tests.

Stability of hypochlorite solutions with magnesian lime as a base.—In the first series of tests the total alkalinity of the base used was equivalent to 34.42

grms. of calcium hydroxide per litre, with an actual amount of calcium hydroxide of 18.5 grms. per litre. The first three samples gave a stable liquor of about 98% availability, since they contained a large excess of calcium base. In the three last samples the total chlorine exceeded the alkalinity of the calcium present; the availability of all of these samples dropped rapidly to about 7% after three days' standing.

A second set of tests was repeated with the object of determining more closely the relation between the excess calcium and the availability of the bleach liquor. When the total chlorine was equivalent to 90% of the calcium present the liquor was perfectly stable, while with 4.8% excess calcium base the liquor was stable for only one day, after which the availability dropped about 5% a day. Moreover, when the total chlorine was just equivalent to the calcium base the availability dropped regularly about 5% a day. In going beyond this limit the depression of the availability increased more rapidly.

In the two series of tests the calcium base used was only about half of what it had been in the previous tests with calcium lime as a base. A third set of tests was therefore carried out with magnesium lime. The total alkalinity of the base was 61.5 grms. per litre expressed as calcium hydroxide. In the first two samples the excess calcium was 10 and 5% respectively, and the availability of the bleach liquor 98% after three days. Into the next sample a trifle more chlorine

2. The magnesium hydroxide sustains the stability of the hypochlorite solutions to some extent when the excess calcium is between the limits of 0% and 5%.

3. Even a large excess alkalinity in the form of magnesium hydroxide is incapable of maintaining the stability of calcium hypochlorite when the calcium is exhausted.

4. The absorption of chlorine after the calcium is consumed is very incomplete.

5. When leading chlorine into a mixture of calcium and magnesium hydroxides no magnesium will go in solution before all of the calcium is exhausted.

In order to make this work more complete similar experiments were carried out using small amounts of all the elements of the iron group, including iron, chromium, manganese, nickel, and cobalt. In each case the bleach liquor was very unstable, even when well protected with an ample excess of calcium hydroxide.

Effect of temperature and concentration upon the stability of hypochlorite solutions.

To determine the influence of concentration upon the formation of hypochlorite and the stability of solutions of high density, chlorine was led into a suspension of calcium hydroxide of 172.6 grms. of $\text{Ca}(\text{OH})_2$ per litre until a concentration was reached of 105.5 grms. of total chlorine per litre, leaving 9.9% excess base.

Effect of temperature and concentration upon the availability of bleach liquor solutions.

(A). Concentration.

Base.		Strength of liquor.	Available chlorine (grms. per litre).			
$\text{Ca}(\text{OH})_2$ used (g. p. l.).	% Excess.	Total chlorine (grms. per litre).	Time made.	After 1 day.	After 2 days.	After 3 days.
172.6	9.9	150.5	147.88	146.90	146.20	145.00

(B). Temperature.

Base.		Temperature ° C.	Total chlorine (grms. per litre).	Available chlorine (grms. per litre).			
$\text{Ca}(\text{OH})_2$ (g. p. l.).	% Excess.			Time made.	After 1 day.	After 2 days.	After 3 days.
31.7	11.7	30	27.20	26.99	26.96	26.96	26.90
31.7	12.21	35	27.05	26.81	26.80	26.80	26.76
31.7	11.3	40	27.30	26.90	26.82	26.82	26.78
31.7	9.4	45	27.80	27.30	27.30	27.22	27.22
31.7	6.3	50	28.60	28.00	27.98	27.98	27.98
31.7	4.2	55	29.20	28.55	28.53	28.52	28.52
31.7	10.0	60	27.62	27.00	26.96	26.96	26.90
31.7	7.9	70	28.15	27.42	27.42	27.40	27.40
31.7	8.6	80	28.00	27.30	27.21	27.20	27.19
31.7	11.3	90	27.30	26.50	26.42	26.42	26.40

was led than corresponded to the alkalinity of the calcium present. This sample soon turned pinkish and the availability fell rapidly to 12.1%. In the other samples the total chlorine was gradually increased until the excess alkalinity dropped to 10%. The samples turned pinkish as they were made and smelled strongly of chlorine. The liquor proved very unstable. After three days the pinkish coloured samples contained 15% of the total chlorine in the form of chlorate.

The effects of magnesium upon hypochlorite solutions may be summarised thus:—

1. The magnesium hydroxide has no effect upon the availability of calcium hypochlorite solutions provided the liquor is protected by at least 5% calcium base.

The availability of this liquor as made was 98.2% and after one, two, and three days respectively, 97.5, 97.2, and 96.3%.

From these results it appears that the concentration of the liquor has very little effect upon its stability. Stable bleach liquor of lower densities is usually greenish in colour, while at a high density it is yellowish. Bleach liquor of course settles more slowly with increasing concentration.

The effect of temperature was next examined by leading chlorine into calcium hydroxide at varying temperatures, starting at 30° C., and increasing the temperatures by 5° up to 60° C., then increasing the temperature by 10° up to 90° C. The table shows the temperatures of the finished liquor.

The chlorine was led into the base at such a rate that the sample was finished in half an hour. The total chlorine and the excess base were in each case about the same.

From the table on the preceding page it is seen that even high temperatures have very little effect upon the availability, it being decreased only 2.2% by raising the temperature from 30° to 90° C.

Nottingham Section.

Meeting held at Nottingham on Wednesday, March 24th, 1915.

MR. JOHN WHITE IN THE CHAIR.

THE EDUCATION OF THE INDUSTRIAL CHEMIST OF THE FUTURE.

BY R. M. CAVEN, D.Sc., F.I.C.

I prefer to speak of the education rather than of the training of the future industrial chemist. So far as a distinction can be drawn between the two things, education develops incipient faculties, while training shapes mature powers. A trained man does what he is trained to do; an educated man brings an alert mind to new problems.

In the first place I would advocate breadth of view. A good part of the education and training of the industrial chemist is identical with that of other professional chemists.

For years to come a German training will be out of the question. This circumstance affords a splendid opportunity for our educational authorities to supply the lack, and to supply it so efficiently that nothing shall at length be lacking. The universities must realise the magnitude of their task, and, what is more important because more difficult, the British public and manufacturers must learn the meaning and value of scientific education.

No young man can learn to be a professional chemist by attending evening classes at a technical college after his day's work is done. A youth must give his best time, all his available time, to be educated for the profession.

Dignity must be added to the popular conception of the professional chemist in the future. When the importance of the work he can perform, and the extent of the education and training which will be required to fit him for that work, are fully recognised, then, it may be hoped, adequate remuneration for his services will be forthcoming.

The preliminary education of the future professional chemist should be liberal and good, and should include as a minimum a grounding in English, Mathematics, French, and German, if not Latin; early specialisation should be shunned like poison. My own very pronounced opinion is that instruction in elementary physics and mechanics should precede the teaching of chemistry, for the theoretical foundations of chemistry are laid in physics, and, to a less degree, in mechanics. It will be time enough for a lad's liking for chemistry to show itself during the last year or two years of his school course. No harm will be done if he proceeds to the university with a general love for science which has not yet expressed itself in the direction of chemistry. If, however, an early predilection for chemistry is encouraged at the expense of other studies the effect will undoubtedly be harmful.

When the chemistry student enters upon his college career, the important question arises as

to the fundamental principles that are to underlie his education and training. The easiest way for the teacher to go to work in class room and laboratory is to tell the student what he is to learn, and then see that he learns it, or to inform him what he is to do, and make him do it.

This is training without education; it is the method of the drill sergeant. It may be successful in forcing students through examinations, it certainly will be successful in killing originality and independence of thought, in turning students into automata, and making it impossible for them to become the industrial chemists of the future. Another way is to cause a student to embark on a voyage of discovery in unknown seas, without helmsman or pilot, in the hope that by long and perhaps bitter experience he will at length learn the principles of navigation, and succeed in steering his ship to port. This way is very likely to end in distress and eventual shipwreck; it is as little to be commended as the former way. A judicious combination of the two ways is the safest method of teaching.

Facts must be imparted to the student; he cannot discover everything for himself along the pilgrim way of the pioneers; yet the spirit of inquiry must be awakened in him from the first and kept active through his whole career. The easiest way to kill this spirit of inquiry is to overload the student with facts. Facts must be co-ordinated. Un-coordinated facts are best left in the text-books and chemical dictionaries until a use is found for them.

The same principle applies to the student's practical work. It has been a reproach of the teaching of qualitative analysis that the student's memory is filled with a pile of facts and directions which grows to alarming dimensions and has little, if any, educational value. These facts are often presented to the student in such a way that he gains no insight into the principles on which the group separations depend; and when he uses the analytical tables to "do salts," as he says, he employs them in an unintelligent way, with little true knowledge of the significance of what he is doing. Thus the chance of his becoming an intelligent analyst is jeopardised from the first, and the likelihood of his developing into a first rate research chemist is reduced to a minimum.

If a student is intelligent, and is being taught in the right way, his practical work should give rise to all sorts of questionings about chemical processes and reactions; and he may even propose to his instructor alternative methods of procedure. The idea may be very foolish, or it may be wise, and capable of development into something valuable. In any case the instructor will, if possible, answer the proposal with the injunction: try it. He is either a very stupid, or very inexperienced teacher who has never learnt anything from his students. Zealously to watch for, and wisely to nurture fruitful ideas should be amongst the most important responsibilities of the chemistry teacher of the future.

What is needful above and beyond all things else is an alert mind possessed of a scientific culture, a culture based on a broad and sure foundation of fundamental scientific principles. A man with such a mental equipment will discover principles where another man will merely observe, and perhaps imperfectly observe, phenomena. Such a man may have many failures in his early attempts to extend the bounds of our knowledge of chemical science, and to invent or improve processes of chemical manufacture; but these failures he will be content to regard as a preparation for eventual success.

It appears to me that whilst the industrial chemist should be thoroughly grounded in inorganic and organic chemistry, he should pay

particular attention to physical chemistry. For it seems that, except for the production of synthetic drugs, dyestuffs, and other organic substances, future advance is likely to be along the lines of the improvement in the preparation of known substances rather than the synthesis of new ones, and this will result from the novel application of recognised physico-chemical principles to known chemical reactions.

Perhaps the most important question to be faced in the final stages of the student's course is as to how far definite instruction in chemical technology should be attempted. If a student is to become a works chemist, it may be asked, should he not learn something about the construction and use of chemical plant while he is at college? It is true that he makes a superficial acquaintance with the elements of metallurgy and the methods of manufacture of acids, alkalis, and other products in an ordinary course of lectures; but is this enough? Should our universities and technical colleges lay themselves out to reproduce on a working scale models of the plant employed in representative processes of chemical manufacture, such as iron and steel making, the production of acids and alkalis, or the elaboration of coal tar products? One is tempted to ask at the outset how such a thing could be done, and also whether it would be of permanent value if it were done? Would not such working models soon be out of date? Would it be possible to keep pace with the improvements in and additions to chemical plant coincident upon advances in methods of manufacture?

Even if such a thing were attempted would it not go contrary to the methods of teaching I have tried to enunciate? These methods should concern themselves with principles rather than details. I can well believe, however, that a valuable course of lectures relating to chemical technology might be devised in which chemical reactions and the principles underlying them would be carefully classified and elucidated, and their application to modern processes of manufacture made plain. Such lectures might perhaps be accompanied by small scale experiments, here and there, and would be abundantly illustrated by diagrams of actual chemical plant.

Then I think that the final stages of the student's course might include some instruction in machine drawing and the principles of chemical engineering, as well as in metallography, and perhaps some practice in metallurgy.

It will no doubt be held by some that, since professorships of economics and commerce are being established in university centres, the future industrial chemist should avail himself of the facilities thus afforded for commercial training; though upon this question I cannot pronounce any opinion.

But, whatever courses of instruction are included in, or omitted from the student's curriculum, one thing should be kept ever in view: to develop power of initiative and resource, in view of new requirements and new opportunities, so that the coming industrial chemist may play a worthy part in the shaping of the future.

DISCUSSION.

Mr. F. H. CARR agreed that the most important thing needed by the industrial chemist was resource, which could only result in the brain that had been trained to alertness and in the habit of thinking on scientific lines and in a scientific way. Often the mental equipment of the so-called best trained men fell short of much that the college might have given them, and he thought one could detect that in the general attitude which manufacturers in this country took towards the chemist.

When a young man entered a works he was generally made to analyse, and the manager was anxious to protect his business from any foolish thing that this scientific person might promulgate. A fully trained chemist emerging from college, having only gone through a technical training, had to be some time in business, both in the factory and on the business side, in order to gain sufficient knowledge of the commercial aspect. The consequence was that the college student was not at first a very suitable person to advise on business matters and the result was that he was kept to analysis. For a post-graduate course he advocated a course of training in which the student was taught to carry out practical operations from the purely commercial aspect, to ascertain how to obtain the right yield of a product in a minimum of time, and to control a reaction when working first on a small scale and then on a much larger scale. He ought to learn to do the analytical work with a view to speed and accuracy, and he should get an insight into the principles of accountancy and costing. The only way to secure these things being taught would be to establish classes in a limited number of colleges where the actual manufacture of certain chemicals was undertaken. His proposal was to manufacture and sell those compounds, chiefly organic, which we had been accustomed to purchase from Germany, confining the field to those chemicals used in our colleges and for which there is no competition and no significant commercial demand. The colleges would supply these products through one institution: the products would be of a kind most difficult to make, the cost of every batch would be ascertained, and they would be subjected to public criticism because they would be sold. In the course of twelve months a student would learn a great deal of practical manufacture, so that when he got an industrial appointment he would better be able to help his employer.

Mr. SMITH said that the commercial training of the chemist was a very difficult subject because there was the jealousy of the commercial man to contend with. The average commercial man learnt by association with the firm and learnt very easily indeed. The wonderful principles of finance were very simple, and any man with a chemical training would quickly learn them. The jealousy of the commercial man was the stumbling block in the way of the chemist.

Mr. J. T. WOOD said he was sure that genius could not be inculcated at any course of lectures. It was essential to have the right material to work on.

Mr. S. J. PENTECOST said he had always been surprised that the commercial aspect of industrial chemistry had not been taken up by their own City Corporation in relation to the gas undertaking. They had entirely neglected to deal with by-products, and it had always seemed a great pity that they had not arranged a research laboratory in connection with that industry. They might have gone a long way towards solving the difficulty as regards basic products for use in the manufacture of aniline dyes.

The CHAIRMAN thought the whole crux of the matter lay in the attitude of the manufacturer towards the chemist. He regarded the engineer apparently as a man who could show something by his work. He valued his commercial staff because they showed him exactly what profit or loss he was making. He regarded the chemist with contempt because he could sometimes only show a small result from arduous, honest, and prolonged work. As to the idea of making the chemist an engineer, an accountant, and a commercial man generally, he asked, when will he begin to earn his living? The ordinary span of life was not sufficient for all those.

THE EDUCATION OF THE INDUSTRIAL CHEMIST.

BY E. B. R. PRIDEAUX, M.A., D.Sc.

Two logically distinct kinds of education, which may be called the "Technical" and the "University," are usually blended in existing institutions, whether these are called technical Colleges or universities. Under the technical system a student ranges through a wide variety of allied subjects and is given as concisely as possible a selection of those facts and methods which have been proved to possess the highest utilitarian value. Under the university system the student after the liberal training of a pass degree makes an intensive study of, say, two allied sciences with full comprehension as an aim. While the technical system is well exemplified by many schools of engineering, the difficulties of applying it in chemistry are notorious. The Massachusetts Institute of Technology may serve, however, as an example. The student is trained in all necessary kinds of calculation and drawing, and has also gained experience in such processes as the electrolytic production of aluminium or the smelting of ores in small-scale shaft furnaces, after a full course in institutions of this kind. The graduates may also be in possession of manufacturing "tips," they are at home with machinery, and possess a great deal of knowledge which is likely to be immediately useful in the routine of management of many different industries. It may be asked, what more can the manufacturer require than a compendium of immediately practicable information? And indeed, men of ordinary ability trained on these lines, are well fitted to form the backbone if not the head of industrial chemistry. If their energy and initiative is beyond the normal, they also succeed in making a mental synthesis of a mass of information which was not mainly selected with a view to forming a coherent system of knowledge. Since this kind of success, however, is difficult to attain in the full tide of business, and is not specially demanded by the employer as a rule, it will in practice only be secured before a man's life-work is begun. The defect of the "technical" system is that it hinders rather than helps such an early mental synthesis. The scientific industries of the country require for their guidance and furtherance a certain proportion of men who have taken special care to train their scientific imagination. It is the proper business of the university to supply these. The typical University student has a strong theoretical bias and a love of knowledge for its own sake. If the goal of the typical technical college is sufficient grasp of the subject to enable a man to handle ordinary situations, the goal of the university is the fullest comprehension of which he is capable. The whole training, ending with a year of research, should give him such an intensive grasp of the principles of the science, and of the methods of advancing knowledge in one branch, that he will be able to undertake investigations in other branches of which he has had no concrete experience.

This is what the university-trained man has to offer to his employer in place of an elaborate training in technical methods. He is complementary to the technical graduate. Unlike the latter, he is often slow to "make good," but his education has made it easy for him to follow the developments of science and apply them to his business, which may thus hold its own in competition with those of other countries where the value of developing and using the theoretical type of mind is better understood.

The education in the post-graduate year is limited by the available staff and apparatus, and upon these will depend the nature of the research undertaken. There should be a tutorial relation

between teachers and students, so that different aspects of each research problem may be discussed both informally and at a periodical colloquium.

With regard to the choice of apparatus, there appear to be some definite criteria which must be observed in all institutions which do not possess unlimited funds. In the first place it will perhaps be accepted that a good deal of the special apparatus for research should be designed and put together by teachers and students, using as far as possible ordinary laboratory stock. A liberal petty cash allowance which may be spent locally on felt, telephone wire, sheet iron, etc., is also indispensable for this purpose. Compact and portable instruments may be bought if they are relatively inexpensive and easily obtainable in this country. Thus a student need not attempt to make an ammeter but should set up his own capillary electrometer. The provision of expensive apparatus depends of course upon the liberality of university and local authorities or local benefactors. Such apparatus should fulfil the conditions of being difficult or impossible of construction by an amateur, and of permanent value for increasing scientific knowledge. Thus a calorimetric bomb or a small autoclave is a good investment, while a model automatic Sprengel pump would be an extravagance in most cases.

A complete and compact direct reading thermoelectric pyrometer is a necessity in a modern works requiring temperature control. But if a research student wishes, *e.g.*, to take cooling curves of alloys or mixtures of fused salts, he may be supplied with the materials for a base-metal thermo-couple and an ordinary potentiometer bridge. With these he will gain an intimate knowledge of the advantages and defects of one of the most important tools of the modern works chemist.

A preliminary knowledge of the methods of determining hydron concentration, the heats of chemical reactions, the electrolytic conductivity of solutions, etc., will no doubt soon form an essential part of an Honours course in all universities. These methods, included under the name "physical chemistry," will then be used in attacking the problems of academic research, and will finally be employed with confidence in technical investigations.

The choice of a research is guided mainly by the preference of the student and the previous knowledge of the teacher. Few, even of teachers with comparatively large leisure, can be expected to have more than a few "lines" of research properly opened up. These are sufficient, as in most cases the research is suggested by the teacher. For various reasons problems of technical interest are difficult to obtain, and sometimes they have not the necessary scientific interest and relation to existing and proposed theories. Thus a mere investigation of the best proportion of sulphur to produce a given vulcanised product is not suitable, whereas the investigation of the molecular states of the constituents, or of a neat method of analysis might afford good subjects. A young man also has a right to expect that a problem not of his own choosing shall yield some definite results. These conditions being fulfilled, is it necessary that the research shall have any definite connection with probable future work?

The answer that is given to this question will be all-important in shaping university policy. If it can be proved possible to produce a general power of chemical investigation by means of a specific research, then any suitably staffed institution of university standing, without special equipment, will be able to play an important part in training the officers of the army of production. The educational theory of "formal discipline" states that all faculties can be trained by means

of certain selected subjects, notably the traditional classics and mathematics. As applied to school subjects and boys of school age this theory is somewhat discredited. But the branches even of a subject so large as modern chemistry are related to one another more closely. Also a graduate, unlike a school-boy, can apply skill gained in one department to another department. Those who do not become mentally adult in this sense would benefit more by a specific vocational training. But the scientific organiser of industry (who may perhaps at some future date be allowed a voice in the management equal to that of his business colleagues) needs chiefly a fine judgment in selecting from the mass of facts and theories, combined with a practical skill in devising ways and means for attacks upon new problems. This can be gained by suitable research of any sort. For example, the principal type of research at University College, London, was formerly that which involved the preparation and purification of gases, and the manipulation of these at low temperatures. The lessons gained in this kind of research have been successfully applied by the graduates to the most varied kinds of industrial problems.

DISCUSSION.

Mr. CARR did not agree that even simple problems such as the conditions of vulcanising rubber were not suitable subjects for scientific technical research. Many simple processes could be improved if only people of thoroughly scientific training were employed in patiently investigating them. Such problems would teach the student to energise himself and to wrangle with difficulties. Great attention should be applied during the finishing course at college to disciplining the mind to deal with practical problems. It was the energy which the exercise of this discipline brought out, which was one of the very important points in a man's training.

Mr. WILKIE considered that one of the greatest needs for university and college research was enthusiasm. Enthusiasm expended upon carefully selected, suitable subjects was of more value than anything else. That was one of the points where our research centres seemed to lag behind those of Germany. Leeds University had one of the best colloquiums he had heard of, where the professors of chemistry and the allied subjects of engineering met the students and discussed the researches they themselves were undertaking and intended to undertake, and compared the results with those of the same type being undertaken in the continental universities. If industrial chemists could be successfully trained by undertaking researches in rare gases, there would be more enthusiasm developed in researches which were more directly connected with a larger field of industry.

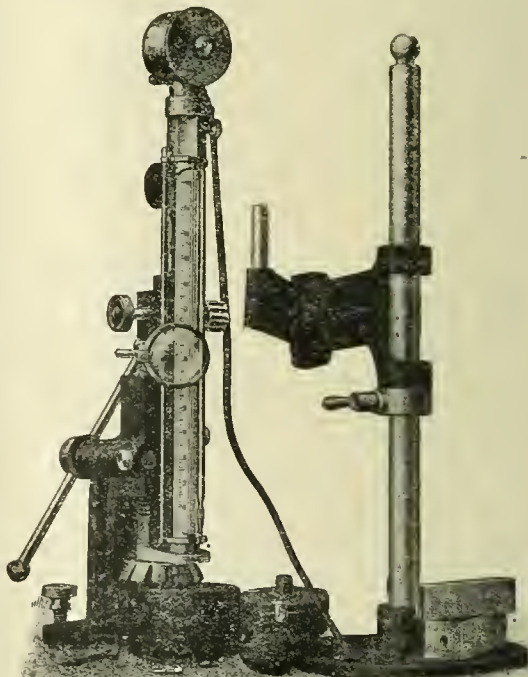
Professor BULLEID said he had been struck with the limited outlook of a number of chemists he had met in works in the application of science to problems outside those with which they were immediately connected, and their lack of appreciation of the all-round nature of a big problem, of which the chemical analysis might be only one small part. He impressed upon his students the fact that they could not afford to neglect anything. He dwelt upon the value of training, the idea of setting out to find something new, devising methods, collecting results, etc. The difficulty with the student who was setting out to do research work was first of all that he must know the problem given to him. The practical thing was for him to find his own problem, to put the question to himself: "Can this be improved?" When a man had been able to find his own problem

he would be prepared, when he got into a works, to experiment. The student ought to devise his own methods and meet his own difficulties, and only fall back on the teacher in the end. He must be expected to blunder, but if he blundered on until he finally succeeded he was a much better man when he got into the works.

The CHAIRMAN said he wondered why a chemist should always be required to know a good deal about other sciences. No living chemist was an authority on every branch of chemistry, and he wondered what type of man it was that was to be able to take up all kinds of research work, that was also to be able to perform accurate analyses with speed, and was also to have a fairly wide knowledge of all kinds of abstruse engineering problems.

Mr. COLLITT mentioned that Sheffield University provided quite as good a training as the continental one Dr. Prideaux had mentioned. He did not think there was a university in the world which gave such a good metallurgical training. He was inclined to ask whether the chemist of the future was going to spend the greater part of his time in the laboratory or in the works. If in the steel or blast works he did not seem satisfied to remain a chemist. The reason was lack of proper remuneration. His position as a chemist had never been properly valued.

Dr. PRIDEAUX, in reply, urged that the best incentive a man could get was a scientific interest in a problem. If a man in a works had a theoretical problem to investigate he would see the business aspect of it fast enough in the interest of his employers. The best thing would be to follow a university training with two years in a technical high school, but that course was too long and expensive and therefore they had to fall back upon practical politics, at all events in England.



The Shore Scleroscope.

Mr. BERNARD COLLITT gave a description of the Shore Scleroscope, and demonstrated its use. It is particularly useful in gauging the hardness of case-hardened steel parts. Briefly, the instrument consists of a small hammer, the striking face of which is a diamond. The hammer is allowed to fall a certain distance (about ten inches) down a vertical glass tube on to the material to be tested. At the back of the glass tube is a scale divided into 140 divisions, the figure of 100 representing a well hardened tool steel. After striking the material under test, the hammer rebounds and the height of rebound as read off on the scale at the back of tube is the hardness number.

An illustration of the instrument appears on the preceding page.

Obituary.

C. A. R. TENNANT.

Second Lieutenant C. A. R. Tennant, who was killed near Ypres on May 9th, was educated at Eton and afterwards entered the firm of C. Tennant, Sons, and Co., 9, Mincing Lane, E.C. For some years he had been in the Montreal branch of the firm, but at the outbreak of war he returned to England and enlisted in the London Scottish. In January he was given a commission in the 3rd Dorsetshire Regiment and left for France in March, attached to the 2nd Devonshire Regiment.

Journal and Patent Literature.

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I.—GENERAL PLANT; MACHINERY.

Solar energy: Utilisation of.—A. S. E. Ackermann. J. Roy. Soc. Arts, 1915, 63, 538—565.

THE history of the subject is outlined briefly and special reference made to investigations culminating in the establishment of the Shuman-Boys sun-power plant at Meadi, near Cairo, during 1912 and 1913. This apparatus consists of five parallel units arranged with their axes N and S and mounted so as to "follow the sun" automatically. Each unit, 205 ft. long, is composed of a boiler placed on edge in a channel-shaped reflector of parabolic cross-section; and each boiler, placed at the focus of its reflector, is surrounded by an air space enclosed by a single thickness of glass. The total area of sunshine collected is 13,269 sq. ft., the concentration effected by the reflectors being $4\frac{1}{2}$ to 1. In an extended series of trials made with this plant, the maximum quantity of steam produced was 12 lb. per 100 sq. ft. of sunshine per hour, i.e., 183 sq. ft. of sunshine per brake horse-power (1 b.h.p.=22 lb. of steam at atmospheric pressure); the maximum thermal efficiency was 40.1% (solar constant=7.12 B.Th.U. per sq. ft. per min.). In the best one-hour run, 1442 lb. of steam at atmospheric pressure was produced. The utilisation of solar energy is regarded as almost a solved problem where sunshine is plentiful and coal only obtainable at £3 10s. per ton.—W. E. F. P.

PATENTS.

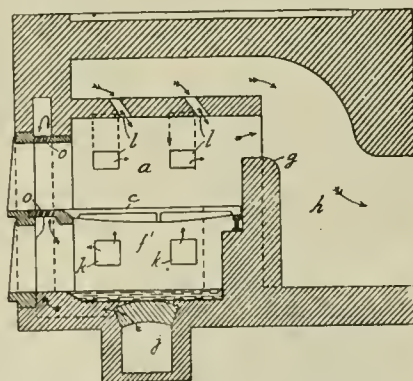
Drying cylinders; Construction of steam-heated.—H. Smith, and Mather and Platt, Ltd., Manchester. Eng. Pat. 8401, April 3, 1914.

IN steam-heated cylinders for drying continuously textile or other goods, the ends are formed with slightly conical flanges which fit into the cylinder shell, the ends of which are also slightly tapered, so that the joint is kept tight by the internal pressure. Rings of corresponding shape are forced on to the ends of the cylinders to strengthen the joints. Special means are provided for ensuring a tight joint between the hollow trunnions and

the cylinder, and between an air or vacuum valve and the cylinder. To collect condensation water, troughs are arranged along the sides, converging towards one another at one end and discharging into a collecting chamber which delivers into the hollow trunnion.—W. F. F.

Furnaces for supplying heated air and gas employed in drying processes. The Staveley Coal and Iron Co., Ltd., and C. P. Markham, Chesterfield. Eng. Pat. 20,232, Sept. 26, 1914.

LOW-GRADE fuel is burned in the closed combustion chamber, *a*, provided with a grate, *c*, and a closed ashpit, *f'*. Air enters through the flue, *j*,

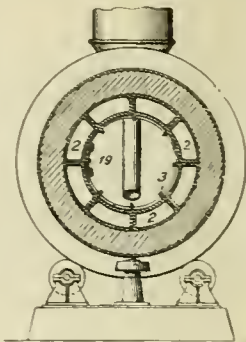


and circulates through the hollow walls of the combustion chamber. Part enters the ashpit through the ports, *k, k*, and serves as primary air for combustion; part enters the fire-door through the slots, *o, o*, for the purpose of preventing the door becoming overheated; part enters the combustion chamber through the ports, *l, l*, and serves as secondary air for combustion; and part mixes with the products of combustion, which enter the conduit, *h*, through the port, *g*.—W. H. C.

Drying apparatus. G. H. Hagan, Pittsburgh, Pa. U.S. Pat. 1,126,197, Jan. 26, 1915. Date of appl. Jan. 22, 1914.

A CYLINDER, 19, is built up of a number of hollow longitudinal sections, 2. One wall, 3, of each section projects into the cylinder, 19, and as the whole is rotated, these projections serve to lift up and stir the material, which is passed through the cylinder in one direction, whilst hot gases from a furnace are passed through the hollow sections, 2, in the reverse direction.

—W. H. C.



Desiccating apparatus. E. E. Eldredge, Chevy Chase, D.C. U.S. Pat. 1,134,731, April 6, 1915. Date of appl. April 11, 1914.

ATOMISED fluid to be desiccated is injected into the innermost of a number of communicating horizontal concentric cylinders, and travels between the concentric walls, from which the dried residue is removed by conveyors.—W. F. F.

Liquids; Evaporation and distillation of—C. T. Thorsell, Gothenburg, and H. L. R. Lunden, Stockholm, Sweden. Eng. Pat. 9295, April 14, 1914.

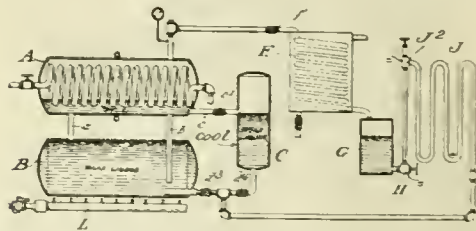
To avoid loss due to the latent heat of the vapour, distillation is effected at or near the critical temperature and pressure of the liquid. The vapour produced at the critical point is condensed at a slightly lower temperature and pressure in a coil immersed in the fresh liquid which is being pumped to the still. This liquid is thereby heated to nearly the critical point. The energy still contained in the condensed liquid is used to drive a reciprocating piston which operates the pump.—W. F. F.

Filtering; Cloths for—T. D. Morson and C. S. Roy, Ponders End, Middlesex. Eng. Pat. 10,527, April 28, 1914.

A FILTER cloth which resists acids, alkalis, and alkaline hypochlorites, is woven from threads composed of glass wool or like vitreous silicious material.—W. F. F.

Refrigeration; Process of—Refrigerating apparatus. W. J. Kelly, Chicago, Ill. Assignor to Autovacuum Refrigerating Co., New Orleans, La. U.S. Pats. 1,122,602 and 1,122,603, Dec. 29, 1914. Date of appl. March 5, 1914.

The apparatus consists of two superposed vessels, A, B, connected by the pipes, a, b, provided with an auxiliary tank, C, and connected with a con-



denser, E, a reservoir for liquefied ammonia, G, and a refrigerating coil, J. Starting with A and B full of strong liquor, C partly full of weak liquor, and G partly full of condensed ammonia, which passes through the valves, H, J², to the coil, J, where it is expanded and produces the required

refrigeration. B is heated by the burner, L, or by a steam coil. The greater part of the ammonia and a portion of the water is distilled off and condensed, the condensed liquid collecting in G. During this time the expanded ammonia from the coil, J, is absorbed by the weak liquor in C. When the distillation is completed and the volume of liquor in the containers reduced to the level shown, the heating is stopped and the valve, J¹, is closed and d³ and d⁴ are opened. The condensed ammonia is now absorbed by the weak liquor remaining in B, and the strong liquor from C also passes into B. When C is empty it cools and a vacuum is formed, so that some of the weak liquor resulting from the mixture of strong liquor from C with the weak liquor in B, returns and fills C to the level of the pipe, c. The valve, c¹, is now closed, and the reserve of weak liquor is held till the liquor in A, B, is saturated with ammonia; when this is the case the valve, d³, is closed and the valves, J¹ and d⁴, are opened, and the ammonia is again distilled off from A, B, the weak liquor in C serving to absorb the ammonia while the distillation is taking place.—W. H. C.

Kiln; Downdraught, continuous—F. D. Shaw, Chicago, Ill. U.S. Pat. 1,133,582, March 30, 1915. Date of appl. March 9, 1912.

HOT gases from oil burners are forced downwards into a central heating chamber formed above the arched roof of a tunnel kiln. The hot gases pass downwards from this chamber on to the materials travelling through the kiln, through passages formed along the arched roof.—W. H. C.

Kiln; Continuous compartment gas-fired—W. D. Richardson, Worthington, Ohio. U.S. Pat. 1,133,885, March 30, 1915. Date of appl. June 9, 1913.

GAS passes from a main to a distributing chamber, and thence by flues to several ports within the firing compartment, the ports being arranged in staggered relation to one another. Air is conveyed to the firing compartment by suitable flues and delivered downwards to the gas.—W. H. C.

Filtering apparatus; Rotary—L. Hertenbein, Levallois-Perret, France. Eng. Pat. 22,840, Nov. 20, 1914. Under Int. Conv., Nov. 26, 1913. SEE Fr. Pat. 465,323 of 1913; this J., 1914, 540.

Filter. C. Butters, Oakland, Cal. U.S. Pat. 1,136,863, April 20, 1915. Date of appl. June 18, 1913.

SEE Fr. Pat. 472,017 of 1914; this J., 1915, 410.

Drying apparatus. G. Binder, Rochester, N.Y., Assignor to American Laundry Machinery Co., Cincinnati, Ohio. U.S. Pat. 1,136,645, April 20, 1915. Date of appl. Jan. 21, 1914.

SEE Eng. Pat. 8936 of 1914; this J., 1915, 16.

II A.—FUEL; GAS; MINERAL OILS AND WAXES.

Coal and coke; Exportation of—Board of Trade J., May 13, 1915.

By an Order in Council dated May 6th, the exportation of coal (including anthracite and steam gas, household, and all other kinds of coal) and coke is prohibited on and after May 13th to all destinations abroad other than British Possessions and Protectorates and Allied Countries;

Coal dust; Influence of the quantity and method of distribution of—on its explosiveness and on the strength of the explosion. K. J. Czaplinsky. Oesterr. Zeits. Berg- u. Hüttenw., 1914, 62, 501—509. Z. angew. Chem., 1915, 28, Ref., 51.

THIS is the fifth report on the tests made in the experimental gallery at Babitz in the Rossitz-Oslawan coal district (see this J., 1909, 1224; 1910, 1083; 1912, 629). To lessen the influence of the compression wave preceding the explosion wave on the density of the dust cloud, the dust zones were made as long as possible (up to 294 m.). For the dust examined, the limits within which explosion occurred were 40 grms. and 2000 grms. respectively per cb. m. of air. With increasing density of the dust cloud the force of the explosion increased to a maximum and then decreased. The flame velocities observed were as follows:—40 grms. of coal dust per cb. m. of air, 34 m. per sec.; 60 grms., 60 m.; 80 grms., 65 m.; 100 grms., 90 m.; 200 grms., 170 m.; 800 grms., 108 m.; 1600 grms., 55 m.; and 2000 grms. of coal dust per cb. m., 14 m. per second. Further experiments are to be made in a gallery 600 m. long, as trustworthy results can be obtained only when very long dust zones are used.—A. S.

Coke breeze briquettes. Behr. J. Gasbeleucht., March 6, 1915. J. Gas Lighting, 1915, 130, 212—213.

THE utilisation of coke breeze in gas works for firing boilers necessitates the use of special grates, blowers, etc., and is generally unsatisfactory. In specially constructed suction producers it gives good results, but the demand for breeze for these plants is relatively small; moreover, the demand for breeze for paving and building purposes has fallen, the cheaper clinker being used largely in its stead. At the Kolberg Gas Works good results have been obtained in the manufacture of coke-breeze briquettes by mixing the fine breeze with about 6% of finely divided hard pitch, tipping the mixture into the receiver of an elevator, and transferring it to a funnel-shaped mixing machine into which superheated steam and waste furnace gases are led. This is sufficient to melt the hard pitch, and the hot mixture passes through an outlet at the bottom of the mixer into a filling vessel placed above a rotating moulding table. The briquettes are about 2½ in. long by 2½ in. diam., and when hot are strong enough to withstand handling with coke forks. They may be used in all cases where the layer of fuel is not less than 8—10 inches, and where the draught is sufficient for ordinary 2-inch coke. The best results are obtained in closed iron stoves, central-heating plant, etc. The cost of manufacture is 5½d. per cwt., the lowest selling price on the works is 8½d. per cwt., and under the least favourable circumstances the profit is 4s. 7d. per ton. A complete installation costs £225; with one press working for 300 days of 10 hours in the year, 1050—1125 metric tons of coke briquettes was produced.

—E. R. A.

Calorimetric bomb; Manipulation of the—. Calculation of heats of combustion. W. A. Roth. Annalen, 1915, 407, 112—133. J. Chem. Soc., 1915, 108, ii., 145—146. (Compare this J., 1910, 783).

THE following subjects are discussed: (1) The correction for the exchange of heat with the surroundings. (2) The determination of the water-equivalent of the apparatus. It is shown that the mere exchange of one thermometer for another affects the value. (3) The use of benzoic acid and of sucrose for calibration purposes. (4) The calibration of the apparatus by an electrical method. The difference between this and the thermal method is only about 0.1%. (5) Factors to be used in comparing the thermochemical data of

different investigators. (6) In many cases the molecular heat of combustion of a liquid or solid substance can be roughly calculated by multiplying by 52.2 the number of atoms of oxygen required for the complete combustion of one molecule of the substance.

Calorimetric bomb; Combustion of volatile substances in the—. W. A. Roth and H. Wallasch. Annalen, 1915, 407, 134—145. J. Chem. Soc., 1915, 108, ii., 146.

THE combustion of the vapour of a volatile substance is incomplete, even in the presence of a large excess of oxygen. The authors have tested the methods of overcoming this difficulty proposed by various investigators, and come to the conclusion that no method is applicable universally. In the "protective" methods the use of combustible envelopes is not recommended; glass envelopes are preferable. The following devices, arranged in order of increasing efficiency, are recommended: glass vessels with small caps of gelatin, or, better, celluloid; enclosure of the platinum combustion dish by a glass cover sealed with vaseline, or, best of all, by a "cellon" or "cellophane" cover sealed with vaseline.

Benzol from coal gas; Recovery of—. W. Diamond. North of Eng. Gas Managers' Assoc., May 1, 1915. J. Gas Lighting, 1915, 130, 267—270.

TO recover the maximum quantity of benzol from coal gas, the washing oil should have a sp. gr. between 1.04 and 1.06; when it reaches the latter figure it should be rejected. Comparative experiments with different washing oils showed that coal-tar creosote absorbed five times as much benzol as filtered anthracene oil. The amount of water in the washing oil should not exceed 1%; the presence of 2.5% in creosote reduces its efficiency by over 35%, 7.5% by 45%, and 10% by 73%. By reducing the temperature of the gas below 15° C. and that of the washing oil to 0° C., absorption is increased by 20% but the cost of the cooling is prohibitive. The extraction of 2.1 gallons of benzol from gas per ton of coal results in a decrease of 4.5% in the calorific value of the gas; removal of 2.5 galls. shows a decrease of 7% and of 3 galls. a decrease of 8%.

Mineral oil production of the Red Sea Fields. Board of Trade J., May 6, 1915.

THE development of the Red Sea oilfields progressed very satisfactorily during 1914. The total production of oil from the fields during the year considerably exceeded the output for the previous year; moreover it is anticipated, in view of the fact that oil is now being obtained from the concessions south of Gemsa, that a far larger output will be obtained during 1915. The crude oil is transferred from Gemsa or Hurghada to the refinery at Suez, where it is converted into benzine, kerosene, and liquid fuel. In 1914 the quantity of crude oil imported into Suez for refining was 119,349 metric tons, valued at £E. 179,023, and of heavy benzine distillate 11,893 metric tons, valued at £E. 83,251. The output of the refined products was as follows:—

—	Used in Egypt.		Exported to the East, France, and the Mediterranean.	
	Metric tons.	£ E.	Metric tons.	£ E.
Liquid fuel	6,923	17,307	47,248	118,120
Kerosene	8,638	43,190	22,154	110,770
Refined benzine	1,186	11,860	8,227	82,270
Unrefined benzine	2	14	10,921	16,921
Total	16,749	72,371	94,550	328,081

£E. = £1 0s. 6½d.

Ethane and ethylene; Separation of—, by fractional distillation in a vacuum at low temperatures. G. A. Burrell and I. W. Robertson. J. Amer. Chem. Soc., 1915, 37, 896—902.

ALTHOUGH ethane (b. pt. $-93^{\circ}\text{C}.$) and ethylene (b. pt. $-103^{\circ}\text{C}.$) may be completely separated by fractional distillation at low temperatures (see this J., 1915, 411), the operation is tedious when a considerable proportion of each gas is present in the mixture.—J. R.

Dehydration of water-gas tar at the Amsterdam Western Gas Works. See III.

Progressive reduction of acetylene. Paal and Hohenegger. See XX.

Determination of carbon monoxide by the iodine pentoxide method. Frohose. See XXIII.

PATENTS.

Coal briquettes; Method of carbonising water-soluble binding materials in—, Diamant-Brikettwerke G. m. b. H. Ger. Pat. 280,454, July 8, 1913.

THE briquettes are exposed at once to a temperature of 190° — $200^{\circ}\text{C}.$, so that most of the water evaporates before an impermeable skin is formed on the surface, and carbonisation is then effected in the usual way.—A. S.

Coal briquettes with sulphite-cellulose waste lye as binding material; Manufacture of—, B. Grätz. Ger. Pat. 280,455, Nov. 21, 1913.

FINE coal is mixed with powdered blast-furnace slag, plaster of Paris, cement, or like material capable of combining with water and holding it in combination at temperatures up to $110^{\circ}\text{C}.$; the mass is mixed with about 14% of sulphite-cellulose waste lye containing 50% H_2O , heated, and formed into briquettes, which are heated to carbonise the sulphite-lye.—A. S.

Forestry waste as fuel; Utilisation of—, F. von Kahlsch. Ger. Pat. 280,869, June 14, 1914. Under Int. Conv., Oct. 20, 1913.

LEAF-BEARING material and roots of woody plants are finely divided, mixed with ground wood charcoal or the like, and briquetted.—A. S.

Coke oven for heating with either rich gas or low-grade gas. C. Still. Ger. Pat. 281,252, Aug. 21, 1913.

REGENERATORS for preheating the air for combustion are arranged alternately with recuperators for preheating the heating gas, on both sides of the oven and along the full length of the battery of ovens; the waste gases pass through the regenerators on one side of the oven whilst air is passing through those on the other side. The heating gas may be passed through the recuperators on the same side of the oven as the regenerators through which air is passing, or through those on the opposite side.—A. S.

Gas; Manufacture of— in vertical retorts. J. Bueh. Ger. Pat. 280,746, Sept. 4, 1913.

IN the event of excessive pressure developing in the retorts, steam is blown in at the lower part, whereupon normal conditions are soon restored.—A. S.

Gas generators. G. H. Bentley and E. G. Appleby, London. Eng. Pat. 9040, April 9, 1914.

TO avoid caking of the fuel and clinker formation, the casing is lifted and lowered relatively to the grate and simultaneously revolved eccentrically to the grate.—W. F. F.

Gaseous fuels; Calorimetry of—, H. F. Smith, Lexington, Ohio. U.S. Pat. 1,134,768, April 6, 1915. Date of appl., Feb. 5, 1910.

THE fuel and air in predetermined proportions and at a pressure and temperature which may vary, but must be the same for both, are supplied to a combustion chamber which is at atmospheric pressure. The rise of temperature of the air and combustion products is measured.—W. F. F.

Lubricating oils and greases; Treatment of—, H. E. Wilkinson and H. Steward, London. Eng. Pats. 8279, Apr. 1, and 15,040, June 23, 1914.

WASTE oil or grease, after passing through a filter and magnetic separating apparatus, is heated, mixed with 25% of flour, and cooled in a closed vessel to obtain a lubricant for use in gear-boxes and the like.—W. F. F.

Drying oils; Manufacture of— from products of distillation of mineral oils. De Bataafsche Petroleum Maatschappij, The Hague. Eng. Pat. 23,376, Dec. 1, 1914. Under Int. Conv., Dec. 31, 1913.

A SUBSTITUTE for linseed and similar drying oils is obtained by chlorinating mineral oils and converting the chloro-derivatives into unsaturated compounds by the elimination of hydrochloric acid by heating in presence of a catalyst, such as a metal, preferably zinc, or a metallic chloride.—F. W. A.

Mineral oils and other fluid mixtures of hydrocarbons of analogous composition; Process for improving the quality of—, Badische Anilin und Soda Fabrik. Fr. Pat. 472,776, May 28, 1914. Under Int. Conv., Sept. 1, 1913.

THE oils, etc., are decolorised and deodorised by treatment in the fluid condition with hydrogen, at not above $200^{\circ}\text{C}.$, at atmospheric or increased pressure, and in the presence of a catalyst, such as nickel, iron, cobalt, or copper, or mixtures of these.—C. A. M.

Oven for generating gas and producing coke. H. Koppers, Essen, Germany, Assignor to H. Koppers Co., Chicago, Ill. U.S. Pat. 1,134,683, April 6, 1915. Date of appl., Oct. 21, 1914.

SEE Fr. Pat. 460,517 of 1913; this J., 1914, 68.

Manufacture of lime and gas. Eng. Pat. 5734. See VII.

Process of desulphurising oils, resins, and rubber. Fr. Pat. 473,110. See XII.

Process of rendering petroleum soluble, and product resulting therefrom. Fr. Pat. 472,873. See XIXb.

Analysis of gas mixtures. Ger. Pat. 281,584. See XXIII.

Quantitative gas analysis by an acoustic method. Ger. Pat. 281,157. See XXIII.

IIb.—DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Coal distillation; Products of—, W. J. A. Butterfield. An address delivered at the Cardiff Conference on the extension of British trade, April 20. J. Gas Lighting, 1915, 130, 205—209.

THE output of coal in the United Kingdom in 1913 was 287,430,473 tons, whilst that of Germany was 274,578,000 tons, including 86,093,000 tons of brown coal. The export of coal from Great Britain is, however, much greater than that from

Germany. The quantities retained for home consumption in 1913 were 189,092,369 and 248,958,000 tons respectively, of which 37,483,944 and 62,613,000 tons were carbonised. In Great Britain 42.7% of the total coal carbonised was carbonised in gas works; in Germany 14.4%. As Germany carbonises more coal, and in so doing utilises coke ovens to a greater extent, the raw materials required for many chemical industries are produced in larger quantities than in Great Britain. This advantage is primarily due to the development of the iron industry, which consumes enormous quantities of oven coke, and the possibility of making the home supplies of tar and benzol in the United Kingdom equal to those of Germany, depends very much on our obtaining a supply of good grade iron ore at a price which will enable us to produce pig-iron and steel as cheaply as in the United States, Belgium, and Germany.

Products from the distillation of 100 tons of bituminous coal. The gross yield of coke obtained by the distillation of an average coal is about 70%, of which about 47.5% is saleable, the difference being due to the consumption of coke as the sole fuel for heating the retorts, and also to the production of small breeze which has practically no value, although means of briquetting it have been devised in Germany (see page 539). The yield of saleable coke from coke ovens is about 60%. Retort carbon has a fairly high market value, but the amount obtained is often less than 0.10%. The volatile products of the distillation include about 6 cwt. of ammonia which yields 24 cwt. of high-grade ammonium sulphate, i.e., containing 25% NH_3 . Cyanogen compounds are present to the extent of 50–200 grains of cyanogen per 1000 cub. ft. and are partially abstracted in the cooling and washing and partially in the oxide of iron purifiers. Special processes are applied at large works, especially in Germany, for the direct extraction of cyanogen compounds from the crude gas. Gas from coke ovens usually contains much less cyanogen than that from gas retorts. It is probable that German gas works alone have yielded in recent years cyanogen products equivalent to 10,000 tons of yellow prussiate per annum, while the output from the United Kingdom has not exceeded 5000 tons per annum, a quantity which could be increased to 24,000 tons, if cyanogen extraction were extended to all the gas works. The average yield of cyanides from coal gas in this country should be about 2 cwt. of Prussian blue or 3 cwt. of yellow prussiate or 2 cwt. of sodium cyanide per 100 tons of coal carbonised. By careful working, cyanogen recovery might be extended profitably in this country, and a large proportion of the German export trade in cyanides captured. Hydrogen sulphide and carbon bisulphide are the chief sulphur compounds, and are present to the extent of approximately half a ton of the former and 72 lb. of the latter per 100 tons of coal carbonised. The hydrogen sulphide is generally retained by the oxide of iron in the purifiers, and is finally utilised in the manufacture of sulphuric acid. The amount of acid produced corresponds to 1.8 tons of sp. gr. 1.71. This is more than sufficient to neutralise the ammonia present in the volatile products, and the problem of how to oxidise the sulphur compounds and combine it with ammonia in a single operation, is one worthy of immediate attention. Carbon bisulphide can be effectively removed at small cost where gas of a high degree of purity is required. In practice from 1.5 to 3.0 gallons of benzol are obtained from 1 ton of coal, the average being about 225 gallons per 100 tons of coal carbonised, and it has been ascertained that one-third of the benzol present in coal gas may be abstracted without impoverishing the gas unduly. If this were done it is estimated that the gas works of the United Kingdom could produce 12,000,000 gallons

of benzol per annum, and the coke-ovens another 60,000,000 gallons. The yield of coal tar, freed from water, may be taken as 1000 gallons per 100 tons of coal.—E. R. A.

Separation and identification of certain homologous a-diketones [diacetyl, etc.]. Jollin. See XX.

PATENTS.

Arc light carbons. H. Ayrton, London. Eng. Pat. 8505, April 3, 1914. Addition to Eng. Pat. 22,319 of 1913 (this J., 1914, 686).

THE negative carbon, covered with copper, is cored, a carbon pencil is inserted in the hole, and the intermediate space is filled with a packing of material which will be consumed during use, leaving a hollow near the tip of the inner pencil.—B. N.

Electrode; Arc-light—. W. R. Mott, Lakewood, Ohio, Assignor to National Carbon Co., Cleveland, Ohio. U.S. Pat. 1,131,148, April 6, 1915. Date of appl., June 6, 1913.

THE electrode contains a carbonate, a calcium salt, precipitated silica, and an oxide of tungsten mixed with carbon.—B. N.

Carbon filaments for electric incandescence lamps; Manufacture of—. Siemens u. Halske A.-G. Ger. Pat. 281,015, Feb. 12, 1914.

A SOLUTION of bakelite is used as binding material for the carbon. Bakelite yields a very strong, uniform carbon, and even small quantities have a high binding power. The filaments produced are of uniform structure and low porosity.—A. S.

III.—TAR AND TAR PRODUCTS.

Water-gas tar; Dehydration of— at the Amsterdam Western Gas Works. J. Gas Lighting, 1915, 130, 196.

A CENTRIFUGAL plant which reduced the water in coal gas tar from 25–30% to 2–3% in one operation, was tried with water-gas tar. The first experiments were unsuccessful, but by working at higher temperatures very satisfactory results were obtained. The difference in specific gravity between water-gas tar and water increases considerably with rise of temperature. The centrifugal machine used has a drum revolving at a high rate of speed on a vertical shaft; at the upper part of the interior of the drum is fixed a flat ring, 4 inches wide, fitted so that a small space is left between the inner surface of the drum and the outer circumference of the ring. The tar travels upwards along the inner surface of the drum to the upper surface of the ring, and thence to the tar off-take. The water, being lighter, forms a layer at the side of the tar, and travelling upwards its passage is barred by the ring, so that it is forced along the underside of the ring where the water outlet is fixed. The temperature necessary for the perfect dehydration of the tar is between 60° and 70° C., which is obtained by preheating the tar in a rectangular tank fitted with an outlet pipe for the escape of any gaseous products. The heated tar has often a water content of about 60%, and this is reduced to less than 1% in one operation. Water-gas tar emulsions containing 80–90% of water have been treated in the same apparatus, the working temperature being 95°–100° C., no trouble due to evaporation being experienced at this temperature. The tar obtained has a very low content of "free carbon," viz., 0–4%, and the average calorific value is 17,200 B. Th. U. per lb. The working costs of the treatment are particularly low, and owing to its uniform character

the tar is used largely as a substitute for mineral oil fuel, and commands better prices than those obtained for tar not centrifugally treated.—E.R.A.

Acetylene condensations; Pyrogenic — R. Meyer and H. Fricke. Ber., 1914, 47, 2765—2774. Z. angew. Chem., 1915, 28, Ref., 58.

THE presence of *m*- and *p*-xylene, α - and β -methylnaphthalene, 1,4-dimethylnaphthalene, and hydro-derivatives of naphthalene has been detected in the tar obtained from acetylene (this J., 1912, 633; 1913, 1060). Twenty-three compounds present in ordinary coal tar have now been detected in the acetylene-tar. Aqueous liquor withdrawn from the first furnace of the apparatus contained phenol, acetic acid, and formic acid, produced probably as a result of oxidation by air leaking into the apparatus.—A. S.

Ebullioscopic behaviour of solvents at different pressures. III. Aniline, phenol, naphthalene, and diphenyl. E. Beckmann and O. Liesche. Z. physik. Chem., 1914, 89, 111—124. J. Chem. Soc., 1915, 108, ii., 144.

THE ebullioscopic constants of aniline and phenol have been determined at thirteen different pressures from 760 mm. to 150 mm., naphthalene at four pressures from 763 mm. to 172 mm., and diphenyl at the three pressures, 754, 458, and 188 mm. It is shown that aniline and phenol are very similar in their ebullioscopic behaviour. The constants are very close together even at reduced pressures. The experimental values of the constants agree well with the calculated constants, except those obtained from the Walden formula, and in this case the divergence is greater in the case of phenol than in that of aniline. This indicates a greater association in the case of phenol, and also that aniline is not a strictly normal liquid, even though the association is only slight. The constants obtained experimentally for naphthalene and diphenyl agree satisfactorily with the theory. It is therefore shown that the calculation of the ebullioscopic constants from critical data is allowable in the case of high-boiling liquids. The newly-determined values of *K* are: aniline, 36.9; phenol, 36.0; naphthalene, 58.0; and diphenyl, 70.6.

Chloranil and bromanil; Preparation of — from phenol. Chlorination by means of aqua regia. R. Kempf and H. Mochrke. Ber., 1914, 47, 2615—2622. Bull. Soc. Chim., 1915, 18, 148.

THE best yields of chloranil were obtained by dissolving 10 grms. of phenol in 225 c.c. of concentrated hydrochloric acid and saturating the solution with chlorine, cooling first with water, and afterwards warming on a water-bath. After adding 75 c.c. of concentrated nitric acid, the heating was continued for about 20 hours. Yield 8.9 grms., m. pt. 285°—286° C. Under other conditions oxalic acid and 2,4-dinitro-6-chlorophenol were also produced to the detriment of the chloranil. Bromanil was obtained by adding 25 c.c. of concentrated nitric acid to a solution of 3 grms. of phenol in 74 c.c. of hydrobromic acid (sp. gr. 1.38), and heating for a long time after the initial spontaneous reaction had subsided. The yield was 4.3 grms. of an orange coloured product, m. pt. 260°—270° C. Bromanil was also produced by the action of bromine and nitric acid on phenol. Iodine and nitric acid convert phenol into 2,4-dinitro-6-iodophenol, m. pt. 106°—107° C.—G. F. M.

Nitrosobenzene; Action of acetic anhydride on —. A. Kliegel and H. Huber. Tübinger Chem. Ges., Feb. 26, 1915. Chem.-Zeit., 1915, 39, 229.

ON boiling nitrosobenzene with acetic anhydride,

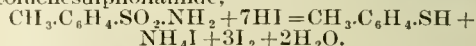
a mixture of azoxybenzene and nitrobenzene together with a little acetanilide and an unidentified substance of m. pt. 245° C. was obtained. —A. B. S.

Benzene derivatives; Replacement of substituents in —. A. F. Holleman. Proc. K. Akad. Wetensch. Amsterdam, 1915, 17, 1027—1034. J. Chem. Soc., 1915, 108, i., 129.

THREE points have been tested, viz., (1) the velocity of transformation in a complete set of isomerides, (2) the effect of changing the reacting agent, and (3) the effect of temperature. The influence of position, of the reagent, and of temperature on the velocity constant followed no definite rule. The three dichlorobenzenes, three chloronitrobenzenes, and six dichloronitrobenzenes have been studied, with regard to the replacement of chlorine by sodium methoxide and diethylamine. It has been found that the replacement of chlorine is largely dependent on the position of the substituents, and influenced by the reagent employed, and that, although the temperature coefficient is fairly constant for one set of isomerides and one reagent, it is not the same for the two reagents, the reaction with sodium methoxide being influenced much more than the reaction with diethylamine.

Arylsulphonamides; Reduction of — by hydriodic acid. E. Fischer. Ber., 1915, 48, 93—102. J. Chem. Soc., 1915, 108, i., 138—139.

THE value of the arylsulphonyl derivatives of organic bases and amino-acids for the isolation of this class of compound is seriously diminished by the difficulty of regenerating the original amino-compound. It is now found that hydriodic acid (with the addition of phosphonium iodide) is a convenient reagent for effecting the recovery of the parent substance, because in a closed vessel at 70°—100° C., concurrent reduction and fission occur which may be typified by the result with *p*-toluenesulphonamide,



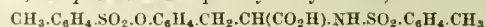
In a like manner the corresponding *p*-toluenesulphonanilide and *p*-toluenesulphonylglycine undergo fission, regenerating the amino-compound. The method is especially useful for the recovery of the optically active amino-acids from their arylsulphonyl derivatives. *p*-Toluenesulphonyl-*d*-phenylalanine,



yields *d*-phenylalanine in excellent yield and approximate optical purity, and by making use of this process *l*-tyrosine has been converted through the *p*-toluenesulphonyl compound and its methyl derivative into active *N*-methyltyrosine, which was identical with natural rhanthin.

Toluenesulphonyl chloride is also sensitive to hydriodic acid, but the free acid and its ethyl ester resist the action of hydriodic acid under similar conditions; saccharin is also resistant.

There is a marked difference between the behaviour of the arylsulphonyl radicle attached to an oxygen atom, and that attached to nitrogen; thus, di-*p*-toluenesulphonyl-*l*-tyrosine,



on treatment with hydriodic acid and phosphonium iodide at 100° C. gives *p*-tolylmercaptan, m.pt. 13°—44°, and *O*-*p*-toluenesulphonyl-*l*-tyrosine, m.pt. 218° C. (corr. decomp.) $[\alpha]_D^{25} = -4.58^\circ$ in *N*/1-hydrochloric acid, —11.68° in *N*/1 sodium hydroxide solution. The striking difference between the behaviour of the free sulphonic acid and its amides extends also to the corresponding benzyl compounds. Benzyllulphonic acid is not reduced, whereas its amide enters into reaction, readily giving, however, benzyl iodide and hydrogen sulphide in addition to ammonia.

Benzotetronic acid [4-hydroxycoumarin]; *Formation of monophenolic ketones and a new synthesis of —*, H. Pauly and K. Lockemann. Ber., 1915, 48, 28—32. J. Chem. Soc., 1915, 108, i., 146.

CONTRARY to the observation of Nencki (this J., 1890, 411), phenol readily undergoes condensation with acetic acid in the presence of zinc chloride, the expected *o*- and *p*-hydroxyacetophenones being separable without difficulty, in respective yields of approximately 5 and 11% of the theoretical. The authors do not regard the acetylation of the hydroxyl group as a necessary intermediate stage in the action. It is found that the additional presence of acetic anhydride has a less favourable effect in the acetylation of phenol than of naphthol, whereas an addition of acetyl chloride causes a marked increase in the yield of the *p*-acetyl derivative. The development of a yellow coloration during acetylation with or without the presence of acetyl chloride is regarded as indicative of the formation of an intermediate compound of organometallic type such as is assumed in the Friedel-Crafts reaction.

4-Hydroxycoumarin (benzotetronic acid) can be obtained in a yield 55% of the theoretical, by treating methyl *o*-acetoxybenzoate with sodium at 165°—175° C. This condensation appears to be a general one for esters of *o*-acyloxybenzoic acids, and methyl *o*-phenylacetoxybenzoate, obtained by heating together methyl salicylate, phenylacetic acid, acetic anhydride, and a little sulphuric acid, likewise undergoes condensation on treatment with sodium at 160°—165° C., giving phenylbenzotetronic acid (4-hydroxy-3-phenylcoumarin), m.pt. 236° C.

Anthradiquinone-1.4.9.10. R. Lesser. Ber., 1914, 47, 2526—2528. Bull. Soc. Chim., 1915, 18, 159.

1.4.9.10-ANTHRADIQUINONE was prepared by oxidising quinizarin dissolved in boiling benzene with a large excess of lead peroxide. It forms long reddish-brown needles, which commence to sublime at about 160° C., and melt towards 185° C. It dissolves in organic solvents giving reddish-yellow to brown solutions which exhibit marked fluorescence. It is also soluble in sulphuric and nitric acids, is stable in the air, and possesses the properties characteristic of quinones.—G. F. M.

Recovery of benzol from coal gas. Diamond. See IIA.

PATENTS.

Chloro-compounds; Preparation of aromatic —. Kinzberger und Co. Ger. Pat. 280,739, Aug. 3, 1913.

AROMATIC nitro-compounds are treated with thionyl chloride above 160° C. The nitro groups and also sulpo groups and hydrogen atoms of aliphatic side chains are replaced by chlorine. The chlorination of nitrobenzene, dinitroanthraquinone, and *p*-nitrotoluene is described.—A. S.

Phenols and their monochloro substitution products; Preparation of monohydric —. Chem. Werke Iehendorf G. m. b. H. Ger. Pat. 281,175, July 10, 1913.

MONO- or dichloro substitution products of aromatic hydrocarbons are heated for a long time with an alkali hydroxide and methyl alcohol, with or without addition of other solvents. The method can be used for the preparation of phenol from chlorobenzene, *o*- or *p*-chlorophenol from *o*- or *p*-dichlorobenzene, and α -naphthol from α -chloronaphthalene. In many cases the yields are nearly quantitative. It is not necessary to use anhydrous methyl alcohol.—A. S.

Condensation products of the anthraquinone series; Preparation of ether-like —. Farb. w. vorm. Meister, Lucius, u. Brüning. Ger. Pat. 280,975, March 14, 1913.

ALIZARIN or one of its substitution products is condensed with an ethylene halide in presence of a substance capable of combining with hydrohalogen acids, and with or without addition of a catalyst, such as copper or a copper compound. The products are useful for the preparation of dyestuffs. The compound obtained from a dialkali salt of alizarin and ethylene bromide forms an orange vat with alkaline hydrosulphite solution.—A. S.

Anthraquinonemercaptans; Preparation of —. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 281,102, Aug. 1, 1913. Addition to Ger. Pat. 204,772.

ANTHRAQUINONEMERCAPTANS are obtained by heating anthraquinonesulphochlorides with alkali sulphides or polysulphides. Sulphinic acids are formed if the reaction mixture be not heated.—A. S.

Isatins; Preparation of —. Farb. w. vorm. Meister, Lucius, und Brüning. Ger. Pat. 281,052, July 19, 1913.

CONDENSATION products of *o*-nitro-aldehydes capable of yielding indigo on treatment with alkalis, e.g., 3,6-dichloro-2-nitrophenyl-lactic methyl ketone, 3,6-dichloro-2-nitrophenyl-lactic aldehyde, or 5-methyl-2-nitrophenyl-lactic methyl ketone, are treated with alkaline oxidising agents, e.g., permanganates, hypochlorites, or ferricyanides, in aqueous solution, whereby they are converted into the corresponding isatins.—A. S.

Aryldiazo compounds containing boron and fluorine; Preparation of complex —. H. Bart. Ger. Pat. 281,055, Oct. 7, 1913.

COMPLEX aryldiazo compounds containing boron and fluorine, more stable than other solid diazo salts, are obtained by the interaction of aromatic diazo compounds with complex borofluoric acids or their salts.—A. S.

Aromatic amines; Preparation of —. C. von Girssewald. Ger. Pat. 281,100, Feb. 6, 1914.

AROMATIC nitro compounds are reduced by hydrogen or a mixture of hydrogen with other gases, e.g. with carbon dioxide or with gases containing carbon dioxide, in presence of water and a catalyst, under high pressure and at a temperature above the boiling point of the amine produced. Iron turnings may be used as catalyst. The process may be made continuous by providing a loaded valve for the escape of the amine vapour.—A. S.

o-Aminobenzenesulphonic acid; *Preparation of —*. J. Obermiller. Ger. Pat. 281,176, Oct. 5, 1913.

THE reaction mixture obtained by sulphonating benzene, containing as little free sulphuric acid as possible, is nitrated at a temperature above atmospheric, and the mixture of nitro-compounds is reduced. The isomeric aminobenzenesulphonic acids are separated by fractional crystallisation of their magnesium salts; or the nitrobenzenesulphonic acids may be separated in like manner, before reduction; in both cases the salt of the *o*-acid is the most soluble. (See also this J., 1914, 130.)—A. S.

Aldehydes; Preparation of aromatic —. C. F. Boehringer und Söhne. Ger. Pat. 281,212, Aug. 7, 1913.

AROMATIC aldehydes are obtained by the action of carbon monoxide under pressure, e.g. 40—90 atmospheres, on aromatic hydrocarbons or their substitution products in presence of aluminium

chloride. Good results are obtained even in those cases where Gattermann's process (this J., 1897, 832; also Eng. Pat. 13,709 of 1897; this J., 1898, 572) either fails or gives poor yields.—A. S.

Uncexplosive preparation [nitro-compounds]. Non-explosive preparations and process of making same.

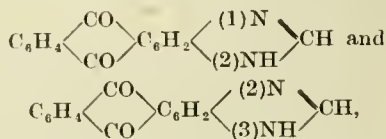
A. Schmidt, Assignor to Farb. vorm. Meister, Lucius, und Brüning, Hoechst, Germany. U.S. Pats. 1,136,723 and 1,136,724, April 20, 1915. Dates of appl., Sept. 29, 1913 and Sept. 22, 1914.

SEE FR. Pat. 463,288 of 1913; this J., 1914, 413.

IV.—COLOURING MATTERS AND DYES.

Iminazoles of the anthraquinone series. A. Schaarschmidt. *Annalen*, 1915, **407**, 176—194. *J. Chem. Soc.*, 1915, **108**, i., 177—178.

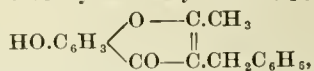
THE 1:2- or 2:3-diaminoanthraquinones condense quantitatively with anthraquinone-2-carboxylic acid or -2-aldehyde or *o*-dichloro-2-methylanthraquinone, and incompletely with anthraquinone-1-carboxylic acid or its nitrile, in presence of sulphuric or acetic acid. The iminazoles of the types:



produced from the highly coloured *o*-diaminoanthraquinone, are faintly yellow and do not yield vat dyestuffs; but the 2-phenyl derivatives are yellow and dye cotton from the vat. Anthraquinone-iminazoles containing an anthraquinonyl group also give vat dyestuffs, unless this group has been produced from anthraquinone-1-carboxylic acid or its nitrile. The acid character of the anthraquinone-iminazoles increases rapidly with the molecular weight. Those of the above types, but not the 2-phenyl derivatives, dissolve in dilute mineral acids. Sodium hypochlorite and bromine water have no action on anthraquinoneiminazoles, and alkaline reducing agents only attack the carbonyl groups.—F. W. A.

Benzo- γ -pyrones and flavones; Syntheses of—. I. S. Jacobson and B. Ghosh. *Chem. Soc. Trans.*, 1915, **107**, 424—434.

THE condensation of unsubstituted or methyl-substituted aceto- or benzoyl-acetic esters with phenols in presence of sulphuric acid, leads to the formation of substituted coumarins, but if the ester contains a group of greater complexity, benzo- γ -pyrones are produced. Thus ethyl benzyl-acetoacetate condensed with resorcinol to give 7-hydroxy-3-benzyl-2-methylbenzo- γ -pyrone,

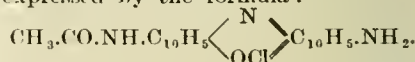


which formed long yellowish needles, m. pt. 186° C. In a similar manner γ -pyrones were prepared from ethyl benzylacetoacetate and *m*-cresol, *a*-naphthol, pyrogallol, phloroglucinol, and orcinol. They formed yellow or white needles, and exhibited a greenish fluorescence in concentrated sulphuric acid.—G. F. M.

Azoxinic colouring matters; Synthesis in the group of—. F. Kehrman and D. Kissine. *Ber.*, 1914, **47**, 3096—3100. *Bull. Soc. Chim.*, 1915, **18**, 168—169.

4-ACETAMINONAPHTHOL, m. pt. 178° C., was converted through its nitroso-derivative by reduction with sodium sulphide into 4-acetamino-2-amino-naphthol. The hydrochloride of this amine was

oxidised by ferric chloride to the corresponding *o*-naphthoquinone. When heated for an hour with aminonaphthoquinone in solution in methyl alcohol, a reddish violet solution was formed which deposited violet blue needles of the chloride of a new colouring matter. The base itself is orange yellow, and it dissolves in alcohol and benzene with a yellowish fluorescence. In concentrated sulphuric acid it dissolves to a greenish black solution. The acetyl group can be removed by dilute sulphuric acid with the formation of the violet sulphate of the diamine. The properties of the colouring matter are similar to those of 3-aminonaphthophenazonium, and it is probable that it contains an amino-group in the *para* position to the azinic nitrogen and has a constitution expressed by the formula:



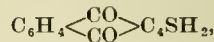
—G. F. M.

2-Amino-3-hydroxyphenazine; *Synthesis of*—. F. Kehrman and D. Kissine. *Ber.*, 1914, **47**, 3100—3101. *Bull. Soc. Chim.*, 1915, **18**, 172.

AMINOHYDROXY-*o*-QUINONE condensed with *o*-phenylenediamine gives 2-amino-3-hydroxyphenazine, identical with the product obtained by the oxidation of *o*-phenylenediamine, the constitution of which is now therefore settled. *o*-Toluylenediamine similarly reacts with aminohydroxy-*o*-quinone, giving a mixture of two isomeric 2-amino-3-hydroxytoluphenazines.—G. F. M.

Thiophen; Condensation of— with phthalic anhydride. W. Steinkopf and W. Butkiewicz. *Annalen*, 1914, **407**, 94—108. *J. Chem. Soc.*, 1915, **108**, i., 155.

o-2-THIENOYLBENZOIC acid, $\text{CO}_2\text{H.C}_6\text{H}_4\text{.CO.C}_6\text{H}_5$, colourless crystals, m. pt. 145°, is prepared from thiophen, phthalic anhydride, and aluminium chloride in carbon bisulphide in the usual manner. Its constitution is proved by the formation of the compound by the oxidation of *o*-tolyl-2-thienyl ketone by chromic and acetic acids. Thiophanthraquinone,



yellow needles, m. pt. 227°—228° C., prepared by heating *o*-thienoylbenzoic acid with phosphoric oxide at 150°, or with concentrated sulphuric acid at 105° C., sublimes readily, forms a brownish-yellow vat with alkaline hydrosulphite, and yields a nitro-derivative, $\text{C}_{12}\text{H}_9\text{O}_4\text{NS}$, yellow crystals, m. pt. 240°—241° C., by treatment with nitric acid of sp. gr. 1.5.

Isocurcumin. G. Heller. *Ber.*, 1914, **47**, 2998—3000. *Z. angew. Chem.*, 1915, **28**, Ref., 64. (See also this J., 1914, 544.)

CURCUMIN gives a bright reddish brown coloration with ferric chloride, whereas isocurcumin gives only a faint yellowish brown coloration. It is probable that the two compounds represent a case of keto-enol isomerism, isocurcumin being a mixture of stereoisomeric ketones with a small proportion of the enol form, whilst curcumin consists of the enol form. A substance with properties closely resembling those of isocurcumin, is obtained by heating curcumin with sodium carbonate solution. Curcumin is converted into hydrocurcumin by treatment with hydrogen in presence of platinum black, but isocurcumin cannot be hydrogenated in this way.—A. S.

Aromatic arsenic compounds. VIII. Some products of the reduction of 2,4-dinitrophenylarsinic acid, and a large class of new derivatives of carbinic acid. Karrer. *See XX.*

PATENTS.

Dyestuffs of the anthraquinone series; Manufacture of greenish-blue — soluble in water. Actienges. f. Anilinfabr. Ger. Pat. 280,616, July 15, 1913.

1-AMINO-4-HALOGENANTHRAQUINONE-2-SULPHONIC acids are heated with aromatic amines, water, and copper or copper compounds, with or without substances capable of combining with acids; the sulpho group remains intact, whilst the halogen is replaced by an arylamino residue.—A. S.

Vat dyestuff; Production of a bluish-green —. L. Cassella und Co. Ger. Pat. 280,711, Sept. 12, 1913.

1-AMINOANTHRAQUINONE is heated to a high temperature with *o*-chlorobenzaldehyde in presence of copper or a salt having a similar action, and a substance capable of combining with acid and with or without a diluent. The product is soluble with difficulty in organic solvents. It dyes cotton fast bluish-green shades from the vat.—A. S.

Aceridone-like condensation products of the anthraquinone series; Preparation of —. L. Cassella und Co. Ger. Pat. 280,712, July 10, 1913.

β -NAPHTHOQUINONE-3-CARBOXYLIC acid is condensed with an aminoanthraquinone in which the ortho-position to the amino group is free, and the product is treated with a condensing agent capable of eliminating the elements of water.—A. S.

Vat dyestuffs; Preparation of —. L. Kalb. Ger. Pat. 280,787, March 26, 1913.

1,1'-DINAPHTHYL-8,8'- or -2,2'-dicarboxylic acid, or their derivatives such as esters, chlorides, or nitriles, or nuclear substitution products of these compounds, are treated with acid condensing agents, e.g., sulphuric acid or aluminium chloride. The products are vat dyestuffs. The simplest one is a quinone of the composition, $C_{22}H_{10}O_2$, having the ketone groups in the amphi-position.—A. S.

Anthracene derivatives [dyestuffs]; Preparation of —. M. Kardos. Ger. Pat. 280,839, Jan. 30, 1913.

ACEANTHRENEQUINONE or one of its halogen-substitution derivatives is treated with hydroxylamine or a substance capable of yielding it. The products dye wool yellow shades from an acid bath, and their alkali salts may be used for the preparation of lakes.—A. S.

Vat dyestuffs of the anthracene series; Preparation of —. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 280,840, June 25, 1913. Addition to Ger. Pat. 268,505 (this J., 1914, 195).

INDAZOLES derived from *o*-diazomethylantraquinones are treated with condensing agents other than the halogens or substances capable of yielding halogens, specified in the chief patent, e.g., with concentrated sulphuric acid or metallic chlorides. The products are in some cases identical with those obtained previously.—A. S.

Sulphonic acids of aromatic aminothiazoles; Preparation of —. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 281,048, June 24, 1913.

DEHYDROTHIOTOLUIDINE, its homologues or substitution products, or the corresponding Primulines, are sulphonated by heating with sulphuric acid to a high temperature. The products are different from the sulphonic acids hitherto known, prepared by the action of fuming sulphuric acid. The azo dyestuffs prepared from the new dehydrothiotoluidinesulphonic acid are faster to light and usually of a deeper colour than analogous dyestuffs from the known sulphonic acids of dehydrothiotoluidine.—A. S.

Indigo series; Preparation of oxidation products of the —. Farb. vorm. Meister, Lucius, und Brüning. Ger. Pat. 281,050, Oct. 14, 1913. Addition to Ger. Pat. 276,808.

THE product described in the chief patent (this J., 1914, 1151) is also obtained when indigo in neutral aqueous suspension is oxidised with permanganate. It is different from dehydroindigo (Ger. Pat. 216,889; this J., 1910, 207). Analogous products can be obtained from homologues and substitution products of indigo.—A. S.

Anthraquinone dyestuffs soluble in water; New blue —. Actienges. f. Anilinfabr. Fr. Pat. 473,208, April 10, 1914. Under Int. Conv., July 14, 1913.

SEE Ger. Pat. 280,616 of 1913; preceding.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Nitration of cellulose and decomposition of nitro-cellulose by acids and alkalis. Meissner. See XXII.

Nitration of cellulose, with recovery of the acids. Dreger. See XXII.

PATENTS.

Retting fibrous materials; Method and apparatus for —. J. K. Toles, San Francisco, Cal., Assignor to W. R. Brown, Detroit, Mich. U.S. Pat. 1,133,590, March 30, 1915. Date of appl., April 23, 1913.

FLAX straw bales are placed in a horizontal tank partly filled with circulating fluid; the tank is then filled with fluid under pressure, with or without the addition of retting bacteria, and the fluid is heated and continuously circulated under pressure to effect the complete retting of the flax. Means are provided in the circuit to remove gummy substances and acid, produced by fermentation from the retting fluid.—F. W. A.

Retting of flax straw and the like. M. A. Adam, London, W. J. Fernie, Dromara, Ireland, and The Fibre Corporation, Ltd., London. Eng. Pat. 745, Jan. 10, 1914.

THE loosening of fibres of fibrous plants, such as flax, is accelerated by heating the water used for retting to 37° C. for 8 to 24 hours; the further progress of the reaction is unaffected by reducing the temperature to 20° to 25° C.—F. W. A.

Animal fibres and fabrics; Combinations of salts for the treatment of —. [Wool-scouring]. R. Vidal. Fr. Pat. 473,183, Sept. 9, 1913.

A SULPHITE or thiosulphate is dissolved in its water of crystallisation and a powdered anhydrous alkali carbonate, sulphide, or hydroxide is stirred in; mixtures of hydrated alkali salts may be dissolved in their water of crystallisation; polysulphides rich in carbonates are prepared by fusing an excess of an alkali carbonate with sulphur. Any of these combinations may be used for the scouring of animal fibres with or without soap.—J. F. B.

Gas-tight membrane [for balloon fabrics] and method of making it. Deutsche Gasglühlicht A.-G. (Auerger). Fr. Pat. 473,421, June 13, 1914. Under Int. Conv., Aug. 6, 1913.

THE pellicles formed on the surface of cultures of micro-organisms are freed from water by pressure, treated with oil or with an emulsion of oil and albuminoid substances (containing e.g., linseed oil, soap, glycerin, and gelatin), dried in the air and varnished. Increased strength may be given by mercerising the pellicles with alkali solution before the treat-

ment with oil. Several pellicles may be united, or they may be given a backing of textile fabric.

—C. A. M.

Artificial silk from cellulose acetates: Manufacture of—. E. Dammann. Fr. Pat. 473,126. June 6, 1914. Under Int. Conv., June 11, 1913.

ARTIFICIAL threads or ribbons are prepared by squirting an original solution of the crude products of the acetylation of cellulose (*i.e.*, without previous isolation of the cellulose acetate) into a coagulating bath composed of a solution of caustic soda (5%) saturated with a salt, such as sodium chloride or sulphate.—J. F. B.

Artificial threads and other products: Process of precipitating viscose for the manufacture of—. H. Lange and G. Walther. Fr. Pat. 473,256. June 9, 1914. Under Int. Conv., June 19, 1913.

VISCOSE is squirted into a coagulating bath containing a bisulphite compound of an aldehyde, or a reduction product of such compound, *e.g.*, a sulphonylate, or a bisulphite compound of a ketone, or products of condensation obtained by combining phenols or naphthols with aldehydes and sulphites, with or without the addition of inorganic or organic salts, or sugars.—J. F. B.

Paper, paper pulp, or the like: Strainers for use in the manufacture of—. S. Milne, Edinburgh. Eng. Pat. 9315, April 15, 1914.

IN a rotary drum strainer, in which the material passes through the drum from the outside to the inside, the vibrating diaphragm is situated inside the drum and is suspended from a bar passing through the trunnions and supported by spring-plates at each end. The diaphragm vibrates in the strained stuff, and the exterior of the drum is provided with combs or scrapers which sweep the impurities forward and discharge them over the side of the vat automatically.—J. F. B.

Paper pulp; Process of manufacturing—. H. Dolter. Fr. Pat. 472,868. Aug. 22, 1913.

THE vegetable matter taken from the stomachs of ruminants at slaughterhouses is digested with the gastric juices at 38° C. until the non-cellulose matters are dissolved. The juices drained from the pulp may be employed for the digestion of the spent fibrous residues of tanning, colouring, or medicinal materials.—J. F. B.

Paper and other absorbent materials; Process for sizing and colouring—. E. Fues. Fr. Pat. 473,405. June 12, 1914. Under Int. Conv., June 23, 1913, and May 19, 1914.

PAPER or other material is sized by dipping in a pseudo-solution containing a precipitable sizing agent, a precipitating agent, and a protective colloid combined in a single bath, to which a colouring matter may also be added. Suitable sizing agents are: soaps of fatty or resin acids, shellac, albumin, casein, etc.; salts of aluminium may be used as precipitating agents, and solutions of glue or gum arabic as protective colloids.

—J. F. B.

Construction of steam-heated drying cylinders [for textiles]. Eng. Pat. 8401. See 1.

Manufacture of coal briquettes with sulphite-cellulose waste lye as binding material. Ger. Pat. 280,455. See 11A.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Colouring matters on cotton; New—. G. G. Hepburn. J. Soc. Dyers and Col., 1915, 31, 119—120.

THE new colours are obtained by treating, on

the fibre, bases containing primary or secondary amino-groups, other than primary monoamines of the benzene series, with a hypochlorite bath. Dried prints obtained by using a mixture containing 24 grms. of dianisidine, 13 c.c. of hydrochloric acid (132.5 c.c.=1 grm.-mol.), 600 grms. of tragacanth thickener, made up to 1000 grms. with water, gave reddish-brown shades on immersing in sodium hypochlorite solution (3 grms. of active oxygen per litre) for 15 to 30 seconds. Printing colours for Auramine O Conc., Night Blue, Methyl Violet 10B, Rhodamine 6G, Extra, New Methylene Blue N, Methylene Violet 3RA, and Azine Green, are prepared from 25 grms. of the dyestuff, 200 grms. of acetic acid (6° B., sp. gr. 1.045), 600 grms. of tragacanth thickening, and 175 grms. of water. The fents are washed and soaped. No development of colour occurs on replacing the hypochlorite by hydrogen peroxide.

—F. W. A.

PATENTS.

Azo dyestuffs on the fibre: Production of red insoluble—. Farb. vorm. Meister, Lucius, und Brüning. Ger. Pat. 280,371. June 18, 1913.

THE fabric is printed with a mixture containing *p*-nitrodiazobenzene 2.1-naphtholsulphonate, or an analogous compound, dissolved in water in presence of an alkali or an alkaline salt; the colour is developed by drying and then treating with water or acid reagents. *Example*. The printing paste is composed of 170 grms. of *p*-nitrodiazobenzene 2.1-naphtholsulphonate and 60 grms. of borax dissolved in 245 grms. of water and mixed with 420 grms. of gum tragacanth solution (60:1000), 40 grms. of barium chloride solution (1:10), 40 grms. of sodium acetate, and 25 grms. of Para soap PN. After printing, the material is dried, treated in a bath of acetic acid (50 grms. of 50% acid per litre) at 60° C., washed, and soaped.—A. S.

Prints on fabrics; Process of obtaining—. O. Neuberger, Frankfort, Germany. U.S. Pat. 1,135,043, April 13, 1915. Date of appl., Feb. 27, 1914.

FOR obtaining designs on fabrics, reduction dyestuffs, or their leuco-compounds, finely ground with varnish or oil, are applied by means of the lithographic printing process. This may be preceded by an impregnation of the fabric with a solution of an alkali, with or without reducing agents, and the dyestuff may be mixed with part of the reducing agents. The prints are developed by steaming in presence of an alkali and reducing agents.—F. W. A.

Fabrics, threads, cords, etc.; Process for rendering waterproof—. S. Alexander and F. Waterhouse, New Mills. Eng. Pat. 23,709, Dec. 8, 1914.

THE material is passed successively through soap solution, a solution of an iron or copper salt, and potassium bichromate solution. The fabric remains waterproof after washing. It is preferable to use the chromate solution at 30° C. for woollens and 100° C. for other goods.—F. W. A.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Sodium and potassium chlorides; Solubility of mixtures of— in solutions of hydrochloric acid. W. B. Hicks. J. Amer. Chem. Soc., 1915, 37, 844—847.

THE solubility in aqueous hydrochloric acid of sodium and potassium chlorides from a mixture of these salts decreases rapidly as the concentration

of the acid increases. The following values were obtained at 25° C. :—

HCl.	NaCl.	KCl.	Ratio K:Na.
0°	19.95	10.90	0.73
8.61	10.65	7.58	0.95
17.16	3.56	3.80	1.42
20.65	2.03	2.86	1.87
32.78	0.18	1.27	9.57

The decrease is much more rapid for sodium chloride than for potassium chloride, and in 16.2% acid the solubilities are the same (1.4%). The acid of constant boiling-point (20.3%) dissolves 2.0% of potassium chloride and 2.2% of sodium chloride. It is not considered practicable to separate the two salts commercially by fractional crystallisation from aqueous hydrochloric acid.

—J. R.

Hypochlorites; Penot's method of analysing — J. Clarens. Ann. Chim. Analyt., 1915, 20, 81—81.

ALL hypochlorite solutions contain chlorites, and these react with hypochlorous acid to form chlorates and chlorine peroxide. This accounts for the lower results (about 2%) obtained by Penot's method of titration with sodium arsenite solution with starch-iodide paper as indicator, as compared with those calculated from the amount of gas liberated by interaction with hydrogen peroxide, or by Mohr's modification of adding an excess of arsenite and titrating with standard iodine solution. The following modification gives correct results :—The volume of arsenite solution required in Penot's original method, is added at once to the hypochlorite solution; the liquid will still give a blue colour with the starch-iodide paper, and the titration is completed with the standard arsenite solution till the paper ceases to turn blue (see also p. 530).—C. A. M.

Pearls; Studies on — E. Beutel. Oesterr. Chem.-Zeit., 1914, 17, 210—242. Z. angew. Chem., 1915, 28, Ref. 72.

PEARLS contain, on the average, 92.5% CaCO_3 , the remainder being water and conchiolin, an organic substance allied to the proteins. The yellowing and loss of lustre of pearls is due in part to wear of the surface and in part to agglutination of the microscopic surface structure by skin secretions. Deterioration due to the first cause cannot be remedied, but the lustre can be at least partly restored by treatment with suitable fat solvents to remove the skin secretions.—A. S.

Boric water-glass. W. Ackermann. Chem.-Zeit., 1915, 39, 225—226.

A MIXTURE of boric acid and borax containing 1 Na_2O to 3—4 B_2O_3 is moistened and heated on a water-bath until it forms a clear syrupy liquid, which is transparent, colourless, and highly adhesive; it remains syrupy for a long time provided that it is not shaken too much. The syrupy form may be restored by adding a little water to the solid and heating. The product is particularly useful as a flux in hard soldering, as it flows readily, adheres well to metal, does not froth or swell like borax, and can be removed without any trouble from the soldered article. Like silica water-glass, boric water-glass forms, on drying, an opaque mass soluble with difficulty in water, but the boric product resembles more closely phosphoric water-glass obtained by fusing microcosmic salt in platinum.—A. B. S.

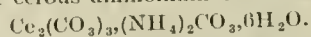
Lead and manganese; Volumetric determination of the higher oxides of — with titanium trichloride. L. Moser. Chem.-Zeit., 1915, 39, 245—247.

Lead peroxide and red lead. A weighed quantity

(0.2—0.5 gm.) is mixed with water (100 c.c.), the mixture is boiled to expel dissolved oxygen, an excess of standard titanium trichloride solution is rapidly added, with shaking, in a current of carbon dioxide, and the violet solution, whilst still warm, is titrated in the usual way with ferric chloride, in the presence of potassium thiocyanate or methylene blue as indicator, in the latter case deducting from the volume of titanium solution required for reduction that corresponding to the indicator added. The strength of the titanium solution is determined in the same manner, by boiling 100 c.c. of water for 5 minutes, adding a measured volume of titanium chloride solution, in a current of carbon dioxide, and titrating with ferric chloride. If iron be present, it must be determined by decomposing the peroxide with hydrochloric acid, boiling off chlorine, and titrating with titanium chloride; the volume of titanium solution found is then deducted from that used in the determination of active oxygen. Chlorides, sulphates, and calcium have no influence on the reaction. *Manganese dioxide.* The very finely powdered material (0.1—0.3 gm.) is mixed with a large excess of titanium chloride solution, in a current of carbon dioxide, and about an equal volume of recently boiled hydrochloric acid (sp. gr. 1.19) rapidly added. The mixture is boiled gently and agitated until solution is complete, 3—5 drops of methylene blue solution are added, and the excess of titanium solution is titrated, deducting also that corresponding to the indicator added. The same method is adopted in standardising the titanium solution, whilst iron is determined and allowed for as above.—F. SODN.

Magnesium chloride as a mineral former. II. *Uranium-cerium-blue and the existence of constitutive colouring.* *Magnesia-red and magnesia-green.* K. A. Hofmann and K. Hösehele. Ber., 1915, 48, 20—28. J. Chem. Soc., 1915, 108, ii., 165—166.

WHEN anhydrous magnesium chloride is used as a solvent for the crystallisation of metallic oxides (this J., 1914, 199), uranium oxide crystallises with cerium oxide, the product having a deep blue colour. The coloured substance is produced by heating a dry mixture of cerium and uranyl sulphates with excess of magnesium chloride in a covered crucible for 15 hours. The resulting deep blue cubic crystals can be separated from the magnesia by reason of their relative stability towards dilute acids. The composition of this uranium-cerium-blue varies slightly, but agrees approximately with that of a compound of uranium dioxide with a bimolecular proportion of cerium dioxide. Uranium dioxide itself can be obtained in a crystalline condition by fusing sodium uranate with magnesium chloride in an analogous manner. A similar deep blue compound of uranium and cerium dioxides can also be obtained by precipitating an aqueous solution of uranyl and cerous nitrates with excess of ammonia or dilute potassium hydroxide solution; the precipitate is at first yellow, but soon changes to a denser blue solid. This result is attributed to a reduction by the primarily produced cerous hydroxide, followed by combination of the resulting dioxides. The blue compound can be isolated by treatment with ammonium bicarbonate solution, which removes excessive uranium dioxide as uranium ammonium carbonate, but if this process is too prolonged the blue compound undergoes decomposition with formation of doubly refracting crystals of cerous ammonium carbonate,



It was not found possible to obtain analogous results by wet methods with other metals in place of uranium. By heating cobalt sulphate with

magnesium chloride in a porcelain crucible, octahedral crystals of "magnesia-red" can be obtained more easily than by the earlier process (Hedvall, this J., 1914, 429); the addition of magnesia is not necessary, as it is produced during the heating. By a similar process nickel sulphate gives rise to green, octahedral crystals ("magnesia-green"). These crystals are mixed crystals of the two oxides. In experiments with manganese, complications arise on account of atmospheric oxidation. Attention is drawn to the ease with which, on fusion with magnesium chloride, many basic oxides react with formation of a chloride which sublimes, leaving a residue of magnesium oxide.

Metal ammonias of chlorates, bromates, and iodates; Stability of the —. Thermal dissociation and explosion. F. Ephraim and A. Jahnson. Ber., 1915, 48, 41—56. J. Chem. Soc., 1915, 108, ii., 166—167.

THE metal-ammonias of the chlorates, bromates, and iodates are easily obtainable, but in the case of the derivatives of the two former, investigation of the dissociation curves is limited by the explosive nature of the compounds at higher temperatures. The explosion temperature of the metal-ammonias derived from the chlorates of the metals zinc, nickel, and copper, coincides approximately with the temperature at which the dissociation pressure becomes equal to the atmospheric pressure, and that this may not be a chance coincidence is confirmed by the fact that under increased pressure the explosion temperature is raised. With the metal-ammonias derived from the bromates, on the other hand, no marked difference is observable between the explosion temperature under ordinary atmospheric pressure and in sealed vessels. In the case of the metal-ammonias of the iodates of copper, nickel, zinc, and cadmium, dissociation occurs at relatively low temperatures, although explosions cannot be produced in the open atmosphere, but only in sealed vessels, the requisite temperatures being between 210° and 219° C. The metal-ammonias of the chlorates and bromates, in addition to exploding on heating, can also be exploded by shock.

The following compounds are described: Copper-tetrammine chlorate, deep blue needles; copper-hexammine chlorate, deep blue; nickel-hexammine chlorate, blue crystals, m.pt. near 180° C.; zinc-tetrammine chlorate, colourless crystals; zinc-hexammine chlorate; cadmium-hexammine chlorate, colourless crystals; cadmium-tetrammine chlorate; cobalt-hexammine and cobalt-tetrammine chlorates were unstable, as also was a manganese-ammine chlorate of unknown ammonia content. There were also obtained: Copper-tetrammine bromate, blue needles; nickel-hexammine bromate, violet, crystalline powder; zinc-tetrammine bromate, crystalline powder; cadmium-tetrammine bromate, crystalline powder; anhydrous copper iodate (that described by Ditte, J. Chem. Soc., 1892, 62, 1388, is the monohydrate), brown; copper-tetrammine iodate dihydrate, blue prisms; copper-pentammine iodate; nickel-pentammine iodate, violet; nickel-pentammine iodate trihydrate, reddish-violet crystals; zinc-tetrammine iodate, colourless needles; cadmium-tetrammine iodate, microscopic prisms.

Ammonium salts; Action of — on mercuric iodide. I. I. Guareschi. Atti R. Accad. Sci. Torino, 1914—1915, 50, 231—236. J. Chem. Soc., 1915, 108, ii., 167—168.

WHEN a mixture of mercuric iodide with a little ammonium bromide is heated in a long, narrow tube of hard glass, violet iodine vapours are evolved, the aqueous extract of the cold mass giving an intense coloration with starch solution.

The reaction, which is shown clearly by as little as 0.0001 grm. of mercuric iodide, is due to the formation and subsequent decomposition of ammonium iodide; it takes place also in solution. The presence of mercuric chloride or bromide, or lead bromide hinders the reaction, which is, however, not affected by an excess of potassium bromide. When heated with ammonium chloride, mercuric iodide yields scarcely any iodine, whilst with ammonium sulphate or nitrate much iodine is liberated, but the cold mass gives no coloration with starch solution. The reaction is given also by ammonium bichromate. Mercurous iodide and ammonium bromide yield no iodine, the reactions occurring being expressed by the equations: $\text{Hg}_2\text{I}_2 + 2\text{NH}_4\text{Br} = \text{HgBr}_2 + \text{Hg} + 2\text{NH}_4\text{I}$; $2\text{NH}_4\text{I} = 2\text{NH}_3 + \text{H}_2 + \text{I}_2$, and $\text{Hg} + \text{I}_2 = \text{HgI}_2$. The presence of mercurous iodide or bromide also prevents the reaction with mercuric iodide. Mercuric iodide is readily soluble in cold ammonium bromide solution, and if the dry residue of the liquid is heated, iodine vapour is immediately evolved. This reaction allows of the separation and characterisation of mercuric iodide when mixed with large proportions of many other insoluble red compounds; thus, mercuric sulphide (cinnabar) containing only 0.1% of the iodide responds to the test. This is not the case, however, when the mixture of mercuric sulphide and iodide is heated with water and ammonium bromide, owing to the formation of ammonium sulphide, sulphur, etc. When a mixture of a little mercuric iodide with much manganese dioxide is slowly heated, iodine vapour is liberated at first, but the mercuric iodide subsequently sublimes; with rapid heating, scarcely any iodine is set free. Addition of ammonium bromide to this mixture results in the copious evolution of iodine vapour. If a mixture of mercuric iodide and antimony sulphide is heated with ammonium bromide, ammonia is liberated in large quantity and a sublimate forms, but no iodine can be detected. When this mixture is treated with aqueous ammonium bromide and the dried crystalline residue of the solution heated, faintly violet vapours form, but no reaction is given with starch; the presence of an iodide is, however, shown by addition of chlorine water.

Aluminium nitride; Sublimation and dissociation of —. F. Fichter and G. Oesterheld. Z. Elektrochem., 1915, 21, 50—54. J. Chem. Soc., 1915, 108, ii., 168—169.

ALUMINIUM nitride is usually obtained as a grey, amorphous mass, but some specimens contain rosettes of colourless, hexagonal needles. The results of experiments show that the crystals are the result of sublimation. Aluminium nitride begins to sublime in a tungsten tube at $1870^\circ \pm 20^\circ$ when under a pressure of 14 mm. of nitrogen, and at $1890^\circ \pm 20^\circ$ the sublimation is very rapid under the same conditions. The sublimation is accompanied by a partial dissociation of the nitride into its elements; the distillate settles as a crystalline deposit, which contains considerable quantities of metallic aluminium. The dissociation is more complete the lower the pressure of nitrogen, and it is still more complete when aluminium nitride is heated in hydrogen at 2 mm. pressure. When higher pressures of nitrogen are used the tungsten tube is attacked. Experiments in carbon or graphite tubes filled with nitrogen at atmospheric pressure show that sublimation occurs without the formation of metallic aluminium, but the sublimate is contaminated with aluminium carbide and carbon. When aluminium carbide is heated quickly to 2000°C. , it partly dissociates, and leaves a residue of graphite. When an arc is struck between aluminium electrodes in nitrogen, a fine, grey sublimate of aluminium nitride which contains

metallic aluminium, is formed. This product can be freed from aluminium by distillation of the aluminium at 1840° C. in hydrogen of low pressure.

Chromic oxide; Hydrous.—C. F. Nagel, jun. J. Phys. Chem., 1915, 19, 331—337.

HYDROUS chromic oxide is brought into colloidal solution by caustic alkali. It can adsorb to some extent hydrous oxides of iron, manganese, cobalt, nickel, copper, and magnesium, and thus bring them also into colloidal solution. These oxides adsorb chromic oxide, and thus tend to remove it from its colloidal solution in alkali. In the presence of glycerin, hydrous iron oxide is brought into colloidal solution by alkali, and then loses its tendency to precipitate chromium oxide. By adding potassium hydroxide rapidly and in not too great excess to a solution of chromic sulphate a good chromic oxide jelly can be obtained. (See also this J., 1914, 75.)—C. A. M.

Magnetisability of the oxides of manganese, chromium, uranium, molybdenum, and tungsten. E. Wedekind and C. Horst. Ber., 1915, 48, 105—112. J. Chem. Soc., 1915, 108, ii., 140—141.

THE magnetisability of the oxides of manganese is very similar to that of the oxides of vanadium or titanium; the monoxide is rather more strongly magnetic than the dioxide, whilst the results obtained with barium manganate and potassium permanganate show that the susceptibility decreases with increasing valency. The mixed oxide, Mn_2O_3 , is most strongly magnetic, corresponding with Fe_2O_3 and Ti_2O_3 , whilst the sesquioxide appears to be unexpectedly less magnetic than the other oxides. Chromium trioxide is less magnetic than the sesquioxide, whilst the salt-like oxides, Cr_2O_3 and Cr_2O_5 , are about three thousand times more strongly magnetic than the former. In the cases of the sulphides, CrS and Cr_2S_3 , the susceptibility decreases with increasing valency, thus differing from the sulphides of vanadium; the greatest susceptibility is shown by the sulphide, Cr_2S_4 . Uranium di- and tri-oxides are more strongly magnetic than the metal, and show a perceptible increase in susceptibility with diminishing valency; in the case of the mixed oxide, U_3O_8 , the expected increase in magnetisability was not observed. Similar results were obtained with the oxides of molybdenum and tungsten. Barium manganate was prepared in a slightly impure state by addition of excess of aqueous barium hydroxide to a moderately concentrated solution of potassium permanganate and cautious addition of hydrogen peroxide until the solution was only faintly pink; the dark precipitate was repeatedly washed with water. Chromous sulphide, CrS , grey powder, sp. gr. at 14° C., 3.909, was obtained by heating the sesquisulphide in a stream of hydrogen for twelve hours at as high a temperature as possible. The sulphide, Cr_2S_3 , black powder, sp. gr. at 14° C., 3.538, was prepared by heating a mixture of chromium sulphide and sulphur in a current of hydrogen sulphide, the temperature being gradually raised to redness. Excess of sulphur was subsequently removed by carbon bisulphide.

Phosphorescent selenides of the alkaline-earth metals. F. Kittelmann. Ann. Physik, 1915, [iv], 46, 177—196. J. Chem. Soc., 1915, 108, ii., 121.

IN all active preparations of phosphorescent alkaline-earth selenides, which contained copper, manganese, bismuth, lead, silver, zinc, nickel, or antimony as the metallic "impurity," the phosphorescent light was found to show a maximum near the red end of the spectrum. The phosphorescent band has its maximum in all cases at a greater wave-length than that which corresponds with the exciting light. The upper temperature limit, above which the selenides are inactive, is in

general lower than for the corresponding sulphides. So far as the visible spectrum is concerned, the number of phosphorescent bands exhibited by the selenides is small in comparison with that shown by the sulphides, and the chief maxima are displaced towards the red end of the spectrum as compared with the maxima characteristic of the corresponding sulphides. The intensity and the duration of the phosphorescence are also much smaller for the selenides than for the sulphides.

Didymium group; Fractional crystallisation of the picrates of the rare earths of the—. L. M. Dennis and F. H. Rhodes. J. Amer. Chem. Soc., 1915, 37, 807—815.

UPON repeated fractional crystallisation of a mixture of the picrates of the rare earths of the didymium group containing also small amounts of the elements of the yttrium and erbium groups, the members of these three groups accumulated in the least soluble, intermediate, and most soluble fractions, respectively. Yttrium could also be separated from erbium and holmium in a similar manner, but the individual elements of the didymium group were non-separable, and no concentration of neodymium or praseodymium was observed.—J. R.

Lead oxides; Determination of the higher—. J. Milbauer and B. Pivnicka. Z. anal. Chem., 1914, 53, 569—581. Z. angew. Chem., 1915, 28, Ref., 75.

BUNSEN'S method, in which chlorine liberated from hydrochloric acid by lead dioxide is determined iodometrically, gives satisfactory results when concentrated hydrochloric acid is used, but is too complicated for ordinary use. The method of Lux (Z. anal. Chem., 1880, 19, 153; see also Chwala and Colle, this J., 1911, 802), using excess of oxalic acid and then titrating the excess not oxidised, is suitable for technical purposes. Finzi and Ropuzzi's method (Z. anal. Chem., 1902, 41, 741), depending upon the action of hydrazine acetate on the lead oxides in presence of acetic acid, gives high results. The authors utilise the reaction, $PbO_2 + 2NH_4OH + 2KOH = Pb(OK)_2 + 4H_2O + N_2$; no heating is required, and the results, though somewhat low, are much better than those obtained by Finzi and Ropuzzi's method.—A. S.

Lead and the end product of thorium. Part II. A. Holmes and R. W. Lawson. Phil. Mag., 1915, 29, 673—688. (See this J., 1914, 1206.)

CALCULATIONS based on the assumption that the total lead found in certain minerals is the sum of the uranium-lead (radium G), the thorium-lead (thorium E), and the original lead, give the half period of decay of thorium E as about 10^6 years. The suggestion that the end product of thorium E is an isotope of bismuth is considered unlikely, as the latter has not been detected in thorite and allied minerals. It is probable that the final product is an isotope of either thallium or polonium. It may be considered as proved that the stable uranium-lead has a lower atomic weight than ordinary lead, but the evidence in the case of thorium-lead is much less certain owing to its instability. The crude estimation of the age of a mineral based on its Pb : Ur ratio can now be corrected by atomic weight determinations, allowance being made for the presence of original lead and for thorium-lead; but this would barely affect the time-scale as at present constituted.

—E. H. T.

Bismuth from pitchblende; α -Radiation of—. L. Meitner. Physikal. Zeits., 1915, 16, 4—6. J. Chem. Soc., 1915, 108, ii., 126.

ACCORDING to experiments made by Fajans and

Towara (Naturwissenschaften, 1914, 2, 685), the residues from Joachimsthal pitchblende contain a new element of the bismuth series which emits α -rays and is characterised by a half-decay period of less than 10^8 years. For various reasons this result seemed to be improbable, and the author re-investigated the bismuth residues from the above source. It was found that the α -ray activity exhibited by the bismuth is due to ionium, and that it can be completely removed by the addition of a small quantity of thorium to the bismuth solution, and subsequent separation of these elements by appropriate methods.

Radioactive substances; The gases produced by —.
Decomposition of water. A. Debiérne. Ann. Phys., 1914, [ix.], 2, 97—127. J. Chem. Soc., 1915, 108, ii., 126—127.

THE author gives a summary of the results which have been obtained up to the present time in the investigation of the gases produced in the decomposition of water by radioactive substances. These results would seem to show that the chemical decomposition is due to the action of the α -, β -, and γ -rays which are emitted by these substances. It is suggested that the products of decomposition are formed in three different ways: (1) by direct collision of the charged particles with the molecules of water, (2) by local rise of temperature along the path of the particles, (3) by ionisation and subsequent interaction between the ions and other constituents of the water. The ions produced by the action of the rays on water are supposed to be similar to the ions produced in gases, and are

represented by the symbols, H_2O^+ and H_2O^- . By interaction of these ions with the hydrogen and hydroxyl ions in the water, hydrogen, hydrogen peroxide, and oxygen are formed in accordance with the equations: $\text{H}_2\text{O}^+ + \text{H} = \text{H} + \text{H}_2\text{O}$; $\text{H}_2\text{O}^+ + \text{OH} = \text{H}_2\text{O} + \text{OH}$; $2\text{OH} = \text{H}_2\text{O}_2$; $4\text{OH} = 2\text{H}_2\text{O} + \text{O}_2$.

The relative importance of the above three processes cannot be determined with any degree of certainty, but it would seem that the first and second are of greater significance for the α -rays than for the β -rays. The fact that nearly pure hydrogen is obtained in the decomposition of water by β -rays would suggest that the gaseous product is in this case due to the third process. The importance of the third process in the action of both kinds of rays is shown by a calculation of the quantity of gas which would be evolved by 1 gm. of radium in radioactive equilibrium. In this it is assumed that the number of ions formed in the water is equal to the number which would be produced in a gas. The calculated rate at which gas would be liberated is of the same order as that which has been actually observed in the author's experiments.

Electric discharges; The chemical action of —.
The role of ionisation [in fixation of nitrogen].
 E. Briner. Jour. Chim. Phys., 1915, 13, 18—32.

THE chemical activity of electric discharges is due to thermal, ionic, and photochemical action, but in the fixation of nitrogen, as ammonia or nitric oxide, the photochemical action does not take part. The ultraviolet rays do not cause the formation but the destruction of these compounds, and the results obtained show that the chemical activity of the arc is principally of a thermal character and not of ionic origin.—B. N.

Carbon monoxide; Action of bromine on —.
 A. Piva. Gaz. Chim. Ital., 1915, 45, I., 219—237.

USING bromine and carbon monoxide dried by means of phosphorus pentoxide, only a very small proportion of the bromine disappeared even on prolonged exposure to sunlight, e.g., 2.29% in 32

hours in one experiment. When water was added in increasing quantities, the amount of bromine combined increased: for example, with a quantity of water about the same as that of the bromine, 80% of the bromine was combined in 32 hours in presence of sunlight, and over 20% even when the mixture was protected from the light. The final reaction products are carbon dioxide and hydrobromic acid, and it is considered probable that the carbon monoxide and bromine first unite to form carbonyl bromide and that equilibrium is attained when only a small proportion of this is formed; in presence of water the carbonyl bromide is decomposed, thus disturbing the equilibrium and giving opportunity for the formation of more carbonyl bromide.—A.S.

Hydrogen arsenide; A hydrate of —. de Forcrand. Comptes rend., 1915, 160, 467—470.

A HYDRATE of hydrogen arsenide was formed when the gas, generated by the action of water on aluminium arsenide, was compressed with a few drops of water in a Cailletet apparatus. The hydrate has a critical temperature of decomposition at 28.2°C ., when its dissociation pressure, 17.5 atm., is equal to the vapour tension of liquid hydrogen arsenide. At lower temperatures the hydrate is stable under the required minimum pressures corresponding to the temperatures, for example 0.806 atm. at 0°C ., 2.65 atm. at 10°C ., and 6.79 atm. at 18.25°C . The calculated heat of formation is 17.753 cal. from liquid water, and 8.238 cal. from solid water, corresponding to the formula, $\text{AsH}_3 \cdot 6\text{H}_2\text{O}$. The hydrate is closely analogous to those of hydrogen sulphide, phosphide, and selenide, and exhibits almost the same difference in physical constants from the last-named as does the hydrate of phosphine from that of hydrogen sulphide. Hydrogen antimonide also forms an analogous hydrate.—G. F. M.

Hydrogen peroxide solution; Acidity of —.
 T. Callan. Pharm. J., 1915, 94, 413. (See also this J., 1915, 281.)

THE method prescribed in the U.S. Pharmacopœia for the determination of the acidity of hydrogen peroxide solution (addition of 5 c.c. of N/10 sodium hydroxide solution to 25 c.c. of the sample and determination of the excess of alkali, remaining after concentration, by titration with N/10 acid, using phenolphthalein as indicator) gives results which are about three times as high as those found by the B.P. method (direct titration with N/10 sodium hydroxide solution, using methyl-orange as indicator). The discrepancy between the results obtained by the two methods is due to the presence of phosphates in the solution (numerous samples examined were all found to contain phosphates) and to the fact that dissolved carbon dioxide is included in the "acidity" as determined by the U.S.P. method. Both methods are equally accurate, though giving widely differing results in the presence of phosphates (and probably of salts of other polybasic acids), and the method to be preferred depends entirely on what is understood by the term "acidity."—W. P. S.

Hydrazine; Anhydrous —. III. *Anhydrous hydrazine as a solvent.* T. W. B. Welsh and H. J. Broderick. J. Amer. Chem. Soc., 1915, 37, 816—824.

THE approximate solubility of 120 substances in liquid hydrazine is given, together with the action of the electric current upon the solutions. Of the metals examined, only those of the alkali group are appreciably soluble. Sulphur and iodine dissolve readily, with vigorous decomposition of the hydrazine. The solubility of chlorides, bromides, and iodides increases in the order given; the weights dissolved per c.c. of solvent in the case of the sodium compounds are 0.08,

0.37, and 0.61 grm., respectively. Metallic carbonates, oxides, sulphates, and sulphides are at the most only slightly soluble. Nitrates are generally soluble, but in some cases reaction occurs with the solvent. Ammonium compounds dissolve with the evolution of much ammonia due to a process of hydrazinolysis. Tertiary ammonium phosphate is, however, insoluble. Bismuth chloride gives a quantitative precipitation of metallic bismuth; and mercury compounds, with the exception of the insoluble sulphide, yield mercury. Cobalt and silver mirrors are produced under certain conditions, and copper and lead compounds also dissolve with some amount of decomposition.—J. R.

Hydrazine; Anhydrous —. IV. Chemical reactions in anhydrous hydrazine. T. W. B. Welsh and H. J. Broderson. J. Amer. Chem. Soc., 1915, 37, 825—832.

HYDRAZINE sulphide precipitates cadmium and zinc as sulphides from solutions of their salts in anhydrous hydrazine, and the process may be effected quantitatively by titrating the hydrazine sulphide with the cadmium or zinc solution until the yellow colour just disappears. Metallic sodium precipitates cadmium, zinc, and iron, but not magnesium, calcium, or barium from similar solutions. Zinc, copper, tin, and aluminium do not react and magnesium, calcium, and lithium react only slightly with anhydrous hydrazine. Reactions take place in this solvent similar to those which occur in liquid ammonia, water, and other dissociating solvents.—J. R.

Flame reactions. IV. Salts in oxygen and chlorine flames. Bancroft and Weiser. See XXIII.

PATENTS.

Alkali nitrates; Process of decomposition of —. [Manufacture of nitric acid and alumina.] Soc. Anon. des Poudres et Nitrates. Fr. Pat. 473,433, June 13, 1914. Under Int. Conv., June 16, 1913, and June 12, 1914.

A MIXTURE of sodium or potassium nitrate and alumina or bauxite is treated with a current of superheated steam, at a temperature (250°—400° C.) below the decomposition point of the nitric acid which is evolved, and the residue is extracted with water to produce a solution of alkali aluminate, from which pure alumina may be obtained. The reaction is facilitated by adding calcium carbonate (10%) to the charge, and fusion is prevented by introducing 10—15% of crude aluminate from a preceding operation; a barium or strontium compound may also be added to convert silica into an insoluble silico-aluminate.—F. SODX.

Salt; Apparatus for the manufacture of —. H. Frasch, Assignor to United Salt Co., Cleveland, Ohio. U.S. Pat. 1,125,998, Jan. 26, 1915. Date of appl., Apr. 18, 1892.

THE brine is fed into a long shallow pan and heated by steam pipes arranged in the form of transverse grids with spaces between them. Steam is supplied to each coil from a trunk above and the condensed water drains to a main below, and is returned to the boilers. The pan is divided by partitions into heating, settling, and evaporating sections enclosed under one hood. Vapours leave by shafts in the roof and the salt is raked to draining boards through doors in the sides of the cover. In the first section the brine is heated to boiling and concentrated to saturation; calcium sulphate is precipitated, and the liquor passes to the second compartment, which is not directly heated. Slight evaporation and cooling take place and a small quantity of salt is deposited and carries down the suspended impurities, which settle out as the liquid passes slowly to the third

portion for concentration. The pure salt deposited is raked up the gently sloping sides of the pan to draining boards along its margins enclosed under the same hood. After a time it is shovelled to traps and runs down shoots to storage bins below the pans, where the heat radiating from the bottom of the pan further dries the product.

—W. H. H. N.

Alkali chloride solutions; Electrolysis of —. Hoesch und Co. Sulfitecellulosefabrik. Ger. Pat. 280,556, Sept. 6, 1913. Addition to Ger. Pat. 279,998 (this J., 1915, 355).

A PART or the whole of the electrolyte is circulated from the anode compartment, through the diaphragm, into the cathode compartment, and thence to the saturation chamber.—A. S.

Bleach-chamber. A. V. Suchy, Assignor to Niagara Alkali Co., Niagara Falls, N.Y. U.S. Pat. 1,126,586, Jan. 26, 1915. Date of appl., Jan. 22, 1914.

THE chamber floors are cooled by water circulating under them in special structures of reinforced concrete.—W. H. H. N.

Lime and gas; Manufacture of —. R. Pearson, and The Chalk Fuel Power Gas and Bye-Products Corporation, Ltd., London. Eng. Pat. 5734, March 6, 1914.

BRICQUETTES composed of chalk, small coal, solidified tar, and naphtha oil, are heated in steam on a bed of incandescent fuel in a generator. The products are lime, and a gaseous mixture rich in hydrocarbons, suitable for lighting, heating, etc. Ground peat, or peat and chalk, may be used instead of the coal.—E. H. T.

Barium oxide; Process for producing —. S. B. Newberry and H. N. Barrett, Baybridge, Ohio. U.S. Pat. 1,133,392, Mar. 30, 1915. Date of appl., Aug. 15, 1914.

BARIUM sulphate is mixed with barium oxide, the mixture is pulverised till 90% passes a 100-mesh sieve, and then heated, with agitation, to 2700° F. (1480° C.) or over, until the sulphate is converted into oxide with evolution of sulphur dioxide and oxygen.—W. H. H. N.

Volatile compounds and process of producing same. [Calcium carbonitride.] Volatile magnesium compounds and process of producing same. [Magnesium carbonitride.] Alkali-metal silicates; Process of decomposing —. [Alkali carbonitride and aluminium carbonitride.] S. Peacock, Philadelphia, Pa., Assignor to Agricultural Research Corporation, New York. U.S. Pats. (A) 134,411, (B) 134,412, and (C) 134,413, April 6, 1915. Date of appl., April 18, 1914.

(A) A MIXTURE of carbon and a suitable oxide, such as calcium oxide, is heated in an atmosphere containing nitrogen, substantially free from active oxygen, to a temperature at which a volatile carbonitride is produced. (B) A mixture of magnesium oxide and carbon is heated in presence of nitrogen, e.g., in an atmosphere of producer gas, keeping the partial pressure of carbon monoxide below 400 mm., and the carbonitride produced, which is volatile at 1500° C., is collected in a medium free from active oxygen. The product is a soluble white powder, giving a white precipitate with solutions of lead and silver salts, and yielding ammonia with hot water. (C) A finely divided mixture of carbon and a mineral containing an alkali metal and aluminium is heated, in an atmosphere of nitrogen, to a temperature sufficient to produce volatile carbonitrides of these metals, the partial pressure of the reaction products being maintained below 350 mm. The product con-

denses to a powder and reacts with water at 200° C. to give ammonia, alkali carbonate, and alumina.—F. SODN.

Aluminium pernitrides; Process of making——. S. Peacock, Philadelphia, Pa., Assignor to Agricultural Research Corporation, New York. U.S. Pat. 1,134,414. April 6, 1915. Date of appl., April 18, 1914.

A FINELY divided mixture of aluminium phosphate and carbon is heated, in presence of nitrogen, to a temperature above that of formation of volatile carbonitrides and below that at which aluminium nitride is formed, preferably to about 1700° C., the partial pressures of the reaction products being maintained below 400 mm., and the volatile product is collected.—F. SODN.

Radioactive liquids; Economical production of large quantities of——. H. Farjas. Third Addition, dated Aug. 20, 1913, to Fr. Pat. 456,990, July 1, 1912 (this J., 1913, 1028, 1108).

LIQUIDS are rendered radioactive by passing them intermittently or continuously through vessels filled with balls (preferably of small diameter) prepared from radioactive material as already described. Air is treated by passing through a cylinder fitted with a fan and containing an intercepting zone of such radioactive balls.—F. SODN.

Hydrogen; Manufacture of——. J. L. Buchanan, Bromborough, and E. B. Maxted, Rock Ferry. Eng. Pat. 6477, March 14, 1914.

A MAXIMUM yield of hydrogen is obtained by passing carbon monoxide and steam over catalysts consisting of or containing metallic couples. An iron-copper couple may be made by heating iron oxide with sodium carbonate, washing with water to remove caustic alkali, drying, reducing the iron oxide with hydrogen, then cooling, moistening with copper nitrate solution, and heating in a current of hydrogen. The resulting couple is heated to 500° C., and carbon monoxide with an excess of air passed over it. A silver-iron couple is also very effective.—E. H. T.

Hydrogen; Process of manufacturing——, by alternate action of a reducing gas and steam upon heated ferruginous matter. Soc. l'Hydrogène. Fr. Pat. 472,373. May 19, 1914. Under Int. Conv., May 21, 1913.

To prevent accumulation of oxidisable impurities introduced into the ferruginous mass by the gases employed for heating and reducing, the preliminary heating is effected by means of water-gas burnt with an excess of air, and the subsequent, periodical heating with air alone.—E. H. T.

Gases; Methods of and means for effecting the combination of——. [Isolation of nitrogen from the air.] The British Thomson-Houston Co., Ltd., London. From General Electric Co., Schenectady, U.S.A. Eng. Pat. 6739, March 17, 1914.

Two or more gases are caused to interact in a heated porous tube, one being led through it, and the other diffusing into it through the porous walls. By passing air through the tube and causing a reducing gas to diffuse through the walls, nitrogen (containing less than 0.5% of oxygen) can be isolated. The tube is made preferably of alumina, and is heated electrically by a metallic wire encircling it. The whole is embedded in sand in a furnace. The reducing gas, e.g., hydrogen, passes through the sand into the walls of the tube.

—E. H. T.

Nitrogen and oxides of nitrogen; Process for the simultaneous production of——. Farb. vorm. Meister, Lucius, und Brüning. Second Addition, dated April 17, 1914 (under Int. Conv., April 22, 1913), to Fr. Pat. 453,845. Jan. 31, 1913 (this J., 1913, 791, and 1914, 483).

THE air used for oxidising the ammonia is replaced partly or entirely by an equivalent quantity of oxygen.—E. H. T.

Gases; Producing chemical action in——. [Manufacture of oxides of nitrogen.] C. S. Bradley, New York. U.S. Pat. 1,134,583. April 6, 1915. Date of appl., May 1, 1909. Renewed Sept. 2, 1914.

OXIDES of nitrogen are produced by introducing a mixture of nitrogen and oxygen into an enclosed chamber, heating the gases to reaction temperature by electric arcs, and immediately and rapidly discharging the products into an area of reduced pressure, whereby the temperature is reduced below that of dissociation.—W. F. F.

Thermochemical reactions and nitrogenous by-products; Manufacture of materials for producing——. N. Leccesne. (A) Fr. Pat. 472,959. Aug. 27, 1913, and (B) First Addition, dated Aug. 30, 1913.

(A) BAUXITE is strongly heated by the combustion of a highly compressed mixture of gas and air within its pores, and is then slowly cooled by gradually reducing the supply of combustible gas whilst maintaining that of air. The product is a porous mass of corundum which resembles platinum in its ability to bring about thermochemical reactions; its power of separating, decomposing, or condensing gases varies with the pressure of the gaseous mixture employed in its preparation. Granular corundum is obtained by submitting a mixture of bauxite and carbon to combustion in a current of compressed air. In either case, the nitrogen present in the gas used is partly converted into nitric oxide, which may be recovered as nitric acid, and nitrides of the bases are also produced, whilst the formation of cyanogen is observed when a mixture of bauxite and carbon is heated by the combustion of air and coal gas. (B) Corundum, specially suitable as a refractory material, is obtained in compact form by feeding successive charges of crushed bauxite into a shaft furnace heated by an oxidising mixture of compressed air and producer gas; or in granular form by heating an agglomerated mixture of crushed bauxite and carbon in the presence of air, injected under pressure at the lower part of the furnace so as to cool the finished product as it descends. Nitric acid is obtained as a by-product by treating the residual gases.

—F. SODN.

Graphitisation of carbon articles; Method of quick——. J. W. Brown, Lakewood, Ohio, Assignor to National Carbon Co., Cleveland, Ohio. U.S. Pat. 1,133,259, Mar. 30, 1915. Date of appl., May 6, 1912.

THE carbon articles are placed in the graphitising furnace with their largest surfaces in contact and at right angles to the direction of the current. Pressure is applied in the direction of the current.

—W. H. H. N.

Chlorine gas; Process and apparatus for compressing, drying, and transferring——. J. W. Aylsworth, East Orange, Assignor to Halogen Products Co., Glen Ridge, N.J. U.S. Pat. 1,134,432, April 6, 1915. Date of appl., Nov. 6, 1913. Renewed Sept. 2, 1914.

SEPARATE volumes of chlorine gas are entrapped between volumes of sulphuric acid and forced under pressure through a rotating helical pipe coil,

whereby the compressed gas is delivered into a receiver in a dry condition. The acid is subsequently returned to the feed chamber through a vertical U-tube below the two vessels; the height of the U-tube is such that the maximum pressure in the receiver does not force the level of the acid below the bend in the tube.—C. A. M.

Carbides of silicon and by-products [potassium and aluminium carbides]; Process for producing —. S. Peacock, Chicago, Ill., Assignor to Agricultural Research Corporation, New York. U.S. Pat. 1,134,081, Mar. 30, 1915. Date of appl., July 17, 1912.

FINELY divided feldspar is mixed with carbon and heated to the required temperature under reduced pressure in an electric furnace. The volatile carbides of potassium and aluminium are pumped off and burnt in excess of air to oxides. The residue of silica and carbon is heated to the temperature of formation of siloxicon and finally of carborundum.—W. H. H. N.

Hydrogen peroxide solutions; Process for preventing decomposition of —. A. Farago, Budapest. U.S. Pat. 1,134,323, April 6, 1915. Date of appl., April 20, 1914.

SEE Ger. Pat. 275,440 of 1913; this J., 1914, 831.

Hydrogen; Process of making —. R. P. Pictet, Wilmersdorf, Germany. U.S. Pat. 1,134,416, April 6, 1915. Date of appl., May 29, 1911.

SEE Fr. Pat. 421,838 of 1910; this J., 1911, 542.

Hydrogen; Manufacture of —. G. Claude, Assignor to Soc. l'Air Liquide (Soc. Anon. pour l'Etude et l'Exploit. des Proc. G. Claude), Paris. U.S. Pat. 1,135,355, April 13, 1915. Date of appl., Mar. 25, 1913.

SEE Fr. Pat. 453,187 of 1912; this J., 1913, 791.

Boron nitride; Process of making —. G. Weintraub, Lynn, Mass., Assignor to General Electric Co. U.S. Pat. 1,135,232, April 13, 1915. Date of appl., Feb. 3, 1913.

SEE Eng. Pat. 16,468 of 1913; this J., 1914, 421.

Combinations of salts for the treatment of animal fibres and fabrics. Fr. Pat. 473,183. See V.

Process of treating natural silicious materials. [Production of cement and potassium salts.] Fr. Pat. 473,279. See IX.

Bipolar electrode of fused ferric oxide, especially for the production of chlorates. Ger. Pat. 281,511. See XI.

VIII.—GLASS; CERAMICS.

Glass; Some temperature refraction coefficients of optical —. J. W. Gifford. Roy. Soc. Proc., 1915, A, 91, 319—321.

A TABLE is given of the temperature refraction coefficients ($\lambda=5270$) for a rise of 1°C ., the normal temperature being 15°C .. The quantities vary from 0.0000004 for "dense barium crown" to 0.0000105 for borosilicate flint. In the case of Schott's Fluor Crown, of which only one prism could be cut, the coefficient was -0.0000035 . It is the only glass the author has examined in which the sign is negative, i.e. in which the refractive index in air decreases with increase of temperature. Quartz and fluorite behave in the same way.—W. C. H.

PATENTS.

Ovens for earthenware, sanitary ware, bricks, etc. E. V. and H. D. Dunn, Ilaslington. Eng. Pat. 8219, April 1, 1914.

In ovens for pottery ware and bricks, the "bags"

are fitted with an inner lining of fireclay, made in one piece or constructed of quarries, and built into the wall of the oven so as to be flush with the inner face of the latter.—A. B. S.

Furnace for the cupellation or refining of silver, glass blending, enamelling, etc. Eng. Pat. 7633. See X.

IX.—BUILDING MATERIALS.

Wood; Decomposition of — by fungi. C. Wehmer. Ber., 1915, 48, 130—134. J. Chem. Soc., 1915, 108, i., 197—198.

THE decomposition (dry rot) of wood by certain fungi, such as *Merulius lacrymans*, *M. silvestris*, *Comophora cerebella*, and *Polyporus vaporarius*, was studied. 100 parts of well-rotted pine wood (51% C) yielded 50 parts of carbon dioxide, water, etc., 7.5 parts of a water-soluble substance (46—51% C), consisting of a brownish-black, glossy varnish or a dull coal-like powder, 17.5 parts of an alkali-soluble substance (64% C) composed of shiny, blackish-brown particles, and 25 parts of insoluble peat-like residue (60% C) in the form of compact brown masses showing the almost unchanged structure of wood under the microscope. Amorphous substances with successively decreasing oxygen content and strongly increasing carbon content can be isolated from rotten wood; the humus soluble in water contains relatively more oxygen than the original wood. The "acidity" of rotten wood is due to the presence of humus, free organic acids being absent. This "acidity" can be neutralised by alkali, but is restored by boiling with water, the rotten woody fibre merely absorbing the alkali superficially. Sugars are readily attacked by *Merulius*, and the unaffected portions remain as humus.

Determination of iron disulphide (pyrites) in soils. Rodt. See XVI.

PATENTS.

Plaster retarder from bean vines; Manufacture of —. D. Y. Strauss, Artesia, Cal., Assignor to California Retarder and Fibre Co., Los Angeles, Cal. U.S. Pat. 1,134,964, April 6, 1915. Date of appl., March 26, 1914.

THE liquid and soluble constituents of Lima bean vines are extracted, and the extract is partially evaporated and absorbed in an earthy absorbent such as lime.—F. SODN.

Silicious materials; Process of treating natural —. [Production of cement and potassium salts.] H. E. Brown. Fr. Pat. 473,279, June 10, 1914. Under Int. Conv., Aug. 29, 1913.

A MIXTURE of a natural silicate, such as feldspar, and a calcium compound (preferably calcium carbonate), in proportion to give 40—55% CaO in the cement subsequently produced, is melted in a non-reducing or oxidising flame, and, after volatilisation of the alkali, which is recovered, the fused product is disintegrated and converted into a hydraulic cement by treating with a solution of alkaline-earth salts, e.g., magnesium sulphate. The calcium carbonate in the first stage of the process may be partly replaced by sufficient calcium chloride to react with the alkali present.—F. SODN.

Cement making. H. Abraham, Bound Brook, N.J., and H. W. Haines, New York, Assignors to Impervious Products Co. U.S. Pat. 1,134,573, April 6, 1915. Date of appl., March 9, 1910.

SEE Fr. Pat. 426,889 of 1911; this J., 1911, 1061.

Wood; *Method of colouring* —. L. Doyen, Paris. U.S. Pat. 1,135,167. April 13, 1915. Date of appl. Jan. 17, 1913.

SEE Eng. Pat. 1063 of 1913; this J., 1913, 912.

Manufacture of materials for producing thermo-chemical reactions and of nitrogenous by-products. Fr. Pat. 472,959, and Addition. See VII.

Process of impregnating porous substances. U.S. Pat. 1,134,436. See XIII.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Ferrous oxide and carbon; Reactions between — and between carbon monoxide and iron. V. Falcke. Z. Elektrochem., 1915, 21, 37—50. J. Chem. Soc., 1915, 108, ii., 169—170. (Compare this J., 1913, 365.)

Using the same apparatus as previously employed, the author studied the above-mentioned reactions at temperatures from 600° C. upward, and also examined the gaseous products obtained when the reaction mixtures were dissolved in hydrochloric acid. Three varieties of graphite and five varieties of amorphous carbon were used. They were subjected to prolonged purification, and were then analysed and their densities obtained. The solid mixtures examined were introduced into the apparatus in the form of compressed pellets. Below 650° C. none of the highly-purified forms of carbon react with ferrous oxide, and above this temperature the various varieties behave differently, but fall into three groups. Sugar charcoal and charcoal obtained by the action of carbon monoxide on sodium are very inert, and a vigorous reaction does not take place until a temperature of 800° C. has been reached, and in these cases an equilibrium pressure was not obtained. Charcoal obtained by burning acetylene in chlorine, and charcoal from petroleum reacted more easily, showing a vigorous action at 650° C. The three forms of graphite react similarly, and the great capacity of graphite for this reaction is attributed to the fact that the reactions commence slowly, and increase gradually to a definite limiting value, after which they proceed at a constant rate until the reaction is complete, which is taken to imply that a contact reaction occurs in the solid mixture which precedes the evolution of gas, and which is probably one of solution or direct combination. The reaction products of the action of carbon on ferrous oxide contained pure iron, but no hydrocarbons were obtained when the solid product was dissolved in hydrochloric acid. In the case of the action of carbon monoxide on iron, it was found that when carbon monoxide was led into the apparatus until a considerable amount had been absorbed by the iron and the equilibrium pressure set up at 600° C., the product on solution in hydrochloric acid gave large volumes of saturated hydrocarbons, chiefly ethane, but no solid carbon was left. On the other hand, when iron was heated in a stream of carbon monoxide, or when iron was allowed to absorb large quantities of carbon monoxide and then heated in a vacuum, and the product dissolved in hydrochloric acid, no hydrocarbons were evolved, but a residue of carbon remained behind. The work and views of Schenck and his collaborators (this J., 1905, 803; 1907, 692) are criticised.

Platinum, palladium, and gold; Determination of — [in ores]. A. M. Smoot. Eng. and Min. J., 1915, 99, 700—701.

The lead buttons obtained by the ordinary pot assay from two or more fusions, are scorified together

and the resulting button cupelled at a high temperature, at least six times as much silver as the combined weight of platinum, palladium, and gold present being added during the process. The silver bead is parted with nitric acid (1 : 6, followed by 1 : 1), the residue, consisting of the gold and part of the platinum, is washed with water, dissolved in *aqua regia*, and the solution reserved. By the addition of hydrochloric acid to the nitric acid solution, silver is precipitated and the platinum left in solution, but the resulting silver chloride is pink and contains palladium; the silver precipitate is therefore scorified and cupelled with lead, the head dissolved in nitric acid (1 : 6), and the silver re-precipitated with hydrochloric acid, the separation being repeated until the silver chloride obtained is no longer pink. The filtrates from the silver chloride precipitations are added to the *aqua regia* solution previously obtained, the liquid evaporated to dryness, the residue treated with 5 drops of hydrochloric acid and 40 c.c. of water, any insoluble matter ($\text{AgCl} + \text{PbCl}_2$) being rejected unless of a pink colour, when it is re-treated for the recovery of palladium as before. Gold is precipitated from the solution by boiling after the addition of 3 grms. of oxalic acid; the precipitate is allowed to stand overnight before filtration, being then re-dissolved and re-precipitated several times if the ore is rich in platinum and palladium. The final gold precipitate is cupelled with lead and about six times its weight of silver, the bead parted, and the gold weighed as usual. To the combined oxalic acid filtrates, 5 c.c. of hydrochloric acid is added, the liquid diluted to 150 c.c., heated to boiling, and treated while hot with a rapid current of hydrogen sulphide; the precipitate of platinum and palladium sulphides is filtered off, dissolved in *aqua regia*, the solution evaporated to dryness twice with hydrochloric acid, the residue treated with 2 or 3 drops of hydrochloric acid and 2 c.c. of water, and the solution treated with ammonium chloride as usual for the separation of platinum. To avoid the mechanical loss caused by igniting the platinum-ammonium chloride, the latter is dissolved in boiling 5% sulphuric acid, the boiling solution treated with hydrogen sulphide, the precipitate filtered off, the filter burned at a low temperature, the residue scorified with lead, with the addition of six times as much silver as the weight of platinum present, the button cupelled, the bead parted with concentrated sulphuric acid, and the residual platinum weighed. To the filtrate from the ammonium chloride precipitation, an excess of dimethylglyoxime (at least seven times the amount of palladium present) dissolved in hydrochloric acid (2 : 1) is added, the liquid diluted to 250—300 c.c., heated for 30 mins., allowed to stand overnight, and filtered through a Gooch crucible. After being washed first with dilute hydrochloric acid (1 : 1) to remove the excess of precipitant, then with water and alcohol in succession, the precipitate is dried at 110°—115° C. and weighed; it contains 31.686% Pd.—W.E.F.P.

Silver; Determination of — in ores and concentrates containing platinum and palladium. A. M. Smoot. Eng. and Min. J., 1915, 99, 701.

The lead button obtained by ordinary pot assay is dissolved in dilute nitric acid, the insoluble residue is filtered off, washed, and re-scorified with lead, and the button treated with dilute nitric acid as before. To the combined nitric acid solutions, sufficient standard sodium chloride solution is added to precipitate the silver, and, if the latter is small in amount, about 0.5 c.c. of sulphuric acid also, the liquid is stirred, allowed to stand until the supernatant liquid is clear, and then filtered through double papers. The filter is then incinerated and the residue scorified with

lead, the button being cupelled direct if the palladium content of the ore is small, or, otherwise, re-dissolved in nitric acid and the precipitation of the silver chloride repeated.—W. E. F. P.

Tetranickel triarsenide [maucherite] as a silver precipitant. C. Palmer. *Econ. Geol.*, 1914, 9, 664—674. *J. Chem. Soc.*, 1915, 108, ii., 171.

MAUCHERITE (*J. Chem. Soc.*, 1913, 104, ii., 516) from Eisleben and Mansfeld in Thuringia, and temiskamite from Elk Lake, Ontario (this *J.*, 1914, 261), are completely decomposed by a solution of silver sulphate, the nickel and arsenic passing into solution in the ratio given by the formula Ni_4As_3 . One molecule of this compound deposits seventeen atoms of metallic silver in the form of arborescent crystals. It is suggested that temiskamite is identical with the earlier-described maucherite, and that the true formula is Ni_4As_3 , rather than Ni_2As_2 . Samples of the mineral from these three localities (containing 98.62, 95.84, and 92.76% Ni_4As_3 , respectively) had sp. gr. at 25° C. 7.81, 7.80, and 7.73 respectively. Niccolite (NiAs) is also capable of depositing silver from a solution of a silver salt, but smaltite (CoAs_2), cobaltite (CoAsS), and arsenopyrite (FeAsS) are strongly resistant. These reactions have a bearing on the enrichment in silver of mineral veins containing nickel arsenides.

Copper leaching; Some of the problems in —. L. D. Ricketts. *Min. and Eng. World*, 1915, 42, 679—682.

INVESTIGATIONS made with the low-grade, oxidised copper ore of Ajo, Ariz., U.S.A. (an eruptive granite containing about 1.5% Cu, together with salts of iron and aluminium) showed that a high extraction of copper could be obtained by leaching with dilute sulphuric acid, the crushed ore (maximum size 6-mm. cube) being readily permeated and yielding a clear solution; the extraction was dependent more on the time of contact than on the strength of acid. With copper at 12 c. (6d.) per lb. and the cost of mining 25—50 c. (1s. 0½d.—2s. 1d.) per ton of ore, leaching with dilute sulphuric acid, followed by precipitation of copper with pig iron or spongy iron, was commercially practicable. It was more advantageous, however, to recover pure copper direct from the solution by electrolysis, for which purpose the leaching was conducted so that the rate of increase of iron and alumina in the solution was slow, and the iron content of the electrolyte maintained below 0.75% by periodically agitating a portion of the liquid with copper oxide and compressed air; by this method 1.5 lb. of sulphuric acid was lost per lb. of copper produced. Very promising results were obtained by leaching the ore with a sulphuric acid solution of iron and aluminium sulphates, passing the liquid through a tower for the absorption of sulphur dioxide from furnace gases, and electrolysis the solution, the iron and aluminium in the latter acting as depolarisers and catalysts. In the author's opinion this method will probably prove the most economical.—W. E. F. P.

Copper [in brass]; Rapid electrolytic determination of —. W. Theel. *Chem.-Zeit.*, 1915, 39, 179.

COPPER may be determined in brass by dissolving 1 gm. of the sample in 8.5 c.c. of sulphuric acid (1.4) and 1.5 c.c. of nitric acid (sp. gr. 1.4), heating the solution to expel nitrous vapours, then diluting it to 25 c.c., and electrolysis with a current of 2 amps.; the whole of the copper is deposited within 1 hour.—W. P. S.

Copper and aluminium; Thermochemistry of the compounds of —. L. Rolla. *Gaz. Chim. Ital.*, 1915, 45, 1, 192—196.

THE heats of formation of the bromides of copper

and aluminium from the metals and from the three compounds, Cu_3Al , CuAl , and CuAl_2 , by reaction with a solution of bromine in potassium bromide, were determined calorimetrically, and from the results the heats of formation of the intermetallic compounds were calculated: the values obtained were CuAl_2 , +23.29; CuAl , +32.38; Cu_3Al , —13.33 Calories per kilo.-mol. The formation of all three compounds is accompanied by a diminution in volume, the deviations of the observed specific volumes from those calculated according to the law of mixtures being CuAl_2 , 3.8%; CuAl , 2.9%; Cu_3Al , 4%.—A. S.

Nickel; Electrolytic deposition of — from chloride solutions. R. Riedel. *Z. Elektrochem.*, 1915, 21, 5—19. *J. Chem. Soc.*, 1915, 108, ii., 182—183.

IN the extraction of copper from sulphides containing nickel, large quantities of nickel chloride solution are obtained, from which the nickel is removed electrolytically. The author has investigated the conditions of electrolysis at the ordinary temperature in the presence of free hydrochloric acid and in the presence of acetic acid. The current efficiency and the conditions under which a good coherent metallic deposit are obtained in the two cases are compared. The current efficiency over the range 100—80% has been quantitatively determined in its relation to the concentration of hydrochloric acid and acetic acid. In the case of hydrochloric acid, carbon anodes, and in the case of acetic acid, both carbon and nickel anodes were used. The current efficiency decreases with an increase in the acid concentration. With hydrochloric acid it is 80% when the acid concentration has reached 0.07%, whilst in the case of acetic acid this value is only reached with 1.0% of acid. In consequence of this high concentration of acetic acid, its use would remove the necessity of a very troublesome controlling of the acid concentration during the electrolysis, which is always necessary when hydrochloric acid is used. In order that the nickel should be deposited in a usable form, it is necessary that a definite concentration of hydrogen ions should be maintained: when an operation is left to itself, the small quantity of hydrochloric acid allowable is rapidly removed, whereas the larger amount of slightly dissociated acetic acid automatically keeps the hydrogen ion concentration at the right point. The current efficiency increases with the concentration of nickel in the solution. Using a current density of 190 amperes per square metre with a solution containing 4—10% Ni, the efficiency fluctuates between 80% and 90%, and with a current density of 350 amperes per square metre it varies between 85% and 95% in a 1% acetic acid solution. To obtain a continuous coherent deposition of nickel, the current density must be kept within limits which are special for each solution, and depend on the concentration of the solution in nickel and free acid, on the nature of the free acid, the purity of the solution, and the method of stirring the liquid. A continuous stirring of the electrolysis bath is only necessary in the case where the solution becomes alkaline. Porous deposits can be avoided by using a current density which just produces the coherent deposit. A higher value may be used only with a higher concentration of nickel or of acid. The presence of many metallic ions in a hydrochloric acid solution of nickel chloride is unfavourable to the formation of a coherent deposit. The order in increasing harmfulness is Cu^+ , Mn^{2+} , Fe^{2+} , Zn^{2+} , and Pb^{2+} . In an acetic acid solution experiments were made only with zinc and lead as impurity, since it was shown that the deposit of nickel is not so sensitive to the presence of impurities as in the case of hydrochloric acid solutions. The minute traces of foreign metals suffice in a hydrochloric acid solution to produce a spongy

nickel effect, whilst in acetic acid solutions considerable quantities of impurities may be added before any influence is shown in the nature of the deposit. If a spongy deposit is once produced, no change of the conditions of electrolysis is sufficient to bring it back to the coherent condition. As a general result of the work, it follows that in the electrolysis of nickel chloride solutions the addition of hydrochloric acid is harmful, and cannot be considered in the technical electrolysis; a weakly dissociated acid is required, and this is found in acetic acid.

Magnetisability of the oxides of manganese, chromium, uranium, molybdenum, and tungsten. Wedekind and Horst. See VII.

Boric water glass. [Flux for hard soldering metals.] Ackermann. See VII.

Action of metals on the chlorides of carbon. Zappi. See XX.

Determination of arsenic by boiling a hydrochloric acid solution with hydrazine salts and potassium bromide. Jannasch and Seidel. See XXIII.

PATENTS.

Cast-iron; Process for manufacturing Thomas —. F. Dahl. Fr. Pat. 472,696, May 26, 1914. Under Int. Conv., Aug. 1, 1913.

MOLTEN iron containing 20–25% Mn, obtained by direct reduction of manganese iron ores or mixtures in blast-furnaces, is added to molten pig iron in sufficient quantity to produce the required composition.—W. E. F. P.

Iron or steel; Carburizing —. S. S. Eveland, Bryn Mawr, Pa., Assignor to Eveland Electric Riveter Co. U.S. Pat. 1,133,626, March 30, 1915. Date of appl., April 12, 1910.

IRON or low-carbon steel is heated in a closed receptacle with fibrous vegetable waste containing carbohydrates and protein, but not starchy matter, e.g., the fibrous waste from sugar manufacture.—W. F. F.

Steel; Manufacture of —. E. Humbert. Fr. Pat. 472,429, Aug. 25, 1913.

A MIXTURE of 10 to 30% of sand and 70 to 90% of lime is melted, and carbon is added in amount equal to about 10 to 30% of the total weight of the mixture. The steel to be purified is poured on to the molten mixture, so as to transform iron and manganese silicates into an easily fusible calcium silicate.—B. N.

Steel ingots; Manufacture of sound —. K. Canaris. Fr. Pat. 472,594, May 22, 1914.

THE upper surface of the steel is cooled by water or air to produce immediate solidification, and molten steel is then introduced under pressure at the base of the ingot to fill cavities.—B. N.

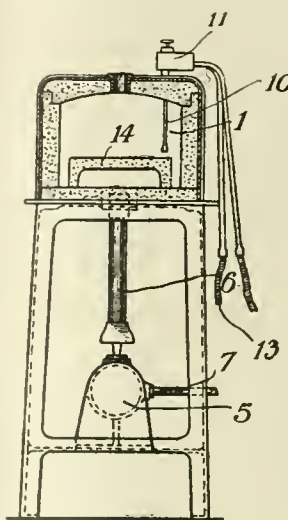
Ferrosilicon product; Crystalline — and method of making the same. Ferrosilicon product and method of continuously producing the same. Ferrosilicon alloys of definite compositions. H. C. Harrison. Lockport, N.Y., Assignor to Electro Metallurgical Co. U.S. Pats. (A) 1,134,127, (B) 1,134,128, and (C) 1,134,129, Apr. 6, 1914. Dates of appl., July 30, Dec. 1, and Dec. 15, 1909. Renewed (A) and (B) Sept. 1, and (C) Sept. 17, 1914.

(A) A PRODUCT consisting of, or containing, bright, hard, brittle, plate-like crystals corresponding to the formula Fe_3Si_2 , is prepared by maintaining "at or above a predetermined critical temperature" a charge calculated to produce ferrosilicon containing 53–54.5% Si.

(B) Ferrosilicon of any definite composition is produced continuously as described under (A), the critical temperature increasing with the silicon content desired. (C) Ferrosilicon of definite composition and constitution, composed of "solid mixtures of definite compounds containing iron and silicon" is claimed.—W. E. F. P.

Furnaces; Gas-fired —. Metal-heating furnace. 1. Hall. Birmingham. Eng. Pats. (A) 7238, March 23, 1914, and (B) 3036 of 1915, date of appl., March 23, 1914.

(A) IN a furnace heated by low-pressure gas, an end view of which is shown in the figure,



gas is supplied to the burners through a pipe, 7, from the outlet, 13, of a regulator, 11, actuated by a thermostat, 10, in the heating chamber, 1, or in a separate chamber adjacent to it. Several heating chambers, one above the other, and each provided with a temperature-indicating device, may be used. A shield, 14, prevents the flame from impinging on the charge. (B) The gas burners, 6, are attached along the top of a relatively large cylindrical chamber, 5. (See also Eng. Pats. 21,072 of 1912;

26,583 and 28,346 of 1913; 5198, 5888, and 6016 of 1914; this J., 1915, 16, 34, 234.)—W. E. F. P.

Furnace for the cupellation or refining of silver, glass bending, enamelling, etc.; Gas-fired —. L. F. Tooth, London. Eng. Pat. 7633, March 26, 1914.

GAS burners, inclined upwards, are arranged in openings at one side of the arched combustion chamber, and exit openings at the opposite side, corresponding with the burners, extend into vertical flues connected with horizontal ones running across the furnace above the combustion chamber. The horizontal flues communicate with vertical downtake flues terminating in a longitudinal trunk connected to the chimney, and are provided at one side of the furnace with doors for the admission of secondary air and at the other with cleaning and inspecting doors.—W. R. S.

Crucible and melting pot furnaces. L. F. Tooth, London. Eng. Pat. 7635, March 26, 1914.

A TILTING furnace mounted on pivots is provided with a cranked flue which enters a hollow sleeve adjacent to one of the pivots; the sleeve communicates with a fixed uptake flue. Above the furnace is a covered preheater, pivoting upon a bracket extending from one of the standards supporting the furnace, and provided with an oblique charging spout. The cover of the preheater can be raised by cams as it is swung aside.—W. R. S.

Metallurgical apparatus [cupola furnace]. C. J. Rice. Ashland, Ky., Assignor to The Pneumatic Cupola Co., Ironton, Ohio. U.S. Pat. 1,133,317, March 30, 1915. Date of appl., July 11, 1912.

A CUPOLA furnace having a set of low-pressure

main tuyères, and below these and above the level of the molten metal a series of high-pressure purifying tuyères entering tangentially and inclined downwards.—W. R. S.

Metallurgical furnace. U. Wedge, Ardmore, Pa. U.S. Pat. 1,133,828, March 30, 1915. Date of appl., Sept. 11, 1912.

A VERTICAL furnace with superposed helical hearths projecting inwards from its outer wall.—W. R. S.

Metallurgical furnace. U. Wedge, Ardmore, Pa. U.S. Pat. 1,133,829, March 30, 1915. Date of appl., Jan. 4, 1913.

A FURNACE having a central rotating shaft with arms, independent of the rabble arms, each of which carries an electrical heating device upon its under side. The heater is connected directly with one pole and indirectly, through the supporting arm, with the other pole of a source of current.—W. R. S.

Roasting furnace; Mechanical —. A.-G. für Zink-Industrie vorm. W. Grillo, and W. Scheffzik. Fr. Pat. 473,310, May 4, 1914. Under Int. Conv., June 9 and 10, 1913.

THE furnace comprises one or several cylindrical or semi-cylindrical muffles, each provided with a horizontal shaft carrying one or more arms supporting a water-cooled bar, parallel to the shaft, on which are fixed interchangeable prongs for advancing the material. With cylindrical muffles, the shaft is rotated by pinions. With semi-cylindrical muffles, the horizontal shaft receives a pendulum-like movement from a rack and pinion. The muffles may be arranged in two vertical rows, and the transporting mechanism moved by two racks forming a frame, to which is attached the piston rod of a hydraulic pump. The movement of the rod is communicated to a revolving cone, forming a valve for controlling the supply and escape of the water actuating the pump, and the dead point of the latter is passed by the frame continuing for a short time in its direction of movement. The ore is delivered from a hopper on to the roof of the furnace at one end and is conveyed to the other end of the roof by scrapers fixed on an endless chain. The inclinations of the lower end of the feed hopper and of the outlet spout are regulated separately, and the lower end of the hopper is provided with a toothed cylinder for conveying the material outwards; a slide above the cylinder regulates the supply of ore. The ore is dried by its passage across the roof and is then introduced into the furnace by means of a cone furnished with teeth revolving in a funnel, the enveloping surface of the cone having an inclination different to that of the funnel. When heating the furnace with solid fuel, heated air is supplied above and below the grates, but when heating with gas, a regulated amount of the gas and pre-heated air may be introduced into each muffle.—B. N.

Nickel, copper, and aluminium, with or without steel; Alloys of —. G. A. Joyce, London. Eng. Pat. 8270, April 1, 1914.

ALLOYS which will take a high polish and do not rust or tarnish on exposure, are composed of: (1) Cu 27.5–40%, Ni 65–45%, steel 5–10%, Al 2.5–5%; (2) Cu 80.5%, Ni 17.06%, Al 2.44%. They contract considerably during cooling and hence are useful for mounting diamonds for technical purposes.—W. F. F.

[Type] metal; Melting of — in melting pots. I. Hall, Birmingham. Eng. Pat. 12,219, May 18, 1914. (See also Eng. Pat. 15,323 of 1913; this J., 1914, 835.)

In a melting pot provided at the bottom with a

valve through which the metal can be poured, the valve is actuated by a spindle surrounded by a tube. The upper end of the tube is open to the air above the surface of the metal, whilst the lower end is immediately over the valve; room is thus afforded for expansion of the metal, and any gases or air imprisoned by the metal escape through the tube.—W. R. S.

Ore or other solid substance suspended in a liquid; Apparatus for the settlement and classification of finely divided —. F. H. Wright, London. Eng. Pat. 18,791, Aug. 18, 1914.

A CONICAL classifier has an inner porous and an outer impermeable wall, and water is supplied to the intermediate space at a greater pressure than that of the liquid in the classifier, so as to prevent accumulation of material on the inner surface of the porous wall.—W. R. S.

Molten metal and other fusible substances; Apparatus for, and method of spraying —. M. U. Schoop, Zürich, Switzerland, Assignor to Metals Coating Co. of America, Boston, Mass. U.S. Pats. 1,133,507 and 1,133,508, March 30, 1915. Dates of appl., Feb. 19 and July 6, 1914.

Two electrodes of the fusible substance are fed towards one another at right angles, one being vibrated by electromagnetic means in series with the electrode, so that contact for the melting current is alternately made and broken. A jet of gas under pressure impinges on the point of contact of the electrodes and produces a spray of the fused material.—W. F. F.

Gases; Preventing escape of noxious — in smelting [sulphide ores]. W. A. Hall, New York. U.S. Pat. 1,133,637, March 30, 1915. Date of appl., June 25, 1913.

THE ore is introduced continuously into the furnace, and the top layer is maintained at a temperature below that at which free sulphur will ignite, by spraying with a liquid containing water; introduction of air is avoided. Sufficient hydrogen sulphide is thus generated in the upper portion of the furnace to reduce the sulphur dioxide in the furnace gases and prevent combustion of the free sulphur produced.—B. N.

Sulphide ores; Process of preventing the escape of sulphur dioxide in smelting —. W. A. Hall, New York. U.S. Pat. 1,134,846, April 6, 1915. Date of appl., June 30, 1913. Renewed Mar. 1, 1915.

IN a process for recovering sulphur as such during the smelting of sulphide ores, the flame of a reducing gas is introduced into the furnace, at a point near the charge level, under conditions whereby the sulphur dioxide in the exit gases is reduced to sulphur; access of air to the gaseous mixture is avoided until the latter has cooled below the oxidation temperature of sulphur.—W. E. F. P.

Metal sheets or plates; Finishing —. A. Ridd, Brackenridge, Pa. U.S. Pat. 1,133,670, March 30, 1915. Date of appl., Dec. 22, 1913.

THE metal plates are placed in a box and subjected to an annealing temperature, out of contact with air. They are then removed in bulk and placed in a heat-retaining receptacle, previously heated to a lower temperature than that used for annealing, through which a heated non-oxidising fluid is passed. The sheets are finally removed, and exposed to air for oxidation.—B. N.

Metallic oxides; Apparatus for the reduction of — with hydrogen. E. C. Kayser, Assignor to The Hydrogenation Co., Cincinnati, Ohio. U.S. Pat. 1,134,745, April 6, 1915. Date of appl., July 18, 1910.

METALLIC oxides are heated in a closed rotating

cylinder provided with fixed radial vanes forming a series of open compartments within the cylinder, while the gas for the reduction is introduced and discharged through the hollow trunnions on which the cylinder is mounted.—C. A. M.

Copper; Metallurgy of —. E. A. C. Smith, New York. U.S. Pat. 1,134,767, April 6, 1915. Date of appl., Feb. 10, 1913.

IN a cyclic process for the extraction of copper from ferruginous ore, the latter is roasted to convert the bulk of the iron into ferric oxide, leached with dilute sulphuric acid, and the solution neutralised by contact with a fresh portion of oxidised ore so as to precipitate the dissolved iron as basic sulphate and increase the copper content of the liquid. After rapid settling, the liquid is decanted, filter-pressed to remove the iron precipitate, and electrolysed to recover the copper and regenerate the acid, the spent electrolyte being then employed to complete the extraction of copper from the partly leached ore.—W. E. F. P.

Metals [copper]; Process for improving the mechanical qualities of —, notably their resistance to tensile strain. Comp. du Telium. Fr. Pat. 473,345, Sept. 18, 1913.

AN aluminate, such as spinel or cymophane, composed of silica, alumina, iron oxides, and magnesia with small quantities of lime, manganese, and water, is incorporated with the molten metal (e.g. copper) during refining.—W. E. F. P.

Aluminium; Process for directly coating — with [precious] metals. M. Canac. Fr. Pat. 472,667, Aug. 12, 1913.

ARTICLES of aluminium or an aluminium alloy are immersed in a boiling, aqueous solution of potash, brushed with milk of lime, immersed in a cold, dilute solution of potassium cyanide and then in a solution of hydrochloric acid containing the chloride of a metal (e.g. iron), and finally electroplated with the desired precious metal, each operation being followed by a washing in cold water.—W. E. F. P.

Zinc vapour; Process and apparatus for obtaining molten zinc from —. C. V. and J. M. J. Thierry. Fr. Pat. 472,879, June 2, 1914.

MIXTURES of zinc vapour and carbon monoxide, produced by the reduction of zinc ores, are passed into a chamber in the upper part of which are one or more metal frames carrying vertical carbon plates, pointed at their lower ends, and spaced 2 or 3 mm. apart. Each frame is surmounted by an asbestos plate and provided with a cover having perforations at the top. On passing through the narrow spaces between the carbon plates, the microscopic droplets of molten zinc carried by the vapours coalesce into macroscopic drops which collect on the sides of the carbon plates; liquid zinc subsequently drips from the pointed ends of the plates to the bottom of the chamber, whence it is discharged periodically. The gas, practically free from zinc, passes around the edges of the asbestos plate and thence to the openings in the cover, where it is burnt.—W. E. F. P.

Aluminium alloys. G. K. F. Axberg. Fr. Pat. 472,930, April 29, 1914.

BRASS is melted in a crucible, then cooled to a suitable temperature, and aluminium is added in small quantities. The mass is stirred whilst zinc and an alloy of magnesium and aluminium are added alternately in small quantities until the desired alloy is obtained, which is then cast. The following are examples: Al, 1 to 6 kilos., Zn, 3 to 9 kilos., alloy of Mg and Al, 2 to 6 kilos., brass, 0.1 to 1 kilo.; or alloy of Mg and Al, 3 kilos., Al, 7 kilos.,

brass 1 kilo.; or Ni, $\frac{1}{2}$ to 2 kilos., Al, 1 to 6 kilos., alloy of Mg and Al, $1\frac{1}{2}$ to 3 kilos.—B. N.

Aluminium alloy; New — and process of manufacture. A. J. de Montby. Fr. Pat. 473,412, June 12, 1914.

AN alloy of Co, 2.5 grms., Ni, 10.0, Ag, 15.0, Cu, 3.5, W, 0.5, Cd, 1.0, Sn, 1.5, and Al, 76, is prepared by melting the metals in an electric furnace, in a crucible containing fluorspar, 1000 grms., powdered wood charcoal, 1000, manganese dioxide, 250, calcined magnesium sulphate, 250, and arsenious acid, 10 grms.; 100 grms. of the alloy and 900 grms. of aluminium are then heated in an ordinary furnace in a plumbago crucible lined with magnesia, and the metals mixed by stirring with a rod of retort carbon covered with magnesia.—B. N.

Metallic oxides; Process of preparing finely divided — for treatment [smelting]. F. Ohlmer. Fr. Pat. 473,044, Sept. 3, 1913.

FINELY divided metallic oxides, such as zinc oxide, are obtained in the form of dense spherical granules, varying in size from that of a grain of millet to that of a small pea, by passing through a rotating drum which is heated externally to a moderate temperature; the material is sprinkled with water or other liquid on entering the drum and leaves in a dry state at the further end. The granulated product, when mixed with carbon, may be reduced in an electric furnace in which the mixture itself constitutes the heating resistance, and sodium carbonate, or other substance increasing the conductivity of the mixture without causing fusion, may be added during the process of granulating.—F. SODN.

Ores, particularly iron ore; Process and furnace for treating — in a finely divided state. G. Gröndal. Fr. Pat. 473,218, Dec. 27, 1913. Under Int. Conv., June 21 and Oct. 11, 1913.

THE finely divided and moistened ore is packed into slightly tapering open-ended receptacles, which are placed end to end and separated at intervals by similar empty chambers, each of which in turn acts as a combustion chamber. Longitudinal channels are formed in each mass of ore for the passage of heating gas. Air is introduced through the empty chamber at one end of the series, and combustible gas or powdered solid fuel into the next empty chamber; the combustion products pass through the remaining series of receptacles and effect sintering of the ore. After treatment, the receptacles are moved forward a step, that nearest the combustion chamber being moved beyond the chamber, so that only the air supply passes through it, to heat the air and oxidise and cool the ore. To reduce the ore to metal, it is mixed with a reducing agent, such as powdered coal, and the gas and air inlets are reversed, so that the ore is finally cooled in a reducing atmosphere.—W. F. F.

Metals and alloys; Process for obtaining — in a finely-divided form. A. Classen. Ger. Pat. 281,305, March 30, 1913.

GELATOSE, obtained by boiling gelatin with water for a long time, is used as a protective colloid to preserve metals in a finely-divided condition. A solution of a salt of the metal may be reduced in presence of gelatose; or metals or alloys may be finely divided by mechanical means, or otherwise, and then mixed with gelatose. Inert substances may be added to the products.—A. S.

[Steel] furnaces. N. E. Maccallum, Phoenixville, Pa., U.S.A. Eng. Pat. 10,598, April 29, 1914. Under Int. Conv., May 13, 1913.

SEE U.S. Pat. 1,106,725 of 1914; this J., 1914, 968.

Ferrochromium; Process of producing carbon-free —. H. Goldschmidt and O. Weil, Essen, Germany, Assignors to Goldschmidt Thermit Co., New York. U.S. Pat. 1,136,669, April 20, 1915. Date of appl., Oct. 29, 1912.

SEE Eng. Pat. 18,671 of 1912; this J., 1913, 430.

Copper: Electrolytic process for the extraction of —. N. V. Hybinette, Christiania. U.S. Pat. 1,136,421, April 20, 1915. Date of appl., May 22, 1913.

SEE Eng. Pat. 22,745 of 1913; this J., 1914, 359.

Copper-smelting furnace. W. G. Perkins, London. U.S. Pat. 1,136,834, April 20, 1915. Date of appl., Jan. 20, 1913.

SEE Eng. Pat. 27,869 of 1912; this J., 1913, 1115.

Titanium alloys and method of producing the same. H. Goldschmidt and O. Weil, Essen, Germany, Assignors to Goldschmidt Thermit Co., New York. U.S. Pat. 1,136,670, April 20, 1915. Date of appl., Oct. 29, 1912.

SEE Ger. Pat. 235,461 of 1909; this J., 1911, 1019.

Alloys; Process of making —. E. D. Gleason, New York, Assignor to Neu-Metals and Process Co., Long Island City, N.Y. U.S. Pat. 1,136,909, April 20, 1915. Date of appl., Nov. 16, 1912.

SEE Eng. Pat. 8790 of 1913; this J., 1914, 488.

XI.—ELECTRO-CHEMISTRY.

Alternating current; Influence of an — on electrolysis by a direct current. (Part II.) J. C. Ghosh. J. Amer. Chem. Soc., 1915, 37, 733–752.

A CURRENT of 30,000 alternations per minute caused a change in the potentials of two platinum electrodes immersed in an electrolyte, but showed no effect of this kind when passed through a reversible voltaic cell. A direct current through a reversible electrolytic cell was unaffected by the simultaneous passage of an alternating current, whereas with an irreversible electrolytic cell the strength of the direct current was greatly increased thereby, owing to a fall in the E.M.F. of polarisation. A similar fall occurred in electrolytic cells containing two cathodes and two anodes when the alternating current passed between the anodes or the cathodes only. In the cadmium-zinc chloride-mercury (or platinum) cell the E.M.F. of the mercury (or platinum) approached that of the zinc upon passing the alternating-current.—J. R.

Chemical action of electric discharges. Role of ionisation [in fixation of nitrogen]. Briner. See VII.

PATENTS.

Furnace; Electric —. J. W. Brown, Lakewood, Ohio, Assignor to National Carbon Co., Cleveland, Ohio. U.S. Pat. 1,134,817, April 6, 1915. Date of appl., Jan. 8, 1912.

THE furnace, with stationary enclosing walls, is provided with vertical upper and lower electrodes, the former being insulated from the charge by a surrounding condensing chamber, in which volatile matter from the charge is collected. The treated material is withdrawn below the lower electrode, thus causing the charge to descend around the condensing chamber and the lower electrode, and past the arc.—B. N.

Electrode of fused ferrie oxide; Bipolar —, especially for the production of chlorates, and electrolytic apparatus for use therewith. S. Laszczynski. Ger. Pat. 281,511, Sept. 12, 1913.

THE electrode is provided on one of its flat sides with a framework of wire gauze of iron, nickel, or the

like, embedded in the material so that the wire is left partly exposed. In use this side of the electrode is made to act as cathode, and the wire is thus protected from corrosion. In applying these electrodes to the electrolytic production of chlorates, an insoluble anode immersed in a special electrolyte in a "blind" cell is used as the first electrode of the series, e.g., an iron anode in alkali hydroxide solution or a lead anode in sodium sulphate solution may be used.—A. S.

Producing chemical action in gases. [Manufacture of oxides of nitrogen.] U.S. Pat. 1,131,583. See VII.

Electrolysis of alkali chloride solutions. Ger. Pat. 280,056. See VII.

XII.—FATS; OILS; WAXES.

Linseed; Cultivation of — in England. J. V. Eyre and E. A. Fisher. J. Agric. Sci., 1915, 7, 120–134.

THE common belief that linseed grown to yield a high quality fibre produces seeds poor in oil, was disproved by Ivanoff (Beihfte zum Bot. Centrbl., 1912, 28, 159), whose results are confirmed by the authors; the only difference between the fibre crop and the linseed crop was one of yield, not of oil content. The rate of oil formation is greatest midway between flowering and final ripening. The oil content of green seeds was found to be 21.05%; of seeds just turning brown, 30.08%; of wholly brown seeds but loose in capsule, 38.03%; of fully ripe seeds, 40.88%. Varieties of seed from foreign countries grown in Kent (Wye), Yorkshire, Devonshire, and Shropshire, produced seeds of which the oil contents were as high as those obtained from the same seeds in those countries. The best results were obtained in Kent, and the plant would probably flourish best in the southern counties. From the combined standpoints of percentage of oil in seed and yield of oil per acre, Plate seed was easily first, Steppe seed a moderate second, Moroccan third, and Dutch the poorest of the four. Comparing imported seed with seed produced from the same sample grown in England, it was found that increase in oil content is accompanied by an increase in size of seed. Repeated growth from the same stock does not entail the production of seeds with diminished oil content. Trials at Rothamsted in 1911 showed that artificial manuring had no effect upon the percentage of oil, but it increased the yield of seed and straw. A combination of nitrogen, superphosphate, and potash gave the best results.—E. H. T.

Lipase; Inactive — and the nature of its co-enzyme. N. Umeda. Biochem. J., 1915, 9, 38–52.

ROSENHEIM (J. Physiol., 1910, 40) has shown that active pancreatic lipase can be separated into two inactive fractions by filtration through filter paper; the portion remaining on the filter contains the thermostable inactive enzyme, which is restored to its original activity by the addition of the filtrate. The author's experiments show that the most active inorganic constituents of the co-enzyme are phosphates; organic substances, probably organic phosphates, are also concerned in the activation of the inactive portion.—W. P. S.

Auxo-lipase of serum. K. Tsuji. Biochem. J., 1915, 9, 53–65.

IT is known that the addition of small amounts of ox-serum to pancreatic extracts increases their power of hydrolysing fats. Results of experiments show that the substance, auxo-lipase, producing the acceleration, is non-dialysable and thermostable, and is destroyed by incineration. It is not identical with the co-enzyme of lipase (see preceding

abstract) and does not appear to have any relation to antitrypsin.—W. P. S.

Emulsification; Theory of——. VI. W. D. Bancroft. J. Phys. Chem., 1913, 19, 275—309.

HYDROXYL ions can be adsorbed from an alkaline aqueous solution by many organic liquids. When solid particles are shaken with water and an immiscible organic liquid, the phase into which they will tend to pass will depend upon which liquid they adsorb. If they adsorb both liquids it is probable that a homogeneous liquid phase is formed about their surfaces. The space between the two liquids into which a suspended substance wetted by them both will pass, is termed the "dimeric interface." If the particles are unable to coalesce into a coherent film the emulsion that tends to form will not last long (e.g. copper powder, kerosene, and water). The name "interfacial" is given to substances that pass into the dimeric interface of two liquids, and if suspended in one liquid they can be shaken from their suspension by the addition of a second liquid towards which they are interfacial. Winkelblech's test for colloids (this J., 1906, 1177) is a means of detecting interfacial substances, and is applicable when a fairly stable emulsion is formed or when the interfacial substance is not readily brought into colloidal solution by either liquid. When an interfacial substance is withdrawn from an aqueous liquid it is probably less hydrous in proportion to the amount of surface of the other liquid. Experiments tend to confirm the view of Briggs (J. Phys. Chem., 1913, 17, 296) that Winkelblech's method will detect substances in colloidal solution in the presence of dissolved substances. In the author's experiments with the method, benzene gave a faint film in the absence of gelatin; this was found to be due to the presence of traces of resins, and the test may therefore be used for the detection of such impurities in benzene.—C. A. M.

Emulsions and emulsification. F. G. Donnan. Lecture before the Royal Institution, April 30, 1915.

THE lecturer dealt with the factors determining the formation, stability, and destruction of emulsions. Emulsions of water in oil, and of oil in water were projected on the screen and their structure and the motion of the emulsion particles in an electric field was shown. The lecturer explained how the stability depended on the particles carrying electric charges, and showed how the variation of the electric charge, as dependent on the addition of acids, alkalis, and salts, affected the stability of the emulsion. Experiments were shown illustrating the effect of electric discharges in coagulating and settling dusts, fumes, and emulsions. In the second part of the lecture the part played by surface tension and surface-concentration (surface adsorption) was discussed. Experiments were shown illustrating the effect of various emulsifying agents on surface tension, and their power in producing stable emulsions. The lecturer explained how stability was caused by the production of concentrated surface layers or surface skins. Experiments were shown demonstrating the formation of such concentrated surface-layers, both at water/air and water/mercury surfaces. The stability of the fat emulsion in milk was dealt with, and a sample of synthetic artificial milk was exhibited. In conclusion, the lecturer pointed out that the two main factors determining the stability of emulsions, namely electric charge and surface layer, were also to be met with in dealing with colloidal solutions. The substances which lowered the surface tension and therefore formed concentrated surface layers (emulsifying agents), corresponded in some degree to the "protective" colloids, which play such an important part in the technical and medical applications of colloidal solutions. Reference was

also made to the possibility that the formation of surface layers may be in part due to electrical adsorption.

PATENTS.

Fats, oils, and the like; Apparatus for the separation of— from liquids and semi-liquids. E. H. Sams, London. Eng. Pat. 10,958, May 4, 1914.

THE apparatus consists of a vessel with a removable inner chamber provided at the top with two flanges to form an annular space between it and the outer vessel. The liquid is introduced into this space and passes through openings into the upper part of the inner chamber; the fat rises to the surface, and solid matter is deposited, whilst the heavier liquid issues through openings in the lower part into the outer vessel, and is run off through a siphon-like pipe.—C. A. M.

Oils or other liquid mixtures; Refining or distillation of——. K. Birkeland and O. Devik, Christiania. Eng. Pat. 11,588, May 11, 1914. Under Int. Conv., May 16, 1913.

THE oil, etc., is forced through a jet into an atmosphere of gas or vapour, e.g. water vapour, and then into the main body of the oil, whereby an emulsion of vapour and oil is obtained. This is discharged through a reducing valve into a low-pressure vessel, where the gas or vapour escapes, and carries off volatile impurities.—C. A. M.

Fatty or other organic compounds; Process for effecting reduction of——. E. C. Kayser, St. Brelade's Bay, Jersey. Assignor to The Hydrogenation Co., Cincinnati, Ohio. U.S. Pat. 1,134,746, April 6, 1915. Date of appl., Oct. 30, 1912.

FATTY or other organic compounds are heated with a catalyst (finely divided nickel) and an organic compound (borneol) capable of yielding hydrogen on contact with the catalyst.—C. A. M.

Oils, resins, and rubber; Process of desulphurising——. Chem. Fabr. Griesheim-Elektron. Fr. Pat. 473,110, June 5, 1914. Under Int. Conv., June 6, 1913.

THE heated material is treated with molecular (gaseous) hydrogen, with or without pressure. The hydrogen may subsequently be freed from hydrogen sulphide and used again.—C. A. M.

Soaps and the like and the process of manufacture thereof. W. Feldenheimer, London. Eng. Pat. 7920, March 28, 1914.

THE use of an argillaceous schist known as "killas" as an admixture with soap is claimed.—C. A. M.

Soap; Manufacture of liquid colloidal——. E. F. Rousseau. Fr. Pat. 472,587, Aug. 9, 1913.

HARD neutral or slightly alkaline soaps are treated in a dialysing vessel with a suitable liquid (water, aromatic infusions) at a temperature below that at which the soap would dissolve. The product is a stable emulsion capable of fixing perfumes and colouring matters.—C. A. M.

Lubricants, emulsions, and other analogous products; Manufacture of——. C. Büchel. Fr. Pat. 472,655, May 25, 1914.

AN acidylarylsulphonimide or one of its salts is incorporated with the substance to be emulsified. The reagent is obtained by treating an arylsulphonamide with the halogen derivative of a fatty acid. The m. pts. of fatty acids are raised by mixing with the acidylarylsulphonimides, and oils and fats are made capable of absorbing more water.—C. A. M.

Manufacture of drying oils from products of distillation of mineral oils. Eng. Pat. 23,376. See IIa.

Treatment of lubricating oils and greases. Eng. Pats. 8279 and 15,010. See IIa.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

White lead paints; Report of the Departmental Committee on —.

The Departmental Committee appointed to consider the danger attendant on the use of paints containing lead was appointed in January, 1911, and its report was issued on May 5th last. That report recommends the restriction of the importation, sale, or use of any paint material which contains more than 5% of its dry weight of a soluble lead compound when determined by the following test: "If the paint or wash be mixed with water, turpentine, oil, varnish, size, or other adhesive or waterproofing substance, it shall first of all be freed as far as possible from such vehicle or adhesive or waterproofing substance by drying or by treatment with ether, petroleum spirit, alcohol, water, or other neutral solvent or solvents. If the residual substance so obtained should contain insoluble varnish matter, size, or other adhesive material which cannot be removed except by the action of reagents which affect the other constituents of the paint or wash, then the proportion of such varnish matter, size, or other adhesive material shall be ascertained by suitable means, and a deduction be made for the same from the weight of residual matter taken for the determination of the soluble lead, so that the proportion of soluble lead found to be present shall be calculated as a percentage of the dry matter free from varnish matter, size, etc. For the determination of soluble lead, a weighed quantity of the dried or dry material, freed as far as possible from oil, or other vehicle, or adhesive substance above described, is to be continually shaken for one hour, at the common temperature, with 1,000 times its weight of an aqueous solution of hydrochloric acid containing 0.25% of actual or real hydrochloric acid. This solution is thereafter to be allowed to stand for one hour, and to be passed through a filter. The lead salt contained in an aliquot portion of the clear filtrate is then to be precipitated as lead sulphide and weighed as lead sulphate." It is recognised that artists' colours would have to be exempt from the 5% restriction, and also certain special branches of the general painting industry, but these exemptions would have to work under controlling regulations. The restriction, it is recommended, should not come into force until after three years from the publication of the Committee's report. The report discusses fully the alternatives to lead compounds, and deals specifically with the supplies of zinc compounds and the manufacture of zinc oxide. The Committee suggests that any legislation should also embrace powers to make regulations under the Factory and Workshops Act dealing with the linseed oil, turpentine, and other media used in all paints, the vapours of which may produce ill-effects.

Ultramarine. L. Bock. Z. angew. Chem., 1915, 28, 117—152.

The formation of ultramarines by treating zeolites with alkali sulphides (Singer, this J., 1910, 577) is considered to show that the grouping of sodium, aluminium, and silica in the ultramarine molecule is similar to that in the zeolites, and this view is further supported by the fact that the sodium, both in ultramarines and zeolites, may be replaced by other metals (Wunder, this J., 1912, 998). The

relationship between blue, green, purple, and red ultramarines is discussed, and possible constitutional formulae are proposed; but the state of combination of the sulphur in the various products is regarded as still doubtful. Pyrometer readings taken during the process of burning ultramarine showed a well-marked maximum in the temperature curve. A higher burning temperature could be used with mixtures rich in alumina than with those rich in silica. It is thought that ultramarines rich in alumina are aluminate-silicates, whilst those rich in silica approximate more closely to double silicates, and that the sodium is less readily replaced in the latter than in the former; the existence of isomeric ultramarines containing —SNa or —SONa groups attached to aluminium or silicon respectively, is considered probable.—F. SOON.

Phenol-formaldehyde condensations using casein as contact substance. H. Kühl. Chem. Ind., 1914, 37, 559—561. Z. angew. Chem., 1915, 28, Ref., 71.

In the preparation of resinous condensation products by heating mixtures of cresol, formaldehyde, and casein (see Fr. Pat. 436,720 of 1911; this J., 1912, 445; also Ger. Pat. 280,648; following), the casein acts as a contact substance as well as a filling material. Resinous products cannot be obtained by heating mixtures of cresol and formaldehyde alone. The lacquers obtained by dissolving the resinous products in alcohol, dry very rapidly and also accelerate the drying of ordinary varnishes. They exhibit pronounced bactericidal action. When mixed with an alcoholic solution of celluloid they yield, on drying, tough elastic masses capable of replacing celluloid in the production of artificial leather.—A. S.

Volumetric determination of the higher oxides of lead and manganese with titanium trichloride. Moser. See VI.

Determination of the higher lead oxides. Milbauer and Pivnicka. See VII.

Magnesium chloride as a mineral former. Uranium-cerium blue and the existence of constitutive colouring. Magnesia red and magnesia green. Hofmann and Höschel. See VII.

PATENTS.

Dyestuff; Composition containing artificial —, and process of making same. F. Reissmann, West Point, N.Y. U.S. Pat. 1,134,486, April 6, 1915. Date of appl., Feb. 6, 1914.

THE product obtained by the action of stannous chloride on "oil of safrol," with or without the addition of sulphur chloride, is dissolved in a mixture of acetone, benzol, and methyl alcohol.—F. W. A.

Primer and varnish and process of preparing same. Paint and varnish. A. Eichler, New York, U.S. Pats. (A) 1,133,432 and (B) 1,133,433, Mar. 30, 1915. Dates of appl., Sept. 12, 1913 and April 11, 1914.

(A) POLYMERISATION products of coumarone are melted at about 160° C. and incorporated by heating with a liquid hydrocarbon solvent, e.g., oil of turpentine, and the resulting uniform product is allowed to cool. (B) Polymerisation products of the coumarone and indene groups are incorporated with linseed oil, with or without the addition of a volatile solvent.—C. A. M.

Gum [resin]; Purified — and process of obtaining the same. W. H. Bradshaw, Brooklyn, N.Y. U.S. Pat. 1,133,790, Mar. 30, 1915. Date of appl., April 25, 1911.

THE resinous by-product obtained in the purifica-

tion of Pontianac and other gums, is treated with a 5% solution of sugar at about 100° C. to remove objectionable impurities.—C. A. M.

Condensation products of phenol and substances containing the methylene radicle; Manufacture of —. L. V. Redman, Chicago. Eng. Pat. 9291, April 14, 1914. Under Int. Conv., Feb. 24, 1914.

CONDENSATION products containing over 25% free phenol are obtained by the interaction of an excess of a phenolic compound with hexamethylenetetramine in absence of water. For instance a mixture containing phenolic groups and methylene groups in the ratio of about 1.5:1 is heated to start the reaction, and when evolution of ammonia stops (180° C.), the mass is again heated to drive off the rest of the nitrogen. The resulting product may be converted into an infusible, insoluble substance in any suitable way, e.g., by heating gently with a sufficient quantity of a substance containing the methylene group, with or without a small proportion of ammonia. (Reference is directed in pursuance of Sect. 7, Sub-sect. 4, of the Patents and Designs Act, 1907, to Eng. Pats. 3496, 3497, and 3498 of 1911 and 6363 of 1912; this J., 1912, 347; 1913, 436.)—C. A. M.

Cresol, casein, and formaldehyde; Preparation of a soluble condensation product from —. H. Kühl. Ger. Pat. 280,648, Aug. 21, 1913.

CRESOL and casein are heated with formaldehyde, with or without a small quantity of potassium carbonate, in an autoclave at 3–5 atmospheres pressure. For example, 250 grms. of granular casein is soaked in 500 grms. of cresol until a uniform mixture is obtained. This is mixed with 400 grms. of formaldehyde, heated in an autoclave until a pressure of 3 atmospheres is attained, and kept at this pressure for 10 mins. The product may be dissolved in alcohol to form a varnish.—A. S.

Porous substances; Process of impregnating —. W. A. Beatty, New York, Assignor to H. H. Smith and J. D. Dusenberry, New York, and T. A. Witherspoon, Washington, D.C. U.S. Pat. 1,134,436, April 6, 1915. Date of appl., Aug. 26, 1913.

THE substances are heated and a partial vacuum is created within their pores. They are then impregnated with a melted synthetic gum obtained as a condensation product in the interaction of dihydroxydiphenyldimethylmethane with formaldehyde (or of other phenols, ketones, and aldehydes), and are finally heated under pressure.—C. A. M.

Rust-preventives; Manufacture of —. MannesmannröhrenWerke. Fr. Pat. 472,884, June 2, 1914. Under Int. Conv., Feb. 5, 1914.

OILS or mixtures of oils and resins are treated with sulphur or sulphur chloride, and the condensation products dissolved in a suitable solvent (e.g. petroleum oil, carbon tetrachloride). The solutions are used alone or after the addition of other products such as coal tar, asphaltum, etc.—C. A. M.

Process of desulphurising oils, resins, and rubber. Fr. Pat. 473,110. See XII.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Castilloa rubber from India. Bull. Imp. Inst., 1915, 13, 17–18.

Two samples of *Castilloa* rubber from India, consisting of small, irregular balls of dark-coloured scrap rubber, gave the following results on analysis:

caoutchouc, (a) 81.6, (b) 60.9; resin, 12.4, 34.3; proteins, 4.7, 3.7; and ash, 1.3, 1.1% respectively, on the dry washed rubber. The rubber was obtained from trees grown experimentally from seed sown in 1907. Sample (a), from male trees, was superior both in composition and physical properties, and would be worth about 1s. 6d. per lb., with fine hard Para at 2s. 6d., and fine plantation Para at 2s. 4d. per lb. Sample (b), from female trees, would be worth about 1s. 3d. per lb.—A. S.

Rubber from Dominica. Bull. Imp. Inst., 1915, 13, 18–20.

Hevea brasiliensis thrives well in Dominica and its cultivation is being extended; about 200 acres were planted with it in 1912. Three samples of Para rubber and one of Funtumia rubber, prepared at the Botanic Station, Dominica, gave the following results on analysis:—

	Para rubber.			Funtumia rubber.
	1	2	3	
Loss on washing (moisture and impurities)	%	%	%	%
Dry washed rubber:—	0.3	0.2	0.4	1.2
Caoutchouc	93.5	94.2	93.4	84.6
Resin	3.5	3.3	4.4	8.8
Proteins	2.7	2.2	2.0	6.4
Ash	0.3	0.3	0.2	0.2

The three samples of Para rubber, viz.: No. 1, thin biscuits of pale rubber, No. 2, thin biscuits of pale to light brown rubber, and No. 3, thin biscuits of dark brown, smoked rubber, were valued at 2s. 1d., 2s., and 2s. 3d. per lb. respectively, with first-quality biscuits at 2s. 4d., and first-quality smoked biscuits at 2s. 6d. to 2s. 7d. per lb. The rubber was somewhat soft and weak, and a little inferior to samples of Para rubber from Dominica examined previously (this J., 1910, 1067; 1913, 203). The Funtumia rubber, thin rough biscuits of light brown rubber, was valued at 2s. per lb. (Nov., 1914).—A. S.

Rubber solutions vulcanised by the ultra-violet rays; Contribution to the study of —. A. Helbronner and G. Bernstein. Rubber Industry, London, 1914, 156–163. (See this J., 1913, 615, 919; 1914, 653.)

THE vulcanisation of rubber in solution in presence of sulphur, under the influence of the ultra-violet rays, was studied. A thin layer of the rubber solution, on an endless band, was carried beneath a cylindrical quartz mercury-vapour lamp, provided with a cooling jacket, and the vulcanised solution was afterwards removed by a scraper. The strength of the rubber when used as a cement was determined by measuring the load required to separate two layers of canvas united by means of the vulcanised solution. The strength and viscosity of the rubber solutions before exposure to the rays varied inversely as the percentage of sulphur employed. The amount of combined sulphur in the vulcanised solutions varied very little for concentrations of rubber up to 6%, but fell very rapidly above that point (the added sulphur being kept constant at 5% on the solution). The amount of combined sulphur and the strength of the vulcanised solutions increased with the amount of sulphur used up to 6–7%, and then diminished. The thickness of the layer of solution employed was varied according to the colour of the rubber, and it was found advisable to allow a margin of 40% above the thickness indicated by the spectroscopic for complete absorption of the rays. Curves are reproduced showing the depolymerising effect of the ultra-violet rays on a

solution of unworked Ceylon rubber—which showed complete depolymerisation (as measured by cementing strength) in seven seconds—and, on the other hand, the repolymerisation of solutions of well-worked rubber containing sulphur, the strength in this case, after 54 seconds' exposure, almost reaching that of the original unworked, unexposed rubber. The vulcanised solutions were permanent, but tended to undergo further vulcanisation after removal from the direct influence of the rays.
—E. W. L.

Vulcanisation. G. Bernstein. *Rubber Industry*, London, 1914, 164—166.

THE following conclusions are drawn as a result of experimental studies of the process of vulcanisation, both by the ordinary methods and by means of actinic rays (see preceding abstract). In vulcanisation, rubber is first depolymerised, then repolymerised in the presence of sulphur, which acts as a catalyst, combination of sulphur with rubber being a subsidiary and secondary reaction. Unless the physical conditions attending vulcanisation are the same in each case, the "coefficient of vulcanisation" is not a measure of the degree of vulcanisation. In cold vulcanisation the reaction is chemical, and a definite chemical product is formed. In vulcanisation by the agency of heat or light the question is not definitely settled, but it is not a case merely of adsorption of sulphur by rubber.—E. W. L.

Balata; The production of—. W. Ter Laag. *Caout. et Gutta-percha*, 1915, 12, 8619—8620.

THE author refers to a number of errors in the literature relative to the production of balata, and describes the processes now employed. In Venezuela the trees are ringed with cuts about a foot apart, and are then felled. The latex is collected in vessels placed underneath the trunk, and from it block balata is prepared by boiling. In Demerara the trees are tapped and not felled, the latex being collected at the foot of the tree, then placed in troughs ("dabris") made of twigs plastered with clay and leaves and allowed to evaporate; successive layers of balata are removed from the surface, when of sufficient thickness, and dried. The technical value of the product depends upon its degree of compactness, which in its turn is influenced by the course of the drying process.
—E. W. L.

PATENTS.

Rubber; Reclaiming—. O. A. Wheeler, Assignor to E. D. and B. Loewenthal, Chicago, Ill. U.S. Pat. 1,135,236, April 13, 1915. Date of appl., Oct. 30, 1912.

SEE Fr. Pat. 452,482 of 1912; this J., 1913, 706.

Caoutchoucs and other colloidal matters; Purification of natural and regenerated—. C. P. Bary, Assignor to H. Dehaugue, Paris. U.S. Pat. 1,136,462, April 20, 1915. Date of appl., Feb. 3, 1912.

SEE Fr. Pat. 426,457 of 1911; this J., 1911, 968.

Process of desulphurising oils, resins, and rubber. Fr. Pat. 473,110. See XII.

Purified gum [resin] and process of obtaining the same. U.S. Pat. 1,133,790. See XIII.

XV.—LEATHER; BONE; HORN; GLUE.

Leather; Nigerian and Somaliland—. A. Seymour-Jones. *Leather Trades' Review*, 1915, 48, 146—150. *J. Royal Soc. Arts*, 1915, 63, 531—532.

SHEEP skins and goat skins are tanned in Nigeria and Somaliland. For depilation, which takes 24

hours or less, the goods are treated in an alkaline bath and subsequently scraped with a blunt knife. The alkali is sometimes only wood ashes, but in Nigeria, "toka," which contains 18.5% CaO and 66% SiO₂, is widely used. Lime is used by the Somalis. Bates are made from the excreta of the "kairo" bird (*Pyromelana afra*) or of domestic fowls. Many natives use instead a drench made from the "dousa" husk. In Nigeria the pods of *Acacia arabica* are used as a tanning material. The tannin is allied to divi-divi and produces a soft white leather. The Somalis use the leaves and young branches of the "watta" bush (*Osyris abyssinica*) or barks from two kinds of acacia. The watta is by far the best material, and colours the leather only slightly. The red dye largely used is from a variety of sorghum, known as "karrandeffi," of which the stems contain a substantive dyestuff of the same type as that present in red sandalwood. The stems are pounded and treated with a solution of potash obtained from bark ashes. The resulting red liquid is rubbed into the skins, which are then washed with water containing a little lime juice, and finally dried in the sun. Less frequently the leather is dyed yellow or green.—F. C. T.

Velvet leather; Manufacture of—. J. W. Dyer. *Leather Trades' Review*, 1915, 48, 26—28.

A METHOD is described for making velvet leather of which the colour will be fast both to rubbing and to water. Persian sheep skins are buffed on the flesh side, then wetted down, and drummed at 35°C. with a solution containing 2% of borax on the dry weight of the skins. After 30 mins. the goods are washed in warm water and sumached for 1 hour. After washing and striking out, they are ready for dyeing. In dyeing, which is done in the drum, it is essential to secure complete penetration. This is effected by the addition of ammonium acetate to the dye liquor. No additions of dye to the solution should be made during the dyeing, as this causes irregular colour when the goods are afterwards buffed. The author gives full details, including recipes for particular colours.—F. C. T.

Colouring of horn. E. Beutel. *Z. angew. Chem.*, 1915, 28, 170—173.

THE bleaching of horn by means of hydrogen peroxide (Margold, Zink, and Beutel; *Oesterr. Chem. Zeit.*, 1913, 38, 21) requires careful supervision, and is unsuitable for use on a small scale. It results in the decomposition of the sulphur compounds present in unbleached horn, which react with neutral lead nitrate solution.

Lead, mercury, and manganese compounds, and also nitric acid, are used in the staining of horn. Unbleached horn reacts with neutral solutions containing 15 to 20% of lead nitrate to form lead sulphide, producing an ebony colour after several days' immersion. The coloured horn is afterwards immersed in a bath containing 5% of hydrochloric acid. The addition of 1% of Flavophosphine to the lead nitrate bath colours the horn in such a manner that it appears to be covered with a network of gold wires. Bleached horn is attacked by an alkaline solution of lead nitrate, which reacts with the horn substance. As horn rapidly loses its polish in alkaline baths, the surface forming a gelatinous mass which solidifies to a vitreous mass on exposure to air, care is needed to obtain a level colouring. A suitable mixing is obtained by grinding to a paste with water one part of red lead, one part of slaked lime, and two parts of sodium carbonate. Translucent horn is immediately stained brown by this mixing; a tortoise-shell appearance is obtained by first treating with nitric acid, and then applying the lead mixture by means of a wooden rod. Prolonged action of this mixing colours the horn deep

black. The tortoise-shell appearance can be modified by adding tin oxide to the mixing. Red stains are obtained by means of a 2% solution of Magenta or Crocein. When brown or black stains are required, the horn is treated with alkali to obtain an uneven coloured surface, which is then polished. On converting the lead sulphide into chloride by immersion in hydrochloric acid (1:5), a glistening appearance is obtained. On treatment with a 4% solution of potassium bichromate, a yellow to brown colour is produced. Neutral solutions containing 10% of mercurous nitrate colour horn grey after several hours. On immersion in liver of sulphur (1:20), the grey becomes deep black, the staining being then non-poisonous. A solution of mercury in nitric acid (4:10, diluted ten times with water) colours horn brilliant red to reddish brown. A warm solution of one part of potassium permanganate in ten parts of water rapidly stains horn yellowish brown, reddish brown, and black. The colour appears to be due to manganese dioxide. The latter can be readily converted into colourless manganese salts by sulphur dioxide, sodium sulphide, or ammonium oxalate. Polished surfaces are only damaged by very prolonged action of the permanganate solution. The action of nitric acid on horn depends on the temperature and concentration; a 1:3 solution stains horn a golden yellow (xantho-protein reaction). Alkaline solutions of silver salts give yellow, brown, and grey stains; further treatment in a bath of liver of sulphur produces black stains, in a bichromate bath brown stains. Gold chloride solutions produce red to brown stains. Although frequently recommended, silver or gold solutions possess no advantages over the cheaper methods of staining.

Aqueous solutions of dyestuffs show the same behaviour towards horn as towards wool; acid dyestuffs are most suitable, the bath being acidified, or the horn first treated, with sulphuric acid. Ponceau and Water Blue RR in admixture give level reddish brown or brownish violet shades on translucent horn; only Ponceau is absorbed by opaque horn. Metanil Yellow rapidly produces a yellow shade; in presence of only small amounts of Ponceau, an orange shade is obtained, but the addition of Water Blue does not give a satisfactory green. Direct Blue 33 mixed with an equal amount of Brilliant Crocein gives a very satisfactory violet. A 0.5% bath of Fast Yellow G to which several drops of Brilliant Crocein have been added dyes horn red, whereas addition of very small amounts of the blue give a green shade. Other dyestuffs suitable for dyeing horn are: Methyl Green cryst. 3G, Janus Green B, Fast Acid Magenta G extra, Rhodamine, Aceto-purpurine 8B, Brilliant Green (new, in crystals), Bismarck Brown G, Methyl Violet No. 0 3R, Cyanol Green B, Naphthol Green B, Diamine Grey G, Fast Green cryst. O, Eosine GGG, Tropaeoline, Acid Green G extra, Auramine, Induline, Fast Red EB, Acid Anthracene Red G, Fast Light Yellow 3G, Alizarin Saphirol B. The dye-bath should contain 0.5% of dyestuff and either sulphuric or acetic acid. For dyeing red shades the most valuable dyestuffs are Ponceau, Safranine, Eosine; for blue, Methylene Blue; for yellow, Flavophosphine; for green, Crystal Green; for violet, Methyl Violet; and for reddish brown, Brown A (Höchst). On mixing 1 to 2% solutions of these dyestuffs with 15% lead nitrate solution, and using the solution for staining, immersion of the stained horn in 5% hydrochloric acid produces an iridescent surface, even on black buffalo horn. For graining, a 4% solution of Wool Blue in alcohol is used.—F. W. A.

Velocity of formation and solution, and the swelling of jellies. Traube and Köhler. See XXIV.

PATENTS.

Tanning; Process of tawing and —. L. E. Levi, Assignor to Pfister and Vogel Leather Co., Milwaukee, Wis. U.S. Pat. 1,135,977, April 13, 1915. Date of appl., Dec. 29, 1913.

HIDES are tanned by immersion in a solution of non-acid ferric chromate or of a non-acid substituted ferric chromate.—F. C. T.

Casein binding materials; Manufacture of —. L. Petersen-Hviid, Copenhagen. Eng. Pat. 1016, Jan. 14, 1914. Under Int. Conv., Jan. 14, 1913.

FRESHLY precipitated curd is mixed with infusorial earth and dried. The mass obtained is easily pulverised to a very fine powder, which possesses a very high binding capacity.—F. C. T.

Albumen compound; Indurated —. B. B. Goldsmith, New York. U.S. Pat. 1,134,527, April 6, 1915. Date of appl., March 2, 1912.

A THERMOPLASTIC compound is prepared by submitting egg- and blood-albumin to the combined action of a normally solid converting agent, *e.g.*, β -naphthol, and an indurating agent, *e.g.* formaldehyde, and heating and pressing the mixture. —J. F. B.

XVI.—SOILS; FERTILISERS.

Soil; Atmosphere of the —. E. J. Russell and A. Appleyard. J. Agric. Sci., 1915, 7, 1—45.

THE free air in a soil, to a depth of 6 inches, occupies from 10—20% of its total volume, and has essentially the same composition as that of ordinary air, but it contains more carbon dioxide (0.25 against 0.03 vol. %), and less oxygen (20.6 against 20.9), and undergoes more fluctuations. The sum of the carbon dioxide and oxygen is only slightly less than in ordinary air, but falls below it when, owing to active nitrification or waterlogging of the soil, the oxygen content is depressed. The changes in composition are mainly due to biochemical activity, which is at a maximum in late spring and autumn, and at a minimum in summer and winter. In autumn, the bacteria increase first, then the carbon dioxide, and finally the amount of nitrate. Soil temperature is the chief factor from November to May; rainfall, and to a lesser extent soil moisture, from May to November. The dissolved oxygen in rainwater probably plays an important part in facilitating biochemical change. Grass land usually contains more carbon dioxide and less oxygen than arable soil. The effect of a growing crop is probably very small, but very difficult to determine owing to the difference in physical condition of cropped and fallow soils. The soil air is very still and usually nearly saturated with moisture; barometric changes, wind velocity, etc. have practically no effect upon it. At 18 inches below the surface there is more carbon dioxide than at 6 inches. Besides the free air there is another atmosphere dissolved in the water and colloids of the soil: it consists chiefly of carbon dioxide and nitrogen, oxygen being almost entirely absent. Anaerobic life in the soil is thus possible. —E. H. T.

Soil; Protozoa of the —. A. Cunningham. J. Agric. Sci., 1915, 7, 49—74. (See Goodey, this J., 1915, 439.)

PROTOZOA cultures were made in soil extracts containing dipotassium phosphate, with and without the addition of protozoa-free cultures containing bacteria. The incubation period was 5 days at 22°C. Soils and cultures were obtained free from active protozoa by heating to 58°C, but at this temperature many encysted forms were also

destroyed. Flagellates were the most abundant in the soil extracts, followed by amoebæ, and ciliates were found only in small numbers. At 22° C., all three forms were present, but below 8° only flagellates, and at 30° practically only ciliates were observed. The number of protozoa diminished in moist soil that was exposed to evaporation, but increased in saturated and 70%-saturated soils: the bacterial content decreased to a greater extent in the latter cases than in the former. It is inferred that some protozoa lead an active life in the soil and multiply when the conditions are favourable. By inoculating nutrient solutions with bacteria alone, and with protozoa and bacteria together, the limiting effect of the protozoa on the number of bacteria was established. Of three similar experiments to ascertain their influence on ammonification, only one indicated inhibition. The reduction in the number of bacteria in soils, partially sterilised with formalin and inoculated with protozoa cultures, was very marked.—E. H. T.

Protozoa; Examination of soil —. C. H. Martin and K. R. Lewin. *J. Agric. Sci.*, 1915, 7, 106—119.

THE fauna found in the cultures from a soil do not necessarily correspond with the fauna present in the soil itself. Active (trophic) organisms in the culture may exist as cysts in the soil, and thecamoebæ develop very slowly, if at all, in cultures on ordinary media. It is probable that trophic protozoa exist in soils, even in such as are relatively dry and poor. The application of farmyard manure introduces a large number of protozoa into the soil, and if the manurial and water contents of the latter be high, these may develop to such an extent that soil sickness results. The nature of the protozoa apparently differs with the soil, but this difference could largely be explained by assuming that the fauna develops in cycles, in the order: small flagellates, larger flagellates and amoebæ, ciliates; such cycles have been observed in culture media. The dominant active soil fauna are amoebæ, thecamoebæ, and small flagellates. Further research is required to determine why large flagellates are frequently found in soil cultures, whereas in fresh films the only flagellates found are very small monads. Soil protozoa should be studied from three points of view: active fauna, encysted fauna, "cultural" fauna.—E. H. T.

Soils; Lime requirement of —. H. B. Hutchinson and K. MacLennan. *J. Agric. Sci.*, 1915, 7, 75—105. (See also this *J.*, 1914, 932, 1065.)

THE amount of lime necessary to produce the partial sterilisation effect in a soil, is determined by finding the quantity that will produce an alkaline reaction of the soil water. 100-grm. lots of the air-dried soil are treated in 250 c.c. bottles with calcium oxide in amounts rising by 0.2 gm. up to 2% of the weight of soil. After adding 50 c.c. of water, the corked bottles are shaken for a few seconds at intervals for 4 hours or more, and the contents are then transferred to, and washed on, a Buchner funnel with 200 c.c. more water. The whole filtrate is then titrated with N/10 acid in presence of phenolphthalein. If a given filtrate does not need more than 5—10 c.c. of this acid, the amount of lime used may be taken as the optimum. By this method the amounts of lime required by different soils agree with those that produce typical partial sterilisation effects, e.g. inhibition of protozoa. These results, and those obtained with pot experiments, show that when the critical amount of lime is added, a maximum production of dry matter is obtained, not only in the first crop, but in the first four crops. Heavier applications of lime augment the ammonia and nitrate production, but do not give a corresponding increase of crop. The addition of the critical amount of

lime to a soil appears to induce a maximum flocculating effect upon it. The authors' method of determining the lime required to effect neutralisation of a soil (this *J.*, 1914, 932) is superior to many others as it does not indicate lime-requirement in the case of neutral soils, and the lime-requirement of a soil is more important than its content of free carbonate. Comparative tests of various lime-treated soils showed proportionate diminution of the lime requirements, and lime added as carbonate has produced increased ammonia and nitrate in laboratory experiments, and greater plant growth in field tests. The effects of lime on field soils may extend to upwards of 17 years. For neutralisation, calcium oxide and calcium carbonate are equally effective. On acid (Woburn) soil, the crop yields were proportional to the reduction in acidity. Ammonification, and to a lesser extent, nitrification, are accelerated by the application of carbonate. The natural flora of soils on the same geological formation bears a definite relation to their lime requirements.—E. H. T.

Soil; Influence of the character of the — on bacteria and the changes in the soil. H. R. Christensen. *Centr. Bakt. Par.*, 1915, ii., 43, 1—166. *J. Chem. Soc.*, 1915, 108, i., 196.

THE results of inoculation experiments with a large number of soils showed that *Azotobacter* occurs very frequently in soils which contain sufficient calcium carbonate to effervesce when treated with hydrochloric acid; neutral soils seldom contain *Azotobacter*, whilst in acid soils it very rarely occurs. It is considered probable that a vigorous growth of *Azotobacter* when a soil is added to a mannitol solution free from phosphates, is a certain indication that the soil is not deficient in phosphoric acid. Microbes which ferment mannitol occur in practically all arable soils, in numbers which seem to depend mainly on the amount of calcium, in a suitable form, in the soil. Great variations occur in the power of different arable soils to decompose peptone, depending partly on the composition (phosphoric acid being especially important), and partly on biological conditions. Addition of calcium carbonate was generally without effect, and none of the soils was influenced by addition of humus. A low power of decomposing peptone indicates unfavourable conditions for the growth of plants. The rate of decomposition of cellulose in soils seems to depend on chemical conditions, since inoculation was without effect. Basic calcium and phosphoric acid are the chief factors. It was previously shown that peat of the "Hochmoor" variety usually fails to produce nitrites in the solutions employed. This is shown to be due to the absence of nitrite organisms, and not to the presence of inhibiting substances.

Soil constituents; Effect of some organic — on nitrogen fixation. H. S. Reed and B. Williams. *Centr. Bakt. Par.*, 1915, ii., 43, 166—176. *J. Chem. Soc.*, 1915, 108, i., 196.

IN a study of the fixation of nitrogen by *Azotobacter* on sand with mineral nutrients and various non-nitrogenous organic compounds, it was found that with the exception of aesculin, quinic acid, and borneol, which increased the activity of *Azotobacter*, all the compounds employed caused a depression. Quinol and salicylaldehyde completely inhibited nitrogen fixation; most of the other compounds were, however, much less injurious than would be expected from their action on higher plants. Many of the nitrogenous compounds employed, which have been found to be assimilated by higher plants, had a depressing effect on fixation, the simpler compounds having a more marked depressing effect than the more complex compounds.

It is considered possible that the simpler compounds (urea, glycine, and formamide) are not toxic, but that their nitrogen is possibly utilised by *Azotobacter* in preference to elementary nitrogen.

Iron disulphide (pyrites) in soils; Determination of —. V. Rodt. Mitt. Materialprüfungsamt, 1914, 32, 431—432. Z. angew. Chem., 1915, 28, Ref. 77.

IRON disulphide has a destructive action on concrete. For its determination the soil is lixiviated with warm hydrochloric acid (1:3) to remove ferrous sulphide and sulphates, then dried *in vacuo* over sulphuric acid, extracted with carbon bisulphide in a Soxhlet apparatus to remove sulphur, again dried *in vacuo*, and then heated on the water-bath with nitric acid (1:3) to which bromine water has been added. Iron is determined in one portion of the resulting solution, and sulphuric acid in another, after evaporating to expel nitric acid and bromine, and dissolving the residue in hydrochloric acid. Sulphur in organic combination is not oxidised by the treatment described. Ferrous sulphide cannot be determined by means of the hydrogen sulphide evolved on treatment with hydrochloric acid, if stannous chloride be added to prevent oxidation, because in presence of this compound iron disulphide is attacked by hydrochloric acid.—A. S.

Sulphur and sulphur compounds in soils; Changes of —. H. Kappen and E. Quensell. Landw. Versuchs-Stat., 1915, 86, 1—34. J. Chem. Soc., 1915, 108, i., 203.

WHEN moist soil is treated with hydrogen sulphide, the soil is blackened, owing to the production of iron sulphide, and a portion of the sulphide decomposes with liberation of free sulphur. The iron sulphide then undergoes a process of oxidation, in which all of the sulphur is liberated, so that the whole of the hydrogen sulphide absorbed is converted into free sulphur. The sulphur is then oxidised to sulphuric acid, the change being more rapid in normal than in sterilised soils. It is, however, doubtful whether the slower oxidation of sulphur in sterilised soils is due to the absence of microbes, or to other changes in the soil due to the sterilising process. Sulphides and sulphites are decomposed more quickly in presence of soil than without soil. In soils the decomposition is so rapid that no injurious effects on germination and growth are to be expected.

Calcium cyanamide; Manurial experiments with decomposition products of —. H. Kappen. Landw. Versuchs-Stat., 1915, 86, 115—136. J. Chem. Soc., 1915, 108, i., 203—204.

EXPERIMENTS were made in small garden plots on the growth of mustard manured with different forms of nitrogen. The yield with urea, prepared from calcium cyanamide, was between those obtained with sodium nitrate and ammonium sulphate, whilst urea nitrate gave much lower results; guanidine nitrate gave the smallest yields. The relatively low results obtained with urea nitrate were found to be due to the presence of a considerable amount of dicyanodiamidine, produced from dicyanodiamide. The results of an experiment in which dicyanodiamidine was added to soil showed that very little ammonia was formed in three days, and no further increase was found in ten days.

Plants; Action of certain compounds of zinc, arsenic, and boron on the growth of —. W. E. Brenchley. Annals of Botany, 1914, 28, 283—301.

ZINC sulphate in high concentration is very toxic to barley and peas, and no evidence of stimulation has been obtained with any strength of the poison down to a lower limit of 1/200,000,000. Arsenious

acid is more toxic in its action on peas and barley than is arsenic acid, peas being particularly susceptible. This distinction holds good for sodium arsenate and sodium arsenite, though in a less degree. Again no stimulation is evident with the smallest quantities so far tested. Boric acid is less poisonous than zinc sulphate or arsenic compounds, especially with peas. To the eye barley shows stimulation with some of the weaker strengths of poison, but this is not borne out by the dry weights. Peas, on the other hand, are definitely stimulated with relatively high concentrations of boric acid. The action of the greater strengths of the poison is well marked in the leaves, which tend to become brown, and to die, in a characteristic manner.

Maize; Chemical poisoning and variation in —. A. Jungelson. Comptes rend., 1915, 160, 481—483.

MAIZE seeds which had been in contact for from 1 to 24 hours with dilute aqueous solutions of copper sulphate, before being sown, produced in many cases abnormal spikes. The percentage of abnormal plants was greater with grains which had been deprived of their seed coat or otherwise mutilated before treatment with the copper salt, than with those which were left intact, although the mutilation alone produced in no single case an abnormal inflorescence. The poisoning of the seed thus induced a special tendency of the plant to assume new forms, this tendency being greater the more intimate the contact between the seed and the toxic agent. This may be an important factor in the evolution of vegetable species.—G. F. M.

Bordeaux mixtures. Fonze-Diacon. See XIXB.

PATENTS.

Manures and fertilisers; Artificial —. T. Twynam, Redcar. Eng. Pats. 5184 and 9124, Feb. 28 and Apr. 11, 1914.

FINELY ground basic slag is treated with a limited proportion of diluted nitric acid, preferably with that of about 33% strength as obtained direct from an atmospheric nitrogen fixation process. The phosphoric acid content is thereby converted into a more readily available form; the iron compounds remain undissolved, and there is no appreciable formation of gelatinous silica. A complete non-hygroscopic plant food is produced by mixing the product with ammonium or potassium sulphate.—E. H. T.

Fertiliser, and process of producing same. C. A. Black, Cleveland, and W. H. Teare, Lakewood, Assignors to J. R. Cowell, Toledo, Ohio. U.S. Pat. 1,121,324, Dec. 15, 1914. Date of appl., March 9, 1914.

LOGGERHEAD sponge, a product found in the sea in certain semi-tropical regions, is cut up, dried to a definite moisture content (6% or less), and granulated. When the drying cannot be done soon after its removal from the sea, the sponge is treated with an antiseptic, e.g., sulphur dioxide, to prevent putrefaction.—E. H. T.

Fertiliser; Process of manufacturing artificial —. H. Herzfeld and O. Hauser, Berlin. U.S. Pat. 1,125,318, Jan. 19, 1915. Date of appl., Sept. 11, 1913.

FOUR parts of a potassium mineral, e.g. phonolite tuff, is heated for 5—15 hours at about 300° C., with one part of the mother liquor left after potassium chloride has been separated from carnallite. The natural silicate is converted into a solid paste, which gradually gives up its fertilising constituents to the soil solution.—E. H. T.

Fertiliser ; Converting meadow or swamp land into —. B. Reichelt, Newark, N.J. U.S. Pat. 1,134,700, April 6, 1915. Date of appl., May 2, 1913.

THE material is heated in a furnace out of contact with the flames to drive off the potash, which is collected. The residue is ground, and then mixed with the potash.—B. N.

Nitrogen and polish ; Concentrated product of — and process of recovering and solidifying the same. [Fertiliser from molasses.] S. W. Sinsheimer, Swink, Colo. U.S. Pat. 1,134,921, April 6, 1915. Date of appl., May 10, 1913. Renewed Jan. 23, 1915.

THE raw waste liquor obtained in the separation of sugar from molasses, is heated to about 100° C. to precipitate sucrate of lime, and filtered. The filtrate is treated with hot furnace gases containing carbon dioxide, the precipitated carbonates are filtered off, the filtrate is concentrated by the combined action of a low temperature and a vacuum, and the residue dried at a low temperature.—B. N.

Nitrate fertiliser and process of making the same. A. Messerschmitt, Stolberg, Germany. U.S. Pat. 1,135,387, April 13, 1915. Date of appl., Oct. 5, 1912.

SEE Ger. Pat. 255,910 of 1911 ; this J., 1913, 439.

XVII.—SUGARS ; STARCHES ; GUMS.

Gentiobiose. G. Zemplén, Ber., 1915, 48, 233—238. J. Chem. Soc., 1915, 108, i., 119—120.

THE biochemical synthesis of gentiobiose by the action of emulsin on dextrose, which was achieved by Bourquelot, Hérissé, and Coirre (this J., 1913, 1080) does not accord with E. F. Armstrong's statement ("The Simple Carbohydrates and the Glucosides," 1912, p. 97) that maltose may be obtained in this way. The formation of an α -disaccharide, like maltose, is also contrary to the established rule that enzymes only bring about the synthesis of those disaccharides which, under other conditions, are hydrolysed in their presence. In the case of emulsin these would be β -disaccharides like gentiobiose, cellobiose, or *iso*-maltose. The author repeated Bourquelot's work with positive results, for he isolated the octa-acetate and phenylsazone of gentiobiose from the product of the action of emulsin on a 50% dextrose solution. With the idea of deciding whether gentiobiose is identical with *iso*-maltose or not, syrups containing the latter were prepared by Fischer's method (this J., 1891, 377) and acetylated. Although the octa-acetate of gentiobiose is readily isolated from very impure products, it could not be obtained from these syrups and it seems to be highly probable, therefore, that gentiobiose and *iso*-maltose are not identical.

Cause and significance of an abnormal reaction obtained in testing urine for sugar with Fehling's solution. Cramer. See XVII.

New test for reducing sugars in urine. Cramer. See XVII.

PATENTS.

Sacchariferous vegetable slices ; Apparatus for leaching —. M. Paschen, Cöthen, Germany. U.S. Pat. 1,134,152, April 6, 1915. Date of appl., Sept. 18, 1913.

THE apparatus consists of a trough divided into a number of leaching chambers by transverse walls, perforated in their lower portions and arranged in

pairs so as to form a number of separating chambers alternating with the leaching chambers. Over each pair of walls an inclined roof, extending from one wall to the other, incloses each separating chamber, and an intermediate partition terminating short of the roof is situated between the walls.

—J. F. B.

Starch, etc. ; Process for treating —. F. P. Bergh and H. C. Neuberger, Assignors to General Reduction Co., New York. U.S. Pat. 1,133,914, March 30, 1915. Date of appl., April 28, 1911.

STARCH with a moisture-content about equal to that of green starch is partially gelatinised by dropping it through a chamber in which it meets hot gases laden with moisture. It may afterwards be dried and disintegrated.—J. H. L.

Carburising iron or steel. [Utilising fibrous waste from sugar manufacture.] U.S. Pat. 1,133,626. See X.

Concentrated product of nitrogen and potash, and process of recovering and solidifying the same. [Fertiliser from molasses.] U.S. Pat. 1,134,921. See XVI.

XVIII.—FERMENTATION INDUSTRIES.

Hops ; Investigations on —. VI. Amount of lupulin in plants raised by crossing. J. Schmidt. VII. Employment of artificial light in the titration of the resins in hops. S. H. Larsen. Comptes rend. Trav. Lab. Carlsberg, 1915, 11, 165—187. (See also this J., 1915, 43, 440.)

VI. MORE than twenty hop plants of various types, from Germany, Austria, England, and Denmark, were crossed with wild Danish male hops in 1911, the seeds were sown in the spring of 1912, and the seedlings, numbering 744, investigated in the season 1913. The resin-content (lupulin-content) was determined by the method previously described (this J., 1915, 43); the average value for the mother plants, exclusive of Danish, was 14.1%, and that for the Danish plants was 8.9%. The resin-content of individual seedlings from the same mother plant often varied over a range of 8% or more, but the mean value for each group of sister-seedlings was lower than that for the mother plant by about 4% on the average, except in the case of Danish hops where no marked decrease was produced by crossing. Seedlings of higher resin content would probably have been obtained if male plants of cultivated hops had been used for fertilising. In most cases, however, individual seedlings of considerably higher resin-content than the mother plant were obtained, and they were in general the more numerous the lower the resin-content of the parent-plant. The selection and vegetative propagation of the best of these seedlings, would in a few years yield a large number of clone-plants (see this J., 1915, 440) of high lupulin-content available for the planting of large gardens.

VII. In carrying out the titration of the resins (see this J., 1915, 43) by artificial light, the author stands the flask on a ground glass plate which forms the cover of a wooden box containing a metal-filament lamp. The results are practically identical with those obtained in daylight.—J. H. L.

Enzymes ; Production of — and its cause. H. Zikes. Monatsh. Landw., 1914, 7, 24. Bied. Zentr., 1915, 44, 68—69. J. Chem. Soc. 1915, 108, i., 197.

YEAST which had been cultivated for fourteen years in dextrose solutions at once fermented sucrose when transferred to sucrose solutions. Similar

results were obtained with maltose solutions. The yeast still contained, therefore, both invertase and maltase in the form of a zymogen.

Phytochemical reductions. V. Intermediary stages in the reduction of nitro-groups to amino-groups. C. Neuberg and E. Welde. *Biochem. Zeits.*, 1914, **67**, 18—23. *J. Chem. Soc.*, 1915, **108**, i., 197. (See also this J., 1914, 434, 608.)

It has been shown already that nitrobenzene is reduced to aniline when added to a sugar-fermentation mixture. When azoxybenzene or azobenzene was added to a fermentation mixture, little if any aniline was formed. On the other hand, from 21 grms. of nitrosobenzene 4.0 grms. of aniline was obtained, and from the same quantity of phenylhydroxylamine, 7.5 grms. In both cases azobenzene was also formed. The results appear to indicate that the intermediate products in the reduction of nitrobenzene to aniline are nitrosobenzene and phenylhydroxylamine. The bearing of these results on the reduction of nitrates by plants is discussed.

*Phytochemical reductions. VI. Formation of *n*-hexyl alcohol by yeast.* C. Neuberg and F. F. Nord. *Biochem. Zeits.*, 1914, **67**, 24—27. *J. Chem. Soc.*, 1915, **108**, i., 197.

WHEREAS aldehydes containing three, four, or five carbon atoms are readily reduced to the corresponding alcohols when added to a yeast fermentation mixture, a considerable resistance is offered to reduction by the 7-carbon atom aldehyde, heptaldehyde. It is now shown that the 6-carbon atom aldehyde, *n*-hexaldehyde, occupies an intermediate position, being reduced with greater difficulty than the lower aldehydes, but offering less resistance than the higher one. The addition of the aldehyde stops fermentation after a period, before the sugar is all destroyed, but the addition of fresh yeast causes the fermentation to start again.

Amylase of potatoes: Changes produced by pathological conditions in the —. G. Doby and J. Bodnar. *Biochem. Zeits.*, 1915, **68**, 191—205. *J. Chem. Soc.*, 1915, **108**, i., 202.

The changes in the concentration of the amylase in potatoes were investigated after varying intervals in the freshly expressed juice, and in juices kept under antiseptic conditions. The results indicated that the ferment exists both in the form of enzyme and zymogen, the former being somewhat sensitive and rapidly destroyed. As long as the tubers contain excess of zymogen, amylase is set free more rapidly from the zymogen than it is destroyed. For a time, therefore, the amylolytic activity of the juice increases. Towards spring, however, the amount of zymogen commences to diminish to such an extent that the amount of amylase destroyed becomes greater than that set free, and the amylolytic activity of the juice diminishes. The amylolytic activity of the juice kept under antiseptic conditions rapidly diminishes. Healthy plants in general yield juices of greater amylolytic activity than those infected with the curly leaf disease.

Chemical poisoning and variation in maize. Jungelson. See XVI.

Individuality of oxidising and reducing enzymes. Bach. See XXIV.

PATENTS.

Saccharification and fermentation of amylaceous substances. A. Molhan, Mons, Belgium. U.S. Pat. 1,134,281, April 6, 1915. Date of appl., July 17, 1914.

SEE Fr. Pat. 471,775 of 1913; this J., 1915, 444.

Alcoholic liquids; Continuous process for the distillation and rectification of —. V. Slavicek, Vienna. U.S. Pat. 1,136,559, April 20, 1915. Date of appl., Oct. 29, 1908.

SEE Fr. Pat. 394,949 of 1908; this J., 1909, 377.

XIXA.—FOODS.

Milk; Determination of total solids and nitrogen in —. G. Meillère. *J. Pharm. Chim.*, 1915, **11**, 167—170.

A WHITE residue of constant weight is obtained by evaporating 5 to 10 c.c. of the milk in a cylindrical dish (7 cm. in diameter by 2.5 mm. in height) for 3 to 4 days in a bacteriological oven at 37° C. The result agrees with that obtained by evaporating the milk for six days at the ordinary temperature or for 48 hours at 37° C. *in vacuo*. The treatment with sulphuric acid in Kjeldahl's process is considerably shortened by using the residue from 10 to 20 c.c. of the milk instead of the milk itself.—C. A. M.

Chicory. V. Grafc. *Biochem. Zeits.*, 1915, **68**, 1—22. *J. Chem. Soc.*, 1915, **108**, i., 200.

THE inulin-content of the roots depends on the water-content of the soil on which the plant is grown, being low when the plant is grown on wet soils. The ash-content varies between 5 and 6%, but the amount of "crude fibre" diminishes in plants from sand and loams, and increases on humus-rich soils. The amounts of inulin and bitter principles obtained from plants grown on loams and sands is also generally larger than those of plants from humus-rich soils. The bitter principle has not been obtained in a pure condition; it appears to be a glucoside of laevulose and a protocatechuic derivative, probably the aldehyde, the former of which is derived from inulin, and the latter from the dextrin-like degradation products of the same. The empyreumatic oil obtained by roasting is analogous to coffee-oil, and the chief constituent is acetic acid; it also contains valeric acid, acetaldehyde, and furfuryl alcohol (23—25%).

Chicory and its substitutes. E. Collin. *Ann. Falsif.*, 1915, **8**, 63—79.

THE supply of chicory, which has been mainly drawn from Belgium and north-eastern France, is now greatly reduced, and the risk of adulteration is consequently greater than usual. The author describes, with the aid of diagrams, the microscopic features of roasted chicory and materials likely to be used as adulterants, *e.g.*, beetroots, carrots, Jerusalem artichokes, barley, wheat, figs, carob beans, peas, beans, vetches, lupins, soya beans, acorns, date stones, grape stones, toasted bread, and peat. Commercial chicory, whether in the powdered or granular form, should be decolorised before microscopic examination, by steeping in a solution of sodium hypochlorite; the time required for decolorisation depends on the degree of torrefaction of the individual particles. In the granular form of chicory, the particles vary from 1 to 4 mm. in size; under a simple lens they appear quite irregular in shape, with a dull, irregular surface sometimes finely striated. Under the microscope the features which distinguish chicory from most of the other materials mentioned are the presence in the woody tissue of dark reticulated laticiferous ducts containing a finely granular matter which the treatment with hypochlorite renders distinctly visible, and the complete absence of crystals, starch, or cells with thick channelled walls.—J. H. L.

Saccharin; Detection and determination of — in foodstuffs. Ceccherelli. Riv. di Igiene et Sanità Publica, 25, 446, 464. Ann. Falsif., 1915, 8, 109—110.

In the determination of saccharin, the treatment of the ether extract with potassium permanganate (cp. Testoni, this J., 1910, 106; Posseti and Issoglio, 1912, 297; Condelli, 1914, 983) is not to be recommended, though it is useful in making qualitative tests. Gum tragacanth, extract of gentian, and certain other substances, after fusion with sodium hydroxide produce colorations with ferric chloride and may therefore interfere with this method of testing for saccharin. The following test, based on the liberation of the amino-group, is described by Tarugi and Leni (Rend. Soc. Chim. Ital., 1911, 7, 320):—A minute quantity of saccharin, heated with a few drops of sulphuric acid until white fumes appear, then cooled, diluted with water, neutralised with soda, and added to a solution of a crystal of phenol in sodium hydroxide, gives a blue colour on addition, drop by drop, of a fresh solution of sodium hypochlorite. The author concludes that there is at present no satisfactory means of determining saccharin, applicable to all cases, but the presence of this substance may be regarded as certain if the ether extract, after treatment with permanganate, yields a residue which glistens slightly, contains sulphur, yields an insoluble silver salt containing 37% Ag, gives the reactions of salicylic acid after fusion with soda but not before, and also gives the Tarugi-Leni reaction after hydrolysis.—J. H. L.

Sodium pyrophosphate administered with food; Toxicity of —. Toxic cotton-seed meal. W. L. Symes and J. A. Gardner. Biochem. J., 1915, 9, 9—16.

SODIUM pyrophosphate administered, with food, to rabbits, cats, and rats, is devoid of the toxic action that it shows when injected intravenously. Administered to a sheep in the same way, however, it proved fatal, the sheep dying after having received a daily dose of 1 grm. of $\text{Na}_4\text{P}_2\text{O}_7 \cdot 10\text{H}_2\text{O}$ for 21 days. The introduction of the salt into the already alkaline contents of the rumen increased the alkalinity of the latter to such an extent as to produce marked softening of the mucous membrane of the organ, inflammation, etc. In the case of rabbits, cats, and rats, probably the salt was neutralised as soon as it reached the stomach.—W. P. S.

Crude fibre; Determination of —. R. Fanto and W. Nikolitsch. Z. anal. Chem., 1915, 54, 73—76. J. Chem. Soc., 1915, 108, ii, 186.

THE filtration of the acid and alkaline solutions in the estimation of crude fibre may be rendered more rapid by the use of a filter-thimble of such capacity that it will hold the whole of the solution. The acid or alkaline digestion mixture is poured into the thimble, and when the liquid portion has passed through, the thimble is suspended in water; the latter passes inwards through the walls of the thimble, which is then raised, and the washing of its contents is continued in this way. This procedure prevents the fine particles of substance from clogging the walls of the thimble. When washed, the crude fibre is rinsed into a platinum basin, dried, and weighed.

Changes produced by pathological conditions in the amylase of potatoes. Doby and Bodnar. See XVIII.

PATENTS.

Cocoa powder: Treating cocoa for making —. W. J. Mellersh-Jackson, London. From Massachusetts Chocolate Co., Boston, Mass., U.S.A. Eng. Pat. 14,456, June 16, 1914.

CAKE cocoa is treated in a breaking up machine

at 120°—135° F. (49°—57° C.) for 20—30 min. until a sufficiently deep colour is obtained. The powder is sucked up into a pipe by a fan and passes through the fan into a hopper; the excess of air passes to a reserve hopper, and the fine cocoa passes from the bottom of the hopper by a pipe leading into another room or compartment and is delivered into an open hopper. From here the powder, which now consists of fine separate particles, is drawn by a fan, together with the air of the room, which is kept at 40°—45° F. (4°—7° C.) into a pipe leading to another hopper where the separation is repeated. A further separation in another hopper follows. In each hopper the air current with the powder enters at the periphery, so that a cyclonic action is produced inside and the powder subjected to great attrition. The cocoa powder obtained from the last hopper is ready to be sifted, and is 90% fine.—J. H. J.

Baking preparation. E. C. L. Kressel, Camden, N.J., Assignor to Wilckes, Martin, Wilckes Co., New York. U.S. Pat. 1,134,956, April 6, 1915. Date of appl., Jan. 15, 1914.

A MIXTURE of an acid mellitate, such as dicalcium mellitate, an alkali carbonate or bicarbonate, and a filler.—J. H. J.

XIXB.—WATER PURIFICATION; SANITATION.

Drinking water; Purification of — by means of calcium hypochlorite. H. Vincent and Gaillard. Comptes rend., 1915, 160, 483—486.

CALCIUM hypochlorite possesses undoubted practical advantages over solutions of alkali hypochlorites for sterilising water. It is conveniently used in the form of compressed tablets, each containing 0.015 grm. of calcium hypochlorite (= 3.5 mgrms. available chlorine) and 0.08 grm. of sodium chloride, the latter being added to promote the diffusion of the active chlorine into the water. Each tablet is sufficient for 1 litre and is added to the water without previous crushing. After 20 mins. practically the whole of the chlorine has diffused into the water and merely a skeleton of calcium carbonate remains. The tablets keep quite well, a diminution of only 0.0003 grm. of active chlorine being observed within 2 months. Drinking water sterilised in this way can be consumed 20 mins. after the addition of the tablet. Its mineral composition is thereby scarcely altered, and its taste is inappreciable. Ammoniacal and albuminoid nitrogen were found to diminish by one-half to three-quarters after the sterilisation with a hypochlorite tablet, whilst all pathogenic organisms, including *Bacillus coli*, were killed in 10—12 mins., even in the presence of much organic nitrogen.—G. F. M.

Iron in water; Determination of — with titanium trichloride. J. Zink and R. Liere. J. Gasbeleucht., 1914, 57, 956. Z. angew. Chem., 1915, 28, Ref., 77.

KNECHT and Hilbert's method of titrating ferric iron with titanium trichloride (this J., 1903, 232, 825; 1907, 1165) gives good results when applied to the determination of iron in water. The water is boiled with nitric acid, treated with ammonia, the precipitated iron and alumina dissolved from the filter in hydrochloric acid, and the solution titrated with titanium trichloride. It is not necessary to pass carbon dioxide through the solution whilst titrating. With a number of waters containing from 0.4 to 30 mgrms. Fe per litre, and also some manganese, the results agreed within ± 0.2 mgrm. Fe per litre with those obtained by the colorimetric method in 50% of the determinations.—A. S.

Organic matter in potable water; Determination of — J. D. Filippo and H. J. Backer. Chem. Weekblad, 1915, 12, 73—78, 150—156. J. Chem. Soc., 1915, 108, ii., 109, 183—184.

CARBOHYDRATES and other organic matter present in water are oxidised to oxalic acid by permanganate in alkaline solution. To avoid the error thus introduced, the solution should be acidified before determining the excess of permanganate by titration by the iodometric method. The permanganate value is unaffected by the presence of either ferric salts or nitrates, or by appreciable quantities of ammonium salts in acid solution. In alkaline solution, ammonium salts exert a slight influence. For water containing a moderate proportion of organic matter and more than 500 mgrms. of chlorine per litre, the oxidation should be carried out in alkaline solution. If the proportion of organic material is very small, this limit should be reduced to 250 mgrms. No correction is necessary with a sulphur content of 0.05 mgrm. per litre. In presence of nitrites, each mgrm. of NO_2 per litre necessitates the subtraction of 1.374 from the permanganate value, but no correction is necessary if the NO_2 -content does not exceed 0.1 mgrm. per litre. In presence of ferrous salts and only a trace of nitrite, the oxidation should be carried out in acid solution, and corrected by deducting the amount of permanganate reduced in the cold by the acidified water. When the nitrite content is high, the ferrous salts should be oxidised by agitation with air, and a correction for nitrite applied as indicated above. Equally accurate results are obtained by the alkaline and acid oxidation, the oxalic acid titration, and the iodometric method. When proteins are present, the acid method is the best.

Bordeaux mixtures. Fonze-Diacon. Comptes rend., 1915, 160, 528—530.

It has been shown that acid Bordeaux mixtures are richer in the tetra-copper basic sulphate; they yield in solution free copper sulphate, in addition to the basic salt, and their anti-bacterial action is high. The more nearly neutral the mixtures are, the less they yield of this basic compound; the alkaline mixtures yield very little. The latter in solution give copper bicarbonate, which, by rapid decomposition with air, gives only copper hydrocarbonate, a form in which the copper is less active.—B. N.

Determination of formaldehyde and methyl alcohol in aqueous solutions. Lockemann and Croner. See XX.

Determination of carbon monoxide by the iodine pentoxide method. Froboese. See XXIII.

PATENTS.

Sewage; Apparatus for the treatment of — T. Craney, Bay City, Mich. U.S. Pat. 1,134,107, April 6, 1915. Date of appl., Feb. 24, 1914.

THE treatment is carried out in a vat divided into compartments by submerged walls. In each compartment a pair of electrodes hangs down from the water level and extends across the vat. A filter screen is supported in an inclined position between the electrodes and the submerged wall on the exit side of each compartment. The sewage passes down one side and under the electrodes, up through the screen and over the submerged wall into the next compartment. The vat may have either a flat or a hopper-shaped bottom, and may have a conveyor along the bottom to remove the separated solids and a conduit at the water level to remove floating solids.—J. H. J.

Sewage; Purifying — and recovering organic matter therefrom. G. W. Miles, Belmont, Mass. U.S. Pat. 1,134,280, April 6, 1915. Date of appl., Feb. 16, 1914.

SULPHUR dioxide is passed into the sewage before decomposition has progressed materially, the resulting sulphurous acid causing the precipitation of organic matter which is ordinarily non-precipitable. The precipitate is allowed to settle and the clarified liquid separated.—J. H. J.

Garbage; Process of incinerating — and apparatus therefor. W. M. Carr, Wheeling, W. Va. U.S. Pat. 1,134,512, April 6, 1915. Date of appl., Dec. 11, 1911.

THE garbage is dried and distilled in a closed vessel, and the carbonised residue is gasified in a producer into which the steam and gas evolved during the drying and distillation of the garbage are also passed. The producer gas is burned and used to dry and distil fresh garbage.—J. H. J.

Petroleum; Process of rendering — soluble, and product resulting therefrom. C. Parigot. Fr. Pat. 472,873, Aug. 23, 1913.

PETROLEUM products or saturated hydrocarbons are heated in an autoclave with sulphuric or nitric acid in the presence of a solvent (e.g. methyl, ethyl, or amyl alcohol), and then with an organic acid compound (e.g. shellac, rosin), and the mixture is neutralised with alkali. The resulting products are soluble in water, have general disinfectant properties, and can be used as insecticides in agriculture.—C. A. M.

Sewage; Apparatus for drying the sludge or solid matter recovered from — A. B. Ogden, Manchester. U.S. Pat. 1,135,390, April 13, 1915. Date of appl., July 13, 1914.

SEE Eng. Pat. 6260 of 1914; this J., 1914, 1221.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Vegetable drugs and poisonous plants; Investigations of — Bull. Imp. Inst., 1915, 13, 28—65.

Hyoscyamus muticus from Egypt. A sample consisting largely of stems, $\frac{1}{4}$ in. to $\frac{1}{2}$ in. diam., together with small stems, broken leaves, and flowering heads, contained 8.3% H_2O and 0.58% of hyoscyamine. Egyptian *H. muticus* is a valuable source of hyoscyamine or atropine (see this J., 1899, 171; 1901, 66; 1903, 1013) and is of special importance at present owing to the failure of continental supplies of atropine. Arrangements have been made for supplying the plant from Egypt to British manufacturers.

Bark and fruits of Strychnos Henningsii, Gilg., from South Africa. The bark contained 4.8%, the husks of the fruit 0.16%, and the kernels 4% of an alkaloid, different from strychnine and brucine, but which could not be obtained in a crystalline condition, except in one experiment in which a few rosettes of white needles were obtained, which decomposed between 260° and 270° C. The husks contained 4.9% of an orange-red fat, and the kernels 17.6% of a pale, brownish-orange oil.

Xanthoxylum brachyacanthum bark from Queensland (see this J., 1913, 251).

Daphnandra micrantha bark from Australia (see this J., 1914, 765).

Peganum Harmala seeds from India. The seeds contain two alkaloids, harmaline and harmine (see this J., 1889, 412; 1897, 1036; 1905, 149; 1912, 659; 1914, 216). The physiological action of harmaline resembles very closely that of quinine

(see this J., 1909, 1324). Harmine has a similar action but is only about half as toxic as harmaline.

Podophyllum Emodi, Wall., from India. Indian podophyllum (*P. Emodi*, Wall.) contains more resin than the American *P. peltatum*, Linn. (see this J., 1896, 918; 1898, 268, 865), and the Indian rhizome has been incorporated in the B.P. 1914. Two samples of rhizomes from cultivated plants contained respectively 10.2 and 10.8% H_2O , 11.1 and 11.7% total resin (podophyllin), and 4.7 and 3.1% podophyllotoxin. A sample of rhizomes from wild plants contained 9.2% H_2O , 15% podophyllin, and about 2.5% podophyllotoxin.

Croton Elliottianus (Baill.) seeds from E. Africa. *Procleolate* (see also this J., 1908, 131). The kernels contained 57.4% of a dark yellow, almost tasteless oil, equivalent to about 34% in the entire seeds. The oil had the sp. gr. 0.927 at 15° C.; acid value, 3.6; saponif. value, 191.6; iodine value, 147; Hehner value, 94.8; solidif. pt. of fatty acids (titer test), about 14° C. The fatty acids consisted of 80% of linolic acid, 10% of oleic acid, and 10% of saturated acids, principally palmitic acid. Physiological investigation by J. T. Cash and W. J. Dilling (J. Pharmacol. and Exp. Therap., 1914, 6, 235) showed that the oil is valuable as a laxative or purgative, owing to its relatively non-irritant action and its high potency in relation to small bulk.

Osleo-resins. Four samples of osleo-resins used as substitutes for, and sometimes as adulterants of, copaiba balsam were examined, viz., *Hardwickia pinnata* balsam from India (see also this J., 1905, 689), osleo-resin or "wood-oil" of *Dipterocarpus crinitus* ("Kruing Sap") from Federated Malay States, somewhat similar to gurjun balsam, and osleo-resin of *Daniella thurifera* (*Paradanella Oliveri*, Rolfe; see Kew Bull., 1912, 96) from the Gold Coast and from Nigeria (see also this J., 1908, 1129, 1162; 1914, 765).

Poisonous plants. Specimens of *Acokanthera reneata*, G. Don, from the Transvaal, and of "Cape Slangkop" (*Ornithoglossum glaucum*, Salisb.) from S. Africa were found to contain poisonous, bitter, amorphous substances with a physiological action similar to that of digitalis (see also this J., 1895, 985; 1902, 1468). The leaves of *Tephrosia Vogeltii*, Hook., from Rhodesia were found to contain 0.15% and the seeds 0.3% of tephrosin (see this J., 1907, 714). The leaves also contained 0.06% of tephrosal and 0.05% of the yellow substance, m. pt. 228°—229° C., isolated by Harriot (*loc. cit.*), whilst the seeds contained 0.008% of the yellow substance and 0.11% of a new, colourless non-nitrogenous substance, m. pt. 158° C.—A. S.

Aromatic distilled waters [cinnamon water and thyme water]. A. Goris and C. Vischniac. Bull. Sci. Pharmacolog., 1915, 65. Pharm. J., 1915, 94, 625.

CINNAMON water on extraction with ether yielded 0.145% of essential oil, of which 92% was cinnamic aldehyde: the remainder gave a reaction for eugenol. The oil remaining after the preparation of the cinnamon water contained 76% of the aldehyde, and also a certain amount of eugenol. The "water" prepared from thyme oil contained 0.057% of essential oil, of which 46% was phenolic, with carvacrol as the principal constituent; the residual thyme oil contained 32% of phenolic substances, consisting almost entirely of carvacrol.

Alkaloidal assays; A possible source of error in—. P. A. W. Self. Pharm. J., 1915, 94, 585—586.

In an alkaloidal assay, if the alkaloid is liberated by ammonia and the volatile solvent employed in the last shaking out is not washed with water, traces of ammonium salts may be carried into the evaporation vessel. On evaporation the alkaloid liberates ammonia in most cases, forming an

alkaloidal salt, hence the result is too high if the residue is weighed and too low if titrated, the error on titration being comparatively large owing to the high molecular weight of most alkaloids. Even 1 mgrm. of an ammonium salt may cause an appreciable error.—T. C.

Cinchonine; Hydrogenation of—. M. Freund and J. A. W. Bredenberg. Annalen, 1914, 407, 43—84. J. Chem. Soc., 1915, 108, i, 159. (See this J., 1915, 376.)

DIHYDRODESOROXYCINCHONINE, m. pt. 134°—135° C., was obtained, together with an isomeric oily base, by reducing cinchonine by Tafel's electrolytic method at a lead cathode in 50% sulphuric acid at 30°—35° C., using a divided cell and a cathode density of 0.023 amp. per sq. cm. at 24 volts. It has an alkaline reaction to litmus and an intensely bitter taste, and in alcohol has $[\alpha]_D^{20} = +250^\circ$. Tetrahydrodesoroxycinchonine is a viscous brown oil, which has $[\alpha]_D^{20} = +64.6^\circ$ in about 3% alcoholic solution. Dihydrodesoroxycinchonine, m. pt. 72°—73° C., separates from ethyl ether in colourless crystals containing ether, m. pt. 61°—62° C. The base has $[\alpha]_D^{20} = +324^\circ$ in about 2% alcoholic solution, absorbs carbon dioxide, is alkaline to litmus, and instantly decolorises acidified potassium permanganate. In contrast to the behaviour of dihydrodesoroxycinchonine, dihydrodesoroxycinchonine is not oxidised to desoroxycinchonine by iodine or mercuric chloride. The oily base obtained by the electrolytic reduction of cinchonine has b. pt. 295° at 18 mm., and $[\alpha]_D^{20} = +95.8^\circ$ in about 4% alcoholic solution; it has been named isodihydrodesoroxycinchonine.

Morphine series of alkaloids; Action of acetic anhydride on the—. II. Study of the morphine bases in which acetic anhydride does not cause the fission of the nitrogen ring. M. Tiffeneau. Bull. Soc. Chim., 1915, 17, 109—114. (See this J., 1915, 509.)

DIACETYLMORPHINE was prepared by warming morphine hydrochloride with acetic anhydride on a water-bath for 20 hours. It melts at 173° C., and boils at 272°—274° C. at 22 mm. On further treatment with acetic anhydride for several hours at 170°—180° C., it undergoes no further change, and under these conditions, therefore, the fission of the nitrogen ring does not take place. In a similar way the hydroxyl groups of codeine, ethylmorphine, and thebaine (prepared by reduction of thebaine with stannous chloride) can be acetylated, and the acetyl derivatives, after treatment with acetic anhydride for 7—8 hours at temperatures of 170°—180° C., can be recovered unchanged, the nitrogen ring remaining intact. Acetylcodeine melts at 133° C., and boils at 258° C. at 11 mm. Acetylmorphine melts at 131° C., and boils at 260°—262° C. at 12 mm. pressure.—G. F. M.

Morphine series of alkaloids; Action of acetic anhydride on the—. III. Apomorphine series: diacetyl- and triacetyl apomorphine. M. Tiffeneau and Porelur. Bull. Soc. Chim., 1915, 17, 114—119.

THE acetylation of apomorphine, hitherto unsuccessfully attempted by Pschorr and others (Ber., 1902, 35, 4385), was accomplished by heating apomorphine or apomorphine hydrochloride with acetic anhydride on a water-bath for 20—30 hours. The product consisted mainly of a mixture of about equal parts of diacetyl- and triacetyl apomorphine. The fission of the nitrogen ring in the latter substance had deprived it of basic properties, and it was separated from the basic diacetyl-derivative by taking advantage of this fact. Diacetyl apomorphine crystallised from a mixture of ethyl acetate and petroleum spirit in needles, m. pt.

129° C.; with an aqueous solution of its hydrochloride $\alpha_D = -67.26^\circ$. Its salts possess the same physiological action as those of apomorphine and have the advantage of being stable in solution. With methyl iodide diacetyl apomorphine gives a methiodide, m. pt. 233° C. Triacetyl apomorphine melts at 137° C., is optically inactive, insoluble in water and acids, and does not possess the emetic properties of the diacetyl-derivative. During the investigation a crystalline apomorphine, free from solvent of crystallisation, was obtained by crystallising from a mixture of chloroform and petroleum spirit. It forms hexagonal lamellæ, m. pt. 195° C.—G. F. M.

Cicutoxin: the poisonous principle in water hemlock (Cicuta). C. A. Jacobson. J. Amer. Chem. Soc., 1915, 37, 916—934.

CICUTOXIN, $C_{15}H_{26}O_3$, which occurs in the root-stalk of the various species of the water hemlock (*Cicuta*), is extracted from the pulped tubers with ether at the ordinary temperature. It is a viscous, yellowish, liquid resin which readily decomposes and polymerises, especially when warmed. It combines violently with free bromine, yields a diacetyl derivative, also lead and barium derivatives, and combines with hydrochloric acid and with ammonia. The substance appears to be a complex pyrone derivative. It is a spasmotoxin, causing death in from thirty minutes to eight hours; the treatment consists in producing vomiting and administering a narcotic. In testing for cicutoxin 2% baryta water is added to the 5% alcoholic solution until a voluminous precipitate appears and the colour changes to light green; upon adding a few more drops of baryta water and allowing to stand, a pea-green to olive-green colour is attained in from one to ten minutes. This changes to a reddish brown if an excess of baryta water has been added, and to dark red on addition of a slight excess of a mineral acid.—J. R.

Anæsthesia by phenylethylmalonylurea. W. L. Symes. J. Physiol., 1915, 49, 126—132. J. Chem. Soc., 1915, 108, i, 194.

PHENYLETHYLMALONYLUREA ("luminal") causes anæsthesia in cats when a dose of 0.2 gm. is injected under the skin; the anæsthesia is usually complete in an hour, and lasts three to five hours. Smaller doses administered subcutaneously or by the mouth act more slowly. Under the influence of the drug, the cat becomes poikilothermic. Cats may with care be kept unconscious for days, and then make a complete recovery; in rabbits intravenous injection may be used; anæsthesia is then rapidly produced.

Lime and lemon as sources of citric acid and essential oils; Notes on the— W. R. Dunlop. Bull. Imp. Inst., 1915, 13, 66—87.

THE lime contains more juice and citric acid but less essential oil than the lemon: the yields per acre are about 914 lb. of citric acid and 65 lb. of oil for the lime, and 634 lb. of acid and 88 lb. of oil for the lemon. The cost of cultivation of the lemon in Sicily is higher, owing to the necessity for irrigation and protection against frost. The production of lemons in Sicily is stationary, but the proportion treated for the production of calcium citrate varies according to the demand. The future development of the industry of citrus products depends almost entirely upon the extension of lime cultivation, which is especially well adapted to the West Indies and Central America. The output of lime products in the tropics is small at present but is rapidly increasing. The calcium citrate exported from the West Indies is of satisfactory quality, but the raw lime juice varies considerably and frequently contains an excessive quantity of sediment. The exports of lime

products from the British West Indies in 1913–1914 amounted to: Dominica, £142,662; Montserrat, £5977; Jamaica (average of last four years), £4179; St. Lucia, £3108; British Guiana, £1530; total £157,456. The author recommends also the cultivation of oranges in the West Indies for the production of essential oils.—A. S.

Arsenic compounds; Aromatic— VIII. Some products of the reduction of 2,4-dinitrophenylarsinic acid, and a large class of new derivatives of carbaminic acids. P. Karrer. Ber., 1914, 47, 2275—2283. Bull. Soc. Chim., 1915, 18, 155—156.

2,4-DINITROPHENYLARSENIOXIDE, a feebly basic substance, was obtained by the action of phosphorus trichloride on an ethereal solution of dinitrophenylarsinic acid. 2,4,2',4'-Tetra-nitroarsenobenzene was prepared by reducing dinitrophenylarsinic acid with hypophosphorous acid in presence of sodium hydroxide, and a small quantity of potassium iodide as catalyst. The reaction proceeded at 50°–60° C., and the product was deposited in brownish-yellow flakes, insoluble in all solvents. Reduced with stannous chloride it gave the corresponding tetra-amino-derivative, which is readily hydrolysed at ordinary temperature to *m*-phenylenediamine and oxides of arsenic. It can be combined with diazo compounds, giving azo-colouring matters. This, and other *m*-diamines whether containing arsenic or not, are characterised by dissolving in excess of sodium carbonate or sodium bicarbonate with the production of carbaminic acid derivatives. This solubility in sodium carbonate or bicarbonate solutions may be used as a test for *m*-phenylenediamines.—G. F. M.

4,4'-Diphenylsemicarbazide as a reagent for the detection of carbonyl derivatives. B. Toschi and A. Angiolani. Gaz. Chim. Ital., 1915, 45, I., 205—213.

4,4'-DIPHENYLSEMICARBAZIDE, obtained in almost quantitative yield by mixing alcoholic solutions of equivalent quantities of diphenylurea chloride and hydrazine hydrate (see Gaz. Chim. Ital., 1914, 44, I., 443), forms an excellent reagent for identifying compounds containing the carbonyl group. It possesses the advantages over semicarbazide that it does not decompose on exposure to air and light and that the diphenylsemicarbazones are less soluble than the corresponding semicarbazones. It reacts readily even with acetone, salicylaldehyde, benzophenone, and certain sugars which react only slowly with semicarbazide. In the case of aliphatic carbonyl derivatives it is preferable to use the hydrochloride of diphenylsemicarbazide; with aromatic compounds the free base is used. The diphenylsemicarbazones of the following compounds are described: acetone, colourless needles, m. pt. 119° C.; acetaldehyde, silky needles, m. pt. 153° C.; cænanthol, colourless needles, m. pt. 133°–134° C.; ethyl acetoacetate, m. pt. 103°–104° C.; dextrose, white needles containing 1 mol. H_2O , m. pt. 164°–166° C.; cinnamic aldehyde, yellow needles, m. pt. 164°–166° C.; cumic aldehyde, m. pt. 162° C.; salicylaldehyde, colourless needles, m. pt. 209° C.; vanillin, white needles, m. pt. 180°–181° C.; piperonal, yellow needles, m. pt. 173° C.; benzophenone, white needles, m. pt. 186°–187° C.; citronellal, white crystals, m. pt. 109°–110° C.; camphor, silky needles, m. pt. 154°–155° C.—A. S.

α -Diketones [diacetyl, etc.]; Separation and identification of certain homologues— J. M. Johlin. J. Amer. Chem. Soc., 1915, 37, 892—896.

DIACETYL and probably other homologous diketones are produced in the destructive distillation of wood and of carbohydrates. Diacetyl occurs in considerable quantities in pyroligneous acid. One

part of diacetyl in 100,000 parts of water gives a recognisable precipitate of the nickel salt of dimethylglyoxime upon the addition of a little nickel chloride, hydroxylamine hydrochloride, and ammonia; the precipitation is rendered quantitative by adding sodium acetate also. The salt is practically insoluble in both cold and hot water. From a mixture containing 0.1 gm. of each of the nickel salts of methylglyoxime, dimethylglyoxime, and methylethylglyoxime, the last-named may be extracted with ether; the extract is shaken with 5% sulphuric acid and evaporated to dryness, and the residue when crystallised from water yields pure methylethylglyoxime, m. pt. 171° C. The residue from the ether extraction is extracted with dilute ammonia, and the undissolved portion shaken with ether and 5% sulphuric acid; the ethereal layer is evaporated to dryness, and the residue recrystallised from water, whereby pure dimethylglyoxime, m. pt. 234°—235° C., is obtained. The ammonia extract is likewise treated with 5% sulphuric acid and ether; the residue from the evaporation of the ether extract is dissolved in water containing a trace of ammonia and a few drops of nickel chloride added to precipitate dimethylglyoxime; methylglyoxime is extracted with ether from the filtrate, and after resublimation melts at 155°—156° C.—J. R.

Glucometahydroxycoumarin and glucoprotocatechuic acid; *Synthesis of* —. F. Mauthner. J. prakt. Chem., 1915, 91, 174—179.

TETRA-ACETYLGLUCOMETAHYDROXYCOUMARIN is produced by the interaction of *m*-hydroxycoumarin and acetobromoglucose in presence of dilute sodium hydroxide and acetone at the ordinary temperature; it is slowly hydrolysed in the cold by dilute baryta water, yielding glucometahydroxycoumarin (m. pt. 219°—220° C.). When *m*-hydroxycoumarin is replaced by the methyl ester of protocatechuic acid the reaction yields the ester of tetra-acetylglucoprotocatechuic acid; this is slowly hydrolysed at 37.5° C. by dilute baryta water, yielding glucoprotocatechuic acid which crystallises in colourless needles, m. pt. 81°—82° C. This acid gives no precipitate with normal lead acetate or freshly prepared gelatin solution; it yields a yellow colour with ferric chloride and an opalescence with basic lead acetate; the alkaline solution does not reduce Fehling's solution upon gentle warming.—J. R.

Phenols and phenolic ethers with unsaturated side chains; *Behaviour of* — *towards ozone*. C. Harries and R. Haarmann. Ber., 1915, 48, 32—41. J. Chem. Soc., 1915, 108, i., 133—134.

THE earlier results obtained in the formation and fission of the ozonides of unsaturated phenols such as eugenol were not entirely satisfactory (compare Harries and Weiss, J. Chem. Soc., 1904, 86, 861), because under the usual conditions the normal course of the changes was considerably disturbed by complications. The problem has therefore been re-examined in the case of the substances detailed below, of which it was found generally possible to prepare the ozonides by treatment of a solution with well-dried 1% ozone. In hexane solution isoeugenol gave a yellow, syrupy ozonide, $C_{12}H_{14}O_5$, which, when produced in acetic acid solution, underwent decomposition, giving acetaldehyde and a 25—38% yield of vanillin, together with resinous substances. It was found that mere treatment of an acetic acid solution of isoeugenol with a current of oxygen for 120 hours also effects partial oxidation to vanillin, this substance being produced to the extent of approximately 12%. By reducing isoeugenol ozonide in ethereal solution by means of zinc dust and acetic acid (compare Harries, J. Chem. Soc., 1905, 88, i., 225; 1906, 90, i., 833), vanillin could be obtained to the extent

of 71% of the theoretical yield. Isoeugenyl acetate is remarkable in combining with more than the expected proportion of ozone, the ozonide produced in ethyl acetate solution being a crystalline solid of the composition, $C_{12}H_{14}O_5$. On fission with acetic acid, this ozonide gives rise to acetylvanillic acid in poor yield. Eugenol ozonide, obtained by the action of 1% ozone on a solution of eugenol in ethyl acetate, is an oily substance which is considerably more explosive than isoeugenol ozonide. When decomposed by warming with acetic acid, no formation of homovanillin is observable, the only product being a brown oil, b. pt. 120°—200° C. at 0.5 mm., which rapidly resinifies. Reduction of eugenol ozonide in ethereal solution by means of zinc dust and acetic acid caused fission with formation of homovanillin, $CH_3O.C_6H_3(OH).CH_2.CHO$, a colourless, viscous oil, b. pt. 110°—114° C. at 0.45 mm., with a smell resembling vanilla; *p*-nitrophenylhydrazones, deep yellow needles, m. pt. 150°; semicarbazones, prisms, m. pt. 173°; oxime, leaflets or needles, m. pt. 115°; bisulphite compound, colourless powder. Eugenyl acetate, in contrast to isoeugenyl acetate, forms a normal ozonide, $C_{12}H_{14}O_5$, which is conveniently obtained by the action of 1% ozone on a solution in hexane; the ozonide separates from ethereal solution in colourless tablets or needles, m. pt. 63° C. Fission of the ozonide by acetic acid produces acetylhomovanillic acid, acetylhomovanillin, and vanillin.

Eugenol methyl ether ozonide (Majima, J. Chem. Soc., 1909, 96, i., 945), on fission by acetic acid, gave methylvanillin. Reduction of the ozonide yielded a yellow liquid, b. pt. 112°—113° C. at 0.6 mm., of which a preliminary examination indicated it to be methylhomovanillin (*p*-nitrophenylhydrazones, m. pt. 157°; semicarbazones, m. pt. 181°).

The above results provide an explanation for the contradictory results of earlier investigators, who have found it possible to obtain vanillin from isoeugenol, using oxygen relatively poor in ozone, whilst later investigators with more effective ozone apparatus at their disposal applied too concentrated ozone and obtained only resinous products.

Vanillin; *Reactions of* —. E. P. Häussler. Z. anal. Chem., 1915, 54, 104. J. Chem. Soc., 1915, 108, ii., 191. (Compare this J., 1914, 612.)

WHEN pepsin is mixed with dilute alcohol and a small quantity of vanillin, and the mixture evaporated, a yellow coloration is obtained; this changes to brownish-violet and then to brownish-red on the addition of 10% hydrochloric acid. Concentrated hydrochloric acid changes the yellow colour to violet, and the mixture becomes black on evaporation. The pepsin employed yielded a brown coloration, but no trace of violet, when treated with hydrochloric acid in the absence of vanillin; it also gave a slight biuret reaction. It has not been ascertained whether the reaction with vanillin was due to the pepsin itself or to the presence of proteins in the same.

Racemic acid; *Conversion of* — *into a mixture of racemic acid and d-tartaric acid by means of l-malic acid*. A. McKenzie. Chem. Soc. Trans., 1915, 107, 440—443.

RACEMIC acid (1 mol.) was neutralised with aqueous potassium hydroxide and *l*-malic acid (1 mol.) added. A dextro-rotatory crystalline product separated which consisted of a mixture of potassium hydrogen racemate and potassium hydrogen *d*-tartrate, affording an example of the activation of an inactive compound by crystallisation from an optically active solvent, viz., a solution of *l*-malic acid.—T. C.

Ether; Oxidation of—. R. M. Isham and C. E. Vail. *J. Amer. Chem. Soc.*, 1915, 37, 902—906.

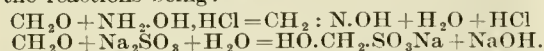
WHEN mixed with air or oxygen, ether vapour oxidises slowly at 110° C. and rapidly at 160° C. to acetaldehyde and acetic acid. Chromic anhydride does not dissolve unchanged in pure ether, as sometimes stated, but even at -10° C. a violent reaction occurs resulting in the formation of acetaldehyde and chromic oxide.—J. R.

Formaldehyde reactions. E. Salkowski. *Biochem. Zeits.*, 1915, 68, 337—346. *J. Chem. Soc.*, 1915, 108, ii., 190.

THE reaction of Leach is sensitive, but it fails in the presence of relatively large amounts of acetaldehyde. ω -Hydroxymethylfurfuraldehyde also gives a positive result with Leach's reagents. This substance also gives a coloration in the reactions of Rimini (this J., 1898, 697, 1076) and of Schryver (this J., 1909, 956), but the shade of colour produced is not exactly that formed by formaldehyde, and is not obtained in dilute solutions, so that the two substances are not likely to be mistaken for one another. Bono's reaction for formaldehyde (this J., 1912, 1048) cannot be used in the presence of ω -hydroxymethylfurfuraldehyde. Least influenced by this substance is Rimini's reaction, both in its original form and when hydrogen peroxide is used instead of ferric chloride; it is less sensitive, however, than Schryver's reaction. As ω -hydroxymethylfurfuraldehyde is always formed by the action of acids on carbohydrates, it must always be sought for in certain cases when the existence of formaldehyde is investigated.

Formaldehyde and methyl alcohol in aqueous solutions; Determination of—. [Analysis of formalin.] G. Lockemann and F. Croner. *Z. anal. Chem.*, 1915, 54, 11—26. *J. Chem. Soc.*, 1915, 108, ii., 190.

IN solutions containing formaldehyde and methyl alcohol, the former may be estimated by titrating the free acid or alkali formed when the solution is treated with hydroxylamine hydrochloride or sodium sulphite, respectively, the equations showing the reactions being:



Methyl alcohol and formaldehyde are then estimated together by oxidation with potassium permanganate, as described by Hetper (this J., 1913, 103).

Methyl alcohol in aqueous solution; Determination of—by means of Denigès' reaction. T. von Fellenberg. *Trav. Chim. Aliment. et d'Hygiène* (Swiss), 1915, 1. *Ann. Falsif.*, 1915, 8, 101. (See this J., 1910, 585.)

AQUEOUS solutions containing very small quantities of methyl alcohol are concentrated by repeated distillation, each distillate representing 50—60% of the liquid distilled; and volatile acids, bases, or aldehydes, etc., are removed by treating the distillates with caustic soda, sulphuric acid, or silver nitrate. Three c.c. of the final distillate is shaken in a wide test tube with 1 c.c. of an aqueous solution containing 10 c.c. of ethyl alcohol and 20 c.c. of concentrated sulphuric acid per 100 c.c., and with 1 c.c. of a 5% solution of potassium permanganate, and then left to stand for 2 mins. At the same time two parallel tests are carried out in the same way with 3 c.c. of water containing 0.005 and 0.001 grm. of methyl alcohol, to serve as standards. After the 2 mins., 1 c.c. of 8% oxalic acid solution is added to each tube, and after a few seconds 1 c.c. of concentrated sulphuric acid, followed immediately by 5 c.c. of a solution containing 5 grms. of magenta, 12 grms. of sodium sulphite, and 100 c.c. of N/1

sulphuric acid per litre. The liquid in the first tube is then diluted with 25 or 100 c.c. of water and compared in a colorimeter with one or other of the standard tests diluted to the same extent, and the quantity of methyl alcohol found by reference to tables.—J. H. L.

Acetylene; Progressive reduction of—. *Catalytic actions of colloidal metals of the platinum group.* XII. C. Paal and C. Hohenegger. *Ber.*, 1915, 48, 275—287. *J. Chem. Soc.*, 1915, 108, i., 113—114.

NUMEROUS experiments were made on the reduction of acetylene by hydrogen in presence of colloidal palladium, partly in a gas burette, partly in a vessel which could be shaken, and partly in an apparatus in which the gases could be circulated. The chief result was the demonstration of the influence of the adsorption of acetylene by palladium on the course of the reaction. Starting with equal volumes of acetylene and hydrogen, and with a fresh palladium solution, so much of the former gas was adsorbed by the colloid and chemically changed, in all probability polymerised (this J., 1913, 186), that the hydrogen was really in effective excess, with the result that varying volumes of ethane were formed and some acetylene remained unchanged. This is probably the reason why in previous investigations on the catalytic reduction of acetylene the chief product was always ethane, even when insufficient hydrogen to complete the first stage—reduction to ethylene—was employed. When the colloid has been in contact with acetylene, it loses the power of adsorbing the gas and the yield of ethylene increases. Indeed, with a slight excess of acetylene, all the hydrogen may be used in the formation of ethylene.

The mixtures of gases were analysed as follows. The two unsaturated hydrocarbons were absorbed by bromine water and the acetylene estimated separately by an approximate method (Hohenegger, *Diss.*, Erlangen, 1912) in which an ammoniacal silver solution was used as the absorbent. Hydrogen was estimated in the residue by absorption with palladium hydrosol and sodium picrate (this J., 1910, 236), and the ethane (and impurities) measured by difference. (See also Karo, *Ger. Pat.* 253,160; this J., 1913, 109.)

Chlorides of carbon; Action of metals on the—. E. V. Zappi. *An. Soc. Quim. Argentina*, 1914, 2, 217—228. *J. Chem. Soc.*, 1915, 108, i., 114.

A STUDY of the interaction, at ordinary and elevated temperatures, of aluminium, magnesium, iron, sodium, and silicon respectively, and carbon tetrachloride, hexachloroethane, hexachlorobenzene, and octachloronaphthalene. At 180° C., aluminium decomposes carbon tetrachloride, liberating carbon, and forming hexachloroethane and aluminium chloride. Under other conditions, aluminium has no action on any of the substances named, or only a very slight effect. The other metals either do not react at all, or only to a very limited degree.

Magnesium citrate; Official—. E. Léger. *J. Pharm. Chim.*, 1915, 11, 157—166.

THE conditions for obtaining a soluble trimagnesium citrate are:—(1) To mix the constituents in the cold; (2) to dry the mass at not above 50° C.; and (3) to use only sufficient water to give complete admixture. The most suitable proportions are:—Citric acid, 100; sifted magnesium bicarbonate, 60; and water, 35 grms. After drying for 2 to 3 hours in an oven at 45° to 50° C. the mass is pulverised. At higher temperatures insoluble magnesium citrate is formed. Crystals separating from the solution of the official citrate had the composition, $(\text{C}_6\text{H}_5\text{O}_7)_2\text{Mg}_3 \cdot 13\text{H}_2\text{O}$. The amount of magnesium oxide left by 1 grm. of

officinal magnesium citrate on ignition is 0.16 to 0.17 grm. instead of 0.15 grm., as prescribed by the French codex.—C. A. M.

Reduction of arylsulphonamides by hydriodic acid. Fischer. See III.

Simultaneous determination of carbon, hydrogen, and mercury in organic mercury compounds. Abelmann. See XXIII.

Velocity of formation and solution, and the swelling, of jellies. Traube and Köhler. See XXIV.

PATENTS.

Alcohols; Manufacture of——. B. S. Lacy, Seward, N.J., U.S.A. Eng. Pat. 20,550, Oct. 5, 1914. Under Int. Conv., Oct. 4, 1913.

ALCOHOLS are produced by bringing alkyl halides into intimate contact with alkaline solutions at a pressure considerably above that of the vapour of the basic solution alone, and at a temperature considerably above 100° C. The rapidity of the reaction varies, *ceteris paribus*, in proportion to the difference between the working pressure and the vapour pressure of the alkaline solution. *Example*: An iron vessel of 9 litres capacity, furnished with stirring gear, is half filled with milk of lime, containing 15% by weight of calcium hydroxide, and kept at 190° C. (=167 lb. pressure). Methyl chloride is passed in until the pressure reaches 263 lb., and this pressure is maintained by regulating the supply of methyl chloride. After 15 minutes, the solution in the vessel contains 7% of methyl alcohol, which may be removed by distillation.—F. Sp.

Halides of methyl and ethyl; Production of——. Actienges. für Anilinfabr. Ger. Pat. 280,740, Aug. 9, 1913.

METHYL or ethyl alcohol is heated with an aqueous solution of a hydrohalogen acid and the corresponding calcium halide in an open vessel at a temperature not above 100° C. A good yield of ethyl chloride is obtained by warming ethyl alcohol and aqueous hydrochloric acid (19° B., sp. gr. 1.152) in presence of anhydrous calcium chloride. An alternative method is to allow a mixture of methyl or ethyl alcohol and hydrochloric acid to flow continuously into a vessel containing heated calcium chloride.—A. S.

Menthylsalicylic methyl ester; Method of manufacture of——. G. Blieberger, New York. U.S. Pat. 1,133,832, March 30, 1915. Date of appl., March 28, 1914.

MENTHYSALICYLIC methyl ester is made by the direct interaction of menthol and a relatively large excess of salicylic methyl ester under the influence of heat. *Example*: 100 parts of salicylic methyl ester is heated with 80 parts of menthol in an inert atmosphere under slight pressure. The first distillate is collected separately, and the residue distilled *in vacuo*.—F. Sr.

Quinolylketones; Preparation of——. Verein. Chininfabr. Zimmer und Co. Ger. Pat. 280,970, Aug. 23, 1913. Addition to Ger. Pat. 268,830 (this J., 1914, 277).

ESTERS of quinolylacetic acids or their nuclear substitution products are alkylated, and the resulting β -ketone-acid esters, alkylated in the side chain, are converted into ketones in the usual way to obtain alkyl homologues of quinolymethylketones or their nuclear substitution products.—A. S.

Propylene from acetylene and methane; Process of producing——. A. Heinemann, London. U.S. Pat. 1,134,677, April 6, 1915. Date of appl., May 27, 1913.

SEE Fr. Pat. 458,397 of 1913; this J., 1913, 1086.

Anhydrides of monobasic organic carboxy-acids; Process for the manufacture of——. A. J. van Peski, Vlaardingen, Netherlands. U.S. Pat. 1,136,630, April 20, 1915. Date of appl., July 30, 1913.

SEE Fr. Pat. 461,540 of 1913; this J., 1914, 219.

Halides of methyl and ethyl; Production of——. Actienges. f. Anilinfabr. Fr. Pat. 472,770, May 28, 1914. Under Int. Conv., Aug. 8, 1913.

SEE Ger. Pat. 280,740; preceding.

Process for effecting reduction of fatty or other organic compounds. U.S. Pat. 1,134,746. See XII.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Selective absorption; A characteristic of——. A. J. Bull and A. C. Jolly. Phot. J., 1915, 55, 134—140.

THE selective absorptions of a number of substances were determined by means of the Hüfner spectrophotometer. The curves are given of some of these—chromates, iron salts, iodine, picric acid, etc. Results obtained with photographic tri-colour filters and tri-colour inks showed, especially in the case of blue inks, wide divergence of the colour from what it is theoretically desirable to obtain; the divergence is so wide as to suggest the impossibility of obtaining either filters or inks of anything approaching the theoretically desirable colours. A high transmission of one part of the spectrum appears to be accompanied by complete absorption of another part only when the latter is of shorter wave-length than the former. The selective absorptions of a number of the same substances were also examined by the aid of a line thermopile, and in general the results confirmed those obtained by the spectrophotometer.—B. V. S.

Photogravure; Machine——. R. B. Fishenden, Phot. J., 1915, 55, 143—176.

FOLLOWING a short historical sketch of photogravure and a comparison of its effects with those of similar processes, a brief description is given of the methods and special appliances now generally used in producing the engraved cylinder and of the printing machinery. There are numerous illustrations and diagrams. In two appendices is given an account of the author's work on certain parts of the process. The best sensitiser for the carbon tissue is potassium bichromate solution; the ammonium salt gives more sensitiveness but poor keeping quality; the double ammonium potassium salt gives low sensitiveness. The best strength for the solution is dependent on the light used for printing, but is generally 5 per cent. In order to obtain uniform porosity of the resist it should be dried, after development, in slightly moist air at not above 21° C. An artificial illuminant is necessary to obtain constant results; comparison of mercury vapour and open, enclosed, and flame arc lamps as to efficiency, quality of print, and amount of heat radiated, showed that, on the whole, the flame arc, working at 110 volts, gave the best results. The use of a vacuum printing frame is recommended, as the thick plate glass used in the ordinary process pressure frame necessitates an increase of exposure which may reach 100%. The etching solution of ferric chloride is usually first treated with ammonia; treatment with metallic copper or cuprous chloride gives similar results; there is no difference in the results obtained with ordinary and with extra pure ferric chloride. The condition of a used etching bath is best ascertained by comparison with a specially made bath of known action. The effect of variation of strength of the etching

bath and of temperature was examined both as to the amount of erosion produced in a given time and as to the time taken to penetrate a certain resist. The rate of erosion increases with increase of strength, especially above 39° B. (sp. gr. 1.37). The rate of erosion increases also with increase of temperature, and the penetration time decreases; to obtain uniform action the temperature should not be below 17° C., and should be under control. The effect of varying the humidity of the atmosphere was also examined. A resist, between development and etching, ages more rapidly in dry air. An increase of moisture in the air up to 82% decreases the penetration time of the resist; above this there is an increase.—B. V. S.

Kinetics of photochemical reactions. Berthelot.
See XXIV.

XXII.—EXPLOSIVES; MATCHES.

Cellulose; Nitration of— and the decomposition of nitrocellulose by acids and alkalis. G. Meissner. *Z. ges. Schiess- u. Sprengstoffw.*, 8, 252. *Monit. Scient.*, 1915, 5, 79—85.

FROM various experiments with nitrocellulose, the author draws the following conclusions:—The highest degree of nitration is attained by nitrating cotton at 20° C. with a mixture of equal weights of nitric acid (sp. gr. 1.5) and sulphuric acid (sp. gr. 1.84). The percentage of nitrogen is increased by nitration *in vacuo*. Prolonging the nitration beyond two hours lessens the yield. The temperature of ignition of nitrocellulose, determined by heating slowly in an oil bath a tube containing the sample, varies from 180° to 190° C., and is 20°—25° higher than that found by dropping samples into the same tube while cooling, until explosion no longer takes place. Nitrocellulose consists of a mixture of cellulose nitrates, of which those with less nitrogen dissolve more readily in ether-alcohol, any insoluble residue containing more than 12% N. Fractional precipitation of an acetone solution of nitrocellulose by water gives precipitates differing only slightly in nitrogen content. Nitrocellulose can be boiled for a limited time with acids of limited concentration without losing weight; the limits depend on the nature of the acid and its concentration, being greater for nitric than for sulphuric acid, and less for collodion cotton than for guncotton. If these limits are exceeded, loss of weight and of nitrogen occurs. It is stated that guncotton, when boiled with nitric acid of any concentration up to 30%, leaves a residue containing not less than 11.44% N, even when the loss in weight has been 50%. Complete decomposition of nitrocellulose with 96% sulphuric acid produces nitrogen acids and oxides, sulphur dioxide, carbon dioxide, oxalic, tartaric, and fatty acids (but not formic or acetic acid). Decomposition of nitrocellulose by alkalis produces sodium nitrate and nitrite, and organic sodium salts. With baryta, some carbonate is formed. Alcoholic caustic soda (20%) produces a pasty mass soluble in water. The quantity of nitrate formed could not be estimated by the nitron method (this J., 1905, 291.451). High results were obtained, and the author suggests that nitron combines with a molecular compound of alcohol and caustic soda, $C_2H_5OH.NaOH$. Nitroglycerin is saponified more rapidly than nitrocellulose. Sulphur dioxide passed through a suspension of nitrocellulose in hot, air-free water is partially oxidised to sulphuric acid. Nitrocellulose dissolves in phenylhydrazine with evolution of gas and formation of a gelatinous reddish-brown substance.—F. Sp.

Cellulose; Nitration of— with recovery of the acids. W. Dreger. *Z. ges. Schiess- u. Sprengstoffw.*, 8, 325. *Monit. Scient.*, 1915, 5, 87—88.

AN application of the principle of counter currents to the washing of nitrocellulose. Six nitrating pans are placed in a circle, and a charge of cotton is nitrated in each successively. Wash water is transferred from pan to pan in such a way that each time it meets a more recently nitrated charge. By the time it has passed through five pans, it has become moderately rich in acid, and in the sixth pan it is used as the first wash of a freshly nitrated charge, after removal of the residual acids. It is then run off and collected. The process has only been tried on a laboratory scale.—F. Sp.

Influence of the quantity and method of distribution of coal dust on its explosiveness and on the strength of the explosion. Czaplinski. See IIA.

Stability of the metal ammonias of chlorates, bromates, and iodates. Thermal dissociation and explosion. Ephraim and Jahnson. See VII.

PATENTS.

Safely explosives. D. J. Metcalfe, A. C. Percy, and Curtis's and Harvey, Ltd., London. Eng. Pat. 13,138, May 28, 1914.

SODIUM chloride (15%) and ammonium oxalate (10%) are incorporated as a safety or cooling agent in an explosive consisting essentially of ammonium nitrate and nitroglycerin.—C. A. M.

Smokeless powder containing phenanthrene; Manufacture of—. G. Spica. Fr. Pat. 473,264, June 9, 1914. Under Int. Conv., June 10, 1913.

COLLODION cotton (62 to 66%) is incorporated with phenanthrene (5 to 7%) and nitroglycerin (28 to 32%), and the mixture freed from water, compressed between cylinders at 100° to 105° C., and the sheets cut into pieces of the desired size. The product has the sp. gr. 1.60; it yields 1014 litres of gas and develops 864 calories per kilo. Its stability compared with cordite in the silvered crucible test is as 2800 to 930.—C. A. M.

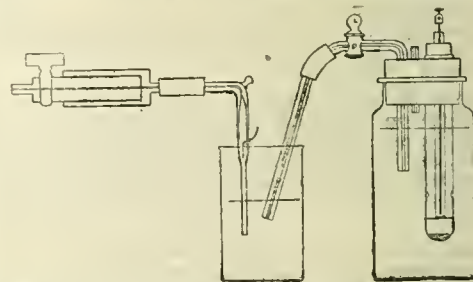
Explosives; Process for manufacturing—. C. Hartmann, Schlebusch, Assignor to Sprengstoff A.-G. Carbonit, Hamburg, Germany. U.S. Pat. 1,135,792, April 13, 1915. Date of appl., Aug. 20, 1913.

SEE Fr. Pat. 460,571 of 1913; this J., 1914, 44.

XXIII.—ANALYTICAL PROCESSES.

Hydrogen electrode; A simple—. H. P. Barendrecht. *Biochem. J.*, 1915, 9, 66—70.

THE electrode (see fig.) consists of a bent piece of glass tubing with a platinum wire sealed in its wall; the upper end of the tube is connected by



a piece of rubber tubing with a perforated brass or copper syringe. The point of the platinum wire is near the lower end of the tube, which is

narrowed. Hydrogen is first admitted through the tap on the syringe, while the piston is pushed home; the tap is then closed and, by drawing the piston in and out several times, equilibrium between the hydrogen and the dissolved carbon dioxide, which the liquid under examination may contain, is secured. Oxygen is removed from the liquid by drawing the latter several times up and down over the blacked wire; the oxygen is thus rapidly reduced and the liquid is then forced down the tube until its surface is near the platinum point. The other half of the galvanic cell consists of a bottle, filled with saturated potassium chloride solution, and closed with a rubber stopper through which three tubes pass. One of these is closed at the bottom, but has two openings in its side and constitutes the mercury-calomel-saturated KCl electrode; the second tube is a capillary provided with a tap and connected with a capillary filled with cotton-wool, this capillary extending into the liquid under examination; the third tube is open to the air and serves to prevent air-pressure in the bottle.—W. P. S.

Zinc; Determination of—as zinc ammonium phosphate, and its application to the separation of zinc (from other metals). P. Artmann. *Z. anal. Chem.*, 1915, 54, 89—102. *J. Chem. Soc.*, 1915, 108, li., 181.

The neutral zinc solution is heated to 70° C. and treated with an excess of diammonium phosphate solution, 2 grms. of ammonium chloride being also added for each 0.1 gm. of zinc present. The mixture is maintained at 70° C. for fifteen minutes, cooled, the precipitate collected, washed, and titrated iodometrically (this *J.*, 1910, 455); three atoms of iodine correspond with one atom of zinc. 100 c.c. of water at 17.5° C. dissolve 0.00145 gm. of zinc ammonium phosphate, corresponding with 0.00053 gm. of zinc, and the results are corrected for this amount, the volume of the reacting solution and the wash-water being taken into account. Zinc may be separated from copper by precipitation as zinc ammonium phosphate provided that ammonium tartrate is present in the solution; when the proportion of copper is large, a double precipitation is necessary.

Flame reactions. IV. Salts in oxygen and chlorine flames. W. D. Bancroft and H. B. Weiser. *J. Phys. Chem.*, 1915, 19, 310—330.

Salts of lithium, potassium, and sodium give both a continuous spectrum and a line spectrum in a Bunsen flame. The introduction of hydrochloric acid into the flame retards the dissociation of the salts and reduces the intensity of the line spectrum. Blue (without yellow) luminescence is produced when sodium salts are introduced into a flame of hydrogen burning in chlorine, or by the slow combustion of sodium in oxygen, chlorine, or bromine, whilst rapid combustion produces yellow with faint blue fluorescence. The yellow fluorescence is attributed to some stage in the reaction from sodium vapour to sodium ion, and the blue to the reaction from sodium ion to undissociated sodium salt. (See also this *J.*, 1914, 570.)—C. A. M.

Copper; Colorimetric determination of—G. Denigès and E. Simonot. *Bull. Soc. Pharm. Bordeaux*, 1914, 337. *J. Pharm. Chim.*, 1915, 11, 180—187.

Two c.c. of a solution of a cupric salt, previously treated with one-fifth of its volume of sulphuric acid, is mixed with 2 c.c. of a reagent prepared by adding 10 c.c. of sulphuric acid drop by drop to 20 c.c. of a 50% potassium bromide solution (which is meanwhile chilled in ice-water) and then separating the clear liquid from the crystalline precipitate. The coloration obtained is compared

with that given under the same conditions by a standard solution of a cupric salt.—C. A. M.

Copper and tin groups; Analysis of the—R. Gilmore. *Chem. News*, 1915, 111, 206—208.

THE sulphides precipitated with hydrogen sulphide are boiled with 5N hydrochloric acid, which dissolves all except those of mercury, copper, and arsenic. Arsenic sulphide is then dissolved by treatment with sodium hydroxide solution. The chlorides in solution are treated with hydrogen peroxide to oxidise the tin, and then re-precipitated with hydrogen sulphide. Antimony and stannic sulphides are extracted from the precipitate with sodium hydroxide solution. Bismuth and lead are separated with potassium bichromate and sodium hydroxide solutions, bismuthyl bichromate being precipitated, and the lead remaining dissolved.—E. H. T.

Lead and mercury; Detection of traces of—G. Meillère. *Ann. Chim. Analyt.*, 1915, 20, 73—77.

THE solution under examination is treated with 0.25 gm. of a copper salt (prepared from electrolytic copper) per litre, and transferred to another flask, whilst the original vessel is rinsed with 10 c.c. of hydrochloric acid for each litre of solution. The solution and washings are treated with hydrogen sulphide at first in the cold and without shaking, and subsequently with agitation on the water-bath. The precipitated copper and lead sulphides are separated in a Gooch crucible, washed, and dissolved in dilute nitric acid, the solution evaporated, and the residue ignited to decompose copper nitrate and organic matter, and dissolved in dilute nitric acid (not exceeding 1 vol. in 15). The solution is electrolysed at not above 40° C., using about 2 volts and 0.2 amp., and the lead oxide deposited on small platinum electrodes. The addition of a copper salt enables traces of lead sulphide to be detected in a liquid containing up to 2% of hydrochloric acid, which will prevent the precipitation of zinc, iron, and manganese. The same principle may be used for the separation of traces of mercury, from 0.1 to 0.2 gm. of the copper salt being added to each litre of solution. Preliminary destruction of organic matter in beer, etc., is unnecessary.—C. A. M.

Cobalt in presence of nickel; Volumetric determination of—A. Metzl. *Z. anal. Chem.*, 1914, 53, 537—541. *Z. angew. Chem.*, 1915, 28, Ref., 77.

COBALTOUS salts are oxidised by hydrogen peroxide to higher cobalt oxides, which are converted into cobaltic hydroxide on boiling with sodium hydroxide solution. The cobaltic hydroxide dissolves in potassium iodide solution, in presence of sulphuric acid, with liberation of iodine, which may be titrated. Nickel compounds are not attacked by hydrogen peroxide. Another method of determining cobalt in presence of nickel is based on the fact that solutions of cobaltous salts, when treated with ammonium chloride and ammonia, yield complex cobalto-ammonium compounds, which can be oxidised to the corresponding cobalti-ammonium compounds, and the latter converted into cobaltic hydroxide by prolonged boiling or by means of alkali.—A. S.

Carbon monoxide; Determination of—by the iodine pentoxide method. V. Froboese. *Z. anal. Chem.*, 1915, 54, 1—11. *J. Chem. Soc.*, 1915, 108, ii., 180.

THE iodine pentoxide should be heated at 100° C. during the reaction. Hydrogen is also oxidised by iodine pentoxide, iodine being liberated; at 70° the reaction with hydrogen is but slight, but at 160° C. large quantities of free iodine are

formed. The quantity of carbon monoxide present may be ascertained by estimating the carbon dioxide formed or the iodine liberated. Estimation of the carbon dioxide yields the more trustworthy results; the carbon dioxide is collected in an excess of barium hydroxide solution, and this excess is titrated, or the barium carbonate may be separated, converted into barium sulphate, and weighed as such. The gas in which the carbon monoxide is to be estimated must be freed from carbon dioxide, acetylene, and ethylene. Small quantities of carbon monoxide in air may be estimated approximately by titrating the liberated iodine, provided that air free from carbon monoxide and dioxide is passed over the heated iodine pentoxide for one hour before and after the passage of the air under examination. The quantity of carbon monoxide in a gas does not affect the method if the rate of flow of the gas through the apparatus does not exceed 1 litre per hour.

Metals; Volumetric determination of — by means of arsenic acid. J. Valentin. Z. anal. Chem., 1915, 54, 76—89. J. Chem. Soc., 1915, 108, ii., 180—181.

The process consists in treating the metallic salt solution with an excess of monopotassium arsenate solution, diluting the mixture to a definite volume, and, after 24 hours, separating the insoluble arsenate by filtration, and estimating the excess of arsenate in an aliquot portion of the filtrate by adding hydrochloric acid and potassium iodide, and titrating the liberated iodine with thiosulphate solution. In the case of magnesium, calcium, strontium, barium, lead, and manganese, the precipitation with the arsenate solution is carried out in an ammoniacal solution; bismuth is precipitated in neutral solution, zinc and cadmium in the presence of sodium bicarbonate, and the mixture is then rendered neutral with acetic acid, nickel, and cobalt in the presence of sodium acetate, and aluminium and chromium in very dilute acetic acid solution.

Arsenic; Determination of — with the Marsh apparatus. O. Rind. Oesterr. Chem.-Zett., 1914, 17, 208—210. Z. angew. Chem., 1915, 28, Ref., 76.

HYDROGEN arsenide from a Marsh apparatus was found to be absorbed quantitatively by soda-lime, which became almost black. On heating the soda-lime in a current of air, arsenic acid was formed and the coloration disappeared. Attempts to determine the amount of arsenic from the increase in weight of the soda-lime gave high results, and it was found that the soda-lime invariably contained zinc. It is concluded that in presence of arsenic a volatile zinc compound, probably zinc hydride, is formed in the Marsh apparatus.—A. S.

Arsenic; Determination of — by boiling a hydrochloric acid solution with hydrazine salts and potassium bromide. P. Jannasch and T. Seidel. J. prakt. Chem., 1915, 91, 133—173.

An amount of the arsenic compound corresponding to not more than 0.3 gm. As_2O_3 is washed into a litre flask with dilute hydrochloric acid; 3 grms. of hydrazine sulphate (or hydrochloride), 1 gm. of potassium bromide, and 100 c.c. of hydrochloric acid (sp. gr. 1.19) are added, and distillation is effected through a condenser and adapter into a water-cooled stoppered litre flask containing 300 c.c. of water and provided with a Péligré exit tube which also contains a little water. The drawn-out end of the adapter is about 3 cm. above the level of the liquid. The preliminary gentle heating is followed by vigorous boiling till about 30 c.c. has distilled. Arsenic is then determined in the distillate either volumetrically by direct titration with $N/10$ potassium bromate or

gravimetrically by evaporating to a small bulk with 50 c.c. of nitric acid (sp. gr. 1.14) and adding magnesia mixture. In the former case $\text{KBrO}_3 = 3\text{As}$, and the indicator consists of a few drops of 2% methyl orange, the end-point being marked by the disappearance of the original red tint. In a series of determinations the amounts of As_2O_3 taken and found, respectively, were: 0.1004, 0.1001; 0.0998, 0.1001; 0.1002, 0.1002; 0.1003, 0.1004; 0.1002, 0.1000 gm. The hydrazine method is especially applicable to mixtures of arsenic with various metals and acids and to arsenical ores. To destroy hydrazine salts the residual liquid is freed from hydrochloric acid by evaporation on the water-bath; nitric acid is added to the cold liquid, which is finally evaporated to dryness on the water-bath; more nitric acid is added and the process repeated. Antimony or mercury may be determined directly in the residual liquid by the sulphide method without first destroying the hydrazine. Copper and silver are determined as free metal by the hydrazine method, lead as lead sulphate, bismuth with ammonia and hydrogen peroxide, cadmium with potassium carbonate, and tin with ammonia: all after first destroying the excess of hydrazine salts, in the case of tin without bringing the residue quite to dryness. Gold is determined as metal by simply rendering the undistilled liquid alkaline and warming. Phosphoric, vanadic, molybdic, and tungstic acids are determined by the usual methods after destroying the hydrazine; arsenic is only completely separated from tungstic acid after repeated distillation. In determining arsenic in ores, e.g., mispickel and proustite, the powdered ore is evaporated to dryness with *aqua regia* and then treated in the manner outlined above.—J. R.

Alkaline-earth metals and alkalis; Separation of — [in qualitative analysis]. R. Gilmour. Chem. News, 1915, 111, 217.

THE following procedure has given excellent results in practice: The filtrate from the iron group is evaporated to dryness and heated to expel ammonium salts; the residue is dissolved in 10 c.c. of water with a few drops of hydrochloric acid if necessary, and any carbonaceous matter filtered off. The filtrate is heated with 5 c.c. of ammonium chloride, 5 c.c. of ammonia, and 10 c.c. of ammonium carbonate solutions and filtered. The washed precipitate is dissolved in not more than 3—4 c.c. of acetic acid, the solution is neutralised with ammonia, then treated with 2 c.c. of acetic acid and diluted to 15—20 c.c., heated to boiling, treated with about 10 c.c. of potassium chromate solution, maintained nearly boiling for 2—3 mins. and filtered from barium chromate. The carbonates of calcium and strontium are reprecipitated from the filtrate by heating with 3—4 c.c. of ammonium carbonate solution in excess of the amount necessary to change the colour of the liquid from orange to yellow. The washed precipitate is dissolved in hot acetic acid, and after being made alkaline with ammonia the liquid, which should not exceed 4—5 c.c., is divided into two portions. The first is boiled for a few minutes with an equal volume of saturated calcium sulphate solution to detect strontium. The second is boiled with an equal volume of a strong solution of potassium ferrocyanide; a white crystalline precipitate or turbidity appearing after a minute or two indicates calcium. The group filtrate from the alkaline-earth carbonates is concentrated to about 10 c.c. and allowed to stand for 15 mins. after addition of 4—5 c.c. of ammonium carbonate solution and 15 c.c. of alcohol, the interior of the vessel being rubbed with a glass rod to induce crystallisation if necessary. The magnesium ammonium

carbonate is filtered off and the filtrate tested for sodium and potassium.—J. H. L.

Carbon, hydrogen, and mercury in organic mercury compounds; Simultaneous determination of—. A. Abelmann. Ber., 1914, 47, 2935–2938. Z. angew. Chem., 1915, 28, Ref., 74.

THE substance is burnt in a combustion apparatus, and a tube filled with spirals of fine gold wire or gold foil to retain mercury vapour is inserted between the combustion tube and the absorption vessels for water and carbon dioxide. After each determination the tube containing the gold is heated *in vacuo* to expel the mercury.—A. S.

Sugar; Cause and significance of an abnormal reaction obtained in testing urine for— with Fehling's solution. W. Cramer. Biochem. J., 1915, 9, 71–77.

A SPECIMEN of urine, containing about 1.5% of dextrose, yielded a scarlet, transparent solution when heated to boiling and mixed with an equal volume of diluted Fehling's solution; after a time, the mixture darkened, and deposited a black precipitate of extremely finely-divided metallic copper. This reduction of cupric salts to metallic copper can be brought about by concentrated aqueous solutions of reducing sugars, but it takes place more readily when the reducing sugar is present in a urine of normal concentration as regards the usual urinary constituents; it is facilitated by the fact that some of the constituents of normal urine (creatinine, urinary colloids, etc.) are capable of holding cuprous oxide in solution. —W. P. S.

Reducing sugars in urine; New test for—. W. Cramer. Biochem. J., 1915, 9, 156–160.

THE test depends on the reduction of mercuric oxide in slightly alkaline solution to metallic mercury. The reagent is prepared by dissolving 0.4 gm. of mercuric oxide and 6 grms. of potassium iodide in 100 c.c. of water, and adjusting the alkalinity of the mixture, by the addition of *N*/10 acid or alkali solution, so that 10 c.c. requires exactly 2.5 c.c. of *N*/10 acid for neutralisation, using phenolphthalein as indicator. To apply the test, 3 c.c. of the reagent is heated to boiling, 0.3 c.c. of the urine is added, the solution again boiled, and, after the lapse of 30 seconds, acidified with acetic acid. Normal urine containing the usual quantity (0.1 to 0.2%) of dextrose yields a very slight turbidity; when the sugar-content increases to 0.5% a distinct turbidity is produced. The reagent may be made more sensitive by increasing its alkalinity, but the normal quantity of sugar in urine then interferes by producing a turbidity; other substances, such as creatinine, also reduce strongly alkaline mercuric oxide solutions. The acetic acid is added to dissolve precipitated phosphates.—W. P. S.

Blood; Improved haemin test for—, with notes on some recently proposed methods. W. Beam and G. A. Freak. Biochem. J., 1915, 9, 161–170.

THE following test yields reliable results when applied to blood stains, fresh or old (12 years), stains partially removed by soap and water, or heated to 160° C., or mixed with earth, or to old stains on rusty iron which has been exposed to strong sunlight and atmospheric conditions for several days. A small quantity of the suspected material is placed in a tube about 4 mm. in diameter and 35 mm. long, a few drops of acetic acid containing from 0.01 to 0.1% of sodium chloride are added, and a very fine cotton thread is inserted in the tube so that its upper end is near the top of the tube and the lower end reaches to the bottom of the liquid; the thread is made to adhere to the side of the tube by moistening it

with the liquid. The tube is maintained in a vertical position and haemin crystals usually appear near the upper half of the thread within about an hour; they gradually increase in size and may be seen with a good hand lens.—W. P. S.

Manipulation of the calorimetric bomb. Calculation of heats of combustion. Roth. See II A.

Combustion of volatile substances in the calorimetric bomb. Roth and Wallasch. See II A.

Separation of ethane and ethylene by fractional distillation in a vacuum at low temperatures. Burrell and Robertson. See II A.

Penol's method of analysing hypochlorites. Clarens. See VII.

Action of ammonium salts on mercuric iodide. Guareschi. See VII.

Volumetric determination of the higher oxides of lead and manganese with titanium trichloride. Moser. See VII.

Determination of the higher lead oxides. Milbauer and Pivnicka. See VII.

Acidity of hydrogen peroxide solution. Callan. See VII.

Chemical reactions in anhydrous hydrazine. Welsh and Broderson. See VII.

Determination of platinum, palladium, and gold [in ores]. Determination of silver in ores and concentrates containing platinum and palladium. Smoot. See X.

Rapid electrolytic determination of copper [in brass]. Theel. See X.

Determination of iron disulphide (pyrites) in soil. Rodt. See XVI.

Employment of artificial light in the titration of resins in hops. Larsen. See XVIII.

Determination of total solids and nitrogen in milk. Meillère. See XIX A.

Detection and determination of saccharin in foodstuffs. Ceccherelli. See XIX A.

Determination of crude fibre. Fanto and Nikolitsch. See XIX A.

Determination of iron in water with titanium trichloride. Zink and Liere. See XIX B.

Determination of organic matter in potable water. Filippo and Backer. See XIX B.

A possible source of error in alkaloid assays. Self. See XX.

Separation and identification of certain homologous α -diketones [diacetyl, etc.]. Johin. See XX.

Reactions of vanillin. Häussler. See XX.

Formaldehyde reactions. Salkowski. See XX.

Determination of formaldehyde and methyl alcohol in aqueous solutions. Lockemann and Croner. See XX.

Determination of methyl alcohol in aqueous solution. Von Fellenberg. See XX.

PATENTS.

Gas analysis; Quantitative — by an acoustic method. Badische Anilin und Soda Fabrik. Ger. Pat. 281,157, May 22, 1913.

SOUND waves are produced in the gaseous mixture under examination, and the tone produced is compared with a note of definite pitch produced simultaneously. The sound waves are transmitted by a microphone or telephone to a vibrating tongue or a small group of vibrating tongues which will respond only to waves of definite frequency, corresponding to a definite composition of the gaseous mixture. The vibrating tongue or tongues may be connected with an alarm or with a recording device. A whistle or pipe actuated by pure air, or a tuning fork, bell, or the like, may be used for producing the standard note for comparison. The method is less sensitive the lower the pitch of the note produced.—A. S.

Gas mixtures; Analysis of —. Badische Anilin und Soda Fabrik. Ger. Pat. 281,584, Jan. 4, 1914.

Two similar vessels, sealed at their lower open ends in liquid in a common receptacle, are filled respectively with the gas under examination and with a standard gas for comparison, e.g., air. The gases are then allowed to flow out through narrow openings, as far as possible under the same pressure, until a definite quantity of the standard gas has escaped: the volume of the other gas escaping in the same time is a measure of the density and hence of the composition of the gas. The movements of the vessels as the gases are introduced and discharged may be made to control automatically the gas inlet and outlet valves and a recording device.—A. S.

Calorimetry of gaseous fuels. U.S. Pat. 1,134,768. See II.A.

XXIV.—MISCELLANEOUS ABSTRACTS.

Advisory Council on industrial research.

ON May 13th the President of the Board of Education stated that he was including in the estimates for salaries and expenses of the Board a sum of £25,000 to £30,000 for the purpose of instituting an advisory council on industrial research, which should represent the various industries of the country and work in co-operation with the Board of Trade to secure closer association of science with industry. He hoped that the advisory council would begin their work in a few weeks.

War economy and chemical industry [in Germany]. Chem.-Zeit., 1915, 39, 251.

IN Germany the control of all raw materials required in the manufacture of munitions of war is in the hands of a special department of the war office. Committees have been appointed to deal with metals, chemicals, skins, leather and tanning materials, jute, flax, linen yarn, rubber, cotton, hemp, tinplate, and organic products, and supervision has been facilitated by establishing raw-material companies, such as Kaemmwooll A.-G., Kriegeschemikalien A.-G., and Kriegesmetall A.-G., and clearing houses for linen yarn, flax, jute, rubber, wool, and horsehair. The resources of Belgium also are being organised and a bureau of administration for raw materials exists in Brussels. Steps have been taken to enlarge the output of ammonia, nitric acid, and calcined alumina, and great activity is reported in the production of metals, especially of refined copper, whilst the refining of zinc constitutes a new industry for Germany. Successful substitutes for aluminium, brass, and copper alloys have been found in tin-

plate, steel, and galvanised iron, respectively, and iron is being employed for making electrical conductors.—F. SODN.

Diffusion in aqueous solution; Counter —. G. S. Walpole. Biochem. J., 1915, 9, 132—137.

EXPERIMENTS described by Osborne and Jackson (Biochem. J., 1914, 8, 246), in which two solutions were placed in contact over a relatively small surface, the one vertically over the other, were repeated; the upper one was a $N/10$ potassium chloride solution and the lower one a similar solution containing also ammonium sulphate (3-mol. strength). The conclusions of Osborne and Jackson are confirmed, but additional determinations of potassium and ammonia in the two solutions suggest the following expression of the results:—After some days the ammonia diffuses into the upper liquid faster than the equivalent quantity of sulphate, with the result that the chloride concentration in the upper liquid increases, whilst the potassium concentration increases in the lower liquid.—W. P. S.

Electrical conductivity of pure liquids. J. Carvallo. Ann. Phys., 1914, [ix.], 1, 171—225; 2, 142—225. J. Chem. Soc., 1915, 108, ii., 135.

THE question as to whether liquids other than water are characterised by a definite limiting conductivity in the pure state has been investigated by experiments on sulphur dioxide, ethyl ether, ammonia, acetone, methyl alcohol, ethyl alcohol, hydrogen cyanide, and hydrogen iodide. Preliminary purification was effected by a series of fractional distillations at the ordinary pressure or in a vacuum, and in some cases further purification resulted on the prolonged passage of a continuous current through the liquid. The electrical treatment was always found to be accompanied by a diminution of the conducting power in the case of ethyl ether, aliphatic hydrocarbons, and ammonia; ethyl alcohol gave an increase, methyl alcohol no effect, and with sulphur dioxide and acetone the change was variable, and depended on the sample of liquid subjected to the action of the current. In the limiting condition reached in the case of sulphur dioxide, ammonia, ethyl ether, and the hydrocarbons, the behaviour of the liquids resembles that which is met with in gases, and suggests that these substances have no measurable characteristic conductivity in the pure state. The following values, representing the minimum observed conductivities, are recorded; in most cases these are very much smaller than the values recorded by previous observers: sulphur dioxide (15°C), 1.8×10^{-11} ; ammonia (15°), 3.8×10^{-10} , (-80°) 4.9×10^{-10} ; ethyl ether (16°), 7.6×10^{-16} ; acetone (15°), 1.2×10^{-10} ; ethyl alcohol (17°), 0.9×10^{-8} ; methyl alcohol ($0-20^{\circ}$), 8.0×10^{-7} ; hydrogen cyanide (0°), 1.1×10^{-7} . It would appear that a limiting conductivity, which is independent of the intensity of the electric field, cannot be regarded as a criterion of a perfectly pure liquid, as suggested by Warburg. This independence has been found in liquids which were known to contain traces of impurities. Under the influence of light, sulphur dioxide decomposed in accordance with the equation $3\text{SO}_2 = \text{S} + 2\text{SO}_3$. The impurities which are thus introduced can only be removed by distillation in a vacuum in the dark or by the electrical method. The solutions of sulphur and sulphur trioxide are photo-electrically sensitive.

The new technical chemistry laboratories of the Imperial College of Science and Technology. Engineering, 1915, 99, 551.

THE new laboratories for chemical technology at the Imperial College of Science, South Kensington,

were opened on May 12th. The laboratories are under the direction of Professor W. A. Bone, F.R.S., and are intended solely for post-graduate work. This post-graduate course extends over two years. In the first year students are practised in technical analyses and the like, whilst in the second year they will engage in research work properly so-called. Professor Bone has, moreover, made arrangements by which a number of selected students go annually to the Skinningrove Iron Works for a month, where they are enabled to gain experience in the conduct of coke-ovens, blast-furnaces, steel furnaces, gas-producers, etc. A temporary arrangement has also been effected with the Home Office, in virtue of which other students are annually given the opportunity of a month's work at the Eskmeals experimental station.

For the present, special attention is to be directed to the detailed study of refractory materials. Research of this class has been somewhat neglected in this country, with the result that for many purposes special firebricks have had to be imported from Germany or America. The work at the new laboratories will, however, soon put our firebrick manufacturers in possession of the requisite data for the production of refractory materials to suit all present requirements.

The new laboratories occupy two floors. On the ground floor are the laboratory for refractory materials and the general analytical laboratory. There is also here a workshop in which instrument-making is carried out, a drawing-office, and a photographic dark-room. On the second floor is a lecture theatre, a room for experiments requiring to be carried out in the dark, a private research laboratory, and a general research laboratory. The laboratory has been provided with a Mond producer fitted with ammonia-recovery plant, and with a gas-holder capable of holding 3000 cub. ft. of gas. Steam, air under pressure, gas, and electricity are laid on to each work-bench. The steam is supplied at 100 lb. pressure from boilers outside the building, but is reduced to 16 lb. before distribution. It is used for drying, distillation, and boiling. The electric current is used in part for operating heaters, but mainly for supplying power for various minor operations, such as the driving of the Sinkinson filtrate-washer.

The analytical laboratory is fitted with complete plant for the investigation of solid, liquid, and gaseous fuels, whilst in the laboratory for refractory materials there is, in addition to grinding and crushing machinery, an Adie tensile-testing machine. An experimental coking plant, with which all the ordinary chemical operations pertaining to coke-oven practice can be carried out, is also installed in this room. A tar-still is another important piece of apparatus here, and the students are required to conduct the complete series of operations included in the passage from crude tar to a finished dye. Provision is made by which any one of the furnaces throughout the building can be coupled up to a recording pyrometer.

In the private research laboratory experiments on the occlusion of gas by heated metals are in progress. The plant here includes two different patterns of molecular air-pumps, by means of which very high vacua can readily be maintained for very long periods of time. Another research in progress in this laboratory has reference to the surface-combustion of gases, such as electrolytic gases, or a mixture of oxygen and carbon monoxide. A plant by which gas can be compressed at 200 atmospheres into cylinders is provided in the general research laboratory. A large furnace has just been erected in this laboratory with a view to determining the relative effects in furnace work of "regenerating" the air supply, the gas supply, or both. Coupled to this is a "Bimeter" CO₂ recorder.

This laboratory also contains an Ionides brass-melting furnace and balanced gas-governor. The latter, when supplied with air and gas at different or varying pressures, passes on a mixture of both at constant pressure and composition to the furnace. This mixture is *per se* explosive, but the designer has succeeded in entirely suppressing back-firing, the mixture not igniting till it reaches the furnace. It enters this tangentially, and whilst burning traces a helical path round the crucible. A very high fuel economy is claimed, 20 lb. of brass being melted with a consumption of but 1.4 to 1.8 cub. ft. of gas per pound.

Photochemical reactions: Kinetics of —. D. Berthelot. Comptes rend., 1915, 160, 519—522.

FROM kinetic, thermal, and electrical energy considerations, it is shown that the speed of the electrons emitted by a surface exposed to radiation is independent of the intensity of the incident ray, but depends on the square root of the frequency, and that in photochemical reactions the frequency plays the same role as temperature in ordinary chemical reactions. Under the influence of light the particles acquire much higher velocities than under the influence of heat; hence increase of temperature has little effect on photochemical reactions. If the temperature coefficient of a photochemical reaction be found to have a value higher than 1.40, this is due to secondary chemical reactions following the primary photochemical reaction.—B. N.

Iodine: Blue adsorption compounds of —. II. and III. Derivatives of α - and γ -pyrone. G. Barger and W. W. Starling. Chem. Soc. Trans., 1915, 107, 411—424.

IN addition to starch, saponarin, apigenin, etc., a large number of synthetic substances give blue additive products with iodine, which are either mixed crystals or amorphous adsorption compounds formed as the result of residual valency. There is a qualitative connection between chemical constitution and power of adsorbing iodine, since closely related substances as dihydrocoumarins, and flavanones, not possessing a crossed conjugated double linkage, :C.C.C:, do not form blue additive compounds with iodine, whilst quinones and phthalains, which contain this linkage, show an identical behaviour to iodine. Aryl groups exert a favourable influence on iodine adsorption: with one benzene ring adsorption occurs with $N/100$ — $N/1000$ iodine, with two benzene rings down to $N/10,000$, and with three benzene rings down to $N/100,000$ iodine. Alkyl groups, particularly the isopropyl-group, diminish the power of adsorption, whilst the introduction of hydroxyl-group in xanthone, and methoxy-groups in thioxanthone greatly increases it, but these regularities apply only within narrow limits.—G. F. M.

Jellies: Velocity of formation and solution, and the swelling, of —. I. Traube and F. Köhler. Intern. Zeits. phys.-chem. Biol., 1915, 2, 42—84. J. Chem. Soc., 1915, 108, ii., 154—155.

THE authors investigated the effects of the addition of various substances on the rate at which gelatin solutions gelatinise, and also on the rate of re-solution of the gel. The formation of the gel is hindered by chloroform, ether, and other narcotics, a large number of which were tested. The solution of the gel, on the other hand, is accelerated, and when the narcotics are arranged in the order corresponding with the degree to which they hinder the formation of the gelatin gel, it is found to be practically the same order as that for the acceleration of gel solution. Non-electrolytes, such as glycerol and the sugars, which increase surface tension, accelerate gel

formation, and correspondingly inhibit gel solution. Acids in amounts of less than 0.01 mol. per litre increase the rate of gel formation. Above this concentration they exert an inhibiting action, which reaches a maximum when the solution contains 0.019 mol. of almost any acid per litre. The rate of solution of the gel is affected in exactly the reverse manner. Bases similarly inhibit formation and accelerate solution of the gel. Salts, in the case of dilute gelatin solutions, accelerate formation and inhibit solution of the gel, the extent of influence being represented by the order $\text{Ca} > \text{K} > \text{Na}$ for cations and trichloroacetate, salicylate, iodide, bromide, cyanide, nitrate, chloride, sulphate, citrate for anions, the foremost in each series exerting the strongest action. With larger concentrations of the gelatin the order becomes changed. Alkaloidal salts behave in a similar way, provided the gelatin solution is dilute. With more concentrated solutions the effect is reversed. Consequently for certain strengths of gelatin solution, pilocarpine, which has the greatest accelerating action on gel formation in dilute gelatin solutions, and atropine, which has the least, become antagonistic. Similar antagonism occurs between non-electrolytes which lower surface tension and those which raise it; between narcotics and peptone, narcotics and salts, and between various salts, particularly between a calcium and the corresponding sodium salt. The authors show that a complete analogy exists between the swelling of colloids and the formation and resolution of gels. The greater the effect of an agent on the velocity of gel solution or formation, the greater is the effect on the capacity of colloids for swelling. The concentration of acid which produces the maximum inhibiting action on gel formation is approximately that which has the greatest effect on inhibition. The authors point out the bearing of these results on the problems of narcosis, hæmolysis, chemotaxis, inflammation, mechanism of muscle contraction, production of edema, etc.

Solid and liquid phases; Exchange of atoms between—G. von Hevesy. *Physikal. Zeits.*, 1915, 16, 52—55. *J. Chem. Soc.*, 1915, 108, ii., 156.

EXPERIMENTS are described which have enabled the author to measure the rate of molecular exchange at the surface of separation of solids and liquids. The observations were made on lead and its compounds, and measurements of small changes in the distribution of lead at the contact surface were made possible by the addition of traces of thorium-B, which is an isotope of lead, to the liquid or solid phase.

In this way, observations have been made on the molecular exchange between solid lead chloride and a saturated solution of the salt, and at the surface of contact of metallic lead and lead dioxide and solutions of lead nitrate of varying concentration. The rate of exchange at the surface of metallic lead in contact with a solution of lead nitrate containing thorium-B is of such magnitude as to suggest that the exchange is not that which corresponds with complete thermodynamic equilibrium, but is due to the action of "local currents." At some points lead passes into solution, and at others separation takes place. At the surface of contact of pure lead dioxide and a solution which contained lead nitrate (0.001N) and nitric acid (0.001N) and was saturated with "infected" lead dioxide, the rate of exchange was found to be very much smaller. In this case it is possible that the observed rate corresponds approximately with the kinetic exchange which would be found in a condition of thermodynamic equilibrium.

Oxidising and reducing enzymes; Individuality of—A. Bach. *Arch. Sci. Phys. Nat.*, 1915, [iv], 39, 59—71. *J. Chem. Soc.*, 1915, 108, i., 184.

WOKER (this J., 1914, 444) has developed the theory that the different enzyme actions—peroxydase, catalase, oxygenase, and perhydridase—are all due to the action of a single ferment having the properties of an aldehyde which acts differently according to the nature of the medium. A number of experimental facts are now brought forward to refute this hypothesis, and it is shown that each of the enzymes named has a clearly marked individuality. Neither peroxydase, catalase, nor phenolase (that is, peroxydase + oxygenase) are able to reduce ammoniacal silver oxide in the cold, nor do they show a coloration with magenta-sulphurous acid. They have not therefore aldehydic properties. When boiled catalase solution, that is, the substances which accompany catalase and constitute its reaction medium, is added to purified peroxydase, the mixture is unable to liberate oxygen from hydrogen peroxide. In like manner, the addition of boiled peroxydase solution to catalase does not accelerate the oxidising action of hydrogen peroxide. Peroxydase, together with a boiled phenolase solution, is not able to transfer molecular oxygen to oxidisable molecules. The enzyme mixture can only transfer oxygen feebly linked to peroxides to such oxidisable substances. Even in presence of the substances which accompany perhydridase in milk together with acetaldehyde, peroxydase is unable to reduce nitrates. The appropriate medium has no effect in causing the enzyme to exercise a strange property.

Agricultural and forest products of German East Africa. *Bull. Imp. Inst.*, 1915, 13, 110—134. (See also this J., 1915, 361.)

THE chief exports of chemical interest from German East Africa in 1911 and 1912 were:—

Product.	1911.	1912.
	£	£
Copal	5370	5068
Copra	92,249	78,152
Cotton, raw	66,591	105,512
Ground nuts	24,487	63,602
Hides and skins	151,759	203,368
Kapok	1151	3130
Rubber and gutta-percha (plantation)	180,480	362,012
Do. (wild)	58,568	59,298
Sesamé seed	20,191	26,186
Sisal hemp	226,612	367,961
Sorghum	1035	7478
Syrup and molasses	1679	580
Tanning woods and barks	4793	4992
Wax	40,846	41,453
Woods, timber, and charcoal	25,940	11,857

—A. S.

Trade Report.

Russian Customs Tariff. Board of Trade J., May 13, 1915.

A RUSSIAN Imperial Decree was promulgated on March 12th/25th, whereby the proposed changes in the Customs Tariff for imported goods (see this J., 1915, 381) at once become operative.

Books Received.

EXPLOSIVES, THEIR MANUFACTURE, PROPERTIES, TESTS AND HISTORY. By ARTHUR MARSHALL, J. and A. Churchill, 7, Great Marlborough Street, London. xvi + 605 pages. Price 24s.

THIS is an opportune moment for the appearance of a treatise on explosives, for the final decision in the great war in which the chief civilised nations are engaged will depend mainly upon the quality and quantity of the explosives available. This work differs from several of its predecessors in that the author has made a careful study of the literature of the subject and has not merely compiled both good and bad. The references to original sources of information will be found most useful by those who wish to make a more detailed study of any special branch of this very wide subject. The historical portion is brief, especially that relating to the early history of gunpowder. This is, perhaps, as well because the author quotes with approval Gibbon's summary, which is notoriously erroneous.

Mr. Marshall not only deals with the various explosives as such, but also with the properties and preparation of the materials used. Many of these materials are necessarily made in the vicinity of the explosives factory, for instance, nitric acid; but soap is only exceptionally made in connection with explosives and the sketch of the soap industry might, with advantage, be omitted. The description of the processes of manufacture of the various kinds of explosives is clear and concise and the information up to date. The same may be said of the perpetually varying methods of testing. Mr. Marshall's book is evidently the result of careful study as well as practical experience, and can be recommended to all who wish for reliable information on the subject with which it deals.—W. F. R.

REPORT OF THE DEPARTMENTAL COMMITTEE APPOINTED TO INVESTIGATE THE DANGER ATTENDANT ON THE USE OF PAINTS CONTAINING LEAD IN THE PAINTING OF BUILDINGS. [Cd. 7,882.] Wyman and Sons, Fetter Lane, London, E.C. Price 1s. 2d.

BULLETIN OF THE IMPERIAL INSTITUTE. Vol. XIII. No. 1. January—March, 1915. Price 2s. 6d.

THIS issue of the Bulletin contains the results of investigations in connection with vegetable drugs and poisonous plants, wheat from Egypt, the essential oil of *Sherungulu* tubers, rubber from India and Dominica, fibres from various sources, and boxwood from South Africa; also a special article on the lime and the lemon as sources of citric acid and essential oils. The general articles deal with the possibilities of sericulture in British Colonies and Dependencies, and the agricultural and forest products of German East Africa. Abstracts of several of the articles appear in this issue of the Journal.

CHEMICAL TECHNOLOGY AND ANALYSIS OF OILS, FATS, AND WAXES. Vol. III. By Dr. J. LEWKOWITSCH. Edited by G. H. WARBURTON. Macmillan and Co., Ltd., St. Martin's Street, London, W.C. Price 20s.

THIS, the last volume of the fifth edition of Dr. Lewkowitsch's well-known work, covers 455 pages, and contains, besides two chapters, an alphabetical index of the three volumes. Chapter XV. is devoted to the technology of manufactured oils, fats, and waxes, and the technical and commercial examination of the products of the oil, fat, and wax industries. Subdivisions of the chapter deal with edible oils and fats, burning oils, illuminating oils, paint oils, lubricating oils, wool oils, emulsified

oils, hydrogenated, iodised, brominated, sulphurised, boiled, and oxidised oils, vulcanised oils, nitrated oils, sulphonated oils; the candle industry, the fatty acid industry; soap and glycerin manufacture; and the technology of waxes. Chapter XVI. deals with the technology of waste oils, fats, and waxes, and the commercial products derived therefrom.

TEXTILE COLOUR MIXING. By DAVID PATERSON, F.R.S.E. Second Revised Edition. Scott, Greenwood and Son, 8, Broadway, Ludgate, London, E.C. 128 pp. 9 by 5½ in. Price 7s. 6d.

THE early pages of this book are devoted to a brief consideration of the theory of colour and the analysis of light, including a description of the spectroscope and its uses. Subsequent chapters deal with absorption colours, colour mixing, and primary, secondary, and tertiary colours. There are numerous illustrations, including coloured plates and pattern sheets.

THE UTILISATION OF WASTE PRODUCTS. By Dr. THEODOR KOLLER. Translated from the second revised German edition. Scott, Greenwood and Son, 8, Broadway, Ludgate, London, E.C. 327 pages. 9 by 5½ in. Price 7s. 6d.

THE wide range of waste materials covered by this work is shown in the following list of chapter headings:—I. The waste of towns. II. Blood and slaughter-house refuse. III. Fat from waste. IV. Tannery waste. V. Leather waste. VI. Fur and feather waste. VII. Waste horn. VIII. Fish waste. IX. Mother-of-pearl waste. X. Vegetable ivory waste. XI. Waste wood. XII. Cork waste. XIII. Waste paper and bookbinders' waste. XIV. Paper and pulp works by-products. XV. Waste produced in the manufacture of parchment paper. XVI. Wool waste. XVII. Silk waste. XVIII. Waste waters of cloth factories. XIX. Cotton spinners' waste. XX. Jute waste. XXI. Utilisation of rags. XXII. Colouring matters from waste. XXIII. Residues in the manufacture of aniline dyes. XXIV. Dyers' waste waters. XXV. Waste produced in butter making. XXVI. Molasses. XXVII. Waste liquids from sugar works. XXVIII. Fruit. XXIX. Waste products of the manufacture of starch. XXX. Brewers' waste. XXXI. Wine residues. XXXII. India-rubber and caoutchouc waste. XXXIII. Amber waste. XXXIV. Utilisation of turf or peat. XXXV. Manufactured fuels. XXXVI. Illuminating gas from waste, and by-products of the manufacture of coal-gas. XXXVII. By-products in the treatment of coal-tar oils. XXXVIII. Ammonia recovery. XXXIX. Petroleum residues. XL. By-products in the manufacture of rosin oil. XLI. Soap makers' waste. XLII. Alkali waste and the recovery of soda. XLIII. Sulphur. XLIV. Salt waste. XLV. Gold and silver waste. XLVI. Platinum residues. XLVII. Iridium from goldsmiths' sweepings. XLVIII. Metal waste. XLIX. Tin plate waste. L. Calamine slimes. LI. Waste iron. LII. By-products in the manufacture of mineral waters. LIII. Infusorial earth. LIV. Meerscham. LV. Mica waste. LVI. Slate waste. LVII. Broken porcelain, earthenware, and glass. LVIII. Utilisation of waste glass.

FIRST PRINCIPLES OF PRODUCTION. By J. TAYLOR PEDDIE, F.S.S. Longman, Green and Co., 39, Paternoster Row, London. 231 pages. 7¼ by 5 in. Price 5s.

THE subject is dealt with under the following headings: The state and opportunity in industry. Tariffs, free trade, and industry. The importance of science on political economy. Finance and industry. Science and industry. The co-operation of science and industry (by S. R. Illingworth). The influence of brain-power on history and in-

dustry (by Sir Norman Lockyer, with notes by Prof. R. A. Gregory). British Imperialism. German Kultur defined. Steel industry: opportunities for Britain. The concluding chapter consists of excerpts from the lecture on the chemical industries of Germany by Professor Frankland (see this J., 1915, 307).

* New Books.

[The Roman numerals in thick type refer to the similar classification of abstracts under "Journal and Patent Literature" and in the "List of Patent Applications."]

XVI. *Trnka, Dr. R.*: Eine Studie üb. einige physikalischen Eigenschaften des Bodens. (25 S.) Lex 8°. Berlin, Verlag f. Fachliteratur. 1914. M. 1.50.

XIXA. *Richmond, H. D.*: Dairy chemistry: a practical handbook for dairy chemists and others having control of dairies. 2d. ed. rev. Phil. Lippincott. '14. 11 + 131 p. il. 8vo. 1915. \$4.50 n.

XX. *Alessandri, P. E.*: Droghe e piante medicinali (Materia medica vegetale e animale). 2a ediz. Milano, Hoepli. 16°. fig., p. xv + 778. 1915. Lire 7.50.

Finzi: I derivati organici arsenicali in rapporto alla loro azione terapeutica. Padova. 8°. p. 130. 1915. Lire 3.50.

XXIII. *Tower, O. F.*: A course of qualitative chemical analyses of inorganic substances; with explanatory notes. 3rd ed. rev. Phil., Blakiston. [c. 13 + 89 p. 8vo. 1915. \$1 n.

XXIV. *Taylor, W. W.*: The chemistry of colloids, and some technical applications. N.Y., Longmans. 8 + 328 p. figs. tabs. 1915. D. \$2 n.

Ratcliffe, W. H.: Chemistry. Cr. 8vo. Hodder and S. London. 1915. Part 1. pp. 274. 3s. Part 2. pp. 122. 1s. 6d.

Findlay, A.: The phase rule and its applications. 4th ed. Cr. 8vo. pp. 382. Longmans. 1915. Net 6s.

Newell, L. C.: General chemistry. N.Y., Heath. c. '14. 604 p. il. diagrs. 12mo. 1915. \$1.20 n.

Meyer, E.: Storia della chimica dai tempi più remoti all'epoca moderna. Introduzione allo studio della chimica. Ediz. italiana con note dei dott. M. G. e C. Lollini e prefazione del dott. prof. I. Guareschi. Milano, Hoepli. 16°. p. xxviii, 721. 1915. Lire 7.50.

* Dissertations.

[Prices vary, ranging from three to four shillings.]

II. *Terres, E.*: Experimentaluntersuchungen über Verbrennungsgase von Flammen und Motoren. Karlsruhe i. B. (Techn. Hochschule.). 1914. 131 S. m. 17 Fig. u. 1 Taf. 8°.

III. *Armbrustmaeher, A.*: Ueber die halbseitige Reduktion aromatischer Polynitroverbindungen mit Zinnchlorür und mit Schwefelammonium. Bonn. 1914. 50 S. 8°.

Döhling, F.: Die Amidonaphtholdisulfosäure SS. München (Techn. Hochschule.). 1914. 64 S. m. 1 Tabelle. 8°.

Krollpfeiffer, Fr.: Ueber die Einwirkung von Pyridin und Isochinolin auf 2,4-Dinitrochlor-naphthalin. Marburg i. H. 1914. 177 S. 8°.

Wille, R.: Zur Struktur der ultravioletten Absorptionsspektren des Benzols und seiner Monoderivate auf Grund neuer Messungen. Bonn. 1914. 47 S. 1 Taf. 8°.

IV. *Aust, E.*: I. Umwandlungen von tertiären Aminobenzylalkoholen. II. Ueber die Konstitution der Pyroninfarbstoffe. Breslau. 1914. 78 S. 8°.

Beetz, M.: Ueber p-Leukanilin und dessen Derivate. München (Techn. Hochschule.). 1914. 45 S. 8°.

Engelbertz, E.: Ueber chinoide Verbindungen in der Thianthrenreihe. Marburg. 1914. 85 S. 8°.

Schladebach, H.: Beiträge zur Chemie der Pyridinfarbstoffe mit besonderer Berücksichtigung der Psendobasen der Pyridinreihe. Dresden (Techn. Hochschule.). 1914. 65 S. 8°.

Schlieder, K.: Ueber die Nitrophthalaldehydsäuren und die Bildung von Indigodicarbonsäure. Tübingen. 1914. 52 S. 8°.

V. *Döge, P.*: Ueber Formylcellulose. Leipzig. 1914. VI. 95 S. 8°.

Stratmann, G.: Der Einfluss der Schmieröle auf die Wirtschaftlichkeit von Spinnereien. Hannover (Techn. Hochschule.). 1914. 90 S. 12 Abb. 8°.

VII. *Dräger, W.*: Thermodynamische Untersuchungen am Calciumhydroxyd sowie über die graphische und mechanische Berechnung chemischer Affinitäten aus thermischen Messungen. Berlin. 1914. 57 S. 8°.

Enderli, M.: Die Kinetik der Formiatbildung aus Kohlenoxyd und Basen. Techn. Hochschule, Karlsruhe. 1914. 115 S. 8°.

Felkenheuer, B.: Ueber Ammoniakverbindungen der Halogenide des zweiwertigen Kobalts und Nickels. Berlin. 1914. 79 S. m. 2 Tafeln u. 13 Fig.

Friedrich, L. P.: Ueber die Bildungswärmen von V_2O_5 , VCl_3 , VCl_4 , $VOCl_3$ und über die Reaktion $2VCl_3 + Cl_2 \rightleftharpoons 2VCl_4$. Danzig (Techn. Hochschule.). 1914. 56 S. 8°.

Waltzinger, E. A.: Ueber Stickkohlenstoffe. Würzburg. 1913. 73 S. 8°.

X. *Förster, K.*: Probenahmen und Erzreservenbeurteilung in den Goldfeldern Transvaals. Dresden (Techn. Hochschule.). 1914. 62 S., 1 Formular. 4°.

Krueger, H.: Beiträge zur Frage der Martinofenbeheizung. Berlin (Techn. Hochschule.). 1914. 34 S. m. Abb. 8°.

Schirmeister, H.: Beiträge zur Kenntnis der binären Aluminiumlegierungen hinsichtlich ihrer technischen Eigenschaften. Aachen (Techn. Hochschule.). 1914. 15 S. m. 20 Abb. u. 1 Taf. 8°.

Spicker, A.: Zur Kenntnis der Eisenkohlenstoff-Legierungen. Aachen (Techn. Hochschule.). 1914. 14 S. m. 8 Fig. u. 2 Taf. 8°.

XI. *Wicht, H.*: Ueber Eisenoxyduloxyd-Elektroden. Stuttgart (T.H.). 1914. 95 S. gr. 8°.

XIII. *Seidel, Fr.*: Studien über Berlinergrün. Dresden (Techn. Hochschule.). 1914. 49 S. 8°.

XX. *Bauerschmidt, H.*: Komplexe Quecksilberverbindungen der Pyrazolonreihe. Berlin. 1914. 45 S. 8°.

Bry, J.: Zur Pharmakologie der Phenylalkylamine. Breslau. 1914. 46 S. 8°.

Dunnhaupt, F.: Polymerisationen und Autoxydationen einiger Äthylenderivate. Leipzig. 1914. 92 S. 8°.

* Compiled by H. Grevel and Co., 33, King Street, Covent Garden, London, W.C., from whom all the works in the preceding list can be obtained.

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Official Notice.

PATENTS, DESIGNS, AND TRADE MARKS (TEMPORARY) RULES, AUG. 21, 1914.

Until further notice, the following procedure will be adopted, under Rules 2 and 3 of the above Rules, in dealing with all work in connection with Patents, Designs, and Trade Marks (see this J., 1914, 813):—

1. During the continuance of the war no patent will be sealed and no registration of a trade mark or design will be granted to subjects of any State at war with His Majesty (hereinafter called "such subjects").

The term "such subjects," except for the purposes of paragraph 4 hereof, will be taken to include (a) a firm which by reason of its constitution may be considered as managed or controlled by such subjects or the business whereof is wholly or mainly carried on on behalf of such subjects; (b) a company which has received its constitution in an enemy's State; (c) a company registered in His Majesty's Dominions, the business whereof is managed or controlled by such subjects, or is carried on wholly or mainly on behalf of such subjects.

2. As regards applications for patents, designs, or trade marks no distinction will in the first place be drawn between those made by such subjects and those made by other persons. All proceedings thereunder will be carried on as usual down to and including acceptance; but in the case of applications by such subjects all proceedings thereon subsequent to acceptance (except such proceedings and matters as are mentioned in Section 9 of the Patents and Designs Act, 1907) will be suspended until otherwise directed.

The suspension of proceedings upon applications by such subjects will only be recalled or discharged upon proper terms including, if thought fit, the release of the applicant of the privileges and rights which he would otherwise have under Section 10 of the Patents and Designs Act, 1907.

3. Applicants who fail to conform to the provisions of the Patents and Designs Act, 1907, the Trade Marks Act, 1905, and the Rules made thereunder, will run the risk of losing their rights unless they are able to bring themselves under the provisions of Rule 3 of the above Rules. Applications under Rule 3 (a) should be made and will be considered at such time as the applicant, patentee, or proprietor of a design or trade mark as the case may be, is in a position to do the said act or file the said document as aforesaid. Applications under Rule 3 (b) should be made before the date for the doing of any such act.

4. As regards oppositions to the grant of patents and the registration of trade marks, arising after the commencement of the war, (a) oppositions by such subjects in cases where the grant or registration opposed is one to a British citizen or alien friend will not be entertained; (b) in the case where the grant or registration opposed is a grant or registration to any such subject the notice of opposition will be accepted, but all further proceedings will be suspended until the end of the war.

5. As regards inventions communicated by such subjects as aforesaid in respect of which patents are applied for by persons in this country, these will be treated in the same manner as if made directly by the communicator.

Canadian Section.

Meeting held at Toronto, on Thursday, April 29th, 1915.

PROF. J. W. BAIN IN THE CHAIR.

MANUFACTURE OF NITRITE OF SODA.

BY JAMES TURNER.

Of the various methods of converting sodium nitrate into nitrite, practical experience has shown that reduction by means of metallic lead is the method best adapted for working on a large scale. The reason is that both lead and saltpetre melt considerably below the temperature required for the reduction, and therefore the two substances can be brought into very intimate contact.

The transference of oxygen from the nitrate to the lead is slow and gradual, and, by proper regulation of the process, the amount of heat developed by the reduction is insufficient to destroy the nitrate completely; this may occur in the reduction with charcoal or calcium or barium sulphide.

Even in the lead process a percentage of nitrate is always converted into caustic soda, but in this case the by-products can be regenerated without difficulty. The lead oxide formed in the process can be converted easily and cheaply into lead.

The nitrite liquor formed in the lead process is so pure that the preparation of a salt containing a high percentage of nitrite presents no difficulties, while in all the other methods the liquors contain a considerable amount of impurity, making it difficult to prepare a pure salt.

The lead used must be a very pure soft lead, containing not more than about 0.2% of other metals. The lead used for sulphuric acid chambers is quite suitable. Less pure lead induces a violent reaction with consequent loss of yield, and produces too stiff a melt.

Commercial sodium nitrate is generally used, and should not contain more than 1% of sodium chloride, otherwise the melt is liable to become stiff. Recrystallised nitrate will give a better yield, but on account of the expense in recrystallising, it is preferable to use the commercial salt.

The reaction is carried out in a shallow cast-iron pan, which has been cast from the best pig iron procurable. Since the bottoms of the pans are heated to a dark red heat, and exposed to rapid changes of temperature, pans which are badly moulded, or cast from inferior iron, will soon crack or produce crevices, wherein the melt will lodge, and cause it to get overheated. The flue should be so arranged that the fire gases pass evenly around the pan.

The melt is mixed by agitators which extend across the pan, the teeth being so constructed that they clean or stir all the particles both from the sides and bottom of the pan. By continuous stirring, the lead is so divided that it offers a large surface to the nitrate. Good and uninterrupted stirring is therefore necessary for the rapid carrying out of the process.

Stirring is also essential because, at a temperature only a little above that at which the reaction between the lead and the nitrate takes place, lead

will act energetically on the pan, and the overheated lead may cause a violent decomposition.

Again, lead oxide is a bad conductor of heat, and therefore, if it were allowed to remain for any length of time on the hot sides of the pan, overheating might easily take place. On this account, the inner surface of the pan must be smooth. The middle of the bottom of the pan is so arranged that no oxide can deposit there.

The action of lead on melted nitrate commences at about 420° C., and it is best to introduce the lead at that temperature. Sodium nitrate melts at 330° C. and lead at 335° C. The temperature is taken by means of a pyrometer, but an experienced man can also tell by the colour of the oxide formed, as well as by the rapidity with which the lead disappears, if the temperature is right.

The charge usually used for the melt pans is 275 lb. of nitrate and 672 lb. of lead. 250 lb. of the nitrate is put into the pan and heated to 420° C., and then 2 cwt. of lead is added in bars of 25 lb. each. When all the lead has disappeared (which can be ascertained by stopping the agitators and taking a sample out of the middle of the pan) a further 4 cwt. of lead is added, 25 lb. at a time, care being taken that all the lead has been oxidised before making a further addition. This will require about 8 hours in all. When the final charge of lead has been oxidised, a further half hour's heating is given and the melt is finished. The temperature must be kept at about 420° C. during the whole operation. The percentage of nitrite in the melt may be ascertained by titration with permanganate.

The 25 lb. of nitrate is held in reserve, to be used for cooling the pan should it get a little overheated.

The melt is now run into water in a long, semi-cylindrical cast-iron box provided with a strong agitator running through the centre. At one end is a series of taps, at different levels, through which the clear liquors are run. At the end of this box are three cast-iron receiving tanks: No. 1 tank receives the strong liquors from 30° B. downwards, No. 2 tank weak liquors, 5° to 0° B., and No. 3 tank receives the lead oxide. The washer is provided with strong iron covers, having a manhole through which the melt is poured. The washer must contain sufficient water to produce a liquor of about 30° B.

The washer is allowed to run for half an hour, and the contents are then allowed to settle. The clear liquor is run off into No. 1 tank, the washer is again filled with water and allowed to run for another half hour, and the liquor run into No. 1 tank, and this is repeated until all the nitrite is dissolved. All liquors down to about 5° B. go into No. 1 tank.

The weaker liquors are run into No. 2 tank, until the melt is free from nitrite, then the agitators are set in motion, water is allowed to run in continuously, the outlet from the washer is opened, and the water is run into No. 3 tank; this washing is continued until all the lead oxide is washed out of the melt. The residue in the washer consists chiefly of metallic lead and higher oxides of lead, and is run into a receiver beneath the washer.

The liquors from No. 1 tank are treated with a little nitric acid to neutralise any caustic soda which has been formed during the melt, and are then blown into the evaporators. The liquor in No. 2 tank, which contains very little nitrite, is used in place of water for washing the next melts.

The evaporators are made of wrought iron and are provided with steam coils. The evaporation is continued until the liquor reaches 44° B., when it is allowed to settle, and then run into crystallising tanks and allowed to crystallise for several days according to the conditions of the weather.

The best crystallising tanks are made of cast iron, about 12 ft. long, 6 ft. wide, 2 ft. deep.

When crystallisation is finished, the liquors are run off and the crystals are taken from the sides and the bottom and piled up in the centre of the tank to drain; they are then centrifuged and dried in a stove. The product contains about 96 to 98% of sodium nitrite. The mother liquor from No. 1 crystals is evaporated to about 48° B. and the liquor crystallised, yielding nitrite of 85% to 90% purity.

The liquors from No. 2 tank are evaporated to about 50° B. to produce a 70% nitrite. The liquors from No. 3 tank are evaporated to dryness and the residue, which contains about 50% nitrate, is used again in the melt pan.

The mass of lead and higher oxides which is removed from the washers is melted and the lead is run into moulds, holding about 25 lb. each, and is used over again.

The lead oxide is removed from No. 3 box in the form of paste, and is dried slowly on a kiln, ground, and dressed; it is put on the market as litharge.

By careful regulation of the above process, 90% of the theoretical yield of nitrite may be obtained.

A process was patented in 1896 (Eng. Pat. 4743) by Dr. Paul and Messrs. Read Holliday and Sons, Ltd., for the reduction of sodium nitrate by means of caustic soda and sulphur. This process has not proved to be so cheap as the lead process, on account of the difficulty in separating the sodium sulphate from the nitrite, and the maximum yield is only 80% of theory.

In this process, 2200 lb. of sodium nitrate and 380 lb. of caustic soda are melted by open fire in a large cast-iron pan fitted with mechanical stirrers; the flue is constructed to allow even distribution of heat around the pan. When the whole is melted, the agitators are started, the temperature is raised to 400° to 420° C., and 120 lb. of sulphur is added very slowly in small quantities. A further 60 lb. of melted caustic soda is then added, and another 20 lb. of sulphur, and these additions are repeated until a total of 896 lb. has been added, including the 380 lb. of caustic which was put in originally and 300 lb. of sulphur. This process usually occupies about 8 hours.

If the sulphur is added too rapidly, serious explosions may occur; even with the most careful working it is impossible to avoid some explosions, due, no doubt, to organic matter coming in contact with the sulphur and nitrate. If the temperature of the melt is allowed to rise too much, the sulphur will be oxidised.

The sulphur is added to the melt by means of a very long iron rod, with flat end, which is manipulated from behind an iron partition.

When the melt is finished, as shown by testing it with permanganate, it is allowed to run for a further hour or so, and is then transferred to a wash box of similar construction to the melt pan, but having a wrought-iron cover. The wash box must contain sufficient water to produce a clear liquor of about 50° B.

As sodium nitrite is more soluble than the sulphate, a large percentage of the sulphate crystallises out, and is separated by means of a vacuum filter covered with burlap, the clear liquor being run into a boiler. The sulphate, which contains a certain percentage of nitrite, is washed once or twice with water, and the wash-water is used in place of water for the next melt. The liquor in the boiler is evaporated to about 44° B.; during this process a large amount of sodium sulphate separates and is removed at intervals by means of long shovels, and put into perforated wooden boxes placed over the evaporators, so that the liquor can drain back. The concentrated liquor is allowed to settle and run off into the crystallisers, and the mother liquors are worked up as in the lead process.

The reaction involved in this process is:—
 $3\text{NaNO}_3 + 2\text{NaOH} + \text{S} = \text{Na}_2\text{SO}_4 + 3\text{NaNO}_2 + \text{H}_2\text{O}.$

Glasgow Section.

Meeting held at Glasgow on Tuesday, 20th April, 1915.

MIL. ROBERT HAMILTON IN THE CHAIR.

A NEW MACHINE FOR THE PREPARATION OF VULCANISED RUBBER FOR ANALYSIS.

BY R. WHEATLEY, B.SC. (LEEDS), A.I.C., AND B. D. PORRITT, B.SC. (LOND.), F.I.C.

When it is required to examine chemically many samples containing rubber as a constituent, the preparation of the material for analysis necessitates special consideration and occupies a considerable amount of time.

In the preparation of any material for analysis the sample must comply, so far as is practicable, with the following essentials:—

(1) It should represent accurately the bulk.
(2) It should be so prepared that it is thoroughly and uniformly acted on by the reagents subsequently employed.

(3) Its preparation should be as rapid and simple as possible, necessitating the minimum amount of skilled supervision and time.

The methods at present available for the preparation of vulcanised rubber cannot be considered as generally applicable or entirely satisfactory when examined from the above stand-points. The explanation for this must be sought in the wide variation in physical properties of the different types of manufactured goods in which rubber forms a constituent, and the differing processes of manufacture and vulcanisation. The material may vary enormously in character from elastic thread to vulcanite; it may be tough, as in the case of band tyres, or crumbly, like an eraser, and may be bulky or flimsy, as exemplified by railway buffers and cut sheet.

A further complication is introduced by the fact that rubber frequently occurs in combination with textile fabrics, from which its separation is often exceedingly difficult and can at the best be effected only imperfectly.

The general analytical processes employed for the chemical evaluation of rubber goods are designed to ascertain the various additions made to the rubber, whether mineral or organic matter, and generally comprise ash determination by gentle incineration, Soxhlet extraction with acetone, and treatment with alcoholic potash to remove saponifiable organic matter, together with the total sulphur determination.

In the preliminary selection of the sample the following points should be kept in view:—

(1) Rubber may retain a considerable amount of moisture, necessitating preliminary drying, which must be carried out so as to preclude the possibility of the formation of resins by oxidation or the loss of sulphur by heating.

(2) On account of the adhesive character of the unvulcanised material, it is customary to dust the surface with French chalk during the manufacturing processes. An undue proportion of surface material will therefore probably result in an excessive result for mineral matter.

(3) In steam- and press-cured articles, sufficient free sulphur is usually present to migrate and "bloom" on the surface. Neglect of this fact may lead to a considerable error in the determination of sulphur.

(4) A varnish or surfacing is employed in certain instances, for example, goloshes and surgical goods, and should be removed before the sample is prepared for analysis.

(5) More than one quality of rubber compound may be employed in making up an article, for instance, the sole, heel and upper of a shoe, and the tube and cover of a hose.

(6) The raw material may not be uniformly mixed and the vulcanisation in thick articles may not be uniform.

Careful selection and preparation of the sample, fine division, and thorough mixing are therefore necessary to ensure reliable analytical results. The great variation in physical properties, shape, and character of rubber goods, however, renders it unlikely that any one device for the reduction of samples to a fine state of division will be uniformly satisfactory. Up to the present the problem has, therefore, received a considerable amount of attention.

Henriques, in his pioneer work on rubber analysis, alludes to the difficulties involved in the preparation of an average sample, and recommends taking numerous sample strips and cutting these into small pieces.

Weber* recommends the employment of a small laboratory mixing mill with uneven speed rolls to grind the material to a flaky condition. He states, however,† "that if the sample consist chiefly of rubber with but little foreign admixture, it cannot be 'crumbed' by filing, and even on the mixing roller may occasionally refuse to break up, forming sheets instead."

Later writers‡ recommend the use of uneven speed mixing rollers followed by grinding in a mortar or coffee mill when dealing with well-cured samples containing about 50% of mineral matter. Ebonite and soft mixings, which they note as failing to respond to this treatment, must be rasped with a coarse file in the one case and in the other finely chopped with scissors.

Schidrowitz draws attention to the fact that oxidation may take place, with the production of resinous matter, if the sample is subjected to long continued mechanical abrasion at high temperature.

A convenient type of laboratory mixing roll of this kind for the preparation of rubber samples is fully described by Archbutt in a recent publication.§

It has been proposed to take advantage of the fact that rubber becomes brittle at low temperatures, by freezing the samples in liquid air and then powdering in a mortar.|| Owing to the rapidity with which the frozen rubber warms up, passing from a brittle to an exceedingly tough condition, and the fact that liquid air is not available to the average analyst, this suggestion cannot be considered generally practicable.

As a result of experience in dealing with a large variety of samples of different qualities, it was decided that rasping was in general the most satisfactory method for the preparation of material for analysis. This is, however, a very tedious process, and it seemed that some mechanical method of abrasion might be adopted in order to simplify the operation. The methods employed in the factory to "buff" rubber goods were considered, and of these a high speed carborundum wheel and a high speed circular steel toothed cutter seemed to give the most promising results.

The employment of carborundum as an abrasive for this purpose was abandoned, owing to the danger of its loss and the consequent contamination of the sample when dealing with vulcanite and heavily compounded qualities, and we endeavoured to modify the arrangement by substituting a circular flat file mounted on the

* Chemistry of Rubber, p. 237.

† Chemistry of Rubber, p. 227.

‡ Schidrowitz, Rubber, p. 255, and Potts' Chemistry of Rubber Industry, p. 121.

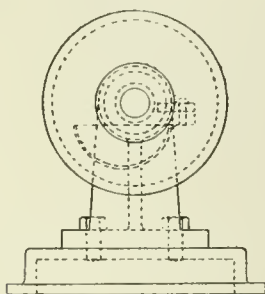
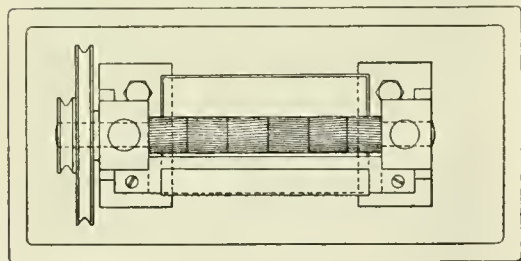
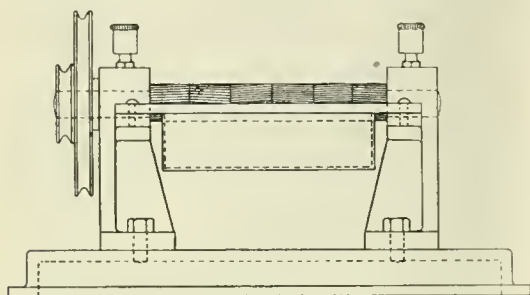
§ Analyst, 1913, 38, 550 (see this J., 1914, 34).

|| Potts' Chemistry of Rubber Industry, p. 53.

rim of a wheel. File-makers condemned the design as impracticable, and on reconsideration the present apparatus was constructed.

The abrasive surface consists of a circular file,* made from a 1-inch diameter rod of file steel, the cutting edges being parallel to the axis. This is mounted in bearings set on a bed plate, and has a double pulley keyed to one end. A small electric shunt-wound motor, of one-eighth H.P., furnishes the necessary motive power to drive the file at 1200—2400 revolutions per min., according to the pulley wheel used. These rotational speeds correspond to peripheral speeds of 314 and 628 feet per minute, respectively.

The rasped rubber falls into a detachable tray placed below the file and supported by a bar running between the brackets.



With this apparatus small vulcanised rubber samples, varying from hard vulcanite to soft pure qualities, may be rapidly and effectively reduced to a fine state of division. For the harder qualities the low speed gives the more satisfactory results, while when dealing with soft material a better result is obtained by increasing the rate of revolution.

As a rise in temperature takes place during the operation and the resultant material is in a finely-

divided condition, it was thought desirable to ascertain whether any alteration took place in the acetone extract, due to oxidation of the rubber or volatilisation of sulphur. Experiments have been made to test this point, and the composition of the rubber was found to be unaltered by the treatment.

With the material in a finely-divided condition there is no difficulty in obtaining a representative sample for analysis.

The acetone extraction is rendered more complete, and the alcoholic potash extraction is made more reliable owing to the state of division being uniform and permitting more thorough penetration by the reagent. This, however, results in certain cases in an increased loss, owing to solution of mineral matter.

From the results of our experiments we draw the following conclusions:—

(1) Small samples of vulcanised rubber may be reduced to a finely-divided condition without alteration in composition.

(2) Care must be taken to protect the finely-divided material from oxidation if not immediately used for analysis, or if preliminary drying is required.

(3) Care must be taken to prevent oxidation during the course of analysis.

It would appear therefore that the reduction of the material to a fine state of division, with the resultant advantages of uniformity of composition and efficiency of extraction, is accompanied by the risk of oxidation.

The present apparatus is ineffective in the case of raw rubber and pure reclaimed rubber; possibly a considerable increase in the speed of revolution might admit of its employment in this field, but, on account of the adhesive nature of the material, the particles would tend to coalesce during subsequent analytical operations and render the preparatory treatment valueless.

Manchester Section.

Meeting held at the Grand Hotel, on Friday, March 5th, 1915.

MR. JULIUS HÜBNER IN THE CHAIR

THE CONCENTRATION OF SEWAGE SLUDGE.

BY J. GROSSMANN, M.A., PH.D., F.I.C.

The disposal of sewage sludge has for a considerable time engaged the attention of those who are interested in the purification of sewage. There is now no difficulty in obtaining a satisfactory effluent, but whatever method of dealing with sewage may be used, the problem of disposing of the sludge has to be taken into consideration, and in the solution of that problem the concentration of the sludge plays an important part.

In general, there should be no difficulty in obtaining a sludge from the settling tanks which contains on an average about 10% of solid and 90% of liquid matter. There are isolated cases of troublesome sludge, owing to local trades, which will not settle to a consistency of more than 5% solids; but in most cases where such abnormally weak sludge is obtained, it is due either to a faulty construction of the tanks, or to faulty work in connection with the emptying of the tanks and the removal of the sludge.

* Makers: Messrs. Alex. Mathieson and Sons, Ltd., Saracen Tool Works Glasgow.

It is evident that even in the simplest modes of disposing of the sludge, which consist in dumping it either on land or into the sea, the concentration of the sludge will affect the cost of disposal very materially.

It is specially important to obtain sludge in the most concentrated form from the settling tanks in those cases where the sludge is carried in boats to the sea, as will be shown further on.

Even where the sludge is submitted to filter-pressing, its original concentration is of some influence on the length of the operation, and therefore to some extent on the cost of the process. I have stated in a previous paper that where lime is used, the most careful experiments show that, taking everything into consideration, a cake containing about 30% of actual dry sludge will cost about 2s. 4d. per ton to produce; calculated on the ton of actual dry sludge, that would come to about 7s. 9d. per ton. If no lime were to be added to the sludge, the cost of filter-pressing would not only be greatly increased, but it would be extremely difficult by that means to get uniform sludge containing 30% of actual dry matter. In many processes dealing with the utilisation of sludge the presence of lime is objectionable and if, therefore, in order to prepare a concentrated sludge for these processes it were necessary to filter-press without lime, considerable additional expense would be incurred.

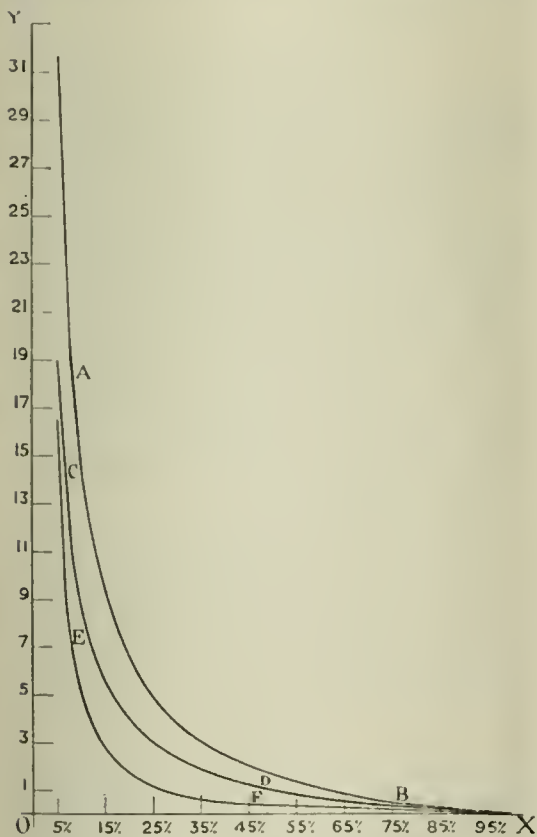


FIG. 1.

Wherever it is desirable to reduce sewage sludge to a state of dryness by means of heat, the amount of water contained in it will determine directly the amount of fuel required for drying, but there is a limit beyond which it may not be worth while to abstract water by purely mechanical means.

In general, if x is the percentage of solid matter and y the amount of water in tons to be evaporated to yield one ton of dry sludge, $y = \frac{100}{x} - 1$. This represents the curve, CD, which is an equilateral hyperbola, with OY as one asymptote and the other parallel to OX but raised up 1 from it, and in which the percentages of solid matter are plotted on the abscissa and the amounts of water to be evaporated on the ordinate. This curve shows that down to a certain point the differences are enormous, and beyond that point they are almost proportionate to the percentage. Suppose that in a properly constructed drying machine one pound of coal will evaporate 6 lb. of water from sludge, and suppose the cost of coal is 10s. per ton, we can plot a curve which shows at once the cost of drying sludge of different percentages. The general formula to this would be as follows:—

If m = price of coal in shillings per ton; n = lb. of water evaporated per ton of coal, and z = cost of evaporating sludge containing $x\%$ of solid matter to dryness,

then $z = \frac{m}{n} \left(\frac{100}{x} - 1 \right)$, and this is represented by the curve AB, in which $m = 10$ and $n = 6$.

If x equals the solid matter in sludge of a certain concentration, x' the percentage of solid matter in another sludge of different concentration, and d the extra cost in evaporating the weaker sludge as compared with the more concentrated sludge, then $d = \frac{100}{x} \left(x - x' \right) \frac{m}{n}$; this is represented by the curve EF, in which $m = 10$ and $n = 6$.

Fig. 1 shows the curves AB, CD, and EF, and the numerical data belonging to them are given in the table.

x Percentage of solid matter.	y Tons of water to be evapor- ated to pro- duce 1 ton dry.	z when $m=10$ and $n=6$ Cost of fuel in shillings at 10s. per ton of coal, 6 lb. water per lb. of coal.	d Differences in shillings in cost.
5	19	31.667	
10	9	15.000	16.667
15	5.67	9.444	5.555
20	4	6.667	2.777
25	3	5.000	1.667
30	2.33	3.889	1.111
35	1.86	3.095	0.794
40	1.50	2.500	0.595
45	1.22	2.037	0.463
50	1.00	1.667	0.370
55	0.82	1.364	0.303
60	0.67	1.111	0.253
65	0.54	0.897	0.214
70	0.43	0.714	0.183
75	0.333	0.556	0.158
80	0.250	0.417	0.139
85	0.176	0.294	0.123
90	0.111	0.185	0.109
95	0.053	0.088	0.097
100	0	0	0.088

It will be seen that whereas the difference in the cost of drying sludge of 5% and 10% solid matter amounts to 16s. 8d. per ton, the difference in drying sludge of 30% solid matter and 35% solid matter only amounts to about 7d. per ton. If, therefore, it would require special apparatus to reduce a 30% sludge to 35%, unless all the costs incidental to this would be less than 1s. per ton of dry matter (which means 2d. per ton of 30% sludge) it would not be worth while to have recourse to that extra operation. The general conclusion to be drawn from these considerations is that on the whole it will not pay to reduce the sludge by purely mechanical means to more than 30% if it has to be subsequently dried by heat. A sludge of 20% even would be economical to dry, and anything

between 20% and 30% would give highly satisfactory results.

These considerations led me to endeavour to find some means by which I could obtain a sludge of 20% or more solid matter by ordinary mechanical means. It is well known that sludge of that consistency can be obtained by draining on sand or cinder beds, but apart from the fact that the sludge obtained would vary considerably in concentration, it would, after draining, have to be removed by manual labour, which is an extremely costly operation, more costly even than that of filter-pressing. It became evident that whatever operation was designed would have to be one which could be carried on automatically by machine power. I constructed a tank on these lines which contained a filtering compartment through which the sludge, which settled in the main part, could drain its superfluous water. After as much of the water as could be drained off had been removed, the concentrated sludge was emptied out of the settling tank by means of a conveyor screw placed at the bottom of the tank and worked from an engine. This arrangement gave fairly satisfactory results, in so far as it was possible to concentrate sludge from 10 or 12% solid matter, or more, to about 17 to 20% of solid matter, but the time occupied was too long. In order to produce this effect the sludge had to settle for a week, and during that time was liable to become partially septicised; cavities would then form in different parts of the mass of sludge and as it is impossible to avoid this septicising of the sludge, which may occur not only in summer but at other times of the year, according to the state in which the sludge leaves the settling tanks, the results obtained in this manner were frequently disappointing. In working drying machines by a continuous and automatic process, which is the only way in which they can be worked where large quantities have to be dealt with, it is of the utmost importance to have material to deal with which is of uniform strength, and the variations produced by the septicising of the sludge were such as, at times, to cause considerable inconvenience to the working of the dryers.

The method which I have described is one in which the sludge settles to the bottom whilst the clear top liquor is automatically drained off through the filtering chamber, i.e., it is a method of settling downwards by gravitation. The question arose whether it would not be possible to find a practicable means of separating part of the water contained in the sludge in such a manner as to make the sludge, so to speak, settle upwards instead of settling downwards, and I found that this object could be attained by means of sulphuric acid. The first experiments were carried out in the laboratory, and I discovered that if sludge from the settling tanks was mixed in the proportion of 1000 parts of sludge to 3 parts of sulphuric acid which had been diluted with water to yield about a 10% solution, and the mixture left standing, a gradual separation took place. At first, after standing for one day, there was a slight amount of almost clear liquor at the bottom, and this separation went on gradually until (after three days) practically one-half of the mass at the bottom was clear liquor, whilst the other half at the top was sludge of nearly double the concentration of the original 10% sludge which had been used for the experiment. It was further found that the sludge thus obtained drained better than the original sludge, and work carried out in the tanks which I had originally designed for the downward settling process, showed that no septic action took place after the treatment with sulphuric acid.

This method for concentrating sludge has now been in use at the Oldham Corporation Sewage Works for more than twelve months, with invariably satisfactory results, and altogether about 80,000 tons of sludge of 19% solid matter has

been treated by it. The composition of the sludge entering the tanks varies from 10 to 13%, and the resulting product fluctuates between 19 and 21% of solid matter. The sludge from the sedimentation tanks is pumped into the patent settling tanks, and in the process of pumping a quantity of sulphuric acid of 148° Tw. (sp. gr. 1.74), previously diluted with about ten times its volume of water, is mixed with it, and the resulting mass left to stand for three days; after that time, the concentrated sludge has separated at the top and the clear water, which is below, is run off through a suitable arrangement of taps. The sludge is left for 24 hours in the tanks for draining, and is then removed by a conveyor screw placed at the bottom of each tank and taken straight from there by means of a bucket elevator into the hoppers of the drying machines, where it is reduced to dryness by means of direct heat. The total cost of the process, calculated per ton of sludge containing 10% dry substance, is as follows:—

Cost of sulphuric acid	0.104s.
" power and labour	0.054s.
Sinking fund charges	0.050s.
	0.208s.
= 2.496d. = 2½d. per ton 10%.	

Calculated on dry substance, it is, per ton, as follows:—

Cost of sulphuric acid	1.04s.
" power and labour	0.54s.
Sinking fund charges	0.50s.
	2.08s.

At the beginning of this year I made further improvements in the construction of my tanks by which I obtain a sludge, on an average, of 26% solid matter. The cost of obtaining 26% sludge is 6½d. per ton.

By adopting a slightly different mode of working, I could obtain a sludge of even higher concentration, up to 30% solid matter, but for the purposes of subsequent drying, there would not be sufficient advantage from a commercial point of view in working for the obtainment of such a concentrated sludge. For the purpose of comparison, it may be stated that the cost of producing sludge of 30% solid matter would be somewhere about 7½d. per ton. As a sludge of this concentration would be equal to the average sludge obtained by filter-pressing without the use of lime, which would cost about 4s. per ton at the least, it is evident that by using my process and apparatus, a saving of over 3s. per ton could be effected, which, in a town of 100,000 inhabitants, would amount to £1,000 per annum.

Equally striking are the figures which we obtain on comparing the present cost of carrying sludge by steamer to the sea with that resulting from the adoption of my concentration process. The average concentration of sludge carried to the sea may be taken at 12½%; it is evident that by concentrating that sludge to 26% its bulk would be reduced more than half, so that a steamer could take in one journey as much as it now takes in two. Apart from the saving in freight charges, there would be a further advantage in places like Manchester and Salford. In these places the steamers in use at present are worked to their fullest capacity and cannot cope with the quantity of sludge which has to be removed. The adoption of my method would do away with the necessity of buying additional steamers which, as they could only be partially employed for some considerable time, would add very greatly to the present cost of sludge removal. The cost of sludge removal in Manchester at present is 9½d. per ton of 12½%; by concentrating this sludge to 26%, the cost would be reduced to 7.68d. per ton. This on a yearly output of 200,000 tons would effect a saving of £1500 per annum.

The most important results of the concentration of sludge by the means which I have indicated will, however, be found in those processes of sludge disposal in which as an incidental part of the process sludge has to be reduced to dryness by heat. It may be said that the preliminary concentration by mechanical means is and will be the fundamental basis of all processes which aim at the production of a material from sludge which is to be used for fertilising purposes, and it is on this account that I have given such special attention to the subject.

I have shown above that where sludge has to be reduced to dryness, it makes little difference in the cost whether we start with a sludge containing 25% solid matter or 30%, but what is of the utmost importance is to ascertain what it costs to reduce the original sludge of 10 or 12½% to 25%. If we compare the different methods which might be used for reducing the sludge to that consistency, we find that in order to produce ultimately one ton of dry sludge it would cost about 12s. to 15s. at least to do this by means of filter-pressing, considerably over 20s. by spreading on filter-beds, and somewhere about 2s. by means of the sulphuric acid process. As the further cost for fuel of producing one ton of dry sludge would be about 5s., the cost of the two items in using my process would be about 7s., whilst the lowest cost in using any other process would be close on 20s. per ton.

It is satisfactory to note that more attention has lately been given to the great importance of utilising the manurial properties contained in sludge. Of course it is evident that as sludge is poor in phosphates and potash salts, it can never be used as a complete manure, but, on the other hand, if properly treated, and if free from grease (which is a highly objectionable constituent), it has been found in practical work to be an extremely valuable fertiliser base on which to build up so-called concentrated manures. Whatever process may be used for producing a fertiliser base from sewage sludge, it is certain that it will necessitate the reduction of the sludge to dryness. Even if there were no other reasons for drying the sludge, the fact that the cost of carriage plays an important part in the manure trade would necessitate it. To the best of my knowledge the method which I have designed for the preliminary elimination of water by mechanical means is more efficient and more economical than any other known method. Even where the sludge is not intended for manurial work but is dumped on the land, it will be found far cheaper to use the settling process which I have described and, if necessary, mix some cinders with the settled product to stiffen it before placing it on the land, than to use either filter-pressing or draining on cinder beds; but it is to be hoped that this enormous waste of material which should go back to the land, and which represents a value of at least £2,000,000 per annum in this country, will not continue indefinitely, and that it will be recognised that sewage sludge is a national asset which should be dealt with by the Government in the interests of agriculture, to which a cheap and efficient manure will be of incalculable benefit.

DISCUSSION.

Mr. F. R. O'SHAUGHNESSY considered that sludge treatment by means of sulphuric acid was an extremely ingenious and interesting process, though he felt doubt as to the results obtainable on a large scale. Some years ago he had conducted experiments with regard to the concentration of sludge by direct gravitation. A tower 20 feet in height and approximately 5 feet in diameter, with apertures at intervals of 2 feet, was used. Experiments were made both with crude sludge and septic sludge, and the results were broadly in agreement with those obtained by Dr. Grossmann at Oldham. With a sludge of

about 10% solid matter, a period of four or five days was required to arrive at the point of maximum concentration of the column of about 83 or 84% water, or about 16 or 17% of solid matter. Also it was found that with the septic sludge used, after the third or fourth day the effect of gravitation was reversed, owing to the development of gas, when the whole operation was ruined. In the end the process did not appear to be practical, though of scientific interest. One very important item, in connection with the treatment of sludge on a large scale by sulphuric acid, was the liquor which was drained off. Dr. Grossmann's diagram indicated that the experiment had worked excellently in the laboratory, but when dealing with tens of thousands of tons of highly acid liquid per annum, a very considerable problem remained to be solved. In concentrating sludge by mechanical means one had a very large quantity of liquor which contained an appreciable quantity of solid matter. Frequently it was convenient to pass the liquor again through the tank system. The whole question was one of economies when one was preparing solid matter for ultimate use in some other process. In a paper read at the International Congress of Applied Chemistry, London, in 1905, Dr. Grossmann referred to 50% concentrated cake when the sludge was pressed, and also to the point that the nitrogenous matter in the sludge was still in the unconverted state, being only very partially affected by the sulphuric acid. That, of course, was a most important matter. There was an enormous loss of nitrogenous matter when it was actually put on the land. He asked what were the actual results obtained in the field, in the case of large-scale experiments, with the products obtained by means of the process under discussion. He could not agree with Dr. Grossmann that the cost of drying sludge on the land would be about 20s. per ton. At the Birmingham sewage works the drying process was actually carried on on a large scale, dealing with hundreds of thousands of tons, for very much less than 20s. per ton. They did not, however, dig the sludge into the land.

Mr. DUCKWORTH thought Dr. Grossmann was modest in allowing 6 lb. of water per lb. of coal. Personally, he was of opinion it would be quite possible to obtain 7 or 8 lb. by evaporation under pressure.

Mr. E. ARDERN agreed that the question of sludge concentration was entirely one of cost and that the comparative costs given for alternate methods of sludge concentration must be accepted with some reserve. In a recent publication by Kershaw, information collected by the Royal Commission on Sewage Disposal was given in tabular form, from which it would be seen that for a representative group of ten towns the average cost of pressing sludge (including cost of lime and capital charges on plant) was 6d. per ton of wet sludge dealt with. It could be assumed that with efficient pressing the moisture content of the sludge would be reduced from 90% to from 50 to 60%, which figure could be compared with the cost given by Dr. Grossmann for reducing the moisture content from 90% to 80% by acid treatment. It was also necessary to know whether the actual volume of sludge was reduced proportionately to the amount of water separated or removed by acid treatment. In his experience this was not the case, owing to the frothing action of the acid, and consequently the removal of say 50% by volume of water did not necessarily mean a reduction by one-half of the sludge to be dealt with. Where acidification was required in the subsequent treatment of the sludge, e.g., in the recovery of grease, etc., he could quite understand the advantage of the preliminary addition of a

small proportion of the total acid required for the purpose of concentration prior to drying or distillation.

Mr. P. GAUNT enquired as to the application of the process, where sludge was disposed of by ploughing into land. Evidently the acid exercised a certain sterilising effect, since septic action was inhibited. How would this affect the subsequent disintegration of the sludge upon the land? Usually a fairly high lime content was maintained in land used for this purpose. A sludge which had been acidified even to a slight degree might prove more resistant to the desired disintegration.

Dr. T. J. I. CRAIG asked Dr. Grossmann what he considered the best method of obtaining the sludge most suitable for the treatment dealt with in the paper. Another point was what became of the sulphuric acid? Was the liquor left acid or was it neutralised in any way by the sludge? Did the addition of acid to the sludge dissolve any valuable constituents such as phosphates?

Dr. BENTLEY inquired whether Dr. Grossmann had tried sodium bisulphate in his process. It was conceivable that a use might be found for this by-product by means of Dr. Grossmann's process.

Mr. S. EVANS asked how much clear liquor was decanted from the bottom of the tank. He suggested that the action might be similar to that which occurred in the separation of some minerals in ore-flotation processes.

Dr. GROSSMANN, in reply, said that the majority of the speakers had referred to the large quantities of acid used, but, as a matter of fact, the acid used specifically for the separation of the sludge was very small, and amounted only to 3 parts H_2SO_4 per 1000 parts of sludge. The acid became practically neutralised, and the liquor which left the tanks was so slightly acid that it was difficult to ascertain its acidity. He wished particularly to emphasise the fact that the results given were not obtained from laboratory experiments, as some of the speakers assumed, but represented facts ascertained on a large scale with all the sludge produced in a town of 150,000 inhabitants over a period of 14 or 15 months, and, so far as he could judge, every sludge would be amenable, or could be made amenable, to the treatment described, no matter how large the town and the quantities to be dealt with might be; he had no doubt that the method could be applied to Birmingham sludge. The liquor which separated from the sludge in his concentration tanks was returned to and mixed with the raw sewage. It only amounted to a small fraction of the total sewage and was beneficial to it, as it contained iron and aluminium salts which had been dissolved out of the sludge by the acid. Although this paper only dealt with the preliminary concentration of sludge and not with his process of grease recovery, he could say, in reply to the question raised, that the de-greased residue produced by his complete process when mixed with suitable other compounds had yielded remarkably good results to farmers. His calculations with regard to the cost of drainage of sludge on cinder beds or similar arrangements were based on the ordinary prices accepted by contractors for excavation work. Considering that it was necessary to dry sludge in such a manner as to prevent over-heating, he considered the result which he obtained, i.e., of evaporating 6 lb. of water with 1 lb. of coal, as highly satisfactory; if the operation were to be carried out under pressure, the temperature would be higher and grease would be destroyed; there would be also great mechanical difficulties, which would render the apparatus too complicated and expensive. The points raised with regard to filter-pressing had been fully dealt with in his paper "Notes on Sewage Sludge and Its Disposal" (this J., Jan. 15, 1912).

In that paper he showed, on figures published by Mr. A. B. Ogden, the then Manager of the Main Sewage Works of the Manchester Corporation at Davyhulme, that the cake which he (Mr. Ogden) assumed contained 50% of solid matter and cost 2s. per ton to produce, could not possibly have contained more than 27.3% of actual sludge, and that the cost of filter-pressing would have been nearer 4s. than 2s. per ton of cake, and probably, taking all matters into consideration, 7s. 4d. per ton of actual dry sludge. He wished again to point out that for purpose of calculations of cost in concentrating or removing sludge by different methods, it was absolutely necessary to reduce the figures to dry actual sludge. There was no perceptible increase in the volume of the sludge caused by treatment with acid although an evolution of gas took place. When mixed with acid, the sludge could remain in the tanks for five or six days without becoming septic, but he could not say whether if spread on the land afterwards it would retain that property. The Oldham sludge was obtained by ordinary sedimentation, and occasionally also a small quantity of aluminio-feric was added to it. There was no doubt that sodium bisulphate (nitrecake) could be used instead of sulphuric acid if, including carriage, etc., the available acid in it could be obtained as cheaply as commercial vitriol.

New York Section.

Meeting held at Rumford Hall, Chemists' Building, on Friday, April 23rd, 1915.

MR. G. W. THOMPSON IN THE CHAIR.

PAINT VEHICLES AS PROTECTIVE AGENTS AGAINST CORROSION.

BY MAXIMILIAN TOCH.

A careful search of the literature of the past twenty years has failed to reveal anything like a systematic investigation of the relative value of different vehicles used in the manufacture of paints for structural steel and the prevention of corrosion. There are a few isolated cases in which boiled linseed oil,* Kauri linseed oil varnish† and spar varnish as protective coatings on structural steel were studied. For many years past much has been written and many investigations have been made on the protective quality of the pigments, but no one has apparently made any study of the vehicles.

It is quite obvious that without a vehicle a pigment is useless, and I know of no instance where a pigment could be used alone, with perhaps the single exception of Portland cement, if that may be classed as a pigment, and, then, Portland cement would be useless unless water is used as a vehicle.

To examine the comparative values of the various vehicles, exposure tests were made in 1913, in which fifty-two steel plates were carefully freed from grease by washing with benzol, dried, sanded, and rubbed clean with pumice, and then coated with the vehicle. Fifty-two paint vehicles or protective vehicles were examined, many of which, of course, are seldom, if ever, used alone, and some of which are failures a short time after they are put on. However, I wished to make the investigation

* C. Von Kreybig, *Farben-Zeit.*, 17, 1766-8. J. N. Friend, Carnegie Scholarship Report, Iron and Steel Inst., May, 1913, 1-9.
† Address of Prof. A. H. Sabin before American Society of Civil Engineers, Nov. 4, 1896 (*Engineering News*, July 28, 1898).

Inspection Report on Steel Plates exposed December 8th, 1913.

Pl. No.	Coating.	April 14th, 1914.	December, 1914.	April, 1915.	Value.
1	Raw linseed oil	Completely rusted	Completely corroded	Completely corroded	1
2	Raw linseed oil plus 10% linoleate drier	About $\frac{1}{2}$ rusted	Badly rusted along edges; partly protected in middle	Completely corroded	1B
3	Raw linseed oil plus 10% Japan drier	Slight rusting	(1) Slight rust along edges; fairly protected over rest of film (2) Badly rusted along edges; partly protected in middle	Completely corroded	1B
4	Raw linseed oil plus 10% Japan drier	Almost completely rusted	Almost completely corroded	Completely corroded	1
5	Japan drier	Completely rusted	Completely corroded	Completely corroded	1
6	Menhaden oil plus 10% Japan drier	Completely rusted	Completely corroded	Completely corroded	1
7	Menhaden oil	Almost completely rusted	Completely corroded	Completely corroded	1
8	Soya bean oil	Completely rusted	Completely corroded	Completely corroded	1
9	Soya bean oil plus 10% light drier	About $\frac{1}{2}$ rusted	Much corroded on upper half, free from rust on lower half	Completely corroded	1B
10	Soya bean oil plus 10% linoleate drier	About $\frac{1}{2}$ rusted	Much corroded on upper half, free from rust on lower half	Completely corroded	1B
11	$\frac{1}{2}$ raw oil, $\frac{1}{2}$ menhaden oil plus 10% linoleate drier	About $\frac{1}{2}$ rusted	Much corroded on upper half, free from rust on lower half	Completely corroded	1B
12	$\frac{1}{2}$ raw oil, $\frac{1}{2}$ soya bean oil plus 10% linoleate drier	About $\frac{1}{2}$ rusted	Badly rusted $\frac{1}{2}$ way down; fairly good on lower fourth of plate	Completely corroded	1B
13	Perilla oil	Completely rusted	Completely corroded	Completely corroded	1
14	Perilla oil plus 10% Japan drier	Almost completely rusted	Completely corroded	Completely corroded	1
15	Petrolatum	Much dirt, slight rusting	Collected much dirt; but well protected from rust	Still very good	4
16	Spar varnish	No rusting	Slight rusting	Unchanged; very good	5
17	Turpentine substitute	Completely rusted	All corroded	All corroded	1
18	Anhydrous pine oil	Completely rusted	All corroded	All corroded	1
19	Benzine	Completely rusted	All corroded	All corroded	1
20	Turpentine	Completely rusted	All corroded	All corroded	1
21	Paraffin oil	Completely rusted	All corroded	All corroded	1
22	Bodied linseed oil and turpentine substitute thinner	No rusting	No rusting	Unchanged; very good	5
23	Bodied linseed oil and turpentine substitute thinner	No rusting	Very slight rusting	Unchanged; very good	5
24	Pyroxylin lacquer	Completely rusted	All corroded	All corroded	1
25	Celluloid solution	Completely rusted	All corroded	All corroded	1
26	No. 38 China wood oil varnish	Slight rusting	Rusted appreciably under whole film	Rather badly corroded	2
27	No. 5 copal, China wood oil varnish	No rusting	No rusting	Rather badly rusted	2
28	No. 6 copal, wood oil varnish	Slight rusting	Rusted much over whole plate	All rusted	2
29	No. 39 China wood oil varnish	Slight rusting	Rusted under whole film to small extent	All rusted	2
30	Steam cylinder oil	Completely rusted	Completely corroded	All rusted	1
31	Gear case oil	Much dirt; slight rusting	Collected very much dirt; shows but little rusting	Still protected	4
32	Blown linseed oil plus turpentine	Slight rusting	(1) Slight rusting in few spots (2) Badly rusted all over	—	2
33	Kerosene oil	Completely rusted	Completely corroded	Completely corroded	1
34	Raw oil plus 2% cobalt drier	About $\frac{1}{2}$ rusted	Rusted badly $\frac{1}{2}$ way down	Completely corroded	1B
35	Raw China wood oil	About $\frac{1}{2}$ rusted	Almost completely corroded	Completely corroded	1
36	$\frac{1}{2}$ raw oil, $\frac{1}{2}$ raw China wood oil	About $\frac{1}{2}$ rusted	Badly corroded $\frac{1}{2}$ way down	Completely corroded	1
37	Blown linseed oil, turpentine substitute, 10% linoleate drier	Slight rusting	Partly rusted in quite a few isolated spots	All corroded	2
38	Raw oil, 10% paraffin oil, 10% Japan drier	About $\frac{1}{2}$ rusted	Badly rusted $\frac{1}{2}$ way down	All corroded	1B
39	China-wood-oil rosin varnish	No rusting	No rusting; very good	Badly corroded	3
40	$\frac{1}{2}$ heavy boiled linseed oil, $\frac{1}{2}$ raw oil	No rusting	No rusting; very good	Badly corroded	3
41	$\frac{1}{2}$ spar varnish, $\frac{1}{2}$ stand oil	No rusting	No rusting; very good	Still good	5
42	80% raw oil, 15% spar varnish, 5% linoleate drier	No rusting	Rusted a little along upper edge and in several other spots	Badly rusted	3
43	$\frac{1}{2}$ raw oil, $\frac{1}{2}$ No. 6 copal wood oil varnish, 5% Japan drier	No rusting	No rusting; very good	Badly rusted	3
44	$\frac{1}{2}$ heavy boiled linseed oil, $\frac{1}{2}$ menhaden oil, 5% Japan drier	No rusting	Very slight rusting	Badly rusted	3
45	$\frac{1}{2}$ heavy boiled linseed oil, $\frac{1}{2}$ soya bean oil, 5% Japan drier	No rusting	No rusting; very good	Badly rusted	3
46	Kettle boiled oil	No rusting	Practically no rusting	Still very good	5
47	Pale refined varnish oil	Completely rusted	Completely corroded	All corroded	1
48	Pale refined linseed oil	Completely rusted	Completely corroded	All corroded	1
49	80% wood oil, 10% No. 38 China wood oil varnish, 10% Japan drier	No rusting	Practically no rusting	Corroded	3
50	90% raw oil, 10% paraffin oil, 1% cobalt drier	No rusting	Somewhat rusted on top; perfectly good at bottom	Still good	5
51	95% spar varnish, 5% petrolatum in turpentine substitute	No rusting	Slight rusting underneath film along edges	Still good	5
52	China wood oil, heated with Tox-tungate and thinned with benzine	No rusting	No rusting at all; very good	Still very good	5

as complete as possible, and for this purpose I selected the same quality of steel, known as cutlery steel, which rusts very rapidly, and which I have been using for many years for exposure tests.

Those plates which have shown no rusting in the year and five months that they have been exposed must be eliminated, since they were coated with the paraffin or machinery oil compounds, and an engineer would not coat steel with paraffin compounds, because the cleaning before the application of any good paint would have to be very carefully carried out, as no protective paint would hold on steel coated with a paraffin base unless it were entirely removed. Then the paraffin, or non-drying oils, all collect a great deal of dirt, and would have to be entirely removed before any paint could be applied.

Plate No. 41 showed excellent results, and a material of this kind would not be so very expensive where engineers demand that steel be coated with a clear liquid in the shop so that the steel may be inspected in the field. This was composed of half spar varnish and half "Stand oil" which is practically a polymerized linseed oil. Linseed oil when heated to 550° with a drier like Japanner's Brown or borate of manganese will produce a very thick viscous liquid, which is largely used as a patent leather finish. This can be reduced with 50% of thinner and still have the fluidity or viscosity of raw linseed oil, and is therefore inexpensive.

Plate No. 50 was coated with a material containing 10% of paraffin oil, which might be classed as an adulterated linseed oil, and while it showed up very well, it could not be recommended because on an exposed structure, like a bridge, a coat of good protective paint would not adhere very thoroughly.

Plate No. 52 was treated with raw China wood oil which had been heated sufficiently to take 10% of a tungate drier, and then thinned with 15% of benzine. This made a material which is hardly more expensive than good boiled linseed oil, and left a most excellent surface for re-painting. In fact, this has proved itself the equal of plates No. 22 and No. 23, and also offers a better surface for re-painting.

Plate No. 46 was coated with kettle-boiled linseed oil, and is very good, but this material might be regarded by some engineers as too expensive for application, as it took all day to make this oil. A carefully selected linseed oil was chosen to start with, to which was added 5% of litharge and no other drier. This oil dried very slowly, but produced a good flexible film which lasted. This must not be confounded with the average boiled linseed oil of commerce.

The various coatings used in these exposure tests (see table on page 593) have been divided according to their protective value into five classes:—

1 and 1B. This class includes those vehicles which have little or no value for the prevention of rusting. It contains:—

(A) The raw and refined drying and semi-drying vegetable oils. (Plates Nos. 1, 7, 8, 13, 35, 36, 47, 48).

(B) The same oils to which 10% of drier has been added (Plates Nos. 2, 3, 4, 6, 9, 10, 11, 12, 14, 34).

(C) The more or less volatile paint thinners (Plates Nos. 17, 18, 19, 20, 33).

(D) Solutions of celluloid and pyroxylin (Plates Nos. 24, 25).

(E) Paraffin oils liquid at room temperature (Plates Nos. 21, 30).

2. Here have been included those vehicles which showed some degree of protection, though not very much at best.

(A) Wood-oil-varnishes containing a certain percentage of rosin (Plates Nos. 26, 29).

(B) Copal-wood-oil varnishes (Plates Nos. 27, 28).

(C) Varnishes made from linseed oil which have been thickened and oxidized by blowing with air, oxygen, or ozonized air (Plates Nos. 32, 37).

This compared with the results obtained below with cooked-oil varnishes proves conclusively that the film yielded by a blown oil is not nearly as waterproof and resistant to severe weather conditions as that formed by a boiled or polymerized oil.

3. This class includes the varnishes or varnish mixtures which protected the steel very nicely as long as weather conditions were not severe and temperature changes not very rapid and pronounced. (Plates Nos. 39, 40, 42, 43, 44, 45, 49).

4. To this class belong the semi-solid and solid paraffin oils. These show a very high degree of protection from rusting. (Plates Nos. 15, 31.)

5. Here we have set down the varnishes and vehicles which afford a high degree of protection against corrosion. To be put in this class a material must be extremely water-proof, it must dry with a film which is very elastic and yet tough in order to be able to withstand "weathering." A film which cannot remain intact against condensed moisture, snow, and ice and despite comparatively wide and sometimes rapid changes in temperature (as between day and night even in rather warm climates) will of necessity afford very little protection for the steel to which it is applied.

As the table shows this class comprises:—

(A) Spar varnish (Plate No. 16).

(B) Varnishes made from linseed oil or China wood oil, which has been thickened by a heat process (Plates Nos. 22, 23, 52).

(C) Open kettle-boiled oil (Plate No. 46).

In plate No. 50 we find a rather anomalous case. It seems that raw linseed oil which has been dried with a small percentage of a liquid paraffin oil proved to be an excellent coating for rust prevention.

The addition of any paraffin or non-drying oil, even in such a small quantity as is shown in Plate No. 50, is dangerous in case repainting becomes necessary. Although I cannot yet state definitely whether linseed oil and paraffin oil dissolve in each other, my idea at present is that, although they apparently make a clear solution, separation takes place. I have made several experiments, and find that a film of linseed oil which contains paraffin oil in some quantity, when apparently dry shows minute globules of paraffin oil in liquid form when the film is heated above 100° C. A film of linseed oil containing 10% of paraffin oil after it is six months old can be shown to contain uncombined paraffin oil by extraction with naphtha. These experiments prove conclusively that it is dangerous to mix a paraffin oil with linseed oil for any purpose, excepting where it is not necessary, or not the intention, to repaint subsequently.

DISCUSSION.

THE CHAIRMAN asked whether the oil which gave such good results was a kettle-boiled oil or a commercial boiled oil, and what was its gravity?

Mr. TOCH replied it was a kettle-boiled oil which he had made himself; he did not know its exact gravity, but was sure it was over 0.980.

Mr. R. H. GAINES confirmed Mr. Toch's statement that heavy paraffin oil protected steel against rust but collected dirt and cinders in the meantime.

Mr. F. S. Low asked whether Mr. Toch had any data on the viscosity of these oils previous to their being applied, for it appeared to him that the value of the oil depended upon the thickness of the coating, and that was probably why the kettle-boiled oil (panel No. 46), and the boiled China wood

oil with the tungate drier (panel No. 52) produced such good results.

Mr. TOCH agreed that the thickness of the coating was in direct ratio to its protective quality, provided it had a protective quality to start with, and assuming, of course, that it was a drying oil. He had not made any measurements of the thickness of the various films, but those that gave good results showed an appreciable thickness of film.

Prof. A. H. SABIN said that a shop coat of linseed oil for bridge work had not entirely gone out of use. There were several different reasons for applying it. The structural metal, as received from the shop, was covered with mill scale. Sooner or later it would come off, carrying with it any paint that had been applied. The shop coat of linseed oil was applied, and the bridge erected; the mill scale was allowed to rust off, and then the bridge was thoroughly cleaned and painted. On another railroad a shop coat of linseed oil was applied, the bridge erected and then painted by the company's painters. Others held that a shop coat of linseed oil enabled the inspector to see whether the rivetting, etc., had been properly done, better than when the work had been painted. The question was whether it was possible to get a vehicle that would work more easily than linseed oil and could be sold at a suitable price.

Mr. STEVENSON said that in the erection of steel the shop coat was almost always torn off in the rough handling it received. It cost more to apply a coat of paint in the shop than it did in the field. Linseed oil gave protection for four or five months, and that was as long as was necessary, and had given very good results except in one or two cases.

Yorkshire Section.

Meeting held at Leeds, on Monday, April 19th, 1915.

MR. F. W. RICHARDSON IN THE CHAIR.

NOTE ON THE BEHAVIOUR OF SOME OILS AND FATTY ACIDS IN MACKEY'S CLOTH OIL TESTER.

BY WILLIAM McD. MACKEY.

In the discussion on the paper by Hyland and Lloyd, "The Oxidation of Oils and Fatty Acids"

(see this Journal, 1915, 62—65), I pointed out that when considering the indications given by such an instrument as the Cloth Oil Tester it should be remembered that one was dealing with the oil in very intimate contact with cotton wool, and that probably the action between the oil and the cotton had something to do with the result. I suggested experiments in which the oil should be spread on some inert substance such as glass wool.

Subsequently Mr. Miller, my assistant, pointed out that experiments had already been made on these lines, and looking back over the laboratory note-books we found that some work had been done in 1895—96. These experiments are now described, together with some experiments made since the meeting already referred to; and they do not bear out the opinion I then expressed. At any rate the heating proceeds rather more rapidly when slag or glass wool is used instead of cotton wool (see Tables 1 and 2).

Tables 3 and 4 deal with oils tested in the usual way in the Oil Tester—that is, spread on cotton wool—and are given to show that the iodine value alone does not give reliable indication as to the behaviour of an oil as regards liability to induce spontaneous heating when spread on fibre.

Table 3 gives the results of experiments on hardened cottonseed oil (samples kindly given by Dr. Armstrong, of Messrs. Joseph Crossfield & Sons, Ltd., Warrington), and are of some interest apart from the question of iodine value, etc.

It will be noted in the case of the "semi-hardened" oil that the free fatty acids "cracked out" and dried (containing any unsaponifiable matter present) give a decided rise of temperature in the Oil Tester, whilst the oil does not; the point of interest is that the iodine value of the free fatty acids is not substantially higher than that of the neutral oil. It will be noted further that the free fatty acids from the cottonseed oil "hardened nearly to saturation" (as described by Dr. Armstrong) do not give any rise of temperature. The iodine value of these was found to be 2.5 (determined by Dr. Ingle). The neutral oil itself was not tested in the Oil Tester, it being presumed to give no rise in temperature.

In Table 4 we have two oleines of similar composition as regards unsaponifiable matter and free fatty acids, and similar iodine value, showing a decided difference in behaviour in the Oil Tester—A (iodine value 81.8) giving no rise, B (iodine value 87.5) showing a very rapid rise, being evidently a distinctly dangerous oil as regards liability to induce spontaneous heating when spread on fibre.

TABLE 1.

	1h. 0m.	1h. 15m.	1h. 30m.	2h. 0m.	Maximum	h. m.
Same sample {	Olive oil on cotton wool	95° C.	—	99° C.	103° C.	105° C. in 3 0
	" " wool	92.2° C.	98° C.	101.7° C.	105° C.	109.8° C. " 4 45
Same sample {	" " slag wool	101° C.	104° C.	105.8° C.	109° C.	111° C. " 3 50
	" " cotton wool	96.5° C.	98.5° C.	100° C.	104° C.	Experiment stopped
Same sample {	" " glass wool	102° C.	108° C.	115.5° C.	—	129° C. in 1 55

TABLE 2.

	1h. 0m.	hrs. min.	
Same sample {	Raw linseed oil on cotton wool, typical of a number of experiments	110° C.	200° C. in 1 11
	Raw linseed oil on slag wool	—	200° C. " 0 43
	Boiled linseed oil on slag wool	—	200° C. " 0 28
	Cottonseed oil on cotton wool	110° C.	200° C. " 1 10
Same sample {	" " slag wool	173° C.	191° C. " 1 10
			Thermometer withdrawn
			" " "
			" " "
			Temperature began to fall after 1 hour 15 min.

NOTE.—In the case of the slag wool 32 grms. was used and in that of the glass wool 28 grms.

TABLE 3.

	1h. 0m.	1h. 15m.	1h. 30m.	2h. 0m.	
Semi-hardened cottonseed oil on cotton wool, iodine value 77.6	95.2° C.	96° C.	96.8° C.	97.2	Experiment stopped
Fatty acids from above sample on cotton wool, iodine value 79.4	111.3° C.	118° C.	—	—	202° C. in 1 hour 24 min. Thermometer withdrawn
Fatty acids from hardened cottonseed oil on cotton wool ("hardened nearly to saturation")	93.5° C.	95.3° C.	96° C.	96° C.	Experiment stopped

TABLE 4.

	1h. 0m.	1h. 15m.	1h. 30m.	2h. 0m.	2h. 15m.	
Oleine "A" on cotton wool, iodine value 81.8	95° C.	96° C.	96.8° C.	97.6° C.	98.8	Experiment stopped
Oleine "B" on cotton wool (similar to above as regards unsaponifiable and free fatty acids) iodine value 87.5 ..	107° C.	222° C.	Thermometer withdrawn			

DISCUSSION.

Mr. F. W. RICHARDSON said that the iodine value of an oil was apparently not so reliable a factor as he had thought in regard to oxidation. In his opinion it was a question whether oxidation under ordinary conditions was comparable with oil tested in the Cloth Oil Tester. His experience was that, all things being equal, the iodine value indicated fairly well the increase of viscosity and the oxidation changes which would take place when an oil was exposed at the ordinary temperature.

Dr. H. INGLE said that Mr. Mackey's results proved that the heating of oils in the Tester, and presumably on the wool, etc., depended upon the surface of oil exposed to the air and not upon any action of the oil upon the fibre. It would be interesting to compare these surfaces of cottonwool, wool, and glass wool, but it was clear that the animal and vegetable fibres might absorb oil into their mass and so reduce the surface layer of the oil exposed. That would explain why in some cases a greater rise in temperature was recorded upon glass wool than on cotton wool, since glass wool was impervious to oil.

The experiments with boiled linseed oil showed the effect of a drier increasing the rate at which the oil would absorb oxygen. The rise in temperature in all cases must depend upon the rate of the oxidation, and the experiment with boiled linseed oil illustrated that point admirably. The iodine value (which, taking all in all, was one of the best tests) only gave the amount of oxygen that might be absorbed, not the rate at which it would happen. He (the speaker) had shown that the acids of linseed oil took over twenty months to dry (this Journal, 1913, p. 639), while the glycerides would dry in a few days, although the iodine value of the acids was higher than that of the glyceride. The same applied to the ethyl esters, as had been shown by himself and also by Dr. Lloyd. However, the actual amount of oxygen absorbed by the acids and ethyl esters was only half that absorbed by the glycerides.

It was the rate of oxidation which determined the rise in temperature, for even if the actual oxygen absorption, measured by direct weighing or by the iodine value, were great, if the rate of absorption were slow, the heat generated was dissipated and no great rise in temperature resulted.

Reverting to the differences in the results which Mr. Mackey had obtained with the free acids and their glycerides, great difficulty was found in explaining this. One suggestion he (the speaker) offered was that decomposition of the peroxide of an acid (at the temperature of the tester) by the formation of alcoholic or aldehydic groups in the

presence of the free acid might give lactones, while these could not be formed from the glycerides. Whether the formation of lactones would give rise to sufficient heat to cause the marked increase in temperature noted by Mr. Mackey was doubtful. Water would aid in the decomposition of the peroxides and the formation of hydroxyl groups, and it had been shown by both Mackey and Lloyd (this Journal, 1915, p. 62) that moisture increased the heat developed in the tester.

He did not think that any appreciable polymerisation of ordinary oils took place below 500° F.

Mr. W. RUSHBY said that when slag wool was used in the Tester, no moisture was present, but if wool or cotton wool were used moisture would be present during the testing, because moisture was naturally present in wool up to 15% and cotton up to 8%.

Mr. RICHARDSON said that his experiments bore out Dr. Ingle's statement. If a level surface were used, the oxidation was proportional to the area of the surface. That was the reason slag wool gave higher results than either wool or cotton wool.

Dr. L. L. LLOYD said that he had carried out some experiments similar to those of Mr. Mackey's. The materials were all thoroughly scoured with benzene, water, and a little potash soap made from stearic acid, then washed with water and air-dried. The method of mixing with the oils and the compactness of the oiled material were approximately similar. The results are given in the following table:—

Oil.	Fibre material.	Max. temp.	Time for max. temp.	Decrease in iodine value.
Olive I.v. 86.8	Glass wool	190° C.	5h. 45m.	37.2
	Cotton "	190° C.	5 40	36.0
	Wool	195° C.	6 15	43.6
Cotton seed I.v. 108.7	Silk	185° C.	6 30	35.1
	Glass wool	200° C.	1 15	36.8
	Cotton "	210° C.	1 15	35.2
Cotton seed hydrogenated I.v. 35.0	Wool	203° C.	1 20	40.3
	Silk	196° C.	1 15	37.1
	Glass wool	96.3° C.	5 30	3.2
Olein 70% I.v. 83.2	Cotton "	95.8° C.	5 30	1.8
	Wool	97.3° C.	5 30	1.8
	Silk	96.1° C.	5 30	1.6
	Glass wool	98.2° C.	5 30	7.9
	Cotton "	96.5° C.	5 30	6.8
	Wool	97.3° C.	5 30	7.3
	Silk	96.8° C.	5 30	6.0

The product extracted from the wool containing the olive oil, after heating in the Mackey Tester, was very dark and was found to contain sulphur, which was no doubt obtained by the decomposition

of the wool. Similarly the cottonseed oil product extracted from the wool also contained sulphur.

From the above figures it appeared that the nature of the material upon which the oil was spread was of little consequence as regards oxidation. It was, however, different where oxidisable oils were exposed, when heating effects took place, because wool, silk, and inert materials did not fire, but cotton fired and burned fairly easily, the cotton charring at about 180° upwards.

Olive oil exposed to the oxidising action of air, when treated in the Mackey Tester, did not show any appreciable heating effect. The oil, however, became oxidised, and after extraction had decreased in iodine value; the oil was also somewhat thicker. If, however, the material were left in the Mackey Tester for about 4 to 5 hours, then the heat produced by oxidation or other causes became apparent and the rise in temperature took place quickly. If olive oil were exposed to the air at ordinary temperature, the absorption of oxygen took place so slowly, that after three years' exposure, in a thin film, the iodine value was reduced only by about 4 to 5%. That the iodine value did not govern the liability to oxidation and firing was proved from the following experiments in the Mackey Tester. Fatty acids of iodine value 77.8 registered 99.5° C. after five hours' treatment in the Tester, ethyl oleate (pure) of iodine value 75.6 registered 213° C. in five and a half hours, the ethyl oleate rising at first extremely slowly and finally very rapidly.

Mr. J. HYLAND, referring to the paper of Hyland and Lloyd, said that by oxidising oils on quartz at 50° C., until a maximum gain in weight was reached, a decrease in iodine value resulted very similar to that found after the oil had been through the Mackey Tester. Ethyl oleate gave a decrease in the tube of 31.4 and in the Mackey Tester 30.8. Also those oils with which a theoretical increase in weight was not reached on account of the decomposition of the oxidation products, were found to be more dangerous when tested in the Mackey Tester; and this, coupled with the fact that moist air was shown to aid in the decomposition of the oxidised oils, and particularly of the fatty acids, probably helped to explain why moist air should aid in the firing of the oils when on the fibre. That the nature of the fibre is of some importance from a firing standpoint was shown from the treatment of "Black Oil Cake," obtained in the Heavy Woollen District. Cake containing cotton fibre could not be stored without risk of firing, whereas cake free from cotton fibre might be stored for a considerable period.

Communications.

A SIMPLE INSTRUMENT FOR THE DETERMINATION OF VISCOSITY.

BY ALAN SPEEDY.

In the determination of viscosity by the aid of viscometers of the Ostwald type, it is customary to immerse the whole apparatus in a medium of high boiling point. The use of a fairly large quantity of some oil or wax transparent at the temperature of observation is thereby necessitated.

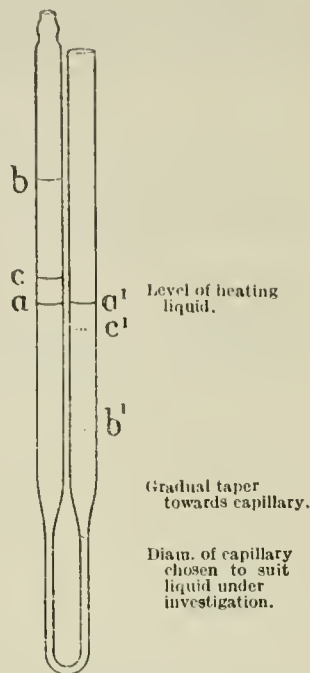
In the simple instrument described below, all difficulty in reading the marks is avoided by placing them above the surface of the liquid, which, therefore, need not be transparent and of which only a moderate quantity is required.

The instrument consists of a piece of glass

tubing drawn out to form a capillary and bent into U shape, as shown in the figure.

The liquid of which the viscosity is to be determined is filtered into the viscometer, which is clamped vertically in the bath so that the level

Rubber tubing
connected here.



Two-thirds scale.

marks, aa' , are just above the surface of the heating liquid. The bath is now heated to the required temperature and after a few minutes the levels, aa' , are carefully adjusted. By means of a piece of rubber tubing the liquid is then slowly sucked up the left limb of the tube until it passes the level, b . It is then allowed to descend. The time taken to fall from b to c is recorded on a stop watch, and the experiment repeated as a check.

Part of the liquid under observation is above the surface of the heating liquid and is, therefore, at a slightly lower temperature, but as the level falls, this part of the liquid regains its former temperature. The error due to unequal viscosity in different regions arising in this way is negligible. It is only the viscosity of the liquid in the capillary tube that counts. The thinness of the wall of the capillary tube ensures that the liquid passing through the tube is at the temperature of the bath. It should be observed that the column of liquid, bc , never reaches the capillary. The level, b' , is well above the point where the constriction in the right limb of the tube begins. The time of flow is taken from b to c only, because on approaching a the motion becomes slow and uncertain.

The constant of the instrument can be obtained by calibrating it with pure phenol (see A. E. Dunstan, *this J.*, 1912, 34, 1063) or sulphuric acid (see *Proc. Chem. Soc.*, 1914, Vol. 80).

The instrument may conveniently be strapped to a thermometer and suspended in the heating liquid, which is contained in a boiling tube. The cheapness of the apparatus renders it possible to choose from a range of tubes one with a capillary of diameter best suited to the viscosity of the liquid which is to be investigated. The best results are obtained if the time of flow is about 1—2 mins. at the temperature of observation.

As an illustration of the degree of accuracy that may be expected from this form of viscometer, the examples contained in the table below are given.

Six oils, of which five were kindly supplied by Messrs. Ragsine and Co., were tested for viscosity in the instrument just described, and also, for the sake of comparison, in two other forms of viscometer, of which one is the totally immersed type,* and the other the well-known Redwood form.

Knecht's process of titration with titanous chloride (J. Soc. Dyers and Col., 1905, 21, 3—6; see this J., 1905, 154) to determine the amount of fading and washing out, etc., of a series of azo dyes, but after numerous trials it was abandoned. It was thought that probably the titanous chloride is so strong a reducing agent that under the conditions of the titration it to some extent decomposes the water of the solution or the carbon dioxide atmosphere in which the reduction is carried out.

Sample.	Nominal sp. gr.	T°	η Dunstan.	η New type.	Secs. Redwood.	Closed flash pt.°F.
Genuine refined pale East Indian rape oil	0.910	60° F. 70° F. 140° F. 200° F.	— 0.7680 0.1864 0.0815	— 0.7669 0.1872 0.0818	535 312 98 55	
American pale oil A.	0.909	70° F. 140° F. 200° F. 250° F.	0.7600 0.1230 0.0497 0.0283	0.7592 0.1224 0.0495 0.0283	348 69 41 34	390
American pale oil B.	0.908	70° F. 140° F. 200° F. 250° F.	— 0.1580 0.0583 0.0328	— 0.1575 0.0578 0.0327	490 80 45 36	400
Russian pale oil	0.908	70° F. 140° F. 200° F. 250° F.	— 0.2624 0.0853 0.0421	— 0.2611 0.0859 0.0423	1235 134 53 40	384
Neptune brand lubricating oil	0.850	150° C. 180° C. 200° C.	0.0718 0.0450 0.0348	0.0714 0.0452 0.0355		
Shale oil distillate	0.840 to 0.860	40° C. 80° C. 100° C.	0.0316 0.0145 0.0114	0.0319 0.0149 0.0117		

The readings of the first two instruments agree within the limits of experimental error. At 140° F. it will be seen that Redwood seconds may be obtained approximately by multiplying these readings by 500.

It is believed that the extreme simplicity of the instrument, and the increased accuracy due to choice of a suitable capillary, as well as its convenience in use, may recommend it to all who have measurements of viscosity to make.

THE USE OF KNECHT'S PROCESS FOR DETERMINING THE FASTNESS OF DYES TO LIGHT AND OTHER AGENCIES.

BY ARABINDA SIRKER.

In a previous investigation carried out in this laboratory (Watson, Sirker, and Dutta, this J., 1911, 30, 6—9) an attempt was made to use

* A. E. Dunstan, *ibid.*

Further experiments proved that this surmise was not correct, and that the difficulties previously experienced were due to the presence of air in the apparatus. For the titration of dyes which are not readily reduced it was necessary to exclude completely every trace of air from the apparatus. When this was done Knecht's process gave quite satisfactory results. It has been found that dyes can be estimated on wool as well as on cotton.

Preparation of dyed samples.—Well-washed wool was dyed in each case in a bath containing 2% dye-stuff and 2% sulphuric acid (on the weight of wool) by boiling for one hour. In each titration, about 100 c.c. of water and 15—20 c.c. of concentrated hydrochloric acid were added to the material to be examined, excess of titanous chloride was added, and the excess was determined by means of standard ferric alum solution. Every precaution was taken to prevent access of air.

Dye.	Mol. wt.	Theoretical value of 0.04 gm. of each dye-stuff expressed in c.c. of titanous chloride (1 c.c. = 0.00166 gm. Fe).	Titanous chloride solution required by the bath after dyeing c.c.	Titanous chloride solution required by the dyed wool (2 grms.). c.c.
1. Benzene-azo-phenol	198	27.29	8.07	19.22
2. Benzene-azo-resorcinol	216	25.01	2.90	22.11
3. Sulphobenzene-azo-phenol	278	19.43	2.76	4.17
4. Benzene-azo-phenol- α -sulphonic acid	278	19.43	0.70	18.73
5. Benzene-azo-salicylic acid	242	22.23	1.20	21.03
6. Bromobenzene-azo-phenol	277	19.50	1.01	18.49
7. Nitrobenzene-azo-phenol	243	55.57	14.19	39.98
8. Benzene-azo-dibromoaniline	355	15.22	3.59	11.63
19. Amino-azo-toluene	225	24.01	0.97	23.04
10. Amino-azo-benzene	197	27.29	10.06	17.23
11. Chrysoidine	285	18.95	15.72	3.25
12. Orange II.	328	16.46	0.979	15.48

The figures in the third column were obtained by calculation, after it had been ascertained that the titanous chloride value of 0.04 gm. of dyestuff for four or five substances differed only by 1 to 1.5% from the theoretical values.

For testing the fastness to light, the samples were exposed at Dacca, in February and March, 1910. The standard samples for these dyeings could not be obtained, therefore the actual quantities of dyestuff which they contained before exposure could not be ascertained. The intensities after exposure were calculated on the assumption that the dyeings originally contained the same amounts of dyestuffs as those dyed under the same conditions and used for the soap, alkali, and acid tests.

The following table shows the results of the tests of fastness to light of various dyes on wool:—

No. Dyeing.	Intensity of shade after 22 days' exposure, expressed as percentage of original intensity.	Percentage of fading in 22 days.	Intensity of shade after 59 days' exposure, expressed as percentage of original intensity.	Intensity of shade after 59 days' exposure, calculated by assuming the intensity after the 22nd day as the original intensity.
1.° Chrysoidine	93.5 (?)	—	75.0 (?)	—
2.° Benzene-azo-resorcinol	88.0 (?)	—	74.0 (?)	—
3. Benzene-azo-phenol	87.0	13.0	81.0	93.1
4. Benzene-azo-salicylic acid	83.6	16.4	72.2	87.5
5. Amino-azo-benzene	82.0	18.0	62.0	75.6
6. Benzene-azo-phenol- <i>o</i> -sulphonic acid	75.6	24.4	66.2	87.5
7. Sulphobenzene-azo-phenol	67.6	32.4	5.6	82.2
8. Nitrobenzene-azo-phenol	61.0	39.0	3.0	86.8
9. Bromobenzene-azo-phenol	56.6	43.4	9.0	68.0
10. Orange II.	30.0	70.0	1.9	73.0
11. <i>o</i> -Amino-azo-toluene	27.5	72.5	2.1	44.0
12. Benzene-azo-dibromoaoline.	13.4	86.6	4.0	29.8

* In cases 1 and 2 the dye could not be reduced completely on the fibre, even in presence of a large excess of titanous chloride.

Fastness to soaping, alkali, acid, and light.—The dyed samples were steeped for 15 minutes at 60° C. in an aqueous solution of neutral soap, containing 15 grms. per litre, rinsed out, and titrated. For the alkali test, they were steeped for 10 minutes in a solution of sodium carbonate (10 grms. crystal carbonate per litre) at 60° C. For the acid test, they were steeped for an hour in a 10% acetic acid solution at 40° C.

Dye.	Shade after soaping.	Shade after washing with alkali.	Shade after washing with acid.
1. Amino-azo-benzene	53.0	80.1	42.0
2. Benzene-azo-dibromoaoline ..	50.2	62.01	98.9
3. <i>o</i> -Amino-azo-toluene	47.5	41.0	94.0
4. Bromobenzene-azo-phenol	43.8	60.0	99.1
5. Benzene-azo-resorcinol	31.0	25.0	93.0
6. Nitrobenzene-azo-phenol	21.6	12.0	74.0
7. Chrysoidine	17.3	9.5	29.1
8. Benzene-azo-phenol	16.6	20.1	62.0
9. Orange II.	10.2	18.0	70.0
10. Sulphobenzene-azo-phenol	7.0	4.0	80.1
11. Benzene-azo-phenol- <i>o</i> -sulphonic acid	4.4	7.1	90.2
12. Benzene-azo-salicylic acid	3.8	19.0	97.0

The results are expressed as percentage of original intensity.

In discussing these results, benzene-azo-phenol was taken as the standard.

Fastness to light.—None of the groups under consideration had a good effect.

The original unexposed samples corresponding to those which were exposed to light were lost. Therefore the original intensity is not known with much certainty. This introduces a possible error in the fastness determination.

Attempts were made to establish a relation between the intensity and the rate of fading,

but no satisfactory conclusion could be drawn. It seems quite probable that such a relation might be traced if several consecutive estimations were made at close intervals (say every 2 or 3 days).

Watson, Sircar, and Dutta place benzene-azo-dibromo-aniline in Class IV. and benzene-azo-phenol in Class V., therefore in order that my results may coincide with those found by them, the dyeings between benzene-azo-phenol and benzene-azo-dibromo-aniline ought to be placed in Classes V, V.—IV., and IV.

Benzene-azo-dibromo-aniline and amino-azo-benzene are the two remarkable exceptions: the introduction of bromine atoms has a worse effect than these authors found, and amino groups had not such a marked effect. The anomalous behaviour of benzene-azo-dibromo-aniline may be due partly

to the fact that in the previous investigation the wool did not take up sufficient dye from the bath.

Fastness to soaping and alkali.—In both cases, introduction of amino groups or bromine atoms has a very good effect, increasing the fastness of benzene-azo-phenol about thrice. The methyl group increases the fastness more than two-fold, and the hydroxyl group is also beneficial. Introduction of sulphonic and carboxylic groups decreases the fastness.

Fastness to acid.—Chrysoidine, with two amino groups, retained only 29% of the total dye on the fibre, and amino-azo-benzene, with one amino group, retained 42%. Introduction of amino groups had therefore a bad effect. The other groups increased the fastness more or less.

These results agree with those obtained by Watson, Sircar, and Dutta.

Practical results.—Considering the results of all the determinations of fastness to various agencies, it is found that only bromine atoms can be introduced without much bad effect. Amino groups decrease the fastness to acid, and hydroxyl and sulphonic groups decrease the fastness to alkali and soap. When the benzene nuclei are replaced by naphthalene, fastness to soap, alkali, and acid is decreased.

The experiments show that the washing out of dyes by soap and alkali depends largely on the presence of acidic groups in the dye, amino-azo-benzene being quite fast and benzene-azo-phenol-*o*-sulphonic acid being practically washed out. In this respect the results do not quite coincide with those of Watson, Sircar, and Dutta.

This view is supported by the fact that dyeings with amino-azo-benzene are very largely destroyed by acid.

In conclusion, I beg to offer my best thanks to Dr. E. R. Watson, Senior Professor of Chemistry, Dacca College, for his kind help and advice.

The Dacca College,
East Bengal, India.

Obituary.

JOHN JACOB BERINGER.

J. J. Beringer, who had been a member of this Society since 1884, died at Camborne on March 27th, 1915. During his earlier career, he was assistant to Professor Huntington at King's College, Lecturer to the Miners' Association of Cornwall, and Public Analyst to the County of Cornwall. He held the position of Principal at the School of Mines, Camborne, from 1882 to the time of his death. Beringer was a recognised authority on all matters relating to the dressing and assaying of tin ores, especially of those of Cornwall, and his original investigations and other work exercised a great influence in the improvements effected in the industry during the last 30 years. He was the author of a standard text-book on assaying and of a considerable number of pamphlets and papers published in the journals of technical societies. His influence in mining and metallurgical teaching has been exerted throughout the world, as his students were drafted to

the principal centres of tin mining and of most other branches of metalliferous mining.

ARTHUR HERBERT CHURCH.

The death occurred at Shelsley, Kew Gardens, on May 31st, of Sir Arthur H. Church, Professor of Chemistry at the Royal Academy. He was born on June 2nd, 1834, and was educated at King's College and the Royal College of Chemistry and at Lincoln College, Oxford. In 1879 he was appointed Professor of Chemistry in the Royal Academy of Arts, and the following year became Lecturer on Organic Chemistry at Coopers Hill College.

Sir Arthur Church was a leading authority in the chemistry of painting, and gave valuable assistance in the work of preserving the paintings in the Houses of Parliament. He discovered turacin, an animal pigment containing copper, and several mineral species, including the only British cerium mineral. He published many books on agricultural chemistry, including the well-known "Laboratory Guide for Agricultural Students," which has run into eight editions. He was elected a Fellow of the Royal Society in 1888, and was created K.C.V.O. in 1909.

Journal and Patent Literature.

PATENT SPECIFICATIONS may be obtained by post by remitting as follows:—

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I.—GENERAL PLANT; MACHINERY.

Pyrometry; Recent progress in —. C. R. Darling.
J. Roy. Soc. Arts, 1915, 63, 590—607.

SINCE 1910 no pyrometers based upon new principles have been introduced, and the advances made have been confined to improvements in methods previously in use. The values now generally recognised for purposes of standardisation are:—Water (b. pt.), 100° C.; aniline (b. pt.), 184°; naphthalene (b. pt.), 218°; tin (m. pt.), 232°; cadmium (m. pt.), 321°; lead (m. pt.), 327°; zinc (m. pt.), 419°; sulphur (b. pt.), 445°; antimony (m. pt.), 631°; sodium chloride (m. pt.), 800°; silver (m. pt. in reducing atmosphere), 961°; gold (m. pt.), 1063°; copper (m. pt., graphite covered), 1083°; lithium metasilicate (m. pt.), 1202°; nickel (m. pt.), 1450°; palladium (m. pt.), 1550°; platinum (m. pt.), 1755°; tungsten (m. pt.) about 3000°; carbon arc, about 3500° C.

Thermo-electric pyrometers.—Base metals have been used to a very considerable extent for the construction of thermo-couples. This has been due not only to the comparative cheapness of such materials, but to the fact that properly-chosen base-metal couples develop a relatively high E.M.F. Kowalke (this J., 1912, 1010; 1915, 379) has shown that base-metal couples are liable to alter if subjected to continued heating, and suggests that such couples should be "aged" by continued heating before calibration. Carbon and graphite couples have been used for temperatures exceeding 1200° C. (Bidwell, Phys. Rev., June, 1914). The potentiometer principle has been largely adopted for commercial instruments.

Resistance pyrometers.—Few changes have been introduced. Sir Wm. Crookes has shown recently (this J., 1912, 540) that platinum is measurably

volatile above 1000° C., and this explains why pyrometers give erroneous readings when continuously used for higher temperatures.

Radiation pyrometers.—There has been a considerable increase in the use of these instruments, and Whipple has applied the Féry pyrometer to the determination of the temperature of molten metals by mounting it at the open end of a fire-clay tube, which is dipped into the molten metal, thus keeping the couple in permanent focus.

Optical pyrometers have been improved in detail and a new type depending upon the principle of colour extinction has been introduced. Lovibond has introduced a colour-matching pyrometer which has been found to be very sensitive.

Recorders.—Instruments which give an inked record are taking the place of the photographic recorder of Roberts-Austen.—W. H. C.

Silica dish; Heat transmission capacity of a —. W. K. Lewis. J. Ind. Eng. Chem., 1915, 7, 410—414.

SOLUTIONS of boiling point ranging from 100° C. (water) up to 240° C. (concentrated zinc chloride) were evaporated in a silica dish set in an ordinary gas crucible furnace, and the heat consumption was calculated from the quantity of water required to keep the volume of the solution constant during evaporation. The results obtained are plotted in curves, and it is shown that the heat absorbed and transmitted by the dish per unit area and time is equal to the sum of two terms, the first of which expresses the quantity of heat transmitted by conduction from the furnace gas and is proportional to the difference in temperature (degrees Centigrade) between the gas and the dish, whilst the second represents the heat transmitted by radiation from the furnace walls, and is proportional to the difference between the fourth

powers of the absolute temperatures of the walls and of the dish. Similar relations hold for any unglazed ceramic material, and therefore in designing fuel-fired furnaces, the aim should be to provide the greatest possible area of furnace wall so placed as to obtain effective contact with the fire gases and the maximum direct radiation to the heat-absorbing surface. The latter object will be best attained by filling the flue with open checkerwork refractory material of high heat-conductivity, so that heat absorbed from the gases will be transmitted rapidly to a surface radiating directly to the object to be heated. In the concentration of sulphuric acid in silica dishes arranged in series, it is recommended that a thick fuel bed be used with insufficient air for complete combustion, and also with injection of steam, if necessary, further to reduce the temperature to which the dishes set directly over the fire are exposed. The carbon monoxide or water-gas produced is burnt by introducing air at different points along the flue, which is provided with heat-conducting refractory material to facilitate transmission of heat to the dishes by radiation. In this way breakage of dishes is minimised and it is possible to maintain at all parts of the flue the highest temperature the dishes can withstand without danger.—A. S.

Fractional distillation with regulated stillheads.
M. A. Rosanoff, J. F. W. Schulze, and R. A. Dunphy. J. Amer. Chem. Soc., 1915, 37, 1072—1079. (See this J., 1915, 301.)

As the regulated stillhead may possibly find industrial application, particularly for the fractionation of liquid mixtures containing three or more constituents, experiments were carried out on a ternary mixture of toluene, carbon tetrachloride, and ethylene bromide. In distillations with a stillhead kept at a constant temperature, the composition of the distillate at any moment is the same as that of the vapour evolved by a mixture whose boiling point is equal to the stillhead temperature. The composition of the distillate from three or more substances depends upon that of the original mixture, and (unlike that of binary mixtures) varies slightly during the course of a single distillation; but the variation shown by successive distillates becomes less and less as the stillhead temperature approaches the boiling point of the most volatile constituent. Practically, therefore, the regulated stillhead can be used to obtain a uniform distillate from a ternary or more complex mixture.—E. H. T.

PATENTS.

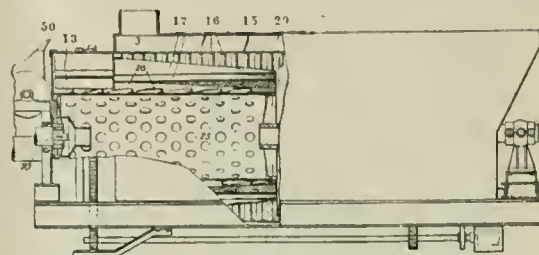
Distilling, evaporating, or concentrating liquids or solutions; [Electrically heated] apparatus for ——. J. Leopold-Brodie, London. Eng. Pat. 1123, Jan. 15, 1914.

The calandria or heating belt of the still or evaporating pan is so constructed that it may be removed bodily from the apparatus. The tubes of the heating belt each contain or are surrounded by a resistance coil through which an electric current is passed. The individual heating tubes, together with the resistances, can also be easily removed.—W. H. C.

Earthy materials [for paving, etc.]; Heating, drying, and pulverising—. M. A. Popkess, New York. Eng. Pat. 9281, April 14, 1914.

The material is fed through a hopper, 50, a measuring device, and a screw conveyor, to the lifting shelves, 13, of the slowly rotating drum, 3. It then drops on the spiral blades, 26, attached to the perforated drum, 25, and is pulverised between the blades, 26, and shelves, 17, while moving forward. The fine material passes through

the tapering screen, 15, to the spiral conveyor blades, 16, which discharge it. A liquid fuel burner, 70, injects hot gases through the drum,



25, and surrounding chamber, the gases finally returning through the annular space, 20, between the fixed casing and rotating drum.—W. F. F.

Solvents; Apparatus for recovering —. E. C. R. Marks, London. From E. I. du Pont de Nemours Powder Co., Wilmington, Del., U.S.A. Eng. Pat. 10,351, April 27, 1914.

THE material containing the solvents to be recovered is placed in or passed through a shallow evaporation chamber, near the bottom, while heating coils are fixed near the top but close to the material. The chamber forms part of a closed air circuit; the hot air and vapours pass from it down a vertical passage to a condenser, from which the condensed solvent is drawn off, and the air then passes upwards over heating coils back to the evaporation chamber. The air leaving the evaporating chamber may be diverted upwards through a baffle chamber, to increase the draught, before passing down to the condenser.—W. F. F.

Centrifugal apparatus for the treatment or extraction of liquids. T. K. Irwin, Westminster. Eng. Pat. 10,810, May 1, 1914.

THE material is thrown from a series of horizontal rotating discs mounted on a vertical shaft, on to the porous walls of a concentric cylinder also carried by the shaft, from which it is removed by cutters adjustable vertically and laterally. The material falls through the inclined radial cutting arms at the base of the cylinder into a receiver provided with a conveyor. The apparatus is more suitable for dealing with materials of small liquid content than that described in Eng. Pats. 1925 and 3526 of 1913 (this J., 1914, 274).—W. F. F.

Cooling towers. F. C. Schmidt, London. Eng.
Pat. 21,205, Oct. 19, 1914.

THE hot liquid trickles down over cooling hurdles divided by vertical partitions which have horizontal extensions, each forming a collecting tray for its own section only. The trays are arranged in steps so that air can be admitted from beneath the lower.—W. F. F.

Mixtures of liquids and solids; Apparatus for treating [filtering]—-. A. E. Vandercook. Alameda, Cal., Assignor to California Macvan Co., San Francisco, Cal. U.S. Pat. 1,135,080, April 3, 1915. Date of appl., March 9, 1914.

THE pulp being filtered is projected directly on to the surface of the filtering medium from apertures in a cross of pipes, which is rotated below the level of liquid pulp in the filter tank, and just above the surface of the filter medium.—W. H. C.

Drying apparatus. A. Tegoli, Assignor to C. R. Bertoli and L. Tantimonaco, Santa Rosa, Cal. U.S. Pat. 1,135,556, April 13, 1915. Date of appl., Sept. 15, 1914.

THE dryer has a middle and two lateral chambers.

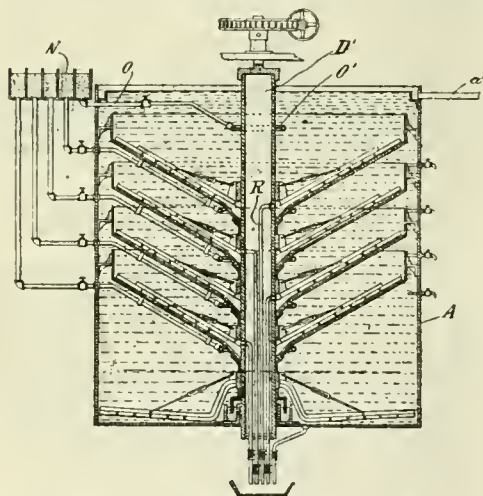
Air currents produced by blast fans in the lateral chambers and an exhaust fan in the middle one are regulated by perforated drawers arranged in drawer spaces above each chamber.—W. H. C.

Separator. W. K. Liggett, Columbus, Ohio, Assignor to The Jeffrey Manufacturing Co. U.S. Pat. 1,135,594, April 13, 1915. Date of appl., Feb. 18, 1907.

PULVERISED material is withdrawn from a disintegrator by a current of air and delivered into the first of two settling chambers, where the coarser particles settle. The finer particles pass along with the air into a second and larger conical settling chamber; the finely divided product settles and is withdrawn through a valved opening in the bottom of the chamber, and the air passes through a screen in this chamber and is returned to the disintegrator. The coarser particles from the first settling chamber are delivered into the return air pipe, and are conveyed back to the disintegrator.—W. H. C.

Separation of finely-divided solids from liquids; Apparatus for the —. J. V. N. Dorr, Denver, Colo. U.S. Pat. 1,135,997, April 20, 1915. Date of appl., June 5, 1913.

THE pulp is fed from the trough, N, through the pipes, O, O', to the space above the superposed conical trays contained in the tank, A. "Sweeps"



attached to the central hollow shaft, D', are rotated above the surface of the trays and sweep the settled solids to the centre and discharge them through the pipes, R. The clarified liquid is discharged through the overflow, A'.—W. H. C.

Classifying comminuted material; Process of and apparatus for —. H. M. Sutton, W. L. and E. G. Steele, Dallas, Tex. U.S. Pat. 1,136,293, April 20, 1915. Date of appl., Aug. 13, 1913.

THE particles are projected upwards intermittently along an inclined, reticulated surface. In the intervals the particles tend to pass downwards owing to the action of gravity. The separated particles are collected separately.—W. H. C.

Solids from liquids; Process of obtaining the —. O. E. Merrell, Assignor to Merrell-Soule Co., Syracuse, N.Y. U.S. Pat. 1,136,356, April 20, 1915. Date of appl., Feb. 16, 1912.

THE liquid is introduced at the vortex of a forward-moving spiral current of air which sprays and vaporises it. The solid constituents are subsequently separated from the moisture-laden air in the form of a dry powder.—W. F. F.

Chemical reactions at high temperatures; Process for effecting —. F. Meyer. Ger. Pat. 281,004, Feb. 5, 1914. Addition to Ger. Pat. 261,922.

INSTEAD of blowing the material under treatment through a "reversed flame" as described in the chief patent (this J., 1913, 900), the flame, preferably under increased pressure, is directed on to the material. The process is applicable to the preparation of nitrides from oxides, the reduction of oxides to metals, and the melting of metals.—A. S.

Filtering apparatus. W. A. Stedman, Wonder, Nev., U.S.A. Eng. Pat. 9919, April 22, 1914. Under Int. Conv., Aug. 13, 1913.

SEE U.S. Pat. 1,100,267 of 1914; this J., 1914, 781.

Drying machine. J. McL. Cameron, London. U.S. Pat. 1,136,933, April 27, 1915. Date of appl., April 25, 1914.

SEE Eng. Pat. 10,467 of 1913; this J., 1915, 262.

Dryer. H. P. Coe, Painesville, Ohio, Assignor to A. S. Williams, Long Island City, N.Y. U.S. Pat. 1,138,086, May 4, 1915. Date of appl., Aug. 7, 1912.

SEE Eng. Pat. 16,712 of 1913; this J., 1914, 72.

Mixing machine. A. A. Warner, Assignor to Landers, Frary, and Clark, New Britain, Conn. U.S. Pat. 1,137,037, April 27, 1915. Date of appl., March 25, 1914.

SEE Eng. Pat. 16,753 of 1914; this J., 1915, 264.

Mixing machine. R. Tiedtke, Assignor to Farb. vorm. Meister, Lucius, u. Brüning, Hoechst, Germany. U.S. Pat. 1,139,085, May 11, 1915. Date of appl., Oct. 27, 1910.

SEE Eng. Pat. 4849 of 1908; this J., 1908, 674.

Gaseous mixture; Process and device for separation of the elements composing a — by centrifugal action. E. Mazza, Turin, Italy. U.S. Pat. 1,137,774, May 4, 1915. Date of appl., May 29, 1911.

SEE Fr. Pat. 430,621 of 1911; this J., 1911, 1366.

Refrigerating apparatus. H. H. Southworth, Cleveland, Ohio, and F. W. Wolf, Chicago, Ill., Assignors to Iceless Machine Co., Cleveland, Ohio. U.S. Pat. 1,139,460, May 11, 1915. Date of appl., Oct. 23, 1912.

SEE Eng. Pat. 27,598 of 1912; this J., 1914, 407.

Stills or evaporating plant for the distillation of tar, pitch, oil, and like heavy liquids or viscous substances. Eng. Pat. 19,392. See III.

Pyrometer. Eng. Pat. 7597. See XXIII.

IIA.—FUEL; GAS; MINERAL OILS AND WAXES.

Coke; Effect of different methods of crushing on the [determination of the] ash of —. F. A. Eastaugh. Inst. Min. and Met., May 20, 1915. [Advance proof.] 3 pages.

FOUR samples of coke were prepared by different methods. No. 1 was broken by means of a wooden mallet, reduced in size by quartering, then ground in a stone mortar to pass a 60-mesh screen. No. 2 was broken on an iron plate by means of a steel hammer and reduced to 60-mesh on a bucking plate. No. 3 was broken in the same manner as No. 2, but the final grinding was done in a hand Weatherhead mill. No. 4 was passed through a Taylor crusher, and ground in a Braund disc mill.

Two grams were taken from each dried sample and burnt, and the amount of iron oxide determined in the ash with the following results:—

No.	Weight of ash.	Weight of Fe_2O_3 in ash.	Percentage of ash.	
			Uncorrected.	Corrected for Fe_2O_3 .
	gram.	gram.		
1	0.3558	0.0093	17.79	17.79
2	0.4156	0.0746	20.78	17.52
3	0.3916	0.0432	19.58	17.88
4	0.3650	0.0321	18.25	17.11

It was assumed that the amount of iron found in the ash of No. 1 was a natural constituent of the coke, and the other results were corrected on this basis. No. 4 seems to be the best result, the amount of foreign matter introduced during the crushing being probably less than in the other three samples.—II. R. D.

Gas; Removal of carbon bisulphide from—. Teune. *Het Gas*, April, 1915. *J. Gas Lighting*, 1915, 130, 334.

EXPERIMENTS were made to test the accuracy of an earlier statement that 40 to 70% of the carbon bisulphide could be removed by passing the gas through spent oxide having a high sulphur content. With spent oxide containing 32.3% S, and with varying velocity and temperature of gas, up to about 12% of its sulphur was removed from the gas. The same result was obtained with pure powdered sulphur, thus showing that no practical purification can be based on this method.—W. F. F.

Methane-air mixtures; Influence of temperature and pressure on the explosibility of—. G. A. Burrell and I. W. Robertson. *J. Ind. Eng. Chem.*, 1915, 7, 417—419.

THE mixtures were ignited in a 100 c.c. glass explosion pipette by means of a spark produced between two platinum wires sealed into the upper part. The pipette was heated to the desired temperature by an electrically heated oven. The lower limit was not changed appreciably by increase of pressure up to 5 atmospheres, but was reduced by rise of temperature from 5.5% CH_4 at the ordinary temperature to 4.98—5.15% at 200° C., and 3.75—4% CH_4 at 500° C.—A. S.

Gasoline vapour and air; Inflammable limits of mixtures of—. G. A. Burrell and I. T. Boyd. *J. Ind. Eng. Chem.*, 1915, 7, 414—417.

THE lower limit of inflammation of mixtures of vapour from gasoline of 73° B. (sp. gr. 0.696) and air was found to be 1.9—2.0% in a 100 c.c. Hempel explosion pipette when the mixture was ignited from the top, and 1.5—1.6% when ignited from below by means of a spark from an induction coil; when ignited from the bottom in a bottle of 2800 c.c. capacity by means of a flash produced by drawing apart two wires through which a current of 7 amp. at 220 volts was flowing, the lower limit was 1.4—1.5%. Under the last-mentioned conditions the upper limit was 6.0—6.4%, as compared with 5.2—5.3% in the Hempel pipette with ignition at the top. Similar results were obtained with vapour from "cleaners' naphtha" of 59°—60° B. (sp. gr. 0.745—0.749). When the temperature of the mixture was raised before igniting, the lower limit gradually decreased until with an initial temperature of 400° C. it had the value 1.02—1.22%.—A. S.

Petrol substitutes in internal combustion engines. Velocity of vaporisation. D. Meneghini. *Annali Chim. Appl.*, 1915, 3, 235—241.

A CURRENT of dry air was drawn through the liquid

under examination contained in a U-tube kept in a thermostat at 25° C., and the amount of liquid vaporised was ascertained from the loss in weight. The duration of each test was 5 mins., and the velocity of the air current was such that 3 litres passed in this period. Under these conditions the percentage loss of weight by the different liquids examined was:—Petrol of sp. gr. 0.700, 20.5; 99% alcohol, 1.99; 95% alcohol, 1.90; 90% and 80% alcohol, 1.85; methyl alcohol, 3.60; benzene, 5.10; toluene, 1.73. Three samples of 90% benzol gave the following results:—I. (81.6% below 85° C., 99.6% below 105° C.), 5.35; II. (77.7% below 85° C., 96.9% below 105° C.), 5.25; III. (51.1% below 85° C., 92.1% below 105° C.) 5.0. Mixtures of alcohol and benzol gave higher values than either of the components singly. For mixtures containing 10% of alcohol by volume the results with the different specimens of 90% benzol were: I., 6.25; II., 6.30; III., 5.30; for 20% alcohol mixtures: I., 6.30; II., 6.55; III., 5.55; for 35% alcohol mixtures: I., 6.40; II., 6.55; III., 5.90; and for 50% alcohol mixtures: I., 6.15; II., 6.20; III., 5.80.—A. S.

PATENTS.

Peat; Utilisation of—. M. A. Adam, and Wet-carbonizing Ltd., London. Eng. Pat. 3888, Feb. 14, 1914.

WET-CARBONISED peat which has been de-watered by pressure to a semi-solid mass, is subjected to a pressure of about 250 lb. per sq. in. in a filter-press with collapsible chambers, while a current of about 50 amps. per sq. ft. at about 50 volts is passing through it. (See also Eng. Pat. 17,610 of 1911 and 25,146 of 1912: this J., 1912, 1171 and 1914, 346.)—W. F. F.

Peat briquettes; Production of wet-carbonised—. N. Testrup, London, and T. Rigby, Dumfries, Assignors to Wetcarbonizing, Ltd., London. U.S. Pat. 1,139,315, May 11, 1915. Date of appl., May 6, 1912.

SEE Eng. Pat. 11,554 of 1911; this J., 1912, 675. The wet-carbonised peat, after being filter-pressed, is disintegrated, dried to a water-content of about 5%, and heated to not above 100° C., before being consolidated by pressure applied suddenly.

Coke, coal, or like granulated substances; Mechanism for screening or sifting—. Drakes, Ltd., Halifax, and A. Walker, Wallsend-on-Tyne. Eng. Pat. 8439, April 3, 1914.

THE material is fed down an inclined reciprocating trough, the bottom of which has a series of combs with pointed fingers pointing down the trough, and having a slight adjustable upward inclination. A rotary cylindrical apparatus may be similarly fitted.—W. F. F.

[Gas] retorts; Apparatus applicable for use in discharging—. Drakes Ltd., Halifax, and A. Walker, Wallsend-on-Tyne. Eng. Pat. 8438, April 3, 1914.

A PORTABLE framework placed at the mouths of a battery of horizontal retorts carries inclined guides which form a single zig-zag path leading from the successive tiers of retorts to a common discharge point.—W. F. F.

Petroleum; Treatment of—. J. A. Dubbs, Santa Monica, Cal., Assignor to National Hydrocarbon Co., Chicago, Ill. U.S. Pat. 1,135,506, April 13, 1915. Date of appl., June 3, 1911.

PETROLEUM is mixed with water under pressure, and the mixture is vaporised, also under pressure. The pressure is then relieved, and the vaporised mixture discharged into a heated chamber in the

form of fine spray. The vapours are subsequently condensed.—W. F. F.

Liquid hydrocarbons; Treatment of — for their purification and the production of motor spirit and by-products. J. J. Shedlock, and Optime Motor Spirit Synd., Ltd., London. Eng. Pat. 1878, Jan. 23, 1914.

THE oil is first freed from pitch, etc., by passing through a vessel containing caustic alkalis or metallic oxides heated to 300°–400° F. (150°–205° C.), and then agitated with an emulsion of oil and 10–20% water. The mixture passes through a vessel containing a catalyst such as iron, steel, or nickel, heated to 500°–900° F. (260°–480° C.) according to the oil to be treated, and the resulting oil and gas then pass to an expansion chamber where the light vapour is removed and liquefied to form a motor spirit. The permanent gases may be used as fuel, and the residual heavy oil may be further treated as desired.—W. F. F.

Distilling coal; Method of —. W. J. Mellersh-Jackson, London. From International Gas Development Co., New York. Eng. Pat. 9849, April 21, 1914.

SEE U.S. Pat. 1,097,513 of 1914; this J., 1914, 685.

Petroleum; Apparatus for the industrial manufacture of a new spirit by the isomerisation of —. A. Testelin, Laeken, and G. Renard, Ixelles, Belgium. U.S. Pat. 1,138,260, May 4, 1915. Date of appl., Aug. 20, 1908.

SEE Fr. Pat. 393,554 of 1908; this J., 1909, 133.

Lubricants. H. Wade, London. From The Pensacola Tar and Turpentine Co., Gull Point, Fla., U.S.A. Eng. Pat. 18,235, Aug. 1, 1914.

SEE U.S. Pat. 1,109,298 of 1914; this J., 1914, 1002.

Process for obtaining ammonia from coke breeze. Ger. Pat. 281,096. See VII.

Detecting, indicating, and recording the presence and proportion of [inflammable] gas in the atmosphere of mines. Eng. Pat. 9196. See XXI11.

Calorimetric apparatus. Calorimeter. Combustion device. U.S. Pat. 1,136,359–1,136,361. See XXI11.

[Gas] calorimeter. U.S. Pat. 1,136,884. See XXI11.

IIb.—DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

PATENTS.

Peat; Utilisation of —. T. Rigby, Dumfries, and Wetcarbonizing, Ltd., London. Eng. Pat. 1676, Jan. 21, 1914.

PEAT which has been subjected to heat treatment such as that described in Eng. Pat. 17,610 of 1911 and 25,146 of 1912 (this J., 1912, 1171, and 1914, 346) is distilled, and by-products such as wax are recovered from the distillation gases. The residue is gasified in a producer, or part may be used as solid fuel, and the gas is treated separately for the recovery of by-products, its heat being used for the distillation process. The producer and still gases, after recovery of by-products, may be mixed and used as fuel.—W. F. F.

Decoloriser [from argol]; Process for making a —. F. W. Spanutius, Assignor to Pan Chemical Co., Hastings-upon-Hudson, N.Y. U.S. Pat. 1,135,216, April 13, 1915. Date of appl., Feb. 7, 1912.

ARGOL is treated with caustic soda to decompose the colouring matter, potassium chloride is added, and the residue, consisting of 50% moisture, and 50% crude fibre of argol, calcium salts, and sand, is separated from the solution. The residue is heated in a retort until carbonisation is complete, the evolved vapour being allowed to escape.

—B. N.

Neon vacuum tubes; Manufacture of —. G. Claude, Bonlogne-sur-Seine, France. Eng. Pat. 2020, Feb. 8, 1915. Under Int. Conv., Feb. 12, 1914.

THE tube to be formed is connected with one or more receptacles containing a purifying agent, such as charcoal, and these are cooled by means of liquid air, hydrogen, oxygen, or nitrogen. When the neon in the vacuum tube has become contaminated with impurities liberated by the passage of the current, the gas is circulated over the purifying agent so as to absorb the neon and impurities, the neon being afterwards liberated in a pure condition. The gas may be transferred to and from the purifying agent (1) by cooling a single receptacle alternately with liquid hydrogen and liquid air; (2) by cooling two receptacles at opposite ends of the vacuum tube with liquid oxygen and liquid nitrogen and then transposing the cooling agents so as to produce circulation of the neon from one receptacle to the other; (3) by expanding and contracting the gas by the heating effect of the current, or by alternately diminishing and increasing the pressure in the vacuum tube by means of a pressure vessel containing mercury, or by two pressure vessels connected one to each end of the vacuum tube. In this latter case the gas may be circulated over heated lithium and the like instead of cooled charcoal. The neon may also be supplied to the vacuum tube through a cooled receptacle containing charcoal to facilitate the formation. (See also this J., 1911, 13, 736.)—B. N.

Wood; Destructive distillation of —. A. Cameron, East Jordan, Mich. U.S. Pat. 1,137,255, April 27, 1915. Date of appl., Sept. 26, 1913.

THE wood is packed into a sealed retort having horizontal supporting members at different levels, so that as the charge shrinks during distillation, separate horizontal layers of charcoal are formed with intervening circulation spaces.—W. F. F.

Wood charcoal; Apparatus for making —. L. Félizat, Assignor to Huilerie et Savonnerie de Lurian, Bouches-du-Rhône, France. U.S. Pat. 1,137,852, May 4, 1915. Date of appl., July 21, 1913.

SEE Fr. Pat. 409,916 of 1909; this J., 1910, 806.

III.—TAR AND TAR PRODUCTS.

Vacuum tar; Saturated hydrocarbons of —. A. Pictet and M. Bouvier. Comptes rend., 1915, 160, 629–631. (See also this J., 1913, 1098; 1914, 70; 1915, 163.)

THE unsaturated hydrocarbons from "vacuum tar" were separated from the saturated members by absorption in liquid sulphur dioxide. Fractional distillation of the unabsorbed (saturated) hydrocarbons at atmospheric pressure resulted in the isolation of four additional hydrocarbons of the general formula, C_nH_{2n} , all of which were unaffected by bromine or permanganate. The following constants of the hydrocarbons are practically identical with those quoted by Mabery (this J.,

1897, 727; J. Amer. Chem. Soc., 1903, 25, 267; 1911, 33, 264) for hydrocarbons obtained from Canadian and Californian petroleum:—

Formula.	B. pt. (730 mm.) ° C.	Sp. gr.	Refractive index at the same temperature.
C_9H_{18}	135—137	0.7590 at 20° C.	1.4212
$C_{10}H_{20}$	160—161	0.7680 at 20°	1.4272
$C_{11}H_{22}$	211—213	0.7862 at 21°	1.4293
$C_{12}H_{24}$	227—229	0.7953 at 20°	1.4379

The substance, C_9H_{18} , is hexahydromesitylene; and all the members of the series are regarded as homologues of cyclohexane. Upon continuing the distillation of the vacuum tar above 240° C. under reduced pressure (15 mm.), the distillate solidified partially upon cooling, and after washing with cold acetone and repeated crystallisation from the same solvent, colourless needles were obtained melting at 62°—63° C. and having the sp. gr. 0.9128 at 25° C. This saturated hydrocarbon, $C_{10}H_{20}$, belongs to the above series and is not formed during distillation, but pre-exists in the coal; it also occurs in Galician and other natural petroleum and is identical with the so-called melene, obtained by Brodie in 1849 by the dry distillation of beeswax.—J. R.

Aldehydes; Action of—on the Grignard reagent. J. Marshall. Chem. Soc. Trans., 1915, 107, 509—523.

WHEN excess of an aliphatic or aromatic aldehyde is added to the Grignard reagent, this excess acts as an oxidising agent and converts the carbinol derivative, which is first formed, into a ketone, being itself reduced to a primary alcohol. Thus benzaldehyde (2 mols.) reacts with magnesium-phenyl bromide (1 mol.) giving benzophenone and benzyl alcohol. If excess of magnesium is present, either due to the formation of diphenyl or purposely added, reduction of diphenylcarbinol to tetraphenylethane or diphenylmethane takes place. The mechanism of the reaction is probably similar to that of the formation of benzoic acid and benzyl alcohol from benzaldehyde in presence of sodium hydroxide. It is suggested that 2 mols. of water are eliminated successively from 2 mols. of the hydrate of benzaldehyde, with formation of a derivative of ethylene oxide, which adds on a molecule of sodium hydroxide to give an ortho-compound yielding benzyl alcohol and benzoic acid on hydrolysis. When ethyl acetate acts on magnesium carbinyl haloids, a good yield of the carbinyl acetate is obtained.—T. C.

PATENTS.

Stills or evaporating plant for the distillation of tar, pitch, oil, and like heavy liquids or viscous substances. Sir K. I. Crossley and H. W. Brighten, Manchester. Eng. Pat. 19,392, Sept. 3, 1914.

THE neck of the still is lagged with asbestos, and has a constricted opening controlled by a valve whose position can be adjusted and indicated. A low-pressure safety valve is also provided.—W. F. F.

Preparation of a pure, pale coumarone-resin from heavy benzols of b. pt. 160—180° C. Ger. Pat. 281,432. See X111.

IV.—COLOURING MATTERS AND DYES.

Orcinolphtaleins, orcinoltetrachlorophtaleins, and their derivatives. W. R. Orndorff and E. R. Allen. J. Amer. Chem. Soc., 1915, 37, 1201—1258.

THE methods of preparing and separating the isomeric orcinolphtaleins have been improved

and the influence of conditions of preparation on the amounts of isomers formed has been studied. *o*-Orcinolphtalein only exists in the colourless lactoid form. An explanation of the colour changes of *o*-orcinolphtalein with alkalis is advanced which is more in accord with the facts than that of Baeyer (Annalen, 1910, 372, 120). With caustic potash the first violet salt formed is the *o*-quinonoid monopotassium salt, the colourless form of which is the monopotassium salt of *o*-orcinolphtaleincarbinolcarboxylic acid; the blue salt is the di- and not the tetra-potassium salt. Both the colourless unstable lactoid and coloured stable *p*-quinonoid forms of the β -compound have been prepared. The γ -phtalein is only known in the coloured form, which behaves as a dimethylfluorescein, and hence has a *p*-quinonoid structure, and not the *o*-quinonoid structure assigned to it by Kehrman (Ber., 1912, 45, 3505). γ -Orcinolphtalein has both acid and basic properties, combining with dry ammonia gas to form a coloured diammonium salt and with dry hydrochloric acid gas to form a coloured hydrochloride. All the isomers form coloured mono-hydrochlorides. Colourless hydrates, acetyl and benzoyl derivatives, and compounds with solvents such as methyl alcohol have been prepared. The three tetrabromo-orcinolphtaleins and the three orcinoltetrachlorophtaleins are colourless lactoid compounds, the bromine atoms in the former case being in the two orcinol residues, exactly as in the case of Eosin. The tendency to assume the free quinonoid form is reduced by the introduction of halogen into the phtalein molecule. This is in agreement with the observations of Orndorff and Hitch (J. Amer. Chem. Soc., 1914, 36, 680) that fluorescein in the free state exists only in the coloured quinonoid form, whereas tetrachlorofluorescein exists in a more stable coloured and a colourless form; Eosin is probably a mixture of the two forms, while free tetrachloro-eosin is colourless, and the coloured modification has not yet been prepared.—F. W. A.

Coal tar products and dyes in America. T. H. Norton. U.S. Bureau of Commerce, April, 1915.

DURING the past few months there has been great advance in the production of dyestuffs. Efforts are being made to increase the output of benzol, and contracts have been placed by one company for 92 additional by-product coke-ovens, with complete equipment for benzol recovery, at an outlay of about £200,000. It is expected that the daily production of benzol in the Pittsburgh district will soon exceed 20,000 gallons. The recovery works of the United States Steel Corporation at Erie (Ind.) are producing 12,000 gallons of benzol per day. Additional recovery plants are under construction in connection with the coke-works of the Republic Iron and Steel Company at Youngstown (Ohio), of the Lackawanna Steel Company at Buffalo (N.Y.), and of the Inland Steel Company at Inland Harbor (Ind.). The Benzol Products Company have nearly completed at Marcus Hook (Pa.) extensive plant which is to be devoted to the manufacture of intermediates on a large scale. It is hoped to produce in these works most of the aniline oil and salts required by American colour-works. Another company has been established for the manufacture of sulphur colours. The Cambria Steel Company is planning to erect at once plant to manufacture dyestuffs, using as raw material the 6 tons of benzol and its homologues yielded daily by their coke plant. Several firms commanding ample capital are maturing plans for establishing new plants for the production of artificial dyestuffs. The existing American factories for manufacturing coal-tar dyes are making every effort to increase their output, though much hampered by difficulty in

obtaining raw material during the last few months. It is regarded as certain that production will grow rapidly as more ample supplies of benzol, etc., are assured, and various obstacles incident to the complete cessation of the import of intermediate products from Europe are overcome.

Dyeing values of natural Indian dyestuffs. Srivastava. See VI.

Mercury derivatives of aromatic amines. I. Structure of primary and secondary p-aminophenylmercuric compounds. Jacobs and Heidelberg. See XX.

PATENTS.

Selenium dyestuff corresponding to Methylene Blue; "Isolation of the—" W. Fraenkel. Ger. Pat. 280,713, Aug. 16, 1913.

THE product obtained by treating *p*-phenylenediamine or the like with hydrogen selenide or other substance capable of yielding selenium, and then oxidising the mixture, is shaken with phenol, and the phenol solution is separated and shaken with aqueous hydrochloric acid and a solvent for the phenol immiscible with water, *e.g.*, ether or carbon tetrachloride. The dyestuff is converted into its hydrochloride, which dissolves in the aqueous solution and can be recovered by distilling off the water and hydrochloric acid under diminished pressure. The only practical application of the dyestuff is to therapeutic purposes, for which its isolation in the form of its zinc chloride double salt is inadmissible.—A. S.

Arylaminoanthraquinone dyestuffs and process of making same. G. Kränzlein, R. Hagenbach, and F. Giloy, Assignors to Farb. vorm. Meister, Lucius, u. Bräuning, Höchst, Germany. U.S. Pat. 1,138,670, May 11, 1915. Date of appl., May 13, 1914.

SEE Fr. Pat. 472,100 of 1914; this J., 1915, 417.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

PATENTS.

Cellulose compounds [alkali-cellulose]; Manufacture of— Courtaulds, Ltd., London, W. H. Glover, Braintree, and L. P. Wilson, Coventry. Eng. Pat. 13,055, May 27, 1914.

ALKALI-CELLULOSE is matured by treating the mixture of cellulose and alkali with an oxidising agent, such as a soluble peroxide, a hypochlorite, or a current of oxygen alone or mixed with inert gases at above 30° C. The product is particularly adapted for the manufacture of artificial silk by the viscose process.—F. Sp.

Cellulose compounds; Manufacture of— Courtaulds, Ltd., London, and L. P. Wilson, Coventry. Eng. Pat. 14,675, June 18, 1914.

A CATALYTIC agent such as an oxide or hydroxide of iron, nickel, cobalt, cerium, or vanadium, or a mixture of these, is employed to assist the maturing of alkali-cellulose by oxidation, previous to its conversion into cellulose xanthate (viscose).—B. N.

Sugar cane: Process of treating— [Utilisation of bagasse for paper-making.] T. Lee, Dedham, Mass., U.S.A. Eng. Pat. 17,834, July 28, 1914. Under Int. Conv., Sept. 16, 1913.

THE bagasse as it comes from the mills is partially dried and then beaten or otherwise disintegrated,

e.g., in a Williams pulveriser, so that the pith and cortex can be afterwards separated from the rest of the tissue ("selected fibre") which is well suited for paper-making. The granular pith, for example, may be removed by means of a screen of $\frac{1}{4}$ in. mesh, and the selected fibre may be separated from the strips of cortex by a coarser screen. The rejected tissues, which usually exceed 50% of the woody matter of the bagasse, are used as fuel, and the selected fibre is washed and digested, *e.g.*, for 8 hours under a steam pressure of 40 lb. with caustic lye equivalent to 14% NaOH of the weight of the fibre.—J. H. L.

Pyroxylin bodies; Process of forming— F. Kniffen, Assignor to E. I. du Pont de Nemours Powder Co., Wilmington, Del. U.S. Pat. 1,135,026, April 13, 1915. Date of appl., April 12, 1913.

PYROXYLIN products are formed by evaporating a solution of pyroxylin in a mixture of ethyl acetate and benzene.—F. Sp.

Acetylcellulose plastic compounds; Process of making— W. G. Lindsay, Caldwell, N.J., Assignor to The Celluloid Co., New York. U.S. Pat. 1,136,248, April 20, 1915. Date of appl., Nov. 27, 1911.

PLASTIC masses are produced by incorporating acetone-soluble acetylcellulose with tetrachloro-ethylacetanilide and a small proportion of methyl alcohol, *e.g.*, about one to one and a half times the quantity of tetrachloro-ethylacetanilide.—F. Sp.

Films from plastic material; Manufacture of— J. E. Brandeberger, Thion-les-Vosges, France. Eng. Pat. 13,072, May 27, 1914. Under Int. Conv., May 31, 1913.

SEE Fr. Pat. 458,638 of 1913; this J., 1913, 1063.

Esters of cellulose; Manufacture of— Soc. Chim. des Usines du Rhône, Paris. Eng. Pat. 13,696, June 5, 1914. Under Int. Conv., June 25, 1913.

SEE Fr. Pat. 473,399 of 1914; this J., 1915, 488.

Extraction of mineral salts and organic constituents of kelp. U.S. Pat. 1,136,390. See VII.

Process for graining and waterproofing artificial leather [and paper, textiles, etc.]. Ger. Pat. 281,302. See XV.

Manufacture of useful products [celluloid substitutes, etc.] from vinyl esters. Ger. Pats. 281,687 and 281,688. See XIII.

Production of a plastic material suitable for the preparation of a horn substitute, films, threads, lacquers, etc. Ger. Pat. 281,877. See XIII.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Dyeing values of [natural Indian] dyestuffs. J. P. Srivastava. Report to the Director of Industries of the United Provinces, India. J. Soc. Dyers and Col., 1915, 31, 122.

THE dyewoods containing red and yellow colouring matters used in Europe are of American origin; it is suggested that similar woods are also available in India. The dyeing values of thirteen colouring

matters have been investigated: Haldi (*Curcuma longa*), Cutch (*Acacia catechu*), Safflower (*Carthamus tinctorius*), Lac dye, and Indigo are commercial products; Tun (*Cedrela Toona*), Tesu or Dhak (*Butea frondosa*), Arusa (*Adhoda Parica*), and Jangli Nil or Wild Indigo (*Tephrosia purpurea*) are available but not commercial; Harsinghar (*Nyctanthes arbor tristis*) and Naspal (*Punica granatum*) require special arrangements for their collection; and the cultivation of Majith (*Rubia cordifolia*) and Sappanwood or Patang (*Casalpinia sappan*) is believed to have practically ceased. Dye-trials on wool were carried out by immersion in an infusion of the colouring matter, alone, or with the addition of 4% of acetic acid; in some cases the dyed wool was treated with 2% bichromate, and in others wool previously mordanted with bichromate and oxalic acid or with aluminium sulphate and tartar emetic was used. Cotton was steeped overnight in myrobalan extract, squeezed, and then worked in fresh baths containing tartar emetic, stannous chloride, alum, or ferrous sulphate. The most brilliant results were obtained with stannous chloride, tartar emetic and alum being next in value; ferrous sulphate gave grey to black shades. Haldi (Turmeric) gave fairly fast dyeings on wool with the bichromate and oxalic acid mordant, but the colouring matter has the serious drawback that it is turned red by soap. Cutch (Katha), extracted from catechu wood, gives rise to Catechu Brown, one of the fastest colours known; cotton goods are boiled with extract of catechu to which has been added an amount of copper sulphate equal to one-tenth the weight of the colouring matter, the material is squeezed, allowed to stand a short time, boiled in a fresh hot bath containing 2% of potassium bichromate, and then washed and dried. Safflower (Kusum) is separated by macerating with water to extract the yellow colouring matter completely, and then extracting the pink colouring matter by means of dilute sodium carbonate solution; the pink colouring matter is valuable for dyeing cotton and silk; Safflower Yellow does not dye cotton on aluminium or tin mordant, but dyes wool direct. Lac dye yields beautiful scarlet and crimson shades on tin mordant. Harsinghar gives brilliant yellow shades with most mordants on wool; on wool mordanted with bichromate and oxalic acid previous to dyeing a beautiful brown is obtained; the dyeings on wool possess good fastness to milling with soap and soda. Tun gives the best shade on wool with the bichromate and oxalic acid mordant, but the dyeings are not very fast to milling with soap and soda. Arusa gave better results after precipitating the chlorophyll by addition of water to an alcoholic solution; the best shades on wool are obtained with the bichromate and oxalic acid mordant, the fastness of the dyeings being fair. Naspal (Pomegranate rind) gives yellow to full brown shades on wool, of very good fastness to milling. Tepirosia gives dull brown shades, of very good fastness to milling, on the various mordants; after purifying, by addition of water to the alcohol extract and washing out the chlorophyll with petrol, excellent yellow shades, comparatively fast to light, washing, and milling, were obtained. Majith dyes very fast shades on wool and cotton, the best results on cotton being obtained by the Turkey Red process; red, maroon, and claret shades of excellent fastness to light may be obtained with this dyestuff, which is identical with Madder. Sappanwood is similar to logwood, the oxidation of the colouring matter being carried out by the "ageing" process; it can be used for the production of brilliant red, crimson, and purple shades, and is very suitable for calico printing.—F. W. A.

PATENT.

Electrolytic apparatus for the production of bleaching liquor, etc. Eng. Pat. 1672. See XI.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Carbonic acid; Behaviour of — in pure aqueous and saline solutions. E. Wilke. Chem. Ges. zu Heidelberg, Feb. 19, 1915. Chem.-Zeit., 1915, 39, 309.

The general assumption that aqueous solutions of carbon dioxide contain the hydrate, H_2CO_3 , is not in accord with the probability that this substance being a hydroxyformic acid, would exhibit strong acidic properties. A re-determination of electrical conductivity of aqueous solutions of the gas, whilst confirming the values for the dissociation constant, 2.89×10^{-7} , previously found by Walker (Chem. Soc. Trans., 1900, 77, 1), demonstrated also the labile character of such solutions, changes in conductivity being effected by contact with metals, such as gold or platinum, and even by the feeble current used in making the measurements. The dissociation of carbonic acid in salt solutions was studied by determining the hydrogen-ion concentration, using a palladium capillary saturated from within with hydrogen under pressure, as electrode. Carbonic acid was found to be a much stronger acid under these circumstances than in pure aqueous solution, and the conclusion is drawn that in pure aqueous solution a higher hydrate, possibly ortho-carbonic acid, $C(OH)_4$, which is only a very feeble acid, is produced, from which by the dehydrating action of the salt solutions the lower hydrate, $HO.COOH$, is formed, which possesses the strong acid properties expected of it. The fact that electrolysis of pure aqueous solutions of carbonic acid yields only minute traces of formic acid, compared with salt-containing solutions, is held to support this view.—G. F. M.

Limestones for "fat" lime; Structure of —. G. Gallo. Annali Chim. Appl., 1915, 3, 213—224.

In the quarrying of Carrara marble large quantities of small pieces are produced, and these represent a waste product, for the lime obtained on burning the marble, although containing over 97% CaO , is not a "fat" lime, and hence is unsuitable for building purposes, or for gas purification, sugar refining, manufacture of bleaching powder, or other purposes in which a condition of extreme fineness of subdivision is required. Experiments made by the author show that the quality of lime depends not only on the chemical composition, but also very largely on the structure of the limestone from which it is derived. In general a "fat" lime cannot be obtained from a limestone with a macrocrystalline structure, unless this be finely ground and then briquetted, before burning. In most cases grinding and briquetting are not practicable on account of the cost. To determine the quality of the lime the author used a test proposed by Giorgis and Cemi: 500 grms. of the lime is mixed with excess of water (about 1500 c.c.) in a tared cylinder of porous earthenware of about 2 litres capacity. The excess of water drains through the cylinder, and when the lime paste begins to show cracks on the surface, its volume is noted, and the cylinder with its contents is weighed. Under these conditions lime from Carrara marble absorbed about 920 grms. of water and yielded about 1.3 litres of lime paste, whereas a "fat" lime of similar composition from cryptocrystalline Capistrello limestone absorbed 1960 grms. of water and yielded 2.3 litres of lime paste; lime from Carrara marble which was finely ground and passed through a sieve of 4000 meshes per sq. cm. before burning, absorbed 2060 grms. of water and yielded 2.3 litres of lime paste.—A. S.

Lime; Reburning of—*from alkali waste and other forms of precipitated carbonate of lime.* R. K. Meade. *Met. and Chem. Eng.*, 1915, **13**, 289—290.

LIME is recovered from waste calcium carbonate from the manufacture of caustic soda, sugar, etc., by settling or filtering the sludge and calcining in a rotary kiln as used in cement burning. The burnt lime consists of nodules of walnut size down to dust; it has a slightly yellowish or greenish colour and contains a small quantity of impurities taken up in the process; this is counteracted by adding 5—10% of fresh lime at regular intervals. The cost of a plant for treating 25 tons per day is stated to be \$17,000—20,000 (about £3500—£4200), with a fuel and power consumption of 600—800 lb. of coal or 60—80 galls. of oil and 15 kilowatt-hours per ton of lime produced.

—W. R. S.

Ammonia gas for inflating airships. A. Sander. *Chem.-Zeit.*, 1915, **39**, 325—326.

A SUGGESTION has been made recently to substitute ammonia for hydrogen for aeronautical purposes, on the ground of its non-inflammability, its easy liquefaction whereby cylinders of liquid ammonia could be carried on board the airship for use as required, and its solubility in water whereby any desired degree of deflation could be attained by mere absorption in water. The author considers that the disadvantages attending the use of ammonia far outweigh these advantages. Its lifting power is only 0.52 kilo. per cub. metre compared with 1.20 kilos. for hydrogen, and volume for volume it is ten times as costly as hydrogen. Apart also from the destructive action of ammonia on the material of the envelope and its unpleasant effect on the occupants of the airship in case of leakage, mixtures of ammonia and air between the limits of 16.5 and 26.8% NH_3 by vol. are dangerously explosive (see this J., 1914, 1087).—G. F. M.

Hydrazine salts; Behaviour of certain—on decomposition by heat. [Detection of hydronitric (hydrazoic) acid in presence of sulphur dioxide.] J. W. Turrentine. *J. Amer. Chem. Soc.*, 1915, **37**, 1105—1114.

HYDRAZINE monochlorate on decomposition in sulphuric acid solution, yields hydronitric (hydrazoic) acid. The corresponding di-salt gives the same result both in the presence and absence of sulphuric acid. The mono- and diperchlorate of hydrazine yield no hydronitric acid in either acidified or neutral solution. Decomposition of the dry crystallised salt by heat in a stream of carbon dioxide produced hydronitric acid from the latter salt but not from the former; in both cases chlorine, nitrogen, and oxygen were liberated. Hydronitric acid can be detected in the presence of sulphur dioxide by boiling with sodium hydroxide and hydrogen peroxide until effervescence ceases, then acidifying, distilling, and testing the distillate with ferric chloride; a red coloration indicates hydronitric acid.—H. R. D.

Hydrazine sulphate and ammonium hydroxide; Electrochemical oxidation of—, J. W. Turrentine and J. M. Olin. *J. Amer. Chem. Soc.*, 1915, **37**, 1114—1122.

THE investigation was undertaken to discover reactions that would yield nitrogen hydrides such as ammonia, and more particularly hydronitric (hydrazoic) acid as a product, under wider conditions than those obtained by Szarvasy (*J. Chem. Soc.*, 1900, **77**, 603). Hydrazine sulphate in saturated aqueous solution containing 10% by vol. of concentrated sulphuric acid is oxidised electrochemically to hydronitric acid with a

current of 1.5 amperes. The yield is greater when the electrolyte is maintained at 0° C. or lower by means of an ice bath. Ammonium hydroxide in the presence of sodium chloride and glue, using a current of 0.3—0.4 ampere, is oxidised to hydrazine provided that sodium chloride solution is added in small amounts at intervals during electrolysis.—H. R. D.

Sodium and potassium; A new method for the determination of— in a mixture of their salts. K. Okada. *Mem. Coll. Sci., Kyoto Imp. Univ.*, 1914, **1**, 89—93.

ONE grm. of a mixture of sodium and potassium chlorides (or sulphates) and 2.4 grms. (or 2 grms.) of sodium hydrogen tartrate were dissolved in water and made up to 50 c.c. at 25° C. After shaking for 5 hours in a thermostat at 25° C., the residue from 20 c.c. of the clear supernatant liquid was ignited at a red heat and extracted with standard hydrochloric acid; the excess of acid was then determined with standard sodium hydroxide. From the amount of acid used the composition of the original mixture was determined by referring to a curve summarising the results obtained in the above manner with similar mixtures of known compositions. In a series of experiments with the chlorides the actual and determined molar percentages of potassium chloride were, respectively: 52.4, 52.3; 52.3, 52.3; 40.5, 39.5; 33.2, 33.0; 8.0, 8.3; 5.8, 6.6. The results obtained with sulphate mixtures were similarly: 91.1, 90.7; 84.9, 85.3; 79.3, 79.2; 50.6, 50.6; 43.2, 42.9; 25.9, 25.5; 2.8, 2.7. The method is unsatisfactory for chloride mixtures containing less than about 5% KCl; but with sulphate mixtures the degree of accuracy is not affected in this manner.—J. R.

Sodium and potassium sulphates; The double salt of— K. Okada. *Mem. Coll. Sci., Kyoto Imp. Univ.*, 1914, **1**, 95—103.

WATER was saturated with various mixtures of sodium and potassium sulphates, and from analyses of the solutions and residues (see preceding abstract) the existence of a double salt of the formula, $\text{K}_2\text{Na}(\text{SO}_4)_2$, was deduced. This salt forms solid solutions with sodium sulphate but not with potassium sulphate, and data are given for the interval 15° to 50° C.—J. R.

Halides; Titration of small amounts of— F. C. McLean and D. D. Van Slyke. *J. Amer. Chem. Soc.*, 1915, **37**, 1128—1134.

THE halide is precipitated in the presence of a known amount of free nitric acid (about 1 grm.), with an excess of N/25 or N/50 silver nitrate solution. In the case of bromides and chlorides the silver halide is removed by filtration. The excess of silver is titrated with N/50 potassium iodide which has been standardised against the silver nitrate solution. Before titrating, 4 c.c. of a solution containing 446 grms. of trisodium citrate, 19 grms. of sodium nitrite, and 2.5 grms. of soluble starch per litre is added for each gram of free nitric acid present. One drop of N/50 iodide produces a very sharp colour that can be seen in 150 c.c. of solution.—H. R. D.

Sulphides; Oxidation of— with potassium iodate. R. S. Dean. *J. Amer. Chem. Soc.*, 1915, **37**, 1134—1137.

ANDREWS (*J. Amer. Chem. Soc.*, 1903, **25**, 756) has shown that in solutions containing 50% or more of hydrochloric acid, potassium iodate may be used as an oxidising agent, the iodine first liberated being ultimately converted into iodine chloride, ICl , and the end of the reaction being shown by the disappearance of colour in some chloroform mixed with the liquid. In the determination of sulphides the method is found applicable, especially

where the sulphide is easily washed without oxidation, as in the case of As and Sb. In the oxidation of cadmium, zinc, and lead sulphides, one-third of the sulphur is oxidised to sulphuric acid, while two-thirds is liberated as free sulphur. (See also this J., 1911, 549; 1912, 111; 1915, 135.)

—H. R. D.

Calcium hydroxide and sulphur in aqueous solution; Reaction between—[during preparation of lime-sulphur wash]. S. J. M. Auld. Chem. Soc. Trans., 1915, 107, 480—495. (See van Slyke, this J., 1910, 589, and Tartar, this J., 1910, 837; 1914, 351.)

THE preparation and examination of lime-sulphur wash, under conditions which excluded air and carbon dioxide, indicated that lime and sulphur react in aqueous solution with the formation of polysulphides (or oxysulphides) and thio-sulphate only, probably according to the equations: $5\text{Ca}(\text{OH})_2 + 6\text{S} = 2(\text{CaS}_2, \text{CaO}) + \text{CaS}_2\text{O}_3 + 5\text{H}_2\text{O}$, and $\text{CaS}_2, \text{CaO} + x\text{S} + \text{H}_2\text{O} = \text{CaS}_{2+x} + \text{Ca}(\text{OH})_2$. When an excess of sulphur was used, the ratio between polysulphide S + monosulphide S and the monosulphide S alone, usually lay between 4.5 and 5.0, but sometimes exceeded the latter figure. Much of the polysulphide S was extracted by solvents, both from the solution and from the solid obtained by evaporation, and evidence was secured of the probable existence of a stable CaS_2 complex; attempts to prepare calcium disulphide gave only Herschell's crystals, to which the formula, $\text{CaS}_2, \text{CaO}, 7\text{H}_2\text{O}$, is assigned (compare Genther, Annalen, 1884, 224, 178). It is suggested that the polysulphides of calcium possess the constitution $\text{Ca} \begin{smallmatrix} \text{S} \\ \text{S} \end{smallmatrix} \text{S} : \text{S} : \text{S} : \dots$, the atoms of sulphur

in the chain becoming progressively more loosely attached (compare Küster and Heberlein, this J., 1905, 544). Experiments on the action of dilute acids upon the polysulphide solution indicated the possible existence of polysulphides at least as high as CaS_7 .—F. SODN.

Barium oxide, acetic acid, water and magnesium oxide, acetic acid, water; The systems—. J. Iwaki. Mem. Coll., Sci., Kyoto Imp. Univ., 1914, 1, 81—88.

A STUDY of the equilibrium of the systems at 25° C. established the existence of the following acid salts: $3(\text{CH}_3\text{CO}_2)_2\text{Ba}, 3\text{CH}_3\text{CO}_2\text{H}, 11\text{H}_2\text{O}$; $(\text{CH}_3\text{CO}_2)_2\text{Ba}, 2\text{CH}_3\text{CO}_2\text{H}$; $2(\text{CH}_3\text{CO}_2)_2\text{Mg}, 3\text{CH}_3\text{CO}_2\text{H}, 3\text{H}_2\text{O}$ and $5(\text{CH}_3\text{CO}_2)_2\text{Mg}, 10\text{CH}_3\text{CO}_2\text{H}, 7\text{H}_2\text{O}$.—J. R.

Cuprous salts of oxygen acids [cuprous oxalate], and a new method for preparing cuprous salts. L. C. Daniels. J. Amer. Chem. Soc., 1915, 37, 1167—1171.

WHEN red cuprous sulphite ($\text{Cu}_2\text{SO}_3, \text{H}_2\text{O}$) is introduced in small quantities into an excess of a hot solution of oxalic acid, hydrated cuprous oxalate, $\text{Cu}_2\text{C}_2\text{O}_4, 2\text{H}_2\text{O}$, separates as a brown powder. It is also formed by digesting 1 part of cuprous oxide with $2\frac{1}{2}$ parts of oxalic acid in solution. Cuprous oxalate dissolves in dilute hydrochloric acid (1 : 2), and in strong ammonia, without separation of copper; and it is decomposed by warm, dilute nitric and sulphuric acids, giving the cupric salt and free copper. Heated for 2 hours at about 95° C., its colour changes to a dull, dark gray, but the original colour is restored on subsequent treatment with cold dilute nitric acid. When heated in a crucible, it turns grey and then decomposes suddenly, almost explosively.—E. H. T.

Tri-magnesium citrate. E. Léger. Comptes rend., 1915, 160, 660—663. (See also this J., 1915, 574.)

THREE hydrated forms of tri-magnesium citrate

have been isolated containing respectively, 13, 9, and 7—8 mols. H_2O . The salt with 13 mols. H_2O crystallises out very slowly when a warm concentrated solution of citric acid is saturated with magnesium carbonate, and still more slowly when magnesium sulphate is added to tri-sodium citrate. The salt with 9 mols. H_2O is obtained as a crystalline precipitate when a strong solution of tri-magnesium citrate is kept on a water-bath for about 20 hours, or when the solution is simply heated to 110° C.; it is insoluble, even in boiling water, but dissolves in ammonia. The salt with 7—8 mols. H_2O is produced by mixing boiling alcoholic solutions of magnesium acetate (3 mols.) and citric acid (2 mols.); it dissolves in 2 parts of cold water, and the solution deposits crystals containing 13 mols. H_2O on standing. The latter compound loses 11 mols. H_2O at 110° C., and the remaining water is expelled at 150°—155° C. The salt with 9 mols. H_2O is more stable, complete desiccation not being effected below 175° C. Attempts to confirm the existence of basic magnesium citrates were unsuccessful.—E. H. T.

Manganese dioxide; Preparation and transformations of colloidal—. E. J. Witzemann. J. Amer. Chem. Soc., 1915, 37, 1079—1090.

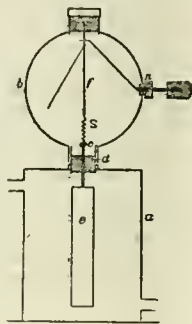
COLLOIDAL manganese dioxide is formed during the oxidation of certain organic compounds with potassium permanganate. A simple method of producing it is by the incomplete oxidation of dextrose with alkaline permanganate, 100 c.c. of potassium permanganate solution (60 grms. in 1100 c.c. water) is added from a dropping funnel, within a period of 5 minutes, to a solution of 5 grms. of dextrose in 20 c.c. of water, made alkaline with a few c.c. of 10% caustic soda. The sugar solution is placed in an ice-bath and kept in agitation. A viscous liquid is rapidly formed which in 5—10 minutes sets to a stiff jelly; this gradually changes to a semi-liquid gel, which in a few days forms a liquid dark-brown colloidal solution. The viscous liquid of the first stage has the properties of a typical emulsoid; the final solution seems to be of a suspensoid character. The conversion of the emulsoid into the jelly would be normal but for the slow but simultaneous conversion into the suspensoid, which is induced by the presence of the alkali. Both transformations are influenced by temperature changes, by changes in the concentration of the reacting liquids, and by the concentration of the alkali. The suspensoid is readily coagulated by warming, but otherwise is very stable, particularly in concentrated solution. Very similar results ensue if, instead of dextrose, galactose, laevulose, lactose, tartaric acid, or glycerol be used, but lactose acts slowly, and in the case of the last two, the gels show little tendency to go into solution. It is regarded as probable that the stimulative effects of manganese in certain biochemical changes may be closely related to the existence and properties of the colloidal dioxide. —E. H. T.

Mercuric sulphate; Action of the halogens upon—. M. Chateau. Bull. Soc. Chim., 1915, 17, 121—124.

BRÜCKNER (Monats. Chem., 1906, 115) has shown that iodine reacts with mercuric sulphate under certain conditions to form a fairly stable complex compound, $6(3\text{HgO}, 2\text{SO}_3)6\text{HgI}_2, \text{HgI}_2\text{O}_4$. The author has found that chlorine and bromine do not behave similarly, but that the products of their reaction upon mercuric sulphate are respectively sulphuric acid, hypochlorous acid, mercurous chloride, and sulphuric acid, hypobromous acid mercurous bromide.—J. P. O.

Radium; Practical methods for the determination of—. I. Interchangeable electroscope and its use. S. C. Lind. J. Ind. Eng. Chem., 1915, 7, 406—410.

A SIMPLE electroscope (see fig.) for determining radium by the emanation method is described. The emanation chamber, *a*, consists of an upright brass cylinder, 4 ins. high and $3\frac{1}{2}$ ins. diam., fitted with an inlet and an outlet tube and a collar screwed into the upper end plate. A brass cylinder, *e*, $\frac{1}{2}$ in. diam., placed centrally in the cylinder and extending to within $\frac{1}{2}$ in. of the bottom and top, serves as electrode. It is carried by a brass rod, $\frac{1}{4}$ in. diam., which passes up through a plug of sealing wax, *d*, in the collar, and ends in a small conical cap, *c*, serving to make contact with the leaf system in the upper detachable part of the electroscope. The latter consists of a horizontal cylinder, *b*, $3\frac{1}{2}$ in. diam. and $1\frac{1}{4}$ in. deep, the ends of which are closed by sheet mica held in place by steel wire rings fitting in grooves in a manner similar to that used for automobile tyres; fine wire gauze in contact with the inner face of the mica serves to lead off stray electrical charges. A telescope is fixed firmly to one end of the cylinder. The leaf system comprises a flat brass rod, *f*, terminating in a brass spring, *s*, to make a light contact with the cap, *c*; the aluminium leaf is attached to a small offset at the top of the brass rod by a moisture contact. The electroscope is charged by means of a brass rod fixed in a hard rubber insulation, *n*, and sloping upwards inside the cylinder so as to make contact with the rod while charging, and then, by turning the rod, with the wire grating of the outer case. The electroscope is charged for 15 mins., using just sufficient voltage to hold the leaf on the desired part of a micrometer scale on the eyepiece of the telescope, and the natural leak is then determined during 15 mins. The upper part is next detached, the lower chamber exhausted, and a dried mixture of emanation and air drawn in. After restoring normal pressure, the emanation is left in the chamber for 3 hours, the top replaced, and charged for 15 mins. as before. The time taken for the leaf to pass over a certain part of the scale is then noted; three readings are usually sufficient, but ten are taken if the deviations are greater than 1%. The instrument is calibrated by using the emanation evolved on dissolving a known weight (20—40 mgrms.) of high-grade pitchblende, the radium content of which is calculated from its uranium content. The quantity of emanation does not correspond exactly to the radium content, owing to the diffusion of a small fraction from the ore; the "emanating power" of the ore must be determined by sealing a weighed quantity in a tube, and, after 1 month or more, drawing off the emanation into an electroscope by means of air. After each measurement dry, dust-free air from outside the laboratory should be drawn through the apparatus for some time, preferably over night. If the emanation chamber becomes contaminated with active deposit, it must be opened, the walls washed with dilute nitric acid (1 : 3), then with water, and dried, these operations being repeated until the natural leak of the instrument is sufficiently reduced.—A. S.



litre. The measurements were made in the usual type of vacuum electroscope with amber insulation, standardised with pitchblende containing 46.2% uranium; the mineral was dissolved in nitric acid, the solution diluted until 250 c.c. contained the same amount of radium as the sample of sea water, and kept for 30 days before using to ensure the presence of the maximum amount of emanation.—H. R. D.

Kelps of the Pacific coast (U.S.A.); Organic constituents of—. D. R. Hoagland. J. Agric. Research, 1915, 4, 39—58.

THE total organic matter in the seven species of kelp investigated, varied from 45 to 74% of the whole plant, and from 50 to 71% of the leaves and stems (dry basis). Most of it is insoluble in water and in alcohol, and some very complex compounds are present in a highly colloidal state. Pentosans were found in all samples, galactans in some, but starch and reducing sugars were absent. From one-third to one-fifth of the total nitrogen is water-soluble, and about the same proportion is non-protein nitrogen; the amounts of ammoniacal and amino-nitrogen were insignificant. Carbohydrates or similar substances compose the main portion of the organic matter, and are of colloidal character. Californian kelps yield no jelly similar to agar-agar. The most important carbohydrate present is "algin," which is best extracted with 2% sodium carbonate solution: it constitutes from 13 to 24% of the dry seaweed. Algin probably consists of a complex composed of compounds of the pentosan type and cellulose. It has weakly acid properties, and the sodium salt precipitates many metals from solution. Some "alginates" might be useful as sizes or mordants. The cellulose content composes about one-half of the crude fibre, or 3—4% of the whole dry plant. The total sulphur averaged about 1% of the dry plant, but *Iridaea* spp. contained 8.16%; nearly all of the sulphur is in organic combination. The iodine can be extracted by cold water or 90% alcohol, and is practically all in the inorganic state. The bromine content is only one-fifth to one-tenth that of the iodine, thus reversing the proportions present in sea water. When the kelps are dried, much potassium chloride appears as an efflorescence, but this contains no iodine. It is very improbable that these kelps possess any value as nutriment for man or animals, and laboratory experiments indicated that the products of their destructive distillation are very much inferior to those from oak sawdust or fir shavings.—E. H. T.

Crystallisation from aqueous solutions; Velocity of—. N. P. Campbell. Chem. Soc. Trans., 1915, 107, 475—480.

By comparing the rates of growth of weighed crystals of alum, suspended in a slightly super-saturated solution of this substance, it was found that the rates of growth on similar crystal faces were proportional to the areas of the faces exposed to the liquid. A large crystal did not grow at the expense of small ones. Alkaline impurities in the solution favoured the development of cube faces, and crystals of potassium alum, allowed to grow in a solution containing Portland cement, were obtained as almost perfect cubes, the octahedral faces being completely suppressed. In a solution saturated with regard to both alum and potassium bichromate, crystals of alum and bichromate, hung side by side, developed with perfect faces.—F. SODN.

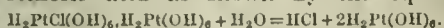
Electrolytes; Photochemical formation of—. M. Boll. Ann. Phys., 1914, 2, 5—54, 226—268. J. Chem. Soc., 1915, 108, ii., 123—124.

The photochemical decomposition of the chloroplatinic acids in very dilute aqueous solutions, on

Radium content of water from the Gulf of Mexico. S. J. Lloyd. Amer. J. Sci., 1915, 39, 580—582.

A SAMPLE of water from the Gulf of Mexico gave a mean reading of 1.70×10^{-12} grm. of radium per

exposure to the rays emitted by a mercury quartz lamp, was determined by measuring the increase in the electrical conductivity. A method of measuring high resistances was employed, involving the use of an alternating current and a quadrant electrometer. The decomposition of hexa-, penta-, tetra-, di-, and mono-chloroplatinic acids proceeded in agreement with the formula for a bimolecular reaction as represented in the following general equation: $2\text{H}_2\text{PtCl}_n(\text{OH})_{6-n} + (2n-1)\text{H}_2\text{O} = (2n-1)\text{HCl} + \text{H}_2\text{PtCl}(\text{OH})_5, \text{H}_2\text{Pt}(\text{OH})_6$. The solutions obtained were metastable, and usually deposited a reddish brown precipitate of platonic hydroxide, accompanied by a further rise in conductivity corresponding with the liberation of hydrochloric acid as shown by the equation:



Experiments with tetrachloroplatinic acid solutions subjected to monochromatic ultra-violet light (λ 2536 and λ 2655) showed that the reaction velocity is proportional to the intensity of the incident radiation, and absorption of the active rays is in accordance with the exponential formula representing the combination of Beer's and Lambert's laws. It is stated that the photochemical decomposition of the acids may be employed in a chemical actinometer ranging from the yellow to the extreme ultra-violet. From observations with monochromatic light (varying from λ 2378 to λ 5460) the reaction velocity is found to increase exponentially with the frequency, and for light of definite wave length the velocity increases considerably with rise of temperature. Experiments on the photochemical decomposition of oxalic acid in the presence of uranyl nitrate show that the reaction is unimolecular, as in the equation: $\text{H}_2\text{C}_2\text{O}_4 + \text{O} = 2\text{CO}_2 + \text{H}_2\text{O}$, the uranyl nitrate acting as a catalyst. In agreement with this, the velocity is proportional to the quantity of light absorbed, and independent of the concentration of the oxalic acid.—B. N.

Indian saltpetre.

A PRESS COMMUNIQUE, dated April 16, 1915, issued by the Indian Department of Commerce and Industry, states that, with a view to encourage the production of saltpetre and its allied salts in the areas in which the administration of the salt revenue is under the control of the Northern India Salt Revenue Department, the Government of India have recently sanctioned the adoption of the following measures: (1) A gradual extension of the areas in which the manufacture of saltpetre and its allied salts is permitted, provided that the extension is in no case allowed to imperil the security of the salt revenue; (2) a reduction of the licence-fees from Rs. 2 and Rs. 10 to Rs. 1 per annum in provinces other than Bihar; (3) distribution of the licences through the agency of the Post Office on payment of a commission of 2 annas to the postal clerk for each licence issued; (4) grant of permission to the owners of saltpetre-refineries to compound for the duty on salt produced during the refining of saltpetre; and (5) removal of some of the restrictions to which factories for the manufacture of sulphate of soda (khari) are at present subject. The question of applying similar measures to the saltpetre industry in Bengal has also been referred for the consideration of the Government of Bengal. It is hoped these measures will remove the obstacles which at present hamper production and ensure an adequate supply of saltpetre and its allied salts to meet the requirements of local industries.

Heat transmission capacity of a silica dish. Lewis. See 1.

Reduction of iron oxides by platinum. Sosman and Hostetter. See X.

Determination of carbon dioxide in baking powder and carbonates. Brubaker. See XIXA.

Solubility of calcium and magnesium carbonates in waters free from carbonic acid in reference to their salt content. Gothe. See XIXB.

Colorimetric detection of oxalic acid and of manganese. Sacher. See XXIII.

Precipitant for ammonia. (Substitute for Nessler's reagent.) Graves. See XXIII.

PATENTS.

Acid-spray catcher. F. Tschudy, Fairfield, Ala. U.S. Pat. 1,135,471, April 13, 1915. Date of appl., Sept. 21, 1914.

THE apparatus comprises an outer and an inner shell, with the intermediate space divided into two compartments by division walls; baffle-plates are placed alternately on the inner and outer walls. The space enclosed by the inner shell forms an outlet conduit, which is divided by a partition into two compartments communicating respectively with the corresponding outer compartments. Means are provided for directing the gas carrying the acid spray to one of the outer compartments and shutting off the other, whereby the latter may be washed without interrupting the flow of gas.—H. R. D.

Nitric acid; Process and apparatus for the preparation of highly concentrated—. R. Schall, and Stickstoffwerke A.-G. Ger. Pat. 280,965, Aug. 30, 1913.

A MIXTURE of dilute nitric acid and a dehydrating agent is passed through a tower provided with a central tube through which heating gases are passed. Ribs of heat-conducting material, projecting from the outer wall of the tube, are arranged in steps or in the form of a screw so as to lengthen the path of the acid along the surface of the tube. The tube and ribs are preferably made of acid-resistant iron-silicon or iron-chromium alloys.—A. S.

Sulphuric acid; Apparatus for concentrating—. A. Bernutat. Ger. Pat. 281,133, March 12, 1914.

THE apparatus comprises three concentrating compartments arranged in series, through which the acid flows in succession, meeting hot gases flowing in the opposite direction. Special conduits are provided through which a portion of the acid in the second and third compartments can flow back to the first, thereby raising the concentration and temperature of the acid in the latter.—A. S.

Sulphuric acid; Reaction tower system for the manufacture of—. E. Hoefling. Ger. Pat. 281,135, Dec. 24, 1912.

THE towers are packed with tubes provided with openings and partitions so as to afford a large number of reaction spaces without unobstructed passages.—A. S.

Ammonia and formic acid; Preparation of—. H. Haakh. Ger. Pat. 281,041, Feb. 11, 1913.

AMMONIA and formic acid are produced by heating compounds of the type of ferrocyanides with water or bases. With potassium ferrocyanide the reaction proceeds according to the equation: $\text{K}_4\text{Fe}(\text{CN})_6 + 14\text{H}_2\text{O} = 4\text{HCO}_2\text{K} + 2\text{HCO}_2\text{NH}_4 + 4\text{NH}_3 + \text{Fe}(\text{OH})_2$.

If decomposition be effected with potassium hydroxide solution, a pure solution of potassium formate is obtained after distilling off the ammonia and separating the precipitated iron hydroxide.—A. S.

Ammonia from gases, vapours, and spray; Process for the recovery of—A.-G. der Chem. Produktionsfabr. Pommernsdorf, and R. Siegler. Ger. Pat. 281,095, April 29, 1913.

THE gas, vapour, or spray is mixed with sulphur dioxide, and ammonium sulphite is separated in the form of a concentrated aqueous solution by mechanical treatment of the mixture in a warm atmosphere saturated with moisture, cooling being avoided. For instance, the mixture may be drawn into the casing of a centrifugal fan. The gases leaving the fan casing still contain small quantities of ammonia and sulphur dioxide, which are recovered in the form of a concentrated solution of ammonium sulphate by passing the gases through a wooden tower packed with wood charcoal or coke. Hydrochloric acid may be used instead of sulphur dioxide.—A. S.

Ammonia from coke breeze; Process for obtaining—C. Waldeck. Ger. Pat. 281,096, Aug. 15, 1913.

THE coke breeze is treated with steam or a mixture of steam and other gases at the temperature most favourable to the conversion of its nitrogen into ammonia, the necessary temperature being attained by passing an electric current through the coke. From 88 to 99% of the nitrogen present in the coke can be converted into ammonia.—A. S.

Ammonia; Preparation of—from a mixture of carbon monoxide, nitrogen, and water. J. Wolf. Ger. Pat. 281,317, Dec. 11, 1912.

A GASEOUS mixture rich in carbon monoxide and nitrogen is produced, for instance by leading air over incandescent coke or the like, and after leaving the generator, is mixed with steam or atomised water. Ammonia, ammonium salts or derivatives, and carbon dioxide are formed, and the yield can be increased by working under pressure; the temperature should be kept between 300° and 450° C.—A. S.

Hydrocyanic acid; Preparation of—synthetically by the circulating passage of a gas mixture through an expanded high potential arc. A. V. Lipinski, Zürich, Switzerland. Eng. Pat. 11,107, May 5, 1914.

A GASEOUS mixture of hydrocarbons, hydrogen, and nitrogen is circulated through an expanded high-potential arc, in which separation of carbon is prevented by blowing in cooled residual gases (freed from hydrocyanic acid) directly behind the point of highest temperature of the reaction mixture. A portion of the residual gas is burnt with air in a special combustion chamber, in order to eliminate hydrogen and replace the nitrogen used in the reaction, and oil gas or natural gas is then added and the mixture again passed into circulation. The yield of hydrocyanic acid may be increased by carburetting the oil gas or natural gas with paraffin hydrocarbons.—F. SODN.

Hydrogen cyanide and cyanogen compounds; Preparation of—by catalytic combination of gaseous or volatile compounds of carbon and nitrogen. C. Beindl. Ger. Pat. 281,723, May 14, 1914.

HIGHER yields are obtained by mixing compounds of the alkalis, alkaline-earths, or earth metals or of molybdenum, uranium, osmium, titanium, etc., or the corresponding ores, with the metal or metals used as catalyst.—A. S.

Alkali lyes; Process for the dehydration of—W. Hentschel. Ger. Pat. 281,792, Aug. 30, 1912.

ALKALI lyes are evaporated by passing them through a series of iron retorts, the solution flowing

as a film over the horizontal bottom of each retort. Concentration to 96–99% strength is effected in retorts heated to a temperature below red heat, and the last traces of water are expelled in retorts heated to redness. Caustic alkali containing 1–4% H₂O vigorously attacks red-hot iron, but has little action on iron at lower temperatures; alkali containing not more than 1% H₂O has little action on red-hot iron.—A. S.

Calcium carbide; Manufacture of—F. M. Becket, Niagara Falls. Assignor to Union Carbide Co., New York. U.S. Pat. 1,137,567, April 27, 1915. Date of appl., Jan. 20, 1915.

A MIXTURE of lime and bituminous coal, in such proportion that the fixed carbon approximately suffices for the carbide-forming reaction, is coked in a by-product oven, so as to yield a mechanically strong aggregate, in which electrodes may be embedded for smelting to carbide.—F. SODN.

Alumina; Method of making alkali-soluble—P. R. Hershman, Chicago, Ill., Assignor to The Mineral Products Co., New York. U.S. Pat. 1,137,617, April 27, 1915. Date of appl., Oct. 29, 1914.

ALUMINA, e.g., calcined alunite, is heated with carbon, in presence of a protective (non-nitrifying) gas, to a temperature sufficient to leave it soluble in alkali, mainly as oxide.—F. SODN.

Hydroxides of metals; Production of—by means of ammonia. H. A. Frasch, New York. U.S. Pat. 1,135,785, April 13, 1915. Date of appl., April 10, 1913.

A SOLUTION of a salt of the metal, e.g., nickel, is boiled in the presence of an ammonium salt and free ammonia, until the hydrated oxide is precipitated. The aqueous ammoniacal vapour evaporated during the process is condensed, and sufficient of the distillate returned to keep the boiling solution alkaline with ammonia during the precipitation of the metallic oxide; or the vaporised ammonia may be concentrated by means of a dephlegmator, and a part of the dehydrated ammonia returned to keep the boiling solution alkaline.—H. R. D.

Kelp; Extraction of mineral salts and organic constituents of—A. G. Artz, Assignor to Kelp Products Co., San Francisco, Cal. U.S. Pat. 1,136,390, April 20, 1915. Date of appl., March 10, 1913.

RAW kelp is subjected to pressure, sulphuric acid is added to the expressed liquid to precipitate the algin, and after filtration, calcium carbonate is added in sufficient quantity to neutralise the acid, and the liquid is made alkaline by the addition of sodium carbonate (10 to 15 lb. per 100 gallons of liquid). The solid organic matter is macerated to a pulp and boiled with the alkaline solution obtained, to extract further algin and the soluble salts contained in the pulp. The solution thus obtained is separated from the cellulose by pressure, and treated with acid to precipitate dissolved algin, filtered, neutralised, and evaporated to remove the salts.—H. R. D.

Potash salts and the like; Apparatus for the continuous decomposition and dissolving of—G. Sauerbrey Maschinenfabr. A.-G. Ger. Pats. (A) 280,557, March 21, 1914, (B) 281,354, Sept. 21, 1913, (C) 281,355, March 21, 1914, and (D) 281,356, Sept. 21, 1913. Additions to Ger. Pat. 262,235.

(A). THE ends of the inner drum of the apparatus described in the chief patent (this J., 1913, 826) are in the form of double cones projecting through the ends of the fixed outer drum and supported, outside the latter, on rollers. The driving wheel

for rotating the inner drum is also outside the fixed outer drum, and hence the bearings, etc., are accessible while the apparatus is working. (B). The lower part of the fixed outer drum is enlarged to form a trough in which is placed a screw. The screw serves to keep the fine solid material in suspension until it is dissolved and to carry forward the heavier material to an elevator which returns it to the inner drum. (C) The solution from the inner drum carrying suspended particles passes first into a heating chamber below the outer drum. This chamber has steeply inclined side walls and is provided with heating pipes and a screw conveyor and agitator at the bottom. It is connected with the outer drum by a series of conduits, between which are transverse partitions so as to cause the liquid to circulate upwards and downwards. Pieces of angle iron, fixed on the outer surface of the inner rotating drum, between the conduits connecting the outer drum and the heating chamber, are so arranged as to cause the solution to circulate from the middle towards the ends. (D) The apparatus consists of two V-shaped troughs, one within, but spaced apart from the other. The material is disintegrated and partly dissolved in the inner trough provided with a screw conveyor and agitator, and flows thence through an opening at the middle into the outer trough, in the lower part of which is another screw conveyor. The inner trough is provided with transverse partitions above the conveyor, and in the spaces between the partitions are agitating blades mounted on a shaft. The liquid carrying suspended matter rises in the outer trough and is caused by baffles to take a sinuous path around heating tubes in the spaces between the side walls of the two troughs.—A. S.

Potassium chloride in a coarsely crystalline form; Process for obtaining —. Consolidierte Alkali-Werke A.-G. f. Bergbau u. Chem. Industrie. Ger. Pat. 281,501, July 2, 1907.

A COOLING liquid is passed through cooling boxes arranged side by side in a trough, and the hot solution of potassium chloride is passed through the trough over the outer surfaces of the cooling boxes, in the opposite direction to that of the cooling liquid. The crystals deposited on the outer walls of the cooling boxes fall to the bottom of the trough when the deposit attains a certain thickness, and are removed by a conveyor.—A. S.

Crystals; Method of removing — from the crystallisation plates of apparatus for crystallising hot-saturated solutions of salts. G. Sauerbrey Maschinenfabr. A.-G. Ger. Pat. 280,915, Aug. 30, 1913. Addition to Ger. Pat. 271,246 (this J., 1914, 484).

THE crystals are removed by a powerful jet of a mother-liquor or other solution incapable of dissolving them.—A. S.

Alunite and the like; Treatment of —. C. H. MacDowell, Chicago, Ill., Assignor to The Mineral Products Co., New York. U.S. Pat. 1,136,549, April 20, 1915. Date of appl., July 31, 1914.

ALUNITE is calcined to drive off sulphurous and sulphuric anhydrides, then heated to a higher temperature in the presence of carbon, and preferably in a current of gas, in order to volatilise and drive off the potash, which is deposited as a solid.—H. R. D.

Radioactive constituents from liquids containing them; Process for obtaining —. H. Stern. Ger. Pat. 280,691, Jan. 10, 1914.

THE radioactive liquid is passed through a filter composed of substances, e.g., natural or artificial zeolites, capable of exchanging bases with the radioactive substances.—A. S.

Chlorides, especially stannic and titanous chlorides; Process for reducing anhydrous, volatile —. F. Meyer and H. Kerstein. Ger. Pat. 281,094, April 30, 1913.

THE chloride is reduced by heating it in admixture with a current of hydrogen or equivalent gas. The gases leaving the reaction chamber are cooled somewhat to condense the reduction product or products and then returned to the reaction chamber in the opposite direction. If an intermediate product is formed, condensation is effected in stages, and the intermediate product is caused to pass in counter-current to the pure final product, free from reducing agent, on its way back to the reaction chamber. The process is applicable to the reduction of the stannic chloride obtained as a by-product in detinning tin-plate, and to the preparation of metals, such as titanium, not easily obtained in a pure condition by other methods. (See also this J., 1913, 1015.)—A. S.

Boric acid compounds [perleborates] containing active oxygen; Preparation of —. J. Auer. Ger. Pat. 281,134, July 4, 1913.

PERTETRABORIC acid or its salts are prepared by the interaction of tetraboric acid (pyroboric acid) with hydrogen peroxide or a mixture of hydrogen peroxide and a metallic peroxide at not above 15° C. and preferably below 0° C. The sodium salt has the formula $\text{Na}_2\text{B}_4\text{O}_{11}$.—A. S.

Oxygen and nitrogen; Preparation of active —. O. Bender. Ger. Pat. 280,966, Feb. 16, 1913.

WATER which has been treated with nitrogen and oxygen under pressure is delivered continuously to the porous walls of a closed, heated generator. The mixture of active oxygen and nitrogen thus produced forms ammonium nitrite when brought in contact with water. It may be used for sterilising water and for converting sulphur dioxide into sulphuric anhydride or acid.—A. S.

Oxides of nitrogen; Preparation of — by combustion of air with the aid of carbon compounds. E. Herman. Ger. Pat. 281,084, April 24, 1913.

METHANE is burnt with air enriched in oxygen in a chamber maintained under high pressure and connected with a condenser in such a manner that condensed water cannot flow back into the reaction chamber. Combustion may be effected in the ordinary way with excess of oxygen, or the methane may be burnt by flameless surface combustion within a mass of zircon. A yield of 3–4% by vol. of oxides of nitrogen is obtained, with a consumption of about 2.5 cub. m. of methane per kilo. of 100% HNO_3 .—A. S.

Carbon monoxide from oxygen and carbon; Furnace for the manufacture of pure —. Ges. f. Chem. Ind. in Basel. Ger. Pat. 280,968, Sept. 25, 1913.

THE furnace is cooled by means of a water-jacket at and near the combustion zone. The oxygen is introduced through a narrow, water-cooled iron pipe, terminating in a nozzle, which projects upwards through the centre of the base of the furnace into the charge of carbon.—A. S.

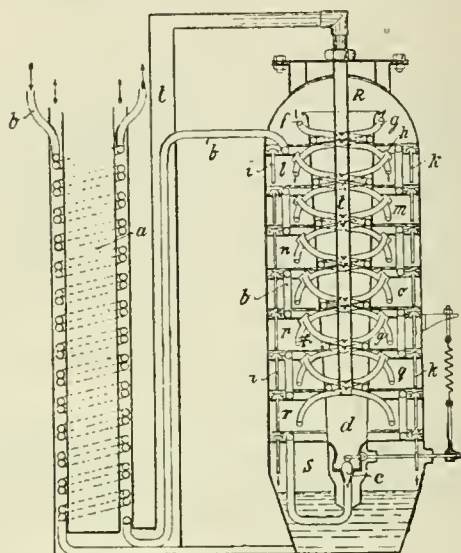
Carbon dioxide from alkaline-earth carbonates; Apparatus for obtaining —. F. Kopp and R. Goerg. Ger. Pat. 281,132, May 4, 1913.

THE material is carried through the calcining chamber on a travelling support, in order to avoid formation of dust.—A. S.

Liquid air; Apparatus for producing — and separating it into its constituents. A. Neumann. Ger. Pat. 281,518, March 2, 1913.

COMPRESSED air passes through the coil, *b*, and valve, *c*, into the tapering tube, *d*, and is gradually

liquefied. When the tube, *d*, is filled, the liquid air overflows into *R*, and flows down through the compartments, *l*, *m*, *n*, *o*, *p*, *q*, *r*, by way of the



tubes, *i*, *k*. The liquid is fractionated in these compartments, and the evolved gas flows into the tubes, *f*, *g*, which pass through the tube, *d*. In these tubes the gas is partially condensed, and the condensed liquid flows into the next lower compartment, whilst the gas rich in nitrogen, which is prevented from returning to the compartments, *l*, *m*, etc., by hoods, *h*, passes through connecting tubes to the tube, *t*, and flows away through the heat-exchanger, *a*. The liquid becomes enriched in oxygen as it descends, and practically pure liquid oxygen collects in *s*.—A. S.

Cyanides; Process for producing—. J. E. Bucher, Providence, R.I., U.S.A. Eng. Pat. 13,332, May 30, 1914. Under Int. Conv., Nov. 7, 1913.

SEE U.S. Pat. 1,120,682 of 1914; this J., 1915, 176.

Carbonitrides; Process of producing—. S. Peacock, Chicago, Assignor to E. I. du Pont de Nemours Powder Co., Wilmington. U.S. Pat. 1,137,524, April 27, 1915. Date of appl., Feb. 14, 1912.

SEE Eng. Pat. 11,390 of 1912 and Fr. Pat. 458,168; this J., 1913, 699, 1067.

Hydrogen peroxide; Process of manufacturing—. W. Weber, Assignor to Henkel und Co., Düsseldorf, Germany. U.S. Pats. 1,138,519 and 1,138,520, May 4, 1915. Date of appl., Feb. 26, 1914.

SEE Eng. Pat. 754 of 1914; this J., 1914, 644.

Process for effecting chemical reactions at high temperatures. Ger. Pat. 281,004. See I.

Electrolytic apparatus for the production of bleaching liquor, etc. Eng. Pat. 1672. See XI.

VIII.—GLASS; CERAMICS.

Stained glass; Contribution to the chemical study of mediæval—. G. Chesneau. Comptes rend., 1915, 160, 622—624.

THE following analytical results were yielded by fragments of stained glass of various colours, dating

from the end of the 13th century, which were detached from the large west rose-window of Rheims Cathedral by a storm in 1886. The data in the fifth column refer to a specimen of the same period from an unknown source.

	Violet.	Blue.	Green.	Red.	Red (L. Appert)
SiO ₂	54.30	53.90	48.60	53.50	56.25
TiO ₂	0.2	0.20	trace	trace	—
SO ₂	—	0.20	—	—	—
Loss on ignition	0.30	0.40	0.30	0.40	—
Al ₂ O ₃	4.20	3.90	5.70	3.00	8.15
CaO	12.60	19.30	14.90	17.80	14.35
MgO	4.70	4.10	5.50	6.10	—
K ₂ O	18.70	12.20	18.10	15.00	17.30
Na ₂ O	1.30	1.90	1.10	1.80	—
PbO	—	trace	—	0.03	—
Bi ₂ O ₃	—	0.02	—	—	—
CuO	0.02	0.13	1.81	0.13	not stated
CoO	trace	0.25	0.06	—	—
NiO	0.06	—	trace	—	—
Mn ₂ O ₄ ..	1.85	3.03	2.39	0.86	—
Fe ₂ O ₃ ..	1.20	0.79	1.65	0.84	3.00
	99.43	100.32	100.11	99.46	99.05

The results illustrate the common origin of the Rheims specimens, which was evidently different from that of the specimen examined by Appert. The violet glass contains manganese as Mn₂O₃ associated with the metallic oxides which occur in impure pyrolusite, and to which the flesh-coloured tinge of 13th century violet glass is attributed. The blue specimen contains the elements occurring in native cobalt sulpharsenide, with the exceptions that the nickel has been eliminated and the copper and manganese reinforced. The red colour is due to cuprous oxide, and the green to the usual copper-iron mixture, containing also a little cobalt and much manganese. The high potash content of the violet and green specimens is attributed to the addition of saltpetre for the purpose of overcoming the reducing action of the furnace gases.—J. R.

PATENTS.

Glass furnace. E. Miller, Columbus, Ohio. U.S. Pat. 1,135,973, April 13, 1915. Date of appl., Feb. 19, 1912.

THE working chamber is an annular trough, in which the molten glass is given a circular motion, past the working hole, by means of a flanged device which can be rotated and dips just below the surface of the glass.—W. C. H.

Glass and art of making the same. H. M. Brookfield, New York. U.S. Pat. 1,136,504, April 20, 1915. Date of appl., Jan. 27, 1912.

A NON-CRYSTALLINE, glassy compound is made by heating a mixture of about 100 lb. of pulverised glass or cullet with 30 lb. of pulverised clay, with or without addition of lime, to about 2500° F. (1370° C.), and cooling and annealing the product. —W. C. H.

Muffle for the distillation of zinc. U.S. Pat. 1,136,519. See X.

IX.—BUILDING MATERIALS.

Portland cement; Value of the high-pressure steam test of—. R. J. Wig and H. A. Davis. Technol. Paper (U.S. Bureau of Standards), No. 47. J. Franklin Inst., 1915, 179, 597—599.

CEMENT pats and briquettes, after 24 hours storage in a damp closet, were treated in steam at 300 lb. per sq. in. pressure for an hour, the total

time in the boiler being 3 hours. Some cements, mixed neat, which are sound according to the standard atmospheric steam test, but unsound in the high-pressure steam, in time show signs of unsoundness when stored under normal conditions in dry air. There is no difference in the cementing quality of cements, and hardly any in the linear change of prisms made of cements, which pass or are rejected by the high-pressure steam test. About 70% of the brands examined passed the high-pressure test. Apparently the coarse particles of a normally unsound cement cause the expansive action, and after ageing for 2 to 6 months such a cement will usually pass the high-pressure test. It is recommended that the test should be made on all cements or concretes that are to be cured in steam above atmospheric pressure. It may forecast the behaviour of cement when exposed in dry air, but not that of concrete as normally exposed, and does not indicate superior cementing power, as judged by the compressive strength. Cements which pass the test do not make more permanent or durable concrete than those which fail to pass it. In some cases, cements which fail to pass the standard atmospheric steam test, but are satisfactory otherwise, may show normal strength in concrete. For practical constructional work, the high-pressure steam test apparently does not forecast the ultimate soundness of concrete.—W. C. II.

Portland cement; British standard specification for —. Engineering Standards Committee, 28, Victoria Street, London, S.W. Price 5s.

IN the new edition of the British Standard Specification for Portland cement, increased fineness of grinding of cement has been legislated for, and the minimum tensile strength at seven days of both neat cement and cement and sand has been raised. The clauses dealing with the preparation of the briquettes have been amplified, the procedure being described in greater detail than has previously been the case. In the case of both neat cement briquettes and cement and sand briquettes, ramming or hammering is prohibited. The increase of tensile strength at twenty-eight days both for neat cement and cement and sand is now given as a formula in place of the fixed percentages which have been specified hitherto.

Refractories; Thermal conductivity of —. B. Dudley, jun. Amer. Electrochem. Soc., April, 1915. Met. and Chem. Eng., 1915, 13, 315—316.

To determine the thermal conductivity of refractory brick under conditions approaching those of actual practice, a furnace having three permanent walls was used, the fourth being constructed with the bricks to be tested (fireclay, silica with clay bond, silica with lime bond, and magnesite). The mean conductivities found, expressed in gm.-calories per second per cub. in. per 1° C., were:—

	At 100° C.	At 1000° C.
Fireclay	0.0043	0.0086
Silica (clay bond)	0.0051	0.0086
Silica (lime bond)	0.0056	0.0108
Magnesite at 445°—830° C.	0.0343.	

—W. R. S.

Fibrox [silicon oxycarbide], a new heat insulator. E. W. Weintraub. Amer. Electrochem. Soc., April, 1915. Met. and Chem. Eng., 1915, 13, 315.

FIBROX, a silicon oxycarbide, is prepared by melting silicon with a catalytic agent, such as calcium fluoride, in a muffle or crucible, carbon monoxide and dioxide diffusing slowly through the containing vessel and combining with the silicon

to a soft, resilient, fibrous material. The average diameter of the fibres is 0.6 μ ; the specific gravity is 1.8—2.2, while the apparent density is 0.0025—0.0030; the volume occupied by air is therefore 99.5—99.9%. The heat insulating capacity is equal to that of compressed wool of fifteen times greater density.—W. R. S.

Structure of limestones for "fat" time. Gallo. See VII.

PATENTS.

Wood preserving medium. Grubenholzimprägnierung Ges. Ger. Pat. 281,691, Oct. 28, 1913.

POLYINITROPHENOLS and their nuclear substitution products in which the hydrogen atom of the hydroxyl is replaced by an alkyl or acyl group, are used as wood preservatives. Acetyldinitrophenol, m. pt. 61° C., is specially suitable. It is easily soluble in organic solvents with the exception of petroleum spirit.—A. S.

Shurry; Apparatus for mixing —. A. Schröder, Charlottenlund, Denmark, Assignor to F. L. Smith and Co., New York. U.S. Pat. 1,137,294, April 27, 1915. Date of appl., Feb. 24, 1914.

THE mixing tank is provided with a number of nozzles projecting through the sides and bottom, for blowing air through the charge in horizontal and vertical directions, and with one or more mechanical agitators having horizontal, hollow arms from which horizontal streams of air are discharged during rotation.—W. E. F. P.

Disinfecting and preserving agent. Ger. Pat. 281,842. See XIXb.

Apparatus for heating, drying, and pulverising earthy materials [for paving]. Eng. Pat. 9281. See I.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Open-hearth furnace; Heating an — by means of tar. A. Greiner. Iron and Steel Inst., May, 1915. [Advance proof.] 4 pages.

AT the Cockerill works (Liège), owing to the shortage of coal due to the war, a 12-ton open-hearth furnace was heated for 10 weeks with coke-oven tar, producing 1896 tons of steel in 215 charges, with an average consumption of 300 lb. of tar per ton, including the amounts required for lighting up and for heating during stoppages; in uninterrupted working the average consumption of tar is 250 lb. per ton. The tar was delivered to the burners at a pressure of half an atmosphere and sprayed with air at a pressure of 3 atmospheres. A new 25-ton furnace, running exclusively on tar, has been in operation for several weeks.—W. R. S.

Iron; Nature of the A2 transformation in —. K. Honda. Iron and Steel Inst., May, 1915. [Advance proof.] 43 pages. (See also this J., 1914, 83, 595.)

THE present investigation is based on the magnetism, thermal expansion, electrical resistance, and other properties of iron, the results confirming the author's previous view that the A2 transformation is not an allotropic change but an intermolecular alteration occurring gradually in the α phase during a large interval of temperature; from the standpoint of the phase rule, β -iron has no existence, being only a condition of α -iron between the critical and A3 points. The magnetic changes observable in nickel, cobalt, and other ferro-magnetic materials at their respective critical ranges are ascribed to a similar cause. According to the theory of ferro-magnetism advocated, the

molecules of ferro-magnetic substances are nearly spherical and those of paramagnetic bodies flattened or elongated. The A2 transformation, or that of any ferro-magnetic into a paramagnetic body at high temperature, is regarded as the consequence of the gradual deformation of the spherical molecules with rise of temperature, the heat evolved or absorbed being the energy of deformation and that imparted to the molecules to cause their rotatory vibrations.—W. E. F. P.

Iron; The diffusion of carbon in—. F. W. Adams. Iron and Steel Inst., May, 1915. [Advance proof.] 14 pages.

HIGHLY polished specimens of steels of different carbon content were bound together and heated in a vacuum to 900°–1000° C. Welding took place at the points of closest contact, with diffusion of carbon from the high-carbon to the low-carbon specimen. When the specimens were not in contact both lost weight. Specimens not in contact, when heated in a rarefied atmosphere of carbon monoxide showed a slight transference of carbon from the high-carbon to the low-carbon specimen. Highly polished specimens of the same steel bound together and heated in a vacuum, also welded together at the points of closest contact. The amount of welding or intercrystallisation taking place between two samples of iron or steel was found to be independent of the carbon-content or the difference of carbon-content of the two specimens, and dependent only on the closeness of contact between the two surfaces.—T. St.

Iron, carbon, and phosphorus. J. E. Stead. Iron and Steel Inst., May, 1915. [Advance proof.] 41 pages. (See also this J., 1914, 173.)

A SUMMARY of previous work is given and the results of recent investigations are discussed more fully. When iron containing 2% P and 0.12% C is carburised by cementation, the ternary eutectoid $\text{Fe}_3\text{P}-\text{Fe}-\text{Fe}_3\text{C}$ (closely resembling pearlite) is formed, and it was found that, by subjecting this phosphorised iron to an annealing process such as is used in making malleable iron, with the object of removing carbon and causing diffusion of phosphorus from the eutectic into the iron, crystalline plates of pure Fe_3P were formed along the cleavages of the iron crystals. With increasing carbon, phosphorus becomes more and more concentrated in the portions solidifying last; the longer the period of cooling, the greater is the tendency to form local, intercrystalline segregations which become "ghost lines" on being extended by forging. Unless associated with a material quantity of slag inclusions, the presence of ghost lines does not appear to be injurious to the strength of steel. Experiments are described showing the white ghost lines in a soft steel plate (0.06% P) to be the parts rich in phosphorus, the last to be invaded by carbon on heating, and the first to part with carbon on cooling; and the parts of iron or steel bars containing phosphorus concentrations to be the most resistant to carburisation by cementation. A new reagent and method (used throughout the present investigation) for detecting variations in the phosphorus content of iron and steel is also described. The reagent is prepared by dissolving 10 grms. of cupric chloride and 40 of magnesium chloride in a little hot water, adding 20 c.c. of hydrochloric acid, and diluting the solution to 1000 c.c. with alcohol. The surface of the specimen is covered with a thin layer of the liquid (not immersed) which is shaken off after 1 min. and replaced by another layer, the process being repeated as often as necessary; after washing with boiling water and methylated spirit in quick succession, the spirit is quickly evaporated by shaking the heated specimen. By this means, copper is deposited, as a hard, coherent layer, first

on the portions containing least phosphorus, but eventually (by repeated applications) over the whole surface of the specimen, the selective action of the reagent being sensitive to differences of less than 0.01% P. The method gives only differential, not absolute results, the rate of attack increasing as the phosphorus content of the metal decreases; with this reagent elements other than phosphorus (e.g., Ni, Cu, As, Cr, Sn, Sb), existing in a state of variable solid solution (i.e., unevenly distributed) in alloys, may also give similar indications.—W. E. F. P.

Steel; Detection of burning in—. J. E. Stead. Iron and Steel Inst., May, 1915. [Advance proof.] 5 pages.

"BURNING" in steel is the result of heating the metal to incipient fusion, and is not due to the formation of films of oxide by the passage into the steel of the oxidising gases of the furnace. The oxide found between the crystals is formed after the material has broken up, when air readily enters the open fissures. The first liquid that forms at the temperature of incipient fusion is rich in phosphorus, and the presence of phosphorus-rich globules and crystal-envelopes is the criterion of "burning." Metal which is simply redshort resembles burnt steel in having cracks lined with oxide, but is free from the globular specks rich in phosphorus. Portions free from cracks should therefore be selected for polishing and etching in investigations as to "burning." The best etching reagent for revealing the phosphorus-rich globules and envelopes is that described in the preceding abstract.—T. St.

Iron, silicon, and carbon alloys; Researches on the—. G. Charpy and A. Cornu-Thenard. Iron and Steel Inst., May, 1915. [Advance proof.] 27 pages.

THE transformation points were investigated by thermal and dilatation measurements in dead soft steels (C 0.10–0.15%; Si 0.1–7%), semi-hard steels (C 0.35–0.40%; Si 0.1–4.5%), and cast irons (C 2% and Si 0.1–7%). The authors confirm that the A3 point rapidly decreases with increase of silicon (disappearing with Si 1.3%), and at the same time rises very slightly on the temperature scale. The temperature at which the A1 transformation takes place rises with the silicon content, this point reaching and then passing the A2 point, whilst becoming gradually less marked. After reaching a given percentage of silicon and for a given rate of variation of temperature, the A1 point completely disappears, and all the carbon of the metal is then found in the state of graphite. The A2 point falls gradually on the temperature scale and becomes gradually less marked as the silicon increases, but it still persists with Si 7%. The authors emphasise the fact that the A2 point can persist when both the A1 and A3 points have disappeared as proving the real and distinctive individuality of the A2 point. As regards the influence of silicon on the solubility of carbon in iron, the results of the tests made with the series of irons with C 2% show that the solubility gradually decreases with rise of silicon, becoming practically nil at 900° C. when the silicon content reaches 5%, and at about 1000° C. with Si 7%. The presence of the silicon reacts, on the one hand, on the temperature limits within which the precipitation of graphite takes place, and, on the other hand, on the rate of transformation of the cementite. Thus, provided that the silicon content exceeds 3%, that the annealing is carried out at above 750° C. but below a certain limit, which is a function of the carbon content, and that the rate of cooling after annealing is very low, the carbon may be wholly precipitated in the graphitic state in forged steels with low or medium

carbon content. Also, the rate of reaction may be influenced to such an extent that in certain irons the graphite precipitation gives rise to a thermal point. This point, which may coexist with the A1 point, possesses special sharpness when the latter has disappeared; it then rises rapidly on the temperature scale, as the silicon content increases. By extrapolating for zero content of silicon from the results obtained, the authors consider that evidence is obtained supporting the double iron-carbon diagram (graphite system and cementite system).—T. St.

Boron in iron; Determination of—. J. M. Lindgren. J. Amer. Chem. Soc., 1915, 37, 1137—1139.

Two to three grms. of iron is dissolved in a round-bottom Jena flask of 800 c.c. capacity in 10 c.c. each of nitric acid (sp. gr. 1.4), hydrochloric acid (sp. gr. 1.2), and water. Double the amount of pure calcium carbonate necessary for complete neutralisation is added, all at once, and the mixture vigorously agitated: 250 c.c. to 300 c.c. of CO_2 -free water is added and the mixture boiled under a reflux condenser for half an hour. About 50 c.c. of asbestos fibre, which has been treated with acid and well washed, is added in a wet state, the mixture is boiled, filtered, and the precipitate washed eight or ten times with hot water. The solution is cooled and titrated with $N/10$ alkali, using phenolphthalein as indicator (compare this J., 1908, 1179).—H. R. D.

Grey cast iron and steel; Relative corrodibilities of—. J. N. Friend and C. W. Marshall. Iron and Steel Inst., May, 1915. [Advance proof.] 5 pages.

Bars of a typical grey cast iron and of a mild open-hearth steel were subjected to tap-water, salt-water, alternate wet and dry and hot and cold, and sulphuric acid tests (see also this J., 1912, 493). In the alternate wet and dry tests the cast iron was usually decidedly superior to the steel; complete immersion tests gave almost identical results for the two metals, except with salt water, which attacked steel more strongly. In acid solutions cast iron was corroded to a much greater degree than steel.—W. R. S.

Iron; Corrosion of—*in aqueous solutions of inorganic salts*. J. N. Friend and P. C. Barnett. Iron and Steel Inst., May, 1915. [Advance proof.] 17 pages.

THE loss of weight of pure electrolytic iron foil was determined after immersion in solutions of aluminium, ammonium, ferrous, magnesium, manganese, potassium, and sodium sulphates, barium, magnesium, potassium, and sodium chlorides, and potassium and sodium nitrates, the results being tabulated for each salt at various temperatures and concentrations. Concentrated solutions of most of the salts were less corrosive than distilled water. As a rule, the rate of corrosion rose with the temperature, whilst the corrosion factor, i.e., corrosion in the salt solution relatively to that in distilled water, fell. In general, and conversely, the more concentrated the solution of any salt, the lower its inversion temperature, i.e., the temperature at which the solution has the same corrosive action as distilled water. The critical concentration corresponding to maximum corrosion tends to fall with rise of temperature.—W. R. S.

Rust; Removal of—*by means of chemical reagents*. J. N. Friend and C. W. Marshall. Iron and Steel Inst., May, 1915. [Advance proof.] 7 pages.

THE object of the experiments was to remove all the rust without dissolving any iron. Sheets of mild open-hearth steel were moistened, exposed

to the air for one month, and thoroughly cleaned with emery paper, the mean loss being taken as a standard of comparison with the results obtained by solvents. Sodium citrate solution acted very slowly and dissolved much metal. Boric acid solution had a good cleaning action, but the loss in weight was 75% more than the standard. Aluminium sulphate solution (10%) gave an excellent metallic surface, but none of the reagents left the metal unattacked.—W. R. S.

Steel ingots; Supplementary notes on the forms in which sulphides may exist in—. J. O. Arnold and G. R. Bolsover. Iron and Steel Inst., May, 1915. [Advance proof.] 4 pages. (See also this J., 1914, 551).

THE addition of about 0.05% of aluminium to molten steel containing about 0.5% S prevented segregation, and gave rise to areas showing the "eutectic" structure of decomposed solid solution or compound ($x\text{Fe}, y\text{MnS}$). These areas were surrounded by regions of ferrite (and pearlite) relatively free from sulphides. A slowly cooled steel to which no aluminium had been added showed marked segregation of carbon, sulphur, and manganese. Micrographically the manganese sulphide was observed to be segregated into relatively large rounded masses, quite different from the eutectic structure formed when aluminium had been added.—T. St.

Special steels; The thermo-electric properties of—. E. L. Dupuy and A. M. Portevin. Iron and Steel Inst., May, 1915. [Advance proof.] 30 pages.

THE investigation was made with 27 nickel steels (Ni 2—30, C 0.1—1.0%), 17 chromium steels (Cr 1—32, C 0.06—1.0%, Si up to 0.75%), 4 manganese steels (Mn 0.4—12, C 0.9%), 7 aluminium steels (Al 2—15, C 0.1—0.9%), 7 silicon steels (Si 0.4—5.5, C 0.2—0.9%), 10 tungsten steels (W 0.4—20.7, C 0.1—0.9%), 8 molybdenum steels (Mo 0.5—4.5, C 0.2—0.8%), 7 very pure ordinary carbon steels (C 0.07—1.6%), and electrolytic iron. Thermo-electric measurements were made between -78° and 0°C . and between 0° and 100°C ., the test-pieces being annealed by heating to 900° — 1000°C . for 3 hours and cooling during 5—9 hours; or hardened by heating to 950° — 1000°C . during 11—13 mins. and quenching in water at 11° — 18°C . In addition to being discussed as separate series, the results are considered collectively in the light of the investigations of Flakén (Ann. Physik, Series 4, 1910, 32, 291) who found that, in the case of a solid solution, a portion of the curve representing thermo-electric force in terms of composition resembles an arc of hyperbola having its concave side either upwards or downwards; whereas the curve for a mixture of two phases is practically a straight line. The thermo-electric force being positive or negative, the definite compounds constituting solid solutions may be either represented in the curves by maxima or minima, or situated along a branch in the form of an S and marked only by a point of inflexion. On this basis, the special steels examined were found to fall into two groups, namely, (1) those containing nickel, manganese, silicon, and aluminium, which gave continuous curves resembling a U or part of a U in shape, indicating the added metals to be in a state of solid solution in the steels; and (2) those containing chromium, tungsten, and molybdenum, the curves for which—although indicating (by the sudden initial fall) the passage of the added metal into solid solution—on the whole resemble an S in form: "double carbide" steels occur in the latter group. It is considered possible to form an idea as to the limit of solubility, in the solid state, of the special metals added to steels, the carbide

becoming isolated (when saturation is reached) either as a constituent of the pearlite or as a super-eutectic constituent.—W. E. F. P.

Vanadium in steel; Simplified ferrous sulphate method for the determination of—G. T. Dougherty. *J. Ind. Eng. Chem.*, 1915, 7, 419—420.

From 2 to 4 grms. of drillings is heated nearly to boiling with 60 c.c. of water and 10 c.c. of concentrated sulphuric acid, 40 c.c. of nitric acid of sp. gr. 1.2 is added, and the mixture is boiled till all nitrous fumes are expelled. After cooling, the solution is treated with 60 c.c. of sulphuric acid (1:2), diluted to 450 c.c., and, after addition of 3 c.c. of a freshly prepared 1% solution of potassium ferricyanide, titrated rapidly with *N*/20 ferrous ammonium sulphate, with constant stirring, until a dark blue colour first appears; 0.4 c.c. is deducted from the volume of ferrous solution used in the case of steels containing up to 0.5% C, 0.5 c.c. for 0.6—0.7% C, and 0.6—0.9 c.c. for 0.9—1.25% C. When the steel contains more than 0.5% C, it is advantageous to add 60 c.c. of sulphuric acid (1:2) and 5—8 grms. of ammonium persulphate after boiling with nitric acid, and continue to boil for 15 mins., before diluting and titrating; the correction is then only 0.35 c.c. for steels with less than 0.5% C, but the same as before for higher carbon contents. The ferrous solution may be standardised against *N*/10 permanganate; the iron value of the permanganate multiplied by 0.917 gives the vanadium value. The method is accurate to within 0.01% V.—A. S.

Ferrovanadium; Technical analysis of—A. Heinzmann. *Chem.-Zeit.*, 1915, 39, 285—287.

THE finely-divided sample (0.5 gm.) is treated with concentrated hydrofluoric acid (10 c.c.), nitric acid is added after the evolution of hydrogen has ceased, and the mixture is heated on a water-bath and then evaporated to dryness. The residue is heated with sulphuric acid to expel all the nitric acid, the sulphuric acid solution diluted with water, boiled, and made up to 200 c.c. Fifty c.c. of this solution is treated with hydrogen peroxide, diluted to 250 c.c., neutralised, and boiled after the addition of 50 c.c. of concentrated sulphurous acid solution. To the boiling solution is now added 20 c.c. of 30% sulphuric acid, the boiling is continued for about 20 minutes while a current of carbon dioxide is passed through the solution, and the iron and vanadium together are then titrated with *N*/10 permanganate solution. A slight excess of *N*/10 ferrous ammonium sulphate solution is added to the titrated solution (spot-tests with potassium ferricyanide are used as indicator), the excess is titrated with *N*/10 permanganate solution, and the titration with the latter solution then continued until a slight reddish-brown coloration is obtained. The number of c.c. of *N*/10 permanganate solution used in the last titration multiplied by 0.00512 gives the quantity of vanadium present, and the iron is found by difference.—W. P. S.

Iron oxides; Reduction of—by platinum. R. B. Sosman and J. C. Hostetter. *J. Wash. Acad. Sci.*, 1915, 5, 293—303.

To demonstrate the absorption of iron from magnetite by platinum under very low oxygen pressure, about 1 gm. of natural magnetite from Mineville, N. Y., was heated to 500° C. in a new platinum crucible in a platinum-rhodium tube vacuum furnace and cooled. The gas produced was pumped out, and the charge then heated to between 600° and 1200° C. The changes in weight of charge and crucible indicate that oxygen is liberated and metallic iron is dissolved by the platinum. At 10.2

mm. oxygen pressure at 1200° C., under which conditions magnetite is nearly completely oxidised to ferric oxide, the crucible gained 1.6 mgrms. Platinum acts on both hæmatite and magnetite at 1200° C. under low pressure of oxygen, absorbing iron and causing evolution of oxygen. Platinum crucibles in which ferric oxide is ignited in air in ordinary analysis, do not take up such amounts of iron as are mentioned. The phenomena observed explain the very common occurrence of small amounts of iron in platinum.—H. R. D.

Litharge; Precious metals in—J. Loevy. *Chem.-Zeit.*, 1915, 39, 287. (See also Michel, this J., 1915, 285.)

FROM 1200 grms. of litharge the author obtained a weighable quantity of gold. Platinum could not be detected in the litharge. The assumption that colloidal platinum occurring in ores cannot be determined by the ordinary assay methods, is disproved by the results of experiments in which colloidal gold and platinum were added to ores and the latter then analysed; from 98 to 99.6% of the two metals was recovered.—W. P. S.

Gold-bearing cyanide solutions; Morro Velho method of assay of—D. M. Levy and H. Jones. *Inst. Min. and Met.*, May 20, 1915. [Advance proof.] 3 pages.

THE method has been in regular use at a plant at Morro Velho, Brazil, for the daily control of solutions passing through the zinc boxes and other solutions. It is based on the precipitation of gold by means of zinc shavings from the boiling solution in presence of suitable quantities of silver and lead salts, to yield with the gold a parting alloy and produce a zinc-lead couple which facilitates the complete separation of metallic gold from solution. The process is as follows: To 453.6 c.c. of rich solution (before passing the zinc boxes) are added in succession 15 c.c. of silver solution, 10 c.c. of sodium cyanide solution, and 5 c.c. of sodium plumbite solution, and the mixture is shaken in a flask of 1½ litres capacity. 20 grms. of zinc shavings is then placed in the solution and the whole gently boiled for 30 minutes and then filtered. To the residual zinc in the flask a little water is added, and 70 c.c. of commercial hydrochloric acid to dissolve the zinc. The contents of the flask are filtered, and both filter and flask are well washed with water. The wet filter is transferred to a No. 10 assay crucible, dried slowly, and carbonized at a moderate heat. The residue is mixed with a fluxing charge and assayed in the usual manner. The following stock solutions are used:—Silver solution: 14.4 grms. of silver nitrate dissolved in water, sodium cyanide added slowly till the precipitate first formed is just redissolved, and the solution then diluted to one litre. Sodium cyanide solution: 100 grms. of sodium cyanide dissolved in water and diluted to one litre. Sodium plumbite solution: 26 grms. of lead acetate dissolved in water, sodium hydroxide solution added until the precipitate first formed just redissolves, and the solution diluted to one litre.—H. R. D.

Gold; Concentration of—in bottoms in the converter. H. F. Collins. *Inst. Min. and Met.*, May 20, 1915. [Advance proof.] 6 pages.

SUCCESSFUL attempts have been made to utilise the gold contents of converter copper not rich enough in precious metals to make electrolytic refining profitable, by means of a partial oxidation of white metal to "pimple" metal and "bottoms," and the separation of the latter before completing the oxidation. The success of the operation depends primarily upon running the charge hot, not losing time in skimming, and not adding too much cold scrap after skimming, so that the reduced copper is at a temperature much above

the melting point of the "pimple" metal; otherwise it is liable to chill in the tap-hole. The converter is provided with a cast iron tapping block fixed opposite the tuyères, having a tap hole $1\frac{1}{2}$ in. in diameter. When lining is being rammed, a $\frac{1}{2}$ in. steel bar is pushed through the hole up to within an inch of the mould, so that the lining may be rammed round it as tightly as possible, and when moulds are removed the bar is withdrawn at the same time to facilitate "drying out." In practice it is easy to recover in the form of bottoms, 70% of the gold originally existing in the charge, the amount of bottoms being 9% of the total weight of converter copper produced.

—H. R. D.

Copper leaching; Discussion on —. Amer. Electrochem. Soc., April, 1915. Met. and Chem. Eng., 1915, 13, 319—324. (See also this J., 1913, 677; 1915, 555.)

U. WEDGE stated that sulphide ores from Ajo, Arizona, ground to 20- or 30-mesh, could be treated successfully by a sulphatising roast not much above red heat. By roasting a mixture of oxide and sulphide ore, or iron pyrites, the necessity for constructing an acid plant could be obviated. G. W. Van Arsdale said that at Douglas, Arizona, sulphatising roasting was now used in conjunction with electrolysis, iron being found not to interfere with the deposition of the copper if kept in the ferrous state by means of sulphur dioxide. Graphite anodes were used. R. F. Bacon stated that the installation and running cost of an electrolytic plant were rather high, and the whole of the copper in solutions obtained by leaching oxidised copper ores was not deposited by the current; a careful adjustment was therefore required, so as to secure a cycle of operations. F. J. Pope had found that most of the iron (90%) and alumina (65—75%) might be precipitated from the electrolyte, together with 50% of the manganese and all of the arsenic, antimony, and bismuth which might be present, by agitating with air at 90° C., and gradually adding finely ground copper oxide in the form of high-grade carbonate ore or roasted concentrate or matte. The precipitation was complete after $3\frac{1}{2}$ hours, when the liquor was filtered and electrolysed. Antimonial lead anodes were used.—W. R. S.

Cobalt; Electroplating with —. H. T. Kalmus, C. H. Harper, and W. L. Savell. J. Ind. Eng. Chem., 1915, 7, 379—399.

This is an abstract of a report to the Canadian Department of Mines, containing an account of a large number of experiments with different cobalt plating solutions both in the laboratory and in the plating department of the Russell Motor Car Co., Toronto. Of the solutions tried the best results were obtained with the following:—1b. 200 grms. $\text{CoSO}_4 \cdot (\text{NH}_4)_2 \cdot 6\text{H}_2\text{O}$ per litre; sp. gr. 1.053 at 15° C. XIIb. 312 grms. CoSO_4 and 19.6 grms. NaCl to 1000 c.c. H_2O , the solution being nearly saturated with boric acid; sp. gr. 1.25 at 15° C. These solutions have a considerably higher electrical conductivity than standard commercial nickel plating solutions, and hence may be operated at a lower voltage for a given speed of plating. When used for very rapid plating a higher voltage is required than is used for most nickel plating baths, but for a given amount of work the power consumption is less than for nickel. Firm, adherent, uniform deposits of cobalt can be obtained on brass, iron, steel, copper, tin, German silver, lead, and Britannia metal with solution 1b at a speed at least four times, and with solution XIIb at least fifteen times greater than that possible with nickel solutions. The cobalt coating is much harder than a nickel coating, and for many purposes the same protective effect as is obtained

with a given quantity of nickel can be obtained with one-quarter of that quantity of cobalt. The cobalt solutions give less trouble in use than nickel solutions, and are also superior in "throwing power," i.e., capacity to coat deeply indented or grooved parts. With solution XIIb, ornamental work on brass, copper, tin, or German silver can be coated in 1 min. so as to withstand the usual commercial tests, including buffing, and satisfactory deposits can be obtained in 15 mins., even for objects exposed to severe atmospheric influences. Thick deposits of cobalt, e.g., on electro-types and electro-dies, are much superior to those of nickel. The composition of the baths remains constant during use, and less ageing is required than with commercial nickel solutions. Skates plated with cobalt in solution XIIb for 3 mins. at 90—100 amp. per sq. ft. of cathode surface, have proved superior to nickel-plated skates in actual use. Electrodeposited cobalt can be readily buffed to a brilliant white, lustrous surface with a slightly bluish cast. In the report of the commercial tests it is stated that the cost of metal for plating a given quantity of work would be considerably less with cobalt than with nickel, whilst on account of the higher speed of plating it would be possible to extend the use of automatic apparatus for conveying the material through the bath to a much greater variety of articles than with nickel, and reduce the labour cost 75%.—A. S.

Lead deposits; Electrolytic —. F. C. Mathers and A. McKinney. Amer. Electrochem. Soc., April, 1915. Met. and Chem. Eng., 1915, 13, 328. (See also this J., 1914, 358, 1158.)

A SMOOTH, coherent deposit may be obtained from lead nitrate with a bath of the following composition: lead nitrate, 10%; acetic acid, 2.5—5%; residue from extraction of aloin from Curaçao aloes, 1%; the latter is dissolved in the acetic acid and added to the lead solution without filtering. A current of 3.7 amp. per sq. ft. may be used. Nitrate baths do not promise to be of practical use, as they deteriorate after 6—7 weeks.

—W. R. S.

Magnesium; Electrolytic preparation of —. F. C. Frary and H. C. Berman. Amer. Electrochem. Soc., April, 1915. Met. and Chem. Eng., 1915, 13, 324—325.

In the electrolysis of molten magnesium potassium chloride in a graphite crucible, dark spots are found in the electrolyte on cooling. They are stated to consist of magnesium suboxide, and their formation to be due to the presence of magnesium oxide. The compound could not be obtained by the action of magnesium upon the oxide, being apparently only formed under the conditions of electrolytic reduction. The electrolyte should be free from magnesium oxide.

—W. R. S.

Sulphates; Formation and decomposition of — during roasting. B. Dudley, jun. Met. and Chem. Eng., 1915, 13, 303—308. (See also this J., 1915, 496.)

THE rate at which a sulphate is formed or decomposed depends upon the rate of diffusion of sulphur trioxide through the contact film surrounding the particle of oxide or sulphate, and on the difference between the dissociation tension of the sulphate and the partial pressure of sulphur trioxide in the gaseous phase. The rate of decomposition, in a current of dry air, of a sulphate (e.g., NiSO_4) dissociating directly to oxide was found to be nearly constant; under the same conditions, the rate of decomposition of a sulphate (e.g., CdSO_4) dissociating first to a basic compound showed a marked decline at the point at which the conversion into the basic sulphate was complete. The rate

of dissociation of a sulphate further increases with that of sulphur trioxide: $2\text{SO}_3 = 2\text{SO}_2 + \text{O}_2$; this is mainly determined by the presence or absence of catalysts, such as ferric oxide. This was proved by heating dehydrated aluminium sulphate in a tube furnace, with and without iron oxide, and determining the loss of weight at regular intervals: the rate of decomposition of the sulphate was in all cases accelerated, and the ratio of sulphur trioxide to dioxide in the evolved gas lowered, by the presence of ferric oxide.—W. R. S.

Metals; The elastic strength of—F. C. Thompson. Faraday Soc., May 11, 1915. [Advance proof.] 13 pages.

THE theory is advanced that the elastic strength of metals is due to surface tension effects of the amorphous "cement" between the crystals, and not to the strength of the cement itself, as hitherto supposed. On this hypothesis, the conditions governing elastic limit are essentially different from those governing maximum stress; the attraction between the crystals being inversely proportional to the distance between them, the elastic strength of the metal is lowered as the thickness of the intercrystalline cement is increased, and the superiority of fine- over coarse-grained metal is due to the increased area across which the attraction occurs. The theory is considered quantitatively and qualitatively, evidence in support of it being deduced from the mechanical properties of pure copper, zinc, antimony, silver, lead, tin, and iron under different conditions, and from variations in the electrical conductivity of iron after different heat treatments.—W. E. F. P.

PATENTS.

Blast furnace; Mode of charging a—, and *construction of the furnace for that purpose*. R. Wright, Jarrold-on-Tyne, and J. Calderwood, South Bank. Eng. Pat. 9939, July 4, 1914.

IN a blast-furnace having a central ore shaft, around the middle portion of which smaller shafts are disposed for the admission of fuel, each of the latter is provided with a metal charging-tube and an inlet for cold air, and discharges into the combustion zone of the furnace at a point directly above a blast tuyère, so that the gases ascending the ore shaft are cooled sufficiently by contact with the undecomposed and relatively cool fuel, to obviate premature fusion of the charge.

—W. E. F. P.

Iron or steel; [Noncorrodible] alloys of—B. Talbot, Middlesbrough. Eng. Pats. 10,582, April 29, and 10,877, May 2, 1914.

THE alloys are prepared by adding to molten iron or steel 0.3—3.0% of copper, casting the metal, rolling the ingots into sheets, piling the latter, and forming the heated pile into the desired shape by hammering, cogging, or rolling. A similar process may be used for the manufacture of articles containing a higher percentage of copper at the exterior than in the interior.—W. E. F. P.

Mild steel; Production of an oxide coating on utensils and the like made of—C. K. Haefner. Ger. Pat. 282,114, April 10, 1913. Addition to Ger. Pat. 257,299.

OXIDES of nickel, copper, and cobalt, in conjunction with manganese dioxide, are used in place of, or together with, the iron oxide specified in the chief patent (this J., 1913, 492).—A. S.

Metal from metal-bearing material; Process for the extraction of—W. H. James, Johannesburg, Transvaal. Eng. Pat. 9846, April 21, 1914.

A SOLUTION of a salt, e.g., sodium chloride, is electrolysed, portions of the electrolyte being withdrawn separately in the vicinities of the electrodes.

The material is leached with the liquor from one of the electrodes, usually that from the anode, and the metal-bearing solution is withdrawn and precipitated with liquor from the other electrode.

—W. R. S.

Ores; [Electrolytic] process and apparatus for treating—L. E. Porter, Los Angeles, Cal., Assignor to H. E. Stock, Casper, Wyo. U.S. Pat. 1,136,483, April 20, 1915. Date of appl., Aug. 27, 1914.

A COMBINED electrolytic cell and agitator is subdivided by porous diaphragms into anode and cathode compartments; a pulsating current of electrolyte containing suspended ore is injected at the bottom of the anode compartment, from which it flows intermittently into the cathode compartment, in which the values extracted in the former are deposited.—W. R. S.

Blast-furnace construction. T. E. Thomas, Niles, Ohio. U.S. Pat. 1,137,244, April 27, 1915. Date of appl., July 17, 1913. Renewed Sept. 24, 1914.

A PORTION of the stack above the bosh of the furnace consists of an inner and an outer wall between which a water-jacket is interposed, consisting of a single metal shell or a series of box-like members of segmental form.—W. E. F. P.

Ore concentration. L. A. Wood, and Minerals Separation Ltd., London. Eng. Pat. 10,312, April 25, 1914.

POWDERED sulphide ores suspended in water, preferably acidified, but free from oil or frothing agent, are subjected to agitation in the lower zone of the ore pulp, and air is admitted below the agitator. The upper zone of the pulp is maintained in a state of comparative quiescence, whereby the finely-divided bubbles of air attach themselves preferentially to selected particles of the ore, such as sulphides, and rise towards the surface of the liquid, discharging their mineral load into a trough or receiver below the surface.—B. N.

Ores and more particularly slimes; Water concentration of—W. M. Martin, Redruth. Eng. Pat. 15,442, June 27, 1914.

THE ore, mixed with water, is made to flow over a stationary or continuously moving acting surface, consisting of a material which only slightly hinders the movement of the larger particles, but is provided with regular or frosted flutings adapted to cause greater hindrance to the smaller particles. The apparatus may be in the form of a wheel, divided into compartments, one surface of each compartment consisting of fluted or frosted glass.

—B. N.

Furnaces; Gas heated annealing—S. N. and E. R. Brayshaw, Manchester. Eng. Pat. 10,630, April 30, 1914.

SEVERAL burner openings are arranged in the bottom of the furnace, each surmounted by a hearth slab upon which the flame is directed. A longitudinal channel is provided at each side of the furnace, below the hearth slabs, for collecting scale or slag, thus preventing impediment to the passage of the flame. A swivelling burner is pivoted below each opening, which is closed by a sliding damper held in position by the burner when the latter is not in operation.—B. N.

Furnace; Reverberatory—for heating, annealing, and like purposes. C. Glossop, Sheffield. Eng. Pat. 10,111, April 24, 1914.

TO ensure uniform heating, the furnace is provided with a perforated bed upon which the charge is placed close to the fire-bridge, and centrally within

the heating chamber, so that the heating gases are caused to traverse the space around the charge before escaping by a vertical down-flue below the bridge.—W. E. F. P.

Furnaces; Crucible and like —. A. C. Ionides, jun., London. Eng. Pat. 15,778, July 1, 1914.

THE combustion chamber is surrounded by a spiral flue, through which the products of combustion pass to the atmosphere. The air or gas for combustion, or both, are preheated on their way to the combustion chamber by passing through spiral conduits.—B. N.

Furnace; Metallurgical —. U. Wedge, Ardmore, Pa. U.S. Pat. 1,137,559, April 27, 1915. Date of appl., Oct. 22, 1913.

IN a furnace of the superposed chamber type, one of the circular hearths, consisting of radial sections, has alternate segments recessed on the under side, and the recesses filled with electrically resistant material. An electric current is passed through each filling, from which heat is radiated to the charge on the hearth below.—W. E. F. P.

[Copper sulphide] ores; Method of treating —. R. Bagdaley, Pittsburgh, Pa. U.S. Pat. 1,135,488, April 13, 1915. Date of appl., June 17, 1913.

IN smelting sulphide ores containing copper, gold, and silver, the flue gases are passed over fresh ore so as to preheat and enrich it, and are then led in small streams into a deep bath containing a neutralising agent, such as milk of lime.—W. R. S.

Bearings or wearing surfaces. The British Thomson-Houston Co., Ltd., London. From General Electric Co., Schenectady, N.Y., U.S.A. Eng. Pat. 10,872, May 2, 1914.

CAST-IRON bearings, etc., are provided with "sherardised" wearing surfaces.—W. E. F. P.

Zinc-producing furnace. A. Zavelberg, Hohenlohehütte, Germany. U.S. Pat. 1,136,304, April 20, 1915. Date of appl., Aug. 25, 1914.

THE furnace comprises two or more superposed rows of shafts containing retort chambers, and a preheater above the upper shaft. The preheater is connected with the upper shaft, and this with the lower one, by means of flues. Packing layers of finely pulverised silica are provided between the walls of adjoining retort chambers.—W. R. S.

Lead and zinc; Separation of the sulphur compounds of — from other ores. E. Langguth. Ger. Pat. 282,131, Oct. 8, 1913.

THE mixed ores, after addition of oil or other suitable organic compound, are treated with a solution of zinc chloride acidified with hydrochloric acid. Sulphides of zinc and lead sink in the solution, whilst other ores float.—A. S.

Muffle for the distillation of zinc. M. Engels, Berlin. U.S. Pat. 1,136,519, Apr. 20, 1915. Date of appl., Feb. 11, 1915.

THE muffle is composed of a fireclay base containing 1–10% of zirconia.—W. E. F. P.

Zinc; Process and electric furnace for obtaining volatile metals, especially —. M. Breslauer. Ger. Pat. 282,141, Jan. 30, 1913.

THE charge is introduced into a carbon tube, preferably vertical, which serves as a resistance heater, and the zinc vapour and carbon monoxide pass through slots or perforations in the tube, into the space between it and the walls of the furnace. The zinc condenses in this space in the liquid state, and the carbon monoxide escapes through openings in the walls.—A. S.

[Gold and silver] ores; Process of treating —. E. M. Hamilton, Bristol, Assignor to C. Butters, Oakland, Cal. U.S. Pat. 1,136,872, Apr. 20, 1915. Date of appl., June 5, 1914.

A MIXTURE of slimes and cyanide solution is made alkaline with lime, the latter precipitated so as to produce caustic alkali in the solution, the mixture filtered, and the precious metals precipitated from the solution by means of aluminium.—W. E. F. P.

Zinc; Process for rendering spongy, electro-deposited — stable. Chem. Fabr. Griesheim-Elektron. Ger. Pat. 282,234, June 29, 1913.

SPONGY zinc is freed from adhering electrolyte and then dried, with exclusion of air.—A. S.

Aluminium and heavy metals; Production of non-corrodible objects of —. A. Lang. Ger. Pat. 282,328, Dec. 4, 1913.

THE parts made of aluminium and of the other metal respectively, before and after they are brought together, are treated by any suitable method to produce on them coatings of oxide or sulphide of the same or of another metal, which are not attacked by dilute acids or alkalis and are capable of withstanding heat and mechanical treatment.—A. S.

Iron oxide ores and iron oxides; Process of reducing —. H. C. Alford, Mobile, Ala., U.S.A. Eng. Pat. 11,224, May 6, 1914.

SEE U.S. Pat. 1,097,156 of 1914; this J., 1914, 698.

Steel; Process of refining — and producing high-phosphorus slag. A. Vögler, Assignor to Deutsch-Luxemburgische Bergwerks- und Hütten-A.-G., Dortmund, Germany. U.S. Pat. 1,137,681, Apr. 27, 1915. Date of appl., Apr. 10, 1912.

SEE Eng. Pat. 19,640 of 1911; this J., 1912, 496.

Ores; Treatment of subdivided — for agglomerating or reducing them, and apparatus therefor. G. Gröndal, Djursholm, and H. Nilsson, Grangårde, Sweden. Eng. Pat. 20,361, Sept. 30, 1914. Under Int. Conv., Oct. 11, 1913.

SEE Fr. Pat. 473,218 of 1914; this J., 1915, 558.

Crucible and like furnace. A. C. Ionides, jun., London. U.S. Pat. 1,138,482, May 4, 1915. Date of appl., Oct. 4, 1912.

SEE Eng. Pat. 2839 of 1912; this J., 1913, 198.

Process for effecting chemical reactions at high temperatures. [Melting metals.] Ger. Pat. 281,004. See I.

XI.—ELECTRO-CHEMISTRY.

Furnace; Vacuum [electric] — for the measurement of small dissociation pressures. R. B. Sosman and J. C. Hostetter. J. Wash. Acad. Sci., 1915, 5, 277–285.

THE furnace comprises a tube acting as the heating element, within which is maintained a high vacuum, and a large, outer, water-cooled iron jacket, within which is maintained an "ordinary" vacuum, surrounding the furnace tube. An alternating current at about 2 volts is supplied to the furnace tube by water-cooled leads, passing through a stone base forming the bottom of the outer jacket. The furnace tube, consisting of an alloy of 80% Pt and 20% Rh, is surrounded by a magnesia tube, and the lower end is sealed into a water-cooled steel tube, passing through the stone

base, whilst the upper end is extended by a steel tube sealed into a glass tube. The charge is carried within the furnace tube by a small platinum crucible suspended by platinum wires from the top of the glass tube, from which is also suspended a Pt-Rh thermo-element. The glass tube is connected on one side to suitable pumps and an oxygen supply, and on the other to three pressure gauges, by means of which pressures ranging from 0.000001 mm. Hg to 2.5 atmos. may be measured. Experiments made on the oxygen pressures produced by 0.5 grm. charges of ferric oxide, heated at different levels in the furnace tube, have shown that there is a range of 25–30 mm. in the tube within which the temperature is uniform within 1° at about 1500° C. The heating current is supplied from the secondary of a transformer, a motor-generator supplying the primary, and the voltage of the generator is regulated by its field current. With a reasonably constant voltage applied to the motor, the temperature is practically constant, about 580 amps. at about 1.8 volts being required for a temperature of 1450° C.—B. N.

Lead; The anodic solution of —. N. M. Bell. Faraday Soc., May 11, 1915. [Advance proof.] 12 pages.

THE electrolysis of lead acetate, sodium acetate, potassium hydrogen tartrate, hydrofluosilicic acid, potassium bromide, and sodium thiosulphate solutions, at various current densities, has shown that an anode of pure lead loses more than may be expected, according to Faraday's law, for divalent ions. With lead acetate, potassium hydrogen tartrate, hydrofluosilicic acid, and potassium bromide, by the use of a blank electrode and by means of time experiments, this extra loss is shown to be due to chemical solution and mechanical detachment in cleaning, and not to the lead dissolving as univalent ions. In the case of sodium acetate and thiosulphate solutions, there is evidence of univalent lead ions in aqueous solution, to the extent of 2.8% in the former and 5.8% in the latter.—B. N.

Cadmium electrode; Reproducibility of the —. F. H. Getman and V. L. Gibbons. J. Amer. Chem. Soc., 1915, 37, 953–970.

THE measurements of the E.M.F. in concentration cells of methyl alcoholic solutions of cadmium iodide show that neither fresh cast rods of cadmium nor spongy cadmium deposited electrolytically are reproducible. Photomicrographs indicate a change in crystalline form. Rods of cadmium which have become grey by standing in cadmium iodide solution, and crystalline deposits of cadmium on cadmium rods or platinum give a constant E.M.F. when measured against an unpolarisable electrode; the E.M.F. of the crystalline is slightly higher than that of the grey cadmium.—H. R. D.

Electrochemical oxidation of hydrazine sulphate and ammonium hydroxide. Turrentine and Olin. See VII.

PATENTS.

Bleaching liquor; Electrolytic apparatus for the production of —, and for other purposes. A. Holliday, Wimbledon, and G. E. Ward, Stratford. Eng. Pat. 1672. Feb. 2, 1915.

THE electrodes are provided with elongated insulated lugs, which are secured to the top plate of a frame by metal studs, a rubber washer being interposed between the upper ends of the lugs and the plate. The bus bars and terminal fittings are enclosed in a protective cover. When the frame is lifted out of the vat any electrode may be removed separately from below, without removing

the top plate of the frame or disconnecting the other electrodes. A deflecting plate is provided to ensure efficient circulation of the liquid.—B. N.

Electrolyte for primary batteries. A. P. Manchester, Providence, R.I. U.S. Pat. 1,137,226, April 27, 1915. Date of appl., Dec. 26, 1912.

ONE pound of an alkali hydroxide, such as sodium hydroxide, of about 28° B. (sp. gr. 1.24), is combined with 273.1 grs. of vegetable starch at about 180° F. (82° C.).—B. N.

Electrodes of manganese dioxide; Manufacture of —. Siemens und Halske A.-G. Ger. Pat. 282,225, Feb. 22, 1914. Addition to Ger. Pat. 221,130.

PYROLUSITE is finely ground, freed from impurities by treatment with dilute sulphuric acid or other acid which does not decompose manganese dioxide, then well washed, dried, moistened with manganese nitrate solution, and formed into electrodes as described in the chief patent (see U.S. Pat. 935,109; this J., 1909, 1144).—A. S.

Preparation of hydrocyanic acid by the circulating passage of a gas mixture through an expanded high-potential arc. Eng. Pat. 11,107. See VII.

[Electrical] *sterilisation of liquids.* Eng. Pat. 9567. See XIXB.

XII.—FATS; OILS; WAXES.

Calcium and magnesium soaps; Formation and solubility of —. J. Zink and R. Liere. Z. angew. Chem., 1915, 28, 229–232. (See also Haupt, this J., 1915, 39.)

THE reaction between soluble calcium or magnesium salts and the alkali salts of fatty acids proceeds quite normally with the formation of an alkali salt and an insoluble soap, the reaction being practically quantitative whichever calcium or magnesium salt is employed. One litre of distilled water at ordinary temperature dissolves about 41, 28, and 91 mgrms. of calcium stearate, palmitate, and oleate and 78, 62, and 103 mgrms. of magnesium stearate, palmitate, and oleate, respectively; the solubility in each case is considerably increased by the addition of small amounts (0.5 and 1 grm. per litre) of sodium chloride.—T. C.

Determination of fat [in animal substances, etc.]. Rosenthal and Trowbridge. See XIXA.

PATENTS.

Linseed oil; Preparation of a substitute for boiled —. E. F. Waentig. Ger. Pat. 281,452, Feb. 28, 1913. Addition to Ger. Pat. 272,465. (See also Ger. Pats. 273,347 and 276,430; this J., 1914, 703, 1020.)

AN animal oil is heated to 280° C., then the supply of heat is cut off, and the containing vessel is insulated to minimise loss of heat. The temperature rises at first, and when subsequently it falls again to 260°–285° C., the material is treated with superheated steam as described in the chief patent (this J., 1914, 604).—A. S.

Soaps; Process for the manufacture of hard —. J. Leimdörfer, Budapest. U.S. Pat. 1,138,230, May 4, 1915. Date of appl., March 28, 1912. SEE Fr. Pat. 442,248 of 1912; this J., 1912, 936.

Food product [from cottonseed oil]. U.S. Pat. 1,135,351. See XIXA.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Pigments; Rapid test for fineness of paint — C. D. Holley and J. C. Brier. Oil, Paint, and Drug Rep., May 10, 1915.

THE Multi-Metal Separating Screen Co. of New York has succeeded in making 350-mesh screens (122,500 apertures per sq. in.) of vanadium-bronze wire about 0.001 in. diam., with which different operators, using different screens, can obtain concordant results. These screens have proved of value for testing the fineness of pigments. The particles passing through can be ground economically in a paint mill, but those retained on the screen, even when present in relatively small amounts, rapidly reduce the efficiency of the mill. The sample (25 grms.) is washed through the screen by means of water, using a soft brush to break up lumps. Calcium and manganese oxides, as used by varnish manufacturers, can be tested in a similar manner, using naphtha instead of water. The results obtained with consignments of various commercial pigments varied greatly in many cases from those yielded by the small sample used as a basis of purchase.—A. S.

Rosin; Use of types of tinted glass for grading — Oil, Paint, and Drug. Rep., May 10, 1915.

A SET of $\frac{1}{8}$ in. tinted glass cubes prepared by the U.S. Bureau of Chemistry has been adopted by the Savannah Board of Trade as standards for the various grades of rosin, with the exception of grades D and B. The component colours of the glass types on the Lovibond tintometer scale together with the corresponding grades of rosin are:—

Grade.	Colours.		Grade.	Colours.	
	Yellow.	Red.		Yellow.	Red.
WW ..	20	2.1	I	40	7.6
WG ..	20	2.5	H ..	45	9.4
N.....	25	3.3	G.....	50	15.5
M.....	30	4.5	F.....	75	34.5
K	35	5.8	E.....	100	52.5

The use of the new standards is to come into operation on June 14, 1915.—A. S.

PATENTS.

Phenolic condensation products. H. Wade, London. From S. Karpen and Bros., Chicago, U.S.A. Eng. Pat. 9292, April 14, 1914.

A REACTION under practically anhydrous conditions is effected between an anhydrous methylene body, such as hexamethylenetetramine, or hydrobenzamide, a phenol, and a phenolic compound with alkylated hydroxyl groups, such as anisol, phenylmethyl ketone, or methyl benzoate. The substances should be used in the approximate ratio of one C_6H_5 group in the phenol and in the phenolic compound, to one CH_2 group in the methylene compound. During the reaction ammonia is evolved, and the mixture gradually becomes viscous and solidifies on cooling. At this stage the compound is soluble in alcohol and some other solvents, and may be used as a varnish, etc. The reaction may be carried on up to this stage by boiling a solution of the mixture in alcohol or other non-aqueous solvent. Further heating of the compound produces an infusible, insoluble substance, which may be used as a substitute for amber, as an electrical insulator, etc. The liquid mixture, after short treatment, may be used as a binder for substances like carborundum.

—B. V. S.

Cinnabar [not sensitive to light]; Manufacture of — A. Eibner, Munich, Germany. U.S. Pat. 1,137,467, April 27, 1915. Date of appl., Sept. 4, 1914.

ORES containing mercuric sulphide are treated with a solution of potassium sulphide so as to produce a solution of the double salt, $HgS.K_2S.5H_2O$, and this is introduced into a cold solution (saturated with sulphur) of liver of sulphur and flowers of sulphur, whereby black mercuric sulphide and complex potassium sulphides are formed. The entire mass is then heated until cinnabar of the desired tint is obtained.—F. SODN.

Plastic material. F. G. Wiechmann, New York, Assignor to Fenoform Corporation, Hastings-upon-Hudson, N.Y. U.S. Pat. 1,135,340, April 13, 1915. Date of appl., Nov. 12, 1909.

THE plastic material is a practically insoluble and infusible substance obtained by the action of a condensation product derived from phenol and formaldehyde, or other suitable compound, upon vegetable protein or vegetable ivory.—E. W. L.

Rosin and turpentine; Process of removing — from resinous woods. W. M. Bashlin, Grove City, Pa. U.S. Pat. 1,136,994, April 27, 1915. Date of appl., May 11, 1912. Renewed Feb. 10, 1915.

RESINOUS wood is heated under reduced pressure, and is then extracted, unsubmerged, with a solvent, which removes rosin and turpentine. The extract is removed, and steam is admitted upwards to drive off the last traces of turpentine; the residue is treated with steam passing downwards and with water at about boiling-point, and the products thus separated from the wood are drawn off at the surface of the water.—E. W. L.

Coumarone-resin from heavy benzols of b. pt. 160°—180° C.; Preparation of a pure, pale — M. Wendriner. Ger. Pat. 281,432, Nov. 8, 1913. Addition to Ger. Pat. 270,993.

THE treatment with sulphuric acid of 60° B. (sp. gr. 1.71), specified in the chief patent (this J., 1914, 474), is omitted, and the benzol is cooled during the addition of the concentrated sulphuric acid, or the latter is added more slowly. Precautions must be taken to avoid overheating of the resin when distilling off the solvent naphtha.—A. S.

Vinyl esters; Manufacture of useful products [celluloid substitutes, lacquers, etc.] from — Chem. Fabr. Griesheim-Elektron. Ger. Pats. (A) 281,687 and (B) 281,688, July 4, 1913, and April 2, 1914.

(A). VINYL esters, e.g., the acetate or monochloroacetate, are polymerised by exposure to light or by heat. Other substances may be added to the esters before polymerisation, and the products may be softened by heating or dissolved in solvents and subsequently again converted into the solid form. The polymerised esters are non-inflammable, odourless, colourless substances suitable as substitutes for celluloid and similar products, and as insulating materials. Their solutions may be used as lacquers, for impregnating purposes, and for the production of films or threads. (B) Polymerisation is effected in the presence of catalysts, such as organic peroxides or ozonides, or organic acid anhydrides in conjunction with perborates, percarbonates, or certain metallic oxides capable of yielding oxygen. The polymerisation is accelerated, and in certain cases the properties of the products are modified.—A. S.

Plastic material suitable for the preparation of a horn substitute, films, threads, lacquers, etc.; Production of a — Chem. Fabr. Griesheim-Elektron. Ger. Pat. 281,877, July 4, 1913.

THE products obtained by polymerisation of vinyl halides, with or without the addition of other

substances, are softened or dissolved by means of suitable solvents, and subsequently reconverted into the solid form. The products are non-inflammable and odourless and may be used for all purposes for which cellulose esters or celluloid have been employed hitherto.—A. S.

Varnish, enamel, or lacquer composition. J. W. Aylsworth, East Orange. Assignor to Condensite Co. of America. Glen Ridge, N.J. U.S. Pat. 1,137,374, April 27, 1915. Date of appl., Dec. 2, 1913.

SEE Eng. Pat. 3497 of 1911; this J., 1912, 347.

Preparation of a substitute for boiled linseed oil. Ger. Pat. 281,452. See XII.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

PATENTS.

Rubber substance [rubber sponge] and process of making the same. P. Schidrowitz and H. A. Goldsbrough, London. Eng. Pat. 1111, Jan. 15, 1914.

RUBBER latex is coagulated under conditions producing a porous or spongy coagulum, and the porous structure is fixed by vulcanisation. Coagulation may be effected by means of a coagulant, or by heat, or by the use of a rubber solvent or precipitant, or by a combination of these. The natural pore formation can be modified or increased by the addition of substances, *e.g.*, carbonates or sulphides, or ammonia, producing gas on subjecting to heat or chemical action. Vulcanisation is effected by means of sulphur, preferably in the presence of a sulphide as carrier, these ingredients being added either before or during the incipient stage of coagulation, after which heat is applied. Fillers, pigments, etc., may be added at any suitable stage. Examples:—(1) Equal volumes of latex and a saturated solution of ammonium carbonate are mixed and heated on a water-bath, and incorporated with 1% of finely divided sulphur; acetic acid is then stirred in, and the containing vessel is placed in a steam vulcaniser and heated for 1 hour at 286° F. (140° C.). (2) 100 grms. of powdered ammonium carbonate is added to 100 c.c. of latex, and the mixture treated with 40 c.c. of carbon bisulphide containing 2 grms. of sulphur. The coagulum is vulcanised under water for about 40 minutes. (3) To 100 c.c. of latex sufficient 5% acetic acid is added to induce creaming; 50 c.c. of water is then added, 3 grms. of finely divided sulphur is stirred in, and sufficient 5% acetic acid added to produce a stiffening, but not complete coagulation. The mixture is vulcanised, with or without previous heating on the water-bath.—E. W. L.

Rubber; Process of vulcanising —. A. Cockburn, Edinburgh. Eng. Pat. 13,571. June 4, 1914.

IN vulcanising massive rubber articles, such as solid tyres, a non-porous product is obtained by applying a pressure of about one ton per sq. in. uniformly over the surface of the article, through the intermediary of a liquid, filling, for example, the annular space between a steel or iron mould and the article. The article is wrapped in a suitable flexible covering before being placed in the mould.—E. W. L.

Purification of unsaturated hydrocarbons containing the conjugated double bond. Eng. Pat. 6897. See XX.

XV.—LEATHER; BONE; HORN; GLUE.

Hides; Disinfection of — from anthrax spores. F. W. Tilley. J. Agric. Research, 1915, 4, 65—92.

THE Seymour-Jones method of disinfecting hides with mercuric chloride solution (1 : 5000) and 1% of formic acid (compare this J., 1912, 35), was found to be ineffective, even without neutralisation of the disinfectant; but if the strength of chloride be 1 : 2500, and the treated hides are not exposed for a week or two to any neutralising agent, its employment can be advised. The Schattenfroh process of treatment with a 2% solution of hydrochloric acid containing 10% of salt, followed by 48 hours' exposure (see this J., 1911, 969), gave entirely good results, but Sevcik (Z. Infektionskrank., 1913, 13, 323—348, 439—452) has found that it did not completely sterilise thick and heavily infected hides. This method, if not perfect, is the best extant. Although more chloride is found in leathers made from hides disinfected by the above processes, the available evidence shows that neither hide nor leather is injured by the disinfection.—E. H. T.

PATENTS.

Leather waste; Compositions utilising —. J. S. Campbell, London. Eng. Pat. 9370, April 15, 1914.

POWDER obtained by grinding leather scrap is heated with animal fat and with oil (such as fish-oil) and subsequently mixed with hair, wool, or vegetable fibrous material, powdered filling material, and a resilient vulcanisable binder. The mixture may be vulcanised after the addition of some material such as sulphur, or may be softened or liquefied by a suitable solvent and applied to a canvas backing.—F. C. T.

Patent-leather; Drying of —. H. Schulz, Worms, Germany. U.S. Pat. 1,137,671, April 27, 1915. Date of appl., March 26, 1915.

PATENT-LEATHER is first dried in an oven and then subjected to the simultaneous action of light and ammonia vapour.—E. W. L.

Leather, artificial; Process for waterproofing and graining —. C. Krug and H. Böllert. Ger. Pat. 281,302, April 22, 1914. Addition to Ger. Pat. 276,553.

THE process described in the chief patent (see Fr. Pat. 464,842; this J., 1914, 559) may be applied to artificial leather, paper, textile fabrics, etc.—A. S.

Gelatin; Method for manufacturing sheets of —. R. A. McQuitty, London. Eng. Pat. 15,465, June 27, 1914.

THIN sheets up to 180 ft. in length are made by spreading liquid gelatin over a flexible band of glazed or japanned material, winding the band round a drying wheel and drying by warm air. The use of ox-gall, oil, or talc for stripping is avoided by this process.—F. C. T.

Production of a plastic material suitable for the preparation of a horn substitute, films, threads, lacquers, etc. Ger. Pat. 281,877. See XIII.

XVI.—SOILS; FERTILISERS.

Kelps of the Pacific coast (U.S.A.): Availability of the nitrogen in —. G. R. Stewart. J. Agric. Research, 1915, 4, 21—38.

THE nitrogen of *Macrocystis pyrifera*, the kelp of most commercial importance, is not in a readily available form, particularly when the kelp is well dried before grinding; the kelp should be

applied in a fresh or partially dried condition. The removal by leaching of the large amount of mineral salts present in both fresh and dried materials, does not affect the availability of the nitrogen. The addition of macrocystis to a fresh soil decreased the rate of transformation of the nitrogen for a time, but the effect was only temporary. The nitrogen of *Nereocystis luetkeana* is much more readily available, and that of *Pelagophycus porra* is available to a moderate extent; but these seaweeds are only of minor commercial importance. Compared with dried blood and cottonseed meal, the fertilising value of the three kelps is very low. The method employed for determining the availability was to trace the extent of ammonification and nitrification taking place in fresh soils of various kinds treated with the fertilisers, under laboratory conditions.—E. H. T.

Nitrogenous fertilisers; New experiments with — in Germany and Austria. I.—M. Gerlach, W. Krüger, H. Roemer, B. Tacke, B. Schulze, W. Schneidewind, and H. Immendorff. Ber. über Landwirt., Berlin, 1914. Part 34, 229 pages. II.—O. Reitmaier and T. Alexander. Z. Landwirt. Versuchsw. Oesterr., 1914, 17, 729—807. III.—L. Hiltner and F. Lang. Prakt. Blätt. Pflanzenbau u. Pflanzenschutz, 1914, 12, 121—128. Bull. Bureau Agric. Intell., 1915, 6, 212—217. (See also this J., 1914, 1022.)

I.—EXPERIMENTS to determine the value of sodium nitrate, ammonium sulphate, calcium cyanamide, calcium nitrate, calcium nitrite (in a few cases), and liquid manure, were conducted under State auspices at seven stations, of which six (Bernburg, Bremen, Bromberg, Breslau, Halle, Jena) issued reports. The fertilisers were tried on cereal and root crops, growing on sandy, loam, and moor soil, the duration being three years, reduced in some cases to two or one. Taking the value of sodium nitrate as 100, the average values of the others, in the order named, were 84, 76, 99, 90, 64. Ammonium sulphate had a value of only 54 upon the wheat plots, but by neglecting these results the average would be raised to 89. Its effects on peaty soils were remarkable: viz., rye 109, oats 103, potatoes 102, and it gave better results on sandy than on loam soils, especially with root crops. There was no considerable difference between the effects of cyanamide on sandy and on loam soils. The various nitrogenous fertilisers had little influence on the percentage of nitrogen in the crops. II.—A comparison of the effects of calcium and sodium nitrates was carried out on similar lines by the Vienna Agric. Exper. Stat. Of 188 experiments, 91 gave reliable and 69 uncertain results, the rest being failures. In general, the action of sodium nitrate was better than that of calcium nitrate, especially on root crops. III.—A series of comparative experiments with cyanamide, etc., on barley and potatoes, grown on light soil at Moosacher, Bavaria, showed that cyanamide is valuable particularly as a top-dressing, for barley, but is not to be recommended for potatoes.—E. H. T.

Soil moisture; Effect on — of changes in the surface tension of the soil solution brought about by the addition of soluble salts. P. E. Karraker. J. Agric. Research, 1915, 4, 187—192.

THE results of preliminary experiments indicate that changes in the surface tension of the soil solution arising from the application of fertiliser salts are of no importance in affecting the moisture condition of the soil.

Nitrogen transformation in soils; Antagonism between anions as related to —. C. B. Lipman. Plant World, 1914, 17, 295—305. Bull. Bureau Agric. Intell., 1915, 6, 205.

SOLUTIONS of sodium chloride, sulphate, and car-

bonate show a mutual antagonism as regards their influence on ammonification in culture experiments. This is the case not only when the stimulating carbonate is one of the salts employed, but also when the toxic sulphate and chloride are used together. Nitrification is depressed in presence of 0.2% of sodium chloride, but increased by 0.05—0.2% of the sulphate. It is depressed 75% below the normal by 0.05% of the carbonate, but the addition of sulphate up to 0.5% then increases it above the normal. When chloride and carbonate are applied together, nitrification is increased by more than 25% above the normal; and the inhibiting action of carbonate present in large quantities can be neutralised, and a stimulating effect obtained, if 0.2% of chloride be added.

—E. H. T.

Ammonia from nitrogenous organic substances; Influence of sugars upon the [bacteriological] formation of —. E. Auel and H. Colin. Comptes rend. Soc. Biol., 1914, 76, 835—837. Bull. Soc. Chim., 1915, 17, 140.

WHEN cultivated upon an entirely nitrogenous medium, *Micrococcus prodigiosus*, Kiehl's bacillus, *Bacillus violaceus*, Eberth's bacillus, and *Proteus vulgaris* always give rise to the formation of a large amount of ammonia; but if dextrose be added, the medium becomes acid. It would therefore appear that the above micro-organisms effecting ammonification no longer behave in their characteristic manner towards nitrogenous substances when assimilable carbohydrates are available.

—J. P. O.

PATENTS.

Fertiliser containing lime nitrogen and tankage material. F. S. Washburn, Nashville, Tenn. U.S. Pat. 1,135,639, April 13, 1915. Date of appl., Nov. 17, 1914.

COMMERCIAL calcium cyanamide, or lime nitrogen, is intimately mixed in predetermined proportions with tankage fertiliser material containing phosphoric compounds, so as to yield a dry product.

—H. R. D.

Phosphates; Manufacture of soluble —. W. B. Bottomley, London. Eng. Pat. 20,788, Oct. 9, 1914.

FINELY divided mineral phosphate is moistened with a putrefying liquor containing a small proportion of a suitable food for micro-organisms, e.g., gelatin or meat extract, together with aerobic organisms, and the mass is maintained at about 30° C. for about a week.—B. N.

Phosphoric acid; Process of rendering available —. W. S. Landis, Niagara Falls, N.Y., Assignor to F. S. Washburn, Nashville, Tenn. U.S. Pat. 1,137,065, April 27, 1915. Date of appl., March 3, 1915.

FINELY powdered phosphate rock is mixed with sodium sulphate and carbon. the mixture is heated to eliminate the acid radical from the salt, then heated more strongly to cause incipient fusing and clinkering, discharged from the furnace, and ground.—B. N.

Acid phosphates [superphosphates] and the like; Manufacturing and curing —. G. L. Pratt, Atlanta, Ga. U.S. Pat. 1,137,531, April 27, 1915. Date of appl., Jan. 30, 1912.

THE finely powdered phosphatic mass is mixed with acid so as to convert it into a viscous mass, which is discharged into an underlying curing den to effect an initial curing, and the resulting dry and friable mass is discharged into an underlying carrier. The latter is transported on a substantially horizontal plane, and the contents are dis-

charged into an underlying storage place for the final curing operation. The various discharging operations from a higher to a lower plane prevent rubbing pressure on the friable mass, which would convert it into a sticky condition.—B. N.

XVII.—SUGARS; STARCHES; GUMS.

Sugar cane; Deterioration of cut—W. E. Cross and J. A. Belile. Intern. Sugar J., 1915, 17, 218—224.

EXPERIMENTS by Hall (Revista Ind. de Tucumán, 1913, 4, 148) have proved that the deterioration of cut cane is not governed by the size of the cane, the thickness of the rind, infestation by borers, or other such conditions. The authors' experiments indicate that the deterioration is due to the presence of enzymes. Stored canes were crushed, one portion (A) of the resulting juice was analysed, and another portion (B) was treated with a mixture of chloroform and toluene (to exclude the action of bacteria), and preserved for 17 days, when it was found that the glucose ratio of (B) had increased very considerably over that of (A). Freshly-milled cane showed similar results under identical conditions, though to a less marked degree, this pointing to the fact that the enzyme is elaborated during storage. The action of invertase in cut cane appears to be connected with the preparation on the part of the plant for germination, the sucrose being hydrolysed to the more readily assimilable invert sugar for the use of the young plant. This would account for the relative susceptibility to inversion of different varieties; the more rapidly germinating kinds invert more rapidly when stored after cutting. In practice deterioration may be prevented or lessened by storing the cane in a heap, covering with trash, and, preferably, drenching with water at frequent intervals.—J. P. O.

Bagasse; Determination of sugar in—N. Deerr. Intern. Sugar J., 1915, 17, 213—215.

LOOSELY-PACKED bagasse (495 grms.) contained in a metal basket ($5\frac{1}{2}$ in. wide \times $10\frac{1}{2}$ in. high) is placed in an extractor consisting of a cylinder (6 in. wide \times $12\frac{1}{2}$ in. high) filled with hot water (containing a little sodium carbonate) up to a draw-off cock $8\frac{1}{2}$ in. from the bottom, and fitted with a reflux condenser. The extractor is placed on an electric stove, the contents are boiled for an hour, then cooled below boiling point, mixed, and 1027 c.c. of the liquid is drawn off and evaporated to slightly less than 200 c.c., preferably on an electric stove provided with a low-water alarm. After cooling, making up the volume to 200 c.c. with basic lead acetate, and filtering, the saccharimetric observation is made, using a 400 mm. tube, the result being multiplied by 0.2 to give the polarisation of the bagasse. By using a large sample, the tedious processes of cutting and sub-sampling are obviated, and by concentrating the dilute aqueous extract a reading of sufficient magnitude to eliminate the error of observation is obtained.—J. P. O.

Sugar; Detection of small quantities of—by the production of formaldehyde, and the constituents of urine which give rise to formaldehyde. E. Sal-kowski. Z. physiol. Chem., 1915, 93, 432—446.

If a dilute solution of formaldehyde (e.g., 1 part in 50,000) is treated with a small quantity of Witte's peptone, and after the peptone has been dissolved by shaking and warming, the solution is treated with 3 drops of 3% ferric chloride solution, and then heated to boiling with about half its volume of hydrochloric acid of sp. gr. 1.19, it becomes violet and finally deep blue, and this colour remains unchanged for months. Formaldehyde is produced in the oxidation of sugar by acid solutions of potassium permanganate (cp. Rosenthaler, this

J., 1914, 224), and the author has endeavoured to apply this reaction, coupled with the colour test for formaldehyde given above, to the detection of sugar in urine. The oxidising solution was made by mixing 30 c.c. of dilute sulphuric acid (200 grms. diluted to 1 litre), 20 c.c. of 1%, or in some cases 5%, potassium permanganate solution, and 50 c.c. of water. The efficacy of the mixture diminishes on long storage, manganese dioxide being deposited, but a slight precipitate does not interfere with the reaction. When the stronger permanganate solution is employed the mixture is best kept in a loosely stoppered bottle as it slowly evolves oxygen. Two c.c. of a 0.1% solution of dextrose was heated with 5 c.c. of this mixture (made with 1% permanganate solution) until manganese dioxide began to separate; after decolorisation by a few drops of oxalic acid solution the liquid showed a strong formaldehyde reaction. Two c.c. of a 0.02% dextrose solution treated in the same way gave no reaction for formaldehyde, probably owing to further oxidation, for when 2—2.5 c.c. of the oxidising mixture was used instead of 5 c.c., a strong formaldehyde reaction was obtained. Two c.c. of normal urine, oxidised with 5 c.c. of the permanganate mixture as described above, and tested for formaldehyde, gave an intense reaction. Attempts to remove the substances responsible for this production of formaldehyde, were unsuccessful, so resource was had to precipitation of the sugar by Brücke's reagent—basic lead acetate in presence of ammonia. It was found that 0.2% of dextrose in urine can be detected with certainty if a measured quantity of the urine is precipitated first with basic lead acetate, and after filtration, with ammonia and basic lead acetate, and the well washed second precipitate is dissolved in hot acetic acid, the solution made up to the original volume of the urine, and 2 c.c. of it oxidised with 5 c.c. of permanganate mixture and tested for formaldehyde. Creatinine produces formaldehyde on oxidation, but the quantity of the former retained by the Brücke precipitate is not sufficient to interfere with the test, though it might exert a reducing action on Fehling's solution.—J. H. L.

Sucrose; Action of chloroform upon the inversion of—in the beetroot. P. Mazé. Comptes rend. Soc. Biol., 1914, 77, 549—550. Bull. Soc. Chim., 1915, 17, 143.

ON placing slices of beetroot containing about 7.5% of sucrose in solutions of chloroform or ether, it was observed that these reagents exerted an accelerating effect upon the action of the invertase, so that a greater formation of reducing sugars took place than occurred when the slices were immersed in pure water.—J. P. O.

Sucrose solutions; Vapour pressure of concentrated—D. O. Wood. Faraday Soc., May 11, 1915. [Advance proof.] pp. 19.

The accompanying table shows the vapour pressure of sucrose solutions, containing 47.97, 61.02, and 69.20 grms. of sugar per 100 grms. of

47.97% solution.		61.02% solution.		69.20% solution.	
°C.	Pressure.	°C.	Pressure.	°C.	Pressure.
60.42	14.60	62.98	15.18	59.0	11.27
63.39	16.58	67.51	18.69	62.9	13.60
66.02	18.47	73.08	23.75	68.2	17.37
72.95	24.78	78.55	29.86	73.9	22.25
74.23	26.25	83.35	36.38	75.1	23.50
80.42	34.49	87.61	42.93	78.8	27.68
82.78	37.39	90.85	48.58	84.9	35.84
84.86	40.10	[92.66	52.71]	89.1	41.64
90.00	49.60	—	—	92.0	46.44

solution, in cm. of mercury, measured directly by a static method. The bearing of the results on the theory of solutions is discussed. For the second and third solutions the lowering of vapour pressure due to the sugar, expressed as a fraction of the vapour pressure of water, diminishes slightly with rise of temperature, indicating a negative latent heat of dilution and a slight apparent fall in the osmotic pressure with rise of temperature. Application of Callendar's hydration formula indicates the association of four molecules of water with each molecule of sugar.—J. H. L.

Glucose [dextrose]; Derivatives of a new form of —. J. C. Irvine, A. W. Fyfe, and T. P. Hogg. Chem. Soc. Trans., 1915, 107, 524—541.

DEXTROSE when shaken for some hours at ordinary temperatures with methyl alcohol containing 1% HCl, is converted largely into a glucoside designated by Fischer as γ -methylglucoside (this J., 1914, 770). This new glucoside is characterised by the ease with which it is hydrolysed by acids, resembling in this respect sucrose and the fructosides, by its capacity to reduce potassium permanganate solution, and by its tendency to unite with an atom of oxygen to give a neutral substance which readily undergoes auto-condensation to a product allied to the disaccharides. It is converted on methylation into tetramethyl- γ -methylglucoside, b. pt. 106° C. at 0.25 mm., $[\alpha]_D$ in water = -14.6°, $n_D = 1.4458$. A study of the hydrolysis of this tetramethyl-derivative to tetramethyl- γ -glucose, which takes place easily with N/100-hydrochloric acid at 40° C., showed that it is a mixture of isomeric compounds. Tetramethyl- γ -glucose retains the capacity to reduce permanganate, and is distinguished from normal methylated glucoses, in chemical reactivity and in all its optical properties. The freshly distilled substance exhibits mutarotation, developing an increase in laevorotatory power. It gives no osazone, but on reduction is converted into a tetramethylhexitol; from its oxidation products a tetramethylgluconic acid was isolated and identified by conversion into the lactone.—G. F. M.

Re-burning of time from alkali waste and other forms of precipitated carbonate of lime. Meade. See VII.

The sugars of dormant and germinating barley and wheat. Kluyver. See XVIII.

PATENT.

Process of treating sugar cane. [Utilisation of bagasse for paper making.] Eng. Pat. 17,834. See V.

XVIII.—FERMENTATION INDUSTRIES.

Barley and wheat; The sugars of dormant and germinating —. A. J. Kluyver. Biochem. Suikerbepl. Brewers' J., 1915, 51, 289—290.

ABOUT 60 grms. of finely ground cereal was digested for 5 hours at 35° C. with 200 c.c. of 80% alcohol and a little calcium carbonate; 130 c.c. of the filtrate was concentrated and the residue was dissolved in 10 c.c. of water. The solutions were fermented, using van Iterson's apparatus, by means of six yeasts of known fermentative power for different sugars, viz.: *S. cerevisiae* (top and bottom), *Torula dattila*, *T. monosa*, *Schizosacch. Pombé*, and lactose yeast. From the results, set forth in the tables, it would appear that maltose, which is absent from the dormant corn, is produced during germination. The sucrose of barley is partially removed during steeping but increases during germination; the raffinose disappears but the monoses (dextrose

and levulose) increase, although a slight destruction of these takes place during kilning.

Percentage of sugars in wheat.

Sugars.	Dormant.	After germinating.		
		44 hours, corns chitted.	9 hours, rootlets 0.5—1.0 cm. long.	12 hours, rootlets 3 cm. and over.
Raffinose ..	0.08	—	—	—
Sucrose	0.73	0.98	1.53	2.79
Monoses ..	0.09	0.20	0.63	1.84
Maltose	—	0.31	1.03	3.19

Percentage of sugars in barley.

Sugars.	Dormant.	After 24 hours.	After steeping 48 hours and germinating.					After curing.	
			24 hrs.	72 hrs.	96 hrs.	120 hrs.	144 hrs.	24 hrs. at 28°-38° C.	48 hrs. at 38°-50° C.
Raffinose	0.45	0.36	0.43	—	—	—	—	—	—
Sucrose ..	0.76	0.56	0.67	0.54	2.14	3.01	3.91	4.44	4.29
Monoses	0.04	0.11	0.10	0.29	1.01	1.43	1.46	1.48	1.33
Maltose	—	—	—	0.47	1.91	2.41	2.84	0.52	1.03

—J. F. B.

Amylases; Studies on —. X. *Comparison of certain properties of pancreatic and malt amylase preparations.* H. C. Sherman and M. D. Schlesinger. J. Amer. Chem. Soc., 1915, 37, 1305—1319.

THE purified amylase preparations obtained from pancreas and from malt are similar in many respects but are not identical substances. Both contain 15—16% N and give similar group-reactions in the chemical classification of protein substances. When heated in solution both yield coagulated albumin and a proteose or peptone in solution; the biuret reactions of these filtrates are pinker than those of the original enzymes. While malt diastase exerts its optimum diastatic power in a slightly acid solution (see this J., 1915, 371), the optimum medium for the action of pancreatic amylase is slightly alkaline, expressed in Sørensen's terms by $pH = 8-8.5$. When each amylase was allowed to act on soluble starch for 30 mins. at 40° C. under its optimum conditions of reaction and salt concentration, the pancreatic amylase showed a diastatic power of 4000 on the "new scale" or 6000 Lintner, producing 10,000 times its own weight of maltose, while malt amylase showed 1570 "new scale" or 2350 Lintner, corresponding to 4000 parts of maltose. Similar differences were observed in long digestion experiments. The most highly purified specimens of pancreatic amylase possess a pronounced proteolytic action on casein and gelatin, whereas purified malt diastase is devoid of proteolytic activity. In pancreatic amylase the amylolytic and saccharogenic powers are concentrated in practically the same ratio, whereas in purified malt amylase these activities are divergent. Both enzymes deteriorate on standing in dilute aqueous solution, but malt amylase is always more stable than the pancreatic. On the other hand, the pancreatic amylase shows greater stability in 50% alcoholic solution and shows a more sustained activity in long-period digestions with an excess of substratum and suitable concentration of electrolytes. Both amylases deteriorate during dialysis, much more rapidly at the ordinary temperature than at 5°—10° C.—J. F. B.

Malt; The proteolytic enzymes of—E. Westergaard. J. Inst. Brewing, 1915, 21, 344—355.

The activity of the proteolytic enzyme at various temperatures was studied in the case of an extract prepared by triturating ground malt with water and sand and pressing out the liquid in a hydraulic press. Determinations of the coagulable protein before and after digestion showed that the proteolytic activity increases fairly rapidly with rise of temperature up to about 50° C., then more slowly to 56°—58° C., between which the optimum temperature seems to lie; it falls off somewhat rapidly above 60° C. Thus the nitrogenous composition of the wort may be varied by suitable adjustment of the temperature during mashing. In the case of digestions carried out at 50° C. and over, the author found by the formaldehyde titration method no indications of the activity of peptases with formation of amino-acids. Other investigations, both with green and kilned malts, showed, however, that peptolytic enzymes (peptases) are produced during germination. Two such enzymes are apparently present in malt, but the activity of one is completely destroyed at 50° C., while that of the other is greatly enfeebled. Since the average temperature in the mash-tun is considerably higher than 50° C., it may be assumed that, as regards the nitrogenous composition of the wort, the mashing process is only concerned with the conversion of proteins into peptones or polypeptides, whilst the formation of amino-acids is, in normal circumstances, solely determined by the malting process. Brewers' yeast possesses very little proteolytic activity, whence it follows that, from a practical point of view, unmodified proteins are useless for yeast nutrition even if they were present in the malt in a non-coagulable form. The peptolytic activity of yeast, on the other hand, is very pronounced, and the presence in the wort of peptones or polypeptides on which the yeast-peptases can act is all that is required. The development of amino-acids in the malt or wort might indeed be harmful by affording a medium for the growth of bacteria which lack the peptase necessary to convert the polypeptides of normal worts.—J. F. B.

Erepsin; Studies on the action of—F. E. Rice. J. Amer. Chem. Soc., 1915, 37, 1319—1333.

ACTIVE erepsin preparations are obtained by grinding the fresh, washed mucous coat of the small intestine with sand and water, allowing to stand for 10 days at 38° C. in presence of a 0.1% solution of sodium carbonate, filtering, acidifying with acetic acid, again filtering, and dialysing the filtrate against flowing water for 10 days. Witte peptone is readily hydrolysed by erepsin and the extent of the digestion is best measured by determination of the quantity of free amino-nitrogen produced; Sørensen's formaldehyde titration method is most suitable. The quantity of amino-nitrogen split off from peptone varies with the amount of peptone present. For comparing the ereptic power of extracts, a solution of Witte peptone, containing 21 mgrms. of amino-nitrogen and 2 c.c. of N/5 sodium hydroxide per 60 c.c. is digested with the erepsin for 10 hours; the quantity of amino nitrogen split off during the first 10 hours is proportional to the weight of erepsin raised to the three-fourths power. Erepsin attacks fibrin in very feebly alkaline solution, but on increasing the quantity of alkali (1.5 c.c. of N/5 sodium hydroxide per 50 c.c.) there is practically no action. Since this amount of alkali does not inhibit tryptic digestion, the method may be used for detecting the presence of trypsin in erepsin preparations. Erepsin hydrolyses gelatin very rapidly; it also attacks the tissue of the mucous coat of the small intestine, inducing autolysis of that tissue. Dry preparations obtained by precipitation with

ammonium sulphate lose their ereptic power more rapidly than aqueous solutions; dilute alcohol is not a satisfactory preservative.—J. F. B.

Yeast; Peptic strength of—T. Bokorny. Allgem. Brauer- u. Hopfenzeit., 1914. J. Inst. Brewing, 1915, 21, 363—364.

A STUDY of the action of yeast on foreign protein matters, such as dried meat and soya beans, indicated that the peptic action is probably not the result of arrested action of the yeast trypsin, but is due to peptic enzymes, the activity of which is, however, much weaker than that of animal pepsin. The quantities of albumoses and peptones produced rarely exceeded 10% of the albumin mixed with the yeast. Most of the experiments were conducted at 35°—40° C.; peptic products were formed in largest amounts in presence of 0.5—1.0% of phosphoric acid, 0.5% of sulphuric acid, or 0.8% of tartaric acid. When the action was limited to 24—48 hours, the products consisted mainly of albumoses, but on prolonged action, e.g., 9 days, in presence of higher concentrations of acid, the albumoses disappeared and peptones were obtained.—J. F. B.

Yeast; Action of some enzymes upon the carbohydrates of—J. Giaga. Comptes rend. Soc. Biol., 1914, 77, 2—4. Bull. Soc. Chim., 1915, 17, 140—141.

PANCREATIC juice slowly hydrolyses the glycogen of yeast cells which have been killed previously by heating; the digestive juice of the snail, owing to the presence in it of other active enzymes, effects the reaction almost instantaneously. When the digestive juice of the snail acts upon yeast deprived of glycogen, reducing sugars consisting of dextrose and a very small amount of mannose are formed to the extent of 20%. Acid hydrolysis, carried out in an autoclave at 120° C. during 2 hours, effects the formation of 33% of reducing sugars, consisting of a mixture of dextrose and mannose.—J. P. O.

Enzymes; Behaviour of—at low temperatures. J. S. Hepburn. J. Franklin Inst., 1915, 179, 581—585.

THE specific activity of many enzymes, including those which produce hydrolysis of fats, carbohydrates, and proteins, oxydases and reductases, clotting enzymes, and zymase, is retained after exposure varying from less than an hour at the temperature of liquid air to 89 months at —9.4° to —12.2° C. The activity of these enzymes has also been studied in certain cases at temperatures ranging from that of an ice-chest down to —9° to —12° C., a considerable reduction in the velocity of their action being always observed.—J. F. B.

[Beers:] *Reducing original gravity* [of—]. P. Petit. Brewer and Maltster, 1915, 34, 69—71. J. Inst. Brewing, 1915, 21, 370—373.

WITH certain waters, e.g., those rich in gypsum and containing little or no alkali carbonates, those containing large amounts of sodium sulphate, and those which introduce a considerable amount of iron into the wort, the original gravity of the wort cannot be reduced without the beer becoming thin and flat; waters rich in organic matter are particularly undesirable owing to the presence of iron. Waters rich in sodium and calcium chlorides and sufficiently calcareous are favourable to "body" and mellowness. Malts of long aerespire, friable and mellow, low-cured and moist, are not suitable for brewing full-bodied beers at low original gravities; the malt must be sharply kilned and employed in a thoroughly dry condition. Very mellow malts are preferably pre-mashed at a high temperature, e.g., 140°—143° F. (60°—62° C.) and mashed quickly. Malts with a considerable proportion of steely points are best

treated by preliminary acidification of the mash. The subsidiary acid mash should be added when the main mash has reached 110° – 113° F. (60° – 62° C.); this eliminates bottom yeast cells, and also facilitates clarification of raw grain worts and improves the stability of the beer. For a full-bodied beer the most valuable dextrins are not those produced by slow saccharification of raw grain below the final mashing temperature, but those produced between 119° and 158° F. (65° – 70° C.). It is most important to boil sharply either with direct fire or high-pressure steam; in the latter case a coil in the mash is preferable to a double-bottomed copper in order to produce a greater caramelising effect. The hops should be added after the wort has boiled for 15–30 mins.; slow passage through the cooler is advisable. A high temperature of fermentation favours the production of acids, which may be so pronounced as to detract from the full-bodied character of the beer, but there is less danger when the malt employed is not too mellow. Contact with air operates against fullness of body, and open fermentation vessels often give poor results with beers of low gravity. A good proportion of carbon dioxide in the beer is indispensable for the full-bodied character. In applying the above rules, attention must be paid to the preservation of stability, and fullness of body must not depend on the presence of traces of starch; the employment of fresh hops in sufficient proportions should always be maintained.—J. F. B.

Methyl alcohol; Determination of — in presence of ethyl alcohol. G. C. Jones. Analyst, 1915, 40, 218–221.

SIMMONDS' directions (this J., 1912, 150) for carrying out Denigès' method for the determination of methyl alcohol need slight amendment in order to obtain accurate results. The Schiff's reagent employed should be prepared by dissolving 0.2 gm. of magenta in 10 c.c. of saturated sulphur dioxide solution and, after 24 hours, diluting the solution with water to 200 c.c. The amount of permanganate solution used for the oxidation must not be less than 2.5 c.c.; when 5 c.c. is employed the sensitiveness of the test is doubled. The quantity of sulphuric acid added with the permanganate may vary from 0.1 to 0.3 c.c., and the period of oxidation, provided it be not less than 3 minutes, appears to be without effect on the results. The subsequent addition of sulphuric acid must be nearly the same in amount in any one set of experiments. Five c.c. of the Schiff's reagent should be added in each case; if 10 c.c. is added, the acid concentration is so much reduced that acetaldehyde from ethyl alcohol develops a coloration. The test may be expected to show the presence of about 0.1% of methyl alcohol in ethyl alcohol, and proportions of about 1% can be determined with an error not exceeding 5%.

—W. P. S.

Alcohol from cassava. A. E. Collens. Bull. Dept. of Agric., Trinidad and Tobago, 1914, 14, 56.

SWEET cassava roots, when pulped, boiled, saccharified with malt, fermented, and distilled, yielded a quantity of alcohol corresponding to 75.6 galls. of 94% alcohol per ton of dry material. In another experiment, where the starch was saccharified with taka-diastase, the yield amounted to 81.5 galls. of 94% alcohol per ton of air-dried slices.

—W. P. S.

PATENTS.

Fermenting tuns. F. Rogerson. London. Eng. Pat. 22,820, Nov. 20, 1914.

THE interior surface of ferro-concrete tuns is coated first with about $\frac{1}{2}$ in. of damp-proof cement (e.g., cement mixed with soapy or greasy materials) and

then with about $\frac{1}{2}$ in. of a porous mixture such as 3 parts of sand and 1 part of cement. When this is dry it is heated and covered with a layer, about $\frac{1}{2}$ in. thick, of a waterproof and acid-resistant mixture of waxes, e.g., beeswax 60%, ceresin 20%, paraffin wax 10%, and carnauba wax 10%, with or without a gum or resin.—J. H. L.

Beer; Process of charging —. O. M. Lamsens. Detroit. U.S. Pat. 1,137,149, April 27, 1915. Date of appl., May 20, 1912.

SEE Fr. Pat. 457,789 of 1913; this J., 1913, 1026.

Process for making a decoloriser [from argol]. U.S. Pat. 1,135,216. See 11b.

XIXA.—FOODS.

Wheat gluten; Colloidal swelling of —. F. W. Upson and J. W. Calvin. J. Amer. Chem. Soc., 1915, 37, 1295–1304.

WHEAT gluten, washed in a stream of distilled water until free from starch, was pressed to a cake from which discs of uniform size and weight were cut, weighed, steeped in various solutions, drained, and weighed again. When moist gluten is steeped in a solution of any acid it swells and absorbs water to an amount depending on the nature and the concentration of the acid. Maximum absorptions are recorded for 0.005N hydrochloric acid, lactic acid between 0.01 and 0.02N, and 0.04N acetic acid. With increase in the concentration of acid the absorption of water rapidly decreases, and in 0.2–0.5N hydrochloric acid the moist gluten loses water. The absorption of water by, and its withdrawal from, the gluten discs is a reversible process which may be performed on the same disc within wide limits without substantial change. The presence of neutral salts opposes the absorption of water by gluten in acid solutions, and, with higher concentrations of salt, may even cause loss of water from moist gluten. Gluten which has taken up water in an acid solution loses water and regains its original properties when placed in a salt solution. Non-electrolytes, such as glycerol and flour or bran extracts, also oppose the absorption of water but in a less marked degree than salt solutions; sugar has very little action except in high concentrations. The absorption of water in acid solutions is increased by rise of temperature. In all these respects the behaviour of gluten is analogous to that of animal colloids such as gelatin, etc.

—J. F. B.

Milk; Human —. A. W. Bosworth. J. Biol. Chem., 1915, 20, 707–709.

HUMAN milk was filtered through a clay filter and the serum and unfilterable portion analysed separately (cf. this J., 1915, 297); the results obtained suggest the following arrangement as representing the condition in which the constituents are present in human milk of normal composition:—Fat, 3.30; lactose, 6.50; proteins combined with calcium, 1.50; calcium chloride, 0.059; monopotassium phosphate, (KH_2PO_4) , 0.069; sodium citrate, 0.055; potassium citrate, 0.103; monomagnesium phosphate, $(\text{MgH}_4\text{P}_2\text{O}_7)$, 0.027%.—W. P. S.

Fat [in animal substances, etc.]; Determination of —. H. Rosenthal and P. F. Trowbridge. J. Biol. Chem., 1915, 20, 711–717.

THE sample is saponified with sodium hydroxide, then diluted with water, acidified with hydrochloric acid, and shaken with ether. The ethereal solution is evaporated to dryness, the residue dissolved in a mixture of petroleum spirit and alcohol, and the solution titrated with N/20 sodium hydroxide solution, using phenolphthalein

as indicator; the neutralised solution is evaporated and the residue dried to constant weight. After deducting the weight of alkali present, the residue of fatty acids is calculated to glyceride, the weight of fatty acid being multiplied by 1.046 for this purpose. The results obtained are more concordant than those yielded by the Kumagawa-Suto method (this J., 1908, 455). To determine fat in blood, an extraction with alcohol should first be made, as recommended by Shimidzu (this J., 1910, 1259).—W. P. S.

Wheat bran; Organic phosphoric acid compound of —. IV. Occurrence of inositol triphosphate in wheat bran. R. J. Anderson. J. Biol. Chem., 1915, 20, 463—473. (See also this J., 1914, 936.)

THE insoluble barium salts obtained by the addition of barium hydroxide to the aqueous hydrochloric acid extract of wheat bran, were further separated by converting into acid barium salts and extracting with cold water. The insoluble portion gave a crystalline strychnine salt forming either needles or plates, which were apparently homogeneous, and which on reconversion into the barium salt gave a white amorphous compound of the composition, $C_6H_5O_{15}P_3Ba_3$, barium inositol-triphosphate. Precipitation of the hydrochloric acid solution of this salt with alcohol furnished an acid salt of the composition, $(C_6H_5O_{15}P_3)_3H_3Ba_3$. The free inositol triphosphate, $C_6H_{15}O_{15}P_3$, prepared from the barium salt, formed a colourless syrup, soluble in water and in alcohol. Unlike phytic acid it gives no precipitate with ammonium molybdate or silver nitrate, and does not at once precipitate egg albumin. The acid does not give a precipitate with barium or calcium chlorides unless previously neutralised with ammonia. On hydrolysis with dilute sulphuric acid at $150^\circ C$, it is decomposed into inositol and phosphoric acid.—G. F. M.

Phytin; Hydrolysis of — by the enzyme, phytase, contained in wheat bran. R. J. Anderson. J. Biol. Chem., 1915, 20, 475—482.

THE chief products of the hydrolysis of phytin by the phytase contained in wheat bran are phosphoric acid and intermediate products consisting of inositol tri-, di-, and monophosphate, identical with the compounds contained in 0.2% hydrochloric acid extracts of the bran. The whole of the phytin is at least partially hydrolysed, and a portion of it completely, since the resulting solution contains free inositol.—G. F. M.

Phytase; Hydrolysis of the organic phosphorus compound of wheat bran by the enzyme —. R. J. Anderson. J. Biol. Chem., 1915, 20, 483—491.

THE presence of phytase in wheat bran causes a rapid hydrolysis of the organic phosphorus compound when the bran is digested with water (see also preceding abstract). The maximum activity of the enzyme occurs in the presence of 0.1% hydrochloric acid and 0.2% acetic acid, and this affords an explanation of the presence of the lower inositol-phosphoric acids, and of the large proportion of inorganic phosphoric acid found in hydrochloric acid extracts of wheat bran. With increasing concentration of hydrochloric acid the activity rapidly diminishes, and by exposure to 0.5% hydrochloric acid the enzyme is destroyed. Wheat bran normally contains about 0.1% of inorganic phosphorus, that is, about 11% of the total soluble phosphorus.—G. F. M.

Phytin in wheat bran. R. J. Anderson. J. Biol. Chem., 1915, 20, 493—500.

FROM the extract obtained by digesting wheat bran with 1% hydrochloric acid, which is sufficiently strong to inhibit the hydrolytic action of phytase

(see preceding abstract) crystalline barium salts of the composition: $C_6H_{12}O_{24}P_6Ba_3 \cdot 8H_2O$ and $(C_6H_{11}O_{24}P_6)_2Ba_3 \cdot 14H_2O$ were isolated. These salts were identical with the tribarium phytate and heptabarium phytate obtained from oats, corn (maize), commercial phytin, etc., and wheat therefore contains in common with these products the same phosphorus compound, namely, phytic acid or inositol hexa-phosphate.—G. F. M.

Cheese; Determination of chlorides in —. E. C. V. Cornish and J. Golding. Analyst, 1915, 40, 197—202.

THE cheese is heated with sulphuric acid in a Kjeldahl flask, into the neck of which is inserted a soda-lime tube of such size that the bulb just blocks the mouth; the evolved gases are aspirated through this tube into silver nitrate solution containing 40% of its volume of nitric acid, and the excess of silver nitrate is then titrated with thiocyanate solution. The method yields concordant results and is more reliable than the ordinary incineration process, owing to the risk of volatilising chlorides in the latter method.

—W. P. S.

Cassava; Hydrocyanic acid content of bitter and sweet —. A. E. Collens. Bull. Dept. of Agric., Trinidad and Tobago, 1915, 14, 54—56.

THE following percentage quantities of hydrocyanic acid were found in (A) sweet and (B) bitter cassava plants, the determinations being made immediately after the plants had been dug up:—Leaves (A) 0.0162, (B) 0.041; peel of stem, (A) 0.043, (B) 0.113; pith of stem, (A) 0.019, (B) 0.076; edible portion of root, (A) 0.0048, (B) 0.053. The hydrocyanic acid content of different parts of the freshly dug roots was the same, but after keeping for 3 days the upper part of the sweet roots contained about twice as much as the bottom portion; loss of water during air-drying also caused the hydrocyanic acid content to increase. When sweet cassava was boiled with water for 1 hour, or roasted, no hydrocyanic acid was developed.

—W. P. S.

Carbon dioxide in baking powder and carbonates; Determination of —. H. W. Brubaker. J. Ind. Eng. Chem., 1915, 7, 432—433.

THE baking powder is treated with a saturated solution of sodium chloride, and the carbon dioxide evolved is caused to displace its own volume of a saturated salt solution in a graduated cylinder. In the case of carbonates the sample is treated first with 10 c.c. of dilute hydrochloric acid saturated with sodium chloride and then, in a second test, with 15 c.c. of the acid solution; from the difference between the two results the correction required for the solubility of carbon dioxide in the acid solution is ascertained. To obviate the necessity of making a correction, 0.5 gm. of precipitated calcium carbonate may be treated with 30—40 c.c. of dilute (1:3) hydrochloric acid, and when effervescence has ceased, 10 c.c. of the clear acid, saturated with carbon dioxide, withdrawn and used in the test.—A. S.

The sugars of dormant and germinating barley and wheat. Kluyver. See XVIII.

Action of crepsin. Rice. See XVIII.

PATENTS.

Flour; Method of treating —. F. D. Larabee, Hutchinson, Kansas, U.S.A. Eng. Pat. 18,506, Aug. 10, 1914.

THE flour is passed between disc grinders of metal with the opposing faces suitably ridged. A rubbing action takes place which breaks down the starch cells, so that more water is absorbed when the

flour is made into dough. The treatment may be effected also by the use of rollers working at a low differential speed and capable of exerting a high pressure.—J. H. J.

Coffee tablet; Process of making a —. R. Hübner, Assignor to G. H. Benjamin, New York. U.S. Pat. 1,137,263, Apr. 27, 1915. Date of appl., Dec. 27, 1909.

COFFEE is extracted with ether, or ether and alcohol, and afterwards with water. The ethereal extract is treated with an alkali and the saponified substances are separated. The two extracts are then mixed and evaporated, and the residue formed into tablets.—J. H. J.

Food product [from cottonseed oil]. J. J. Burchenal, Assignor to The Procter and Gamble Co., Cincinnati, Ohio. U.S. Pat. 1,135,351, Apr. 13, 1915. Date of appl., Nov. 10, 1910.

COTTONSEED oil is incompletely hydrogenised so as to produce a lard-like product of a yellowish or white colour, having an iodine value of 55–80, m. pt. 33°–40° C., titer value 42°–35° C., and giving no reaction for cottonseed oil with Halphen's test.—J. H. J.

Flour; Method of treating —. F. D. Larabee, Hutchinson, Kans., Assignor to W. G. Andrews, Chicago, Ill. U.S. Pat. 1,136,881, April 20, 1915. Date of appl., July 11, 1913.

SEE Eng. Pat. 18,506 of 1914; preceding.

Nitrogen compounds from organic substances of animal origin; Production of soluble —. E. Bohon, Assignor to J. Sloan, Paris. U.S. Pat. 1,138,348, May 4, 1915. Date of appl., Feb. 20, 1914.

SEE Fr. Pat. 460,150 of 1913; this J., 1914, 661.

Milk, artificial; Manufacture of —. F. Gössel, Frankfurt, Germany. U.S. Pat. 1,139,031, May 11, 1915. Date of appl., May 5, 1914. Renewed Mar. 25, 1915.

SEE Fr. Pat. 451,447 of 1912; this J., 1913, 621.

XIXB.—WATER PURIFICATION; SANITATION.

Calcium and magnesium carbonates; Solubility of — in waters free from carbonic acid, in reference to their salt content and organic substances. F. Gothe. Chem.-Zeit., 1915, 39, 305–307, 326–327.

THE solubility of calcium carbonate in water free from carbonic acid varies between narrow limits, amounting on the average to 17.4 mgrms. CaO or 31.0 mgrms. CaCO₃ per litre. The solubility of magnesium carbonate under similar conditions is subject to greater variations, being on the average 94.4 mgrms. MgCO₃ per litre. The solubility of both calcium and magnesium carbonates is increased by the chlorides, nitrates, and sulphates of the alkalis and lowered by the carbonates of the alkalis, and the chlorides, nitrates, and sulphates of the alkaline earths. Ammonium salts cause the decomposition of calcium and magnesium carbonates, hence an increase in their solubility as such is not in question. Organic substances alone, and particularly in presence of neutral salts of the alkali metals, retard the decomposition of the bicarbonates of calcium and magnesium, otherwise the solubility relationships of the carbonates in presence of alkali or alkaline-earth salts above mentioned, holds without exception in this case, the reduction in solubility in presence of calcium or magnesium chlorides being particularly marked. —G. F. M.

Nitrous acid [in water]; Colorimetric determination of —. G. Romijn. Chem. Weekblad, 1914, 11, 1115–1116. Analyst, 1915, 40, 254.

THE reagent used consists of a powdered mixture of α -naphthylamine hydrochloride, 1, tartaric acid, 89, and sulphuric acid, 10 parts; it keeps unaltered for a long time. The water under examination must not contain more than 0.15 mgrm. NO₂ per litre, since otherwise precipitation of the colouring matter formed in the reaction takes place. Should the coloration appear too rapidly, the water must be diluted with distilled water and the test repeated.—W. P. S.

p-Dichlorobenzene; Use of — as insect fumigant. A. B. Duckett. Bull. U.S. Dept. Agric., No. 167, Feb. 10, 1915. 7 pages.

p-DICHLOROBENZENE vapour is heavy, has an ethereal odour, and although harmless to man, animals, plants, and fruits, is fatal to a large variety of insects, both in the adult and larval states. Owing to its great volatility and to the fact that the optimum temperature is 75°–85° F. (24°–30° C.), this fumigant is best applied in a confined space, e.g., in a fumigating chamber, but it can be used in a closed cupboard or a dwelling room. The amount required is from 12–16 oz. per 100 cub. ft. of space, and the time needed is 24–36 hours. It is non-inflammable and very cheap.—E. H. T.

Quaternary salts of hexamethylenetetramine. Jacobs and Heidelberger. See XX.

Reaction between calcium hydroxide and sulphur in aqueous solution [during preparation of lime-sulphur wash]. Auld. See VII.

Precipitant for ammonia. (Substitute for Nessler's reagent.) Graves. See XXIII.

PATENTS.

Water, more particularly feed-water for steam generators, hot-water systems, and the like; Purification of —. C. Haythorpe, London. Eng. Pat. 9396, April 16, 1914.

IN filters for purifying water by galvanic action, copper strips are passed through the carbon of the filter and bolted to zinc blocks forming the ends of the filter. The filter is surrounded by a steam jacket, and is placed at the side of the feed-water pipe and connected to it by inlet and outlet valves, between which is a valve on the feed-pipe. When it is desired to clean the filter, the last-mentioned valve is opened and the inlet valve to the filter closed, whereupon the water passes backwards through the filter and escapes through a scum pipe.—J. H. J.

Sterilisation of liquids [; Electrical —]. T. P. H. Dawe, London. Eng. Pat. 9507, April 17, 1914.

IN the sterilisation of liquids by alternating electric currents, the liquid is passed through a narrow electric zone, at a uniform and relatively high electric density, and disposed transversely to the direction of flow of the liquid. The effective surface of the electrodes may be increased without increasing the thickness of the effective zone; e.g., one or both electrodes may be shielded in a chamber or chambers to which the liquid has access, being fixed in such a manner that as the supply of liquid subsides, the electrodes are gradually uncovered. When a static transformer is employed, the supply of current is automatically controlled by a rheostat as the quantity of liquid is varied.—B. N.

Sewage sludge and the like; Apparatus for drying —. J. Bromet, F. Thorman, and H. C. Wood, Tadcaster, Yorks. Eng. Pat. 14,615, June 18, 1914.

To effect the better breaking up and the more

efficient drying of sewage sludge in the apparatus described in Eng. Pat. 7822 of 1913 (this J., 1914, 565), the heated rotating cylinders are provided, preferably at the feed end, with one or more internal rollers which work against the interior wall of the cylinder and are attached to lever arms hinged to brackets fixed to the girder running through the cylinder. A scraper attached to the girder removes any material adhering to the cylinder. At the exit end of each cylinder a pair of external rollers rotating in opposite directions on fixed and movable shafts, completes the crushing of the material.—J. H. J.

Sewage and analogous liquids; Apparatus for the purification of—W. Jones, and Jones and Attwood, Ltd., Stourbridge. Eng. Pat. 19,916, April 11, 1914.

IN an aerating tank for the treatment of sewage, the floor of the tank is divided into a number of saucer-like depressions, and in the centre of each depression is a porous plate. Compressed air is admitted to chambers below the porous plates, and fine bubbles rise from the upper surfaces of the plates; currents of liquid upwards over the porous plates and downwards between the depressions are thus produced, carrying with them the suspended solids and bacteria. The sewage is admitted at the bottom of one end of the tank and flows over a wall at the other end. After aeration is completed, the liquid is allowed to stand till clear, when the clarified liquid is run off and the solids are allowed to remain; fresh sewage is then admitted at once and the aeration recommenced.—J. H. J.

Coagulant for water purification: Process for making a—A. Jacobson. Council Bluffs, Iowa. U.S. Pat. 1,137,005. April 27, 1915. Date of appl., April 27, 1914.

A COAGULANT consisting of ferrous sulphate and a soluble basic aluminium sulphate, $Al_2(OH)_2(SO_4)_2$, is prepared by passing a solution of aluminium sulphate over metallic iron.—J. H. J.

Disinfectants for mouth-washes; Preparation of easily soluble, stable—E. Langer. Ger. Pat. 281,148, Nov. 28, 1911.

A MIXTURE of sodium fluoride or silicofluoride, or both of these, with tartaric acid and excess of sodium carbonate or bicarbonate is formed into tablets. Succinic acid may be used in addition to tartaric acid, and small quantities of ethereal or other aromatic substances and of soap may be incorporated with the mixture with the aid of alcohol.—A. S.

Formaldehyde; Production of—from its polymerides. G. A. Ranft. Ger. Pat. 281,553, July 4, 1911.

TO generate formaldehyde vapour for disinfecting purposes, polymerised formaldehyde, e.g., trioxymethylene, is treated with water and an alkali or alkaline-earth chloride or a mixture of these, and heated in an open vessel, or hot water or steam may be passed through the mixture: 30 grms. of trioxymethylene is quantitatively depolymerised by a boiling solution of 20 grms. of calcium chloride in 100 grms. of water.—A. S.

Disinfecting and preserving agent. Grubenholzimpregnierung Ges. m. b. H. Ger. Pat. 281,842, March 14, 1914.

A DISINFECTING solution, suitable for wood impregnation and other purposes, is obtained by adding alkali nitrite to an aqueous solution of mercuric chloride; other soluble salts not capable of decomposing alkali nitrite may also be added.

The corrosive action of a 0.1–0.2% solution of mercuric chloride on metals is inhibited by addition of 2% of alkali nitrite.—A. S.

Water; Apparatus for purifying—by means of ozonised air. G. Erlwein, Berlin, and C. Knips. Charlottenburg. Assignors to Siemens u. Halske A.-G., Berlin. U.S. Pat. 1,138,202, May 4, 1915. Date of appl., Nov. 15, 1910.

SEE Eng. Pat. 17,787 of 1910; this J., 1911, 442.

Water; Method of softening—K. Schrempp, Karlsruhe, Germany. U.S. Pat. 1,139,378, May 11, 1915. Date of appl., Feb. 7, 1914.

SEE Fr. Pat. 468,047 of 1914; this J., 1914, 981.

Detecting, indicating, and recording the presence and proportion of [inflammable] gas in the atmosphere of mines. Eng. Pat. 9196. See XXIII.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Glucosides hydrolysable by emulsin; Biochemical detection of—in some plants of the families Papilionaceae and Scrophulariaceae. E. Bourquelot and A. Fichtenholz. J. Pharm. Chim., 1915, 11, 219–225. (See also this J., 1901, 1214; 1912, 299, 510, 1051.)

EXTRACTS of the following plants were subjected to the successive action of invertase and emulsin:—*Cytisus Laburnum*, L., *Ononis Natrix*, L., *Psoralea bituminosa*, L., *Coronilla varia*, L., *Indigofera Leptostachya* (seeds), *Scrophularia aquatica*, L., *Linaria spuria*, Mill., *L. Elatine*, Desf., *L. cymbalaria*, Mill., *L. vulgaris*, Moench., *L. purpurea*, *Euphrasia officinalis*, L., and *Melampyrum arvense*, L. The changes in the optical rotation and cupric-reducing power produced by invertase indicated the presence of sucrose in all cases, except that with *Linaria spuria* the increase in reducing power was less than half that calculated from the change in optical rotation. All the extracts except those from *Coronilla varia* and *Melampyrum arvense* contained glucosides hydrolysable by emulsin, but no attempt was made to isolate them.—J. H. L.

Grecian essential oils. Perf. and Ess. Oil Rec., 1915, 6, 118–119.

AN examination of some essential oils now being distilled in Greece and shipped from Patras, has yielded the following results:—*Oil of laurel leaf*. Sp. gr., 0.915; optical rotation, -17° ; refractive index (20° C.), 1.4670; saponification value, 32.4; cineol content, about 25%. Soluble in 3 vols. of 80% alcohol with slight opalescence. *Oil of fennel*. Sp. gr., 0.937; opt. rotation, $+27^{\circ}$; refr. index, 1.4980. Soluble in 2 vols. of 90% alcohol, insol. in 80% alcohol. Does not solidify at 0° C. Its characters agree with those of wild bitter fennel oil. *Oil of origanum*. Sp. gr., 0.904; refr. index, 1.4892; phenols, 36%. Soluble in 2 vols. of 90% alcohol, insol. in 10 vols. of 80% alcohol. Phenols do not crystallise. *Oil of sage*. Sp. gr., 0.930; opt. rotation, $+7^{\circ}$; refr. index, 1.4615; saponif. value, 21.2. Soluble in 3 vols. of 80% alcohol with slight opalescence. *Oil of rue*. Sp. gr., 0.856; opt. rotation, -1° ; refr. index, 1.4340. Soluble in 3 vols. of 80% alcohol, insoluble in 70% alcohol. Does not solidify. Corresponds with oil of *Ruta bracteosa*.

Solidago [Golden-rod]; Volatile oils of the genus—E. R. Miller and J. M. Moseley. J. Amer. Chem. Soc., 1915, 37, 1285–1294. (See also this J., 1915, 49.)

Solidago rugosa.—Distillation of the fresh plants yielded about 0.4% of light yellow oil: sp. gr. at

25°/25° C., 0.8620; $n_D^{25} = -12.8^\circ$; $n_D^{25} = 1.4813$; saponification value, 4.22; ditto after acetylation, 10.97. These numbers correspond to 1.47% of ester calculated as bornyl acetate and 1.67% of free alcohol as borneol. The fraction representing the greater portion of the oil consisted mainly of α -pinene, while other fractions appeared to contain limonene and possibly β -pinene. *Solidago odora* (scented Golden-rod).—Distillation of the fresh flowering plants yielded 0.64–1.53% (generally over 1.0%) of yellowish oil with an odour of anise, slightly suggestive of saffrol, and a sweetish taste; sp. gr. at 25°/25° C., 0.9310; $n_D^{25} = +13.72^\circ$; $n_D^{25} = 1.5065$; saponification value, 7.9; acid value, 0.63; OC_{11} , 15.9%, corresponding to 3.11% of ester as bornyl acetate, 2.96% of free alcohol as borneol, and 75.89% of methylchavicol. A sample of oil distilled from cultivated dried plants, with a yield of 0.65%, showed: sp. gr. at 25°/15° C., 0.9150; $n_D^{25} = +9.33^\circ$; $n_D^{25} = 1.5140$; saponification value, 8.9; ditto after acetylation, 19.4; soluble in 0.1 vol. of 90% alcohol. The oil of *S. odora* contained 10–15% of terpenes, possibly another alcohol besides borneol, and small amounts of at least three volatile fatty acids and of non-volatile acid. The anise odour is due to methylchavicol, anethol being absent.—J. F. B.

Costus root oil; *Constituents of* —. F. W. Semmler and J. Feldstein. Ber., 1914, 47, 2687–2694. Z. angew. Chem., 1915, 28, Ref., 84–85.

THE oil contains 20% of apotaxene, $C_{11}H_{28}$, an aliphatic hydrocarbon with four double linkages in the molecule; 7% of costol, $C_{11}H_{24}O$, a primary, bicyclic sesquiterpene-alcohol; 6% of α -costene, $C_{11}H_{24}$, a bicyclic sesquiterpene; 6% of β -costene, a monocyclic sesquiterpene; 0.4% of phellandrene, and 0.4% of camphene.—A. S.

Menthol; *Melting and solidification points of* —. R. Meldrum. Chem. News, 1915, 111, 229–231.

THE solidifying point of menthol determined by standard methods ranged from 37.5° to 40.2° C. Even by the method of adding menthol crystals to the melted mass and stirring until thick, the results varied by 0.8° C., according to the rapidity and duration of stirring. The fact that menthol solidifies below its normal melting point is attributed to its becoming colloidal prior to crystallisation, and variations in the colloidal condition and viscosity affect the solidifying point. The melting point by the thermometer bulb method was 42° C., and by the opacity method 42.5° C. The melting point of a mixture of menthol 80, and peppermint oil 20% was 33–34.5° C., and the solidifying point was about 10° C. lower than that of menthol.

—C. A. M.

Uric acid in urine; *Colorimetric determination of* —. S. R. Benedict and E. H. Hitchcock. J. Biol. Chem., 1915, 20, 619–627.

A MODIFICATION of a method proposed by Folin and Denis (J. Biol. Chem., 1913, 14, 95) is recommended. From 2 to 4 c.c. of the urine is treated with 5 c.c. of water and about 20 drops of a solution composed of 3% silver lactate solution, 70, magnesia mixture, 30, and concentrated ammonia, 100 c.c. The mixture is centrifuged, the liquid then decanted as completely as possible, the sediment is treated with 2 drops of a 5% potassium cyanide solution, 1 c.c. of water, and 2 c.c. of uric acid reagent, 10 c.c. of a 20% sodium carbonate solution is added, and, after about 30 seconds, the mixture is diluted to 50 c.c. and the coloration obtained compared with that produced under similar conditions from 5 c.c. of standard uric acid solution. The latter solution is prepared by dissolving 9 grms. of disodium phosphate and 1 grm.

of monosodium phosphate in 300 c.c. of hot water, filtering the solution if necessary, adding 200 mgrms. of pure uric acid and 1.4 c.c. of glacial acetic acid, and diluting the whole to 1 litre; 5 c.c. of chloroform may be added to prevent the growth of bacteria and moulds. The uric acid reagent is prepared by boiling together 100 grms. of sodium tungstate, 80 c.c. of 85% phosphoric acid, and 750 c.c. of water for an hour and a half under a reflux condenser, and diluting the cooled solution to 1 litre.—W. P. S.

Uric acid in blood; *Colorimetric determination of* —. S. R. Benedict. J. Biol. Chem., 1915, 20, 629–631.

TWENTY c.c. of the blood is added to 100 c.c. of boiling N/100 acetic acid, boiled for a moment, diluted with 200 c.c. of boiling water, and the mixture filtered; the insoluble portion on the filter is washed with 50 c.c. of hot water, and the filtrate is evaporated to about 25 c.c. This solution is rinsed into a flask, 2 c.c. of colloidal ferric hydroxide solution is added, the mixture is filtered, the filtrate evaporated to 2 c.c. and treated with ammoniacal silver magnesium solution, and the determination carried out as described in the preceding abstract.—W. P. S.

Arsenic in organic arsenic compounds alone or mixed with organic matters; *Detection and determination of* —. L. Barthe. Bull. Soc. Pharm. Bordeaux, 1914, 340. J. Pharm. Chim., 1915, 11, 245–246.

FOR the characterisation of arsenic in organic compounds, Bressanin's reagent (see this J., 1912, 90, 93) is as sensitive as that of Bougault (compare this J., 1903, 231), but is less suited for distinguishing between different organic arsenic compounds, as the precipitate formed has always the same colour. The author carries out Bressanin's test by adding a few drops of a 10% solution of potassium iodide to a solution of the organic compound in sulphuric acid of sp. gr. 1.53. With acid of higher concentration free iodine is liberated, but this may be eliminated by adding a few drops of sodium bisulphite solution. In toxicological analyses the organic matter should first be destroyed by heating for 2 hours with sulphuric acid (25–30 c.c. of acid to 0.5 grm. of substance) in a flask closed by a funnel. The whole of the arsenic is then precipitable by hydrogen sulphide, although the destruction of the organic matter is not complete; no loss of arsenic occurs by volatilisation. The process is applicable to cacodylic acid, atoxyl, methylarsenic acid, salvarsan, and neo-salvarsan. With more complex compounds, such as the methylarsinate or cacodylate of antipyrine, it is advisable to remove the antipyrine by addition of soda and extraction with chloroform before the digestion with sulphuric acid.—J. H. L.

Arsenious acid or sodium arsenate; *Analysis of pills containing* —. M. Francois and E. Lasausse. J. Pharm. Chim., 1915, 11, 226–237.

THE small pills of the French Pharmacopoeia, each weighing about 0.02 grm. and containing 1 mgrm. of arsenious acid or sodium arsenate, often contain besides gum arabic, lactose, and honey, insoluble matters such as wheat starch. To determine the arsenic, 50–100 of the pills containing arsenious acid, or 100–200 of those containing sodium arsenate, are heated for 3 hours on a water-bath with 20 c.c. of nitric acid of 50° B. (sp. gr. 1.53). The liquid is then diluted with 20 c.c. of water, made alkaline with ammonia, filtered if necessary, treated with ammonia and 20 c.c. of magnesia mixture, and left for 3 days. The precipitate is collected on a double filter, dried at 100° C. for 10 hours, and weighed as $NH_4MgAsO_4 \cdot \frac{1}{2}H_2O$. The filtrate is acidified and treated with hydrogen

sulphide to make sure that it contains no arsenic. The weighed precipitate is tested for phosphorus. —J. H. L.

Mercury derivatives of aromatic amines. I. Structure of primary and secondary p-aminophenylmercuric compounds. W. A. Jacobs and M. Heidelberger. J. Biol. Chem., 1915, 20, 513—520.

THE presence of a primary amino-group in p-aminophenylmercuric acetate is proved by the fact that the substance can be diazotised and combined with phenols and tertiary amines with the production of azo-dyes, hence the monomolecular constitution, $\text{H}_2\text{N} \cdot \text{C}_6\text{H}_4 \cdot \text{HgO} \cdot \text{OC} \cdot \text{CH}_3$, is held to be correct. p-Methylaminophenylmercuric acetate must have a similar constitution as it gives the reactions of a secondary amine, forming a nitrosamine which crystallises in drab-coloured hexagonal lamellæ, m. pt. $183^\circ\text{--}184^\circ\text{C}$. The following azo-derivatives of p-aminophenylmercuric acetate are described: 4-p-dimethylaminobenzeneazophenylmercuric acetate, brick red crystals, m. pt. 215°C .; 4-p-hydroxybenzeneazophenylmercuric acetate, orange crystals m. pt. $218^\circ\text{--}219^\circ\text{C}$.; 4-o-p-dihydroxybenzeneazophenylmercuric acetate, prepared from resorcinol, is a brown powder, m. pt. $190^\circ\text{--}195^\circ\text{C}$. (with decomp.); and 1-amino-2-p-naphthaleneazophenylmercuric acetate-5-sulphonic acid, a brownish black powder. These substances dye silk yellow or orange shades. —G. F. M.

Hexamethylenetetramine; Quaternary salts of —.

(I.) *Substituted benzyl halides and the hexamethylenetetramine salts derived therefrom.* (II.) *Monohaloacetylbenzylamines and their hexamethylenetetramine salts.* W. A. Jacobs and M. Heidelberger. J. Biol. Chem., 1915, 20, 659—683; 685—694.

(I.) SOME 70 new compounds are described, comprising benzyl alcohols and chlorides together with the hexamethylenetetramine derivatives obtained therefrom and from already known benzyl halides. (II.) The preparation and properties of 28 chloroacetyl- and iodoacetylbenzylamines and the quaternary salts obtained by their interaction with hexamethylenetetramine are described. The general method adopted in the preparation of the salts consisted in boiling equimolecular amounts of halide and hexamethylenetetramine with dry chloroform (5 to 7 c.c. for each grm. of base), until, after solution of the components, the quantity of product which separated reached a maximum. The product was separated, washed with dry chloroform and with acetone, and dried over sulphuric acid or calcium chloride and paraffin. The substances represent a new group of bactericides. When their aqueous solutions are allowed to stand or are warmed, formaldehyde is liberated and a product, consisting principally of the methylene compound of the corresponding primary amine, separates as a colloidal suspension, an emulsion, or a crystalline precipitate. —W. P. S.

Amino-acids; Determination of mono-substituted amino groups of — by the formaldehyde-titration method. A. Clementi. Rend. della R. Accad. dei Lincei, 1915, 24, 352. Annali Chim. Appl., 1915, 3, 270—271.

EXPERIMENTS with sarcosine showed that amino-acids with monosubstituted amino groups react with formaldehyde, one mol. of the aldehyde combining with 2 mols. of the acid, with the linking-up of two atoms of nitrogen by a methylene group. Monosubstituted amino-acids behave as monobasic acids in the formaldehyde titration method (see this J., 1908, 135); it is necessary to continue the titration in presence of phenolphthalein until an intense red colour is produced. —A. S.

Salicylates; Some basic [substituted] —. O. de Coninck and Gérard. Comptes rend., 1915, 160, 627—628.

LEAD bromosalicylate, $\text{C}_6\text{H}_3\text{Br} \cdot \text{O} \cdot \text{C}_6\text{H}_4 \cdot \text{O} \cdot \text{Pb} + \text{H}_2\text{O}$, is precipitated by mixing lead acetate and barium bromosalicylate in aqueous solution; lead dibromosalicylate is prepared similarly. Basic barium chlorosalicylate is precipitated when normal barium chlorosalicylate is treated with dilute ammonia; barium iodosalicylate, barium diiodosalicylate, barium nitrosalicylate, and lead aminosalicylate, are prepared similarly. Basic lead salicylsulphonate, $\text{C}_6\text{H}_3(\text{OH}) \cdot \text{SO}_3 \cdot \text{Pb} + \text{PbO}$, is prepared by digesting the free acid with freshly precipitated lead oxide and evaporating to dryness. Anhydrous copper salicylate is obtained by treating the normal salt with excess of ether and heating the resulting monohydrate to $97^\circ\text{--}98^\circ\text{C}$. in a current of dry nitrogen. All these salts are amorphous and practically insoluble in water and neutral solvents, but soluble in mineral acids. Upon heating, the dried salts carbonise readily whilst the moist salts yield an odour of phenol. —J. R.

a-Glycerophosphoric acid; Synthesis of —. O. Bailly. Comptes rend., 1915, 160, 663—666.

THE calcium salt of a-glycerophosphoric acid results from the interaction of sodium monoallylphosphate and a cold, dilute solution of potassium permanganate, followed by treatment with calcium chloride. The α - and β -glycerophosphates of calcium, strontium, and barium were prepared in a crystalline state by the slow evaporation of their aqueous solutions. The weights of the anhydrous salts contained in 100 grms. of their solutions were: for the α -salts, 4.95 at 15°C ., 1.79 at 17°C ., and 1.83 at 16°C ., respectively; and for the β -salts, 1.72 at 15° , 2.35 at 12° , and 57.6 at 15°C ., respectively. —E. H. T.

Aliphatic hydrocarbons; Preparation and melting points of the higher —. P. A. Levene, C. J. West, and J. van der Scheer. J. Biol. Chem., 1915, 20, 521—534.

THE hydrocarbons were prepared in some cases by the reduction of the esters of fatty acids with sodium and alcohol by the method of Bouveault and Blanc (this J., 1903, 888), converting the alcohols thus obtained into iodides, and reducing the latter with zinc and hydrochloric acid. Tetracosane and the higher paraffins were prepared by the action of magnesium on an ethereal solution of the iodides containing half the number of carbon atoms in their molecule. Melting points were determined in a sulphuric acid bath the temperature of which was increasing at the rate of about 1°C . in six seconds. The following are the most important observations recorded: Hexadecane, $\text{C}_{16}\text{H}_{34}$, from ethyl palmitate, m. pt. 20°C .; octadecane, $\text{C}_{18}\text{H}_{38}$, from ethyl stearate, m. pt. 28°C .; eicosane, $\text{C}_{20}\text{H}_{42}$, from erucic acid through arachidic acid and eicosyl alcohol, m. pt. 38°C .; docosane, $\text{C}_{22}\text{H}_{46}$, prepared from erucic acid by reduction with palladium and hydrogen to behenic acid, the ester of which was reduced to docosyl alcohol, m. pt. $73^\circ\text{--}74^\circ\text{C}$., and then converted through the iodide into docosane, m. pt. 47°C .; tetracosane, $\text{C}_{24}\text{H}_{50}$, m. pt. 54°C .; hexacosane, $\text{C}_{26}\text{H}_{54}$, prepared from tridecyl iodide, has m. pt. $59^\circ\text{--}60^\circ\text{C}$.; octacosane, $\text{C}_{28}\text{H}_{58}$, from tetradecyl iodide, has m. pt. $64^\circ\text{--}65^\circ\text{C}$.; triacontane, $\text{C}_{30}\text{H}_{62}$, m. pt. $69^\circ\text{--}70^\circ\text{C}$., dotriacontane, $\text{C}_{32}\text{H}_{66}$, from cetyl iodide and magnesium, m. pt. $74^\circ\text{--}75^\circ\text{C}$.; tetratriacontane, $\text{C}_{34}\text{H}_{70}$, m. pt. $76^\circ\text{--}76.5^\circ\text{C}$.; and hexatriacontane, $\text{C}_{36}\text{H}_{74}$, m. pt. 78.5°C . Cerane, $\text{C}_{26}\text{H}_{54}$, was also

prepared from ceryl alcohol, and melissane $C_{10}H_{18}$, from melissyl alcohol. They form glistening scales of m. pt. 61° and $73-74^{\circ}$ C. respectively.—G. F. M.

Pharmaceutical products of which the Patents have expired. Chem. and Drug., March 20 and 27, April 3, 10, 17, 24, May 1, 8, 15, and 22. (See also this J., 1915, 301.)

Lanolin. Purified wool fat (ointment basis). Pat. 4992 of 1882.

Medinal. Sodium diethylbarbiturate (hypnotic). Pats. 19,411 of 1904 and 2566 of 1905.

Nutrose. Sodium caseinate (nutrient). Pat. 22,190 of 1894. An aqueous solution of casein and sodium hydroxide or bicarbonate is evaporated to dryness in a vacuum.

Orexin. Phenylidihydroquinazoline (used in the form of its tannate as an appetiser and to prevent seasickness). Pat. 13,343 of 1889. *o*-Nitrobenzylformanilide, obtained from *o*-nitrobenzylaniline and formic acid or from *o*-nitrobenzyl chloride and formanilide, is reduced by means of tin and hydrochloric acid, etc.

Orphol. Bismuth β -Naphtholate (internal antiseptic and astringent). Pats. 13,291 of 1892 and 15,361 of 1894. β -Naphthol is treated with bismuth nitrate in presence of caustic soda.

Orthoform. Methyl ester of *m*-amino-*p*-hydroxybenzoic acid (analgesic and antiseptic). Pats. 12,179 of 1897 and 22,106 of 1908. *m*-Nitro-*p*-hydroxybenzoic acid is reduced and the product esterified.

Oxaphor. 50% solution of oxycamphor (substitute for morphine in cardiac dyspnoea and asthma). Pat. 18,035 of 1896. Camphorquinone is reduced in acid, alkaline, or neutral solution.

Pankreon. Tannin-pancreatin compound (digestive). Pat. 14,414 of 1900. Pancreas juice or pancreatin is treated with tannin in aqueous or alkaline solution.

Proponal. Dipropylbarbituric acid (hypnotic). Pat. 1664 of 1903. Dipropylmalonic alkyl ester is condensed with urea in presence of sodium and alcohol, and the sodium salt is decomposed by acid.

Protargol. Silver proteinate (bactericide and antiseptic). Pat. 18,478 of 1897. Obtained from protalbumose or peptone and a silver salt.

Pyramidon. Dimethylaminoantipyrin (antipyretic). Pat. 7709 of 1896 and 9268 of 1897. Pyramidon salicylate is the subject of Eng. Pat. 11,040 of 1900 and the camphorate of No. 22,391 of 1900.

Salipyrin. Antipyrin salicylate (used in rheumatism and influenza). Pat. 10,432 of 1890. Phenylhydrazine, acetoacetic ester, and methyl salicylate are heated in presence of hydriodic acid and methyl alcohol.

Salophen. Acetaminophenylsalicylate (used in choria, neuralgia, etc.). Pats. 11,833 of 1891 and 3435 of 1892. Nitrophenylsalicylate is reduced and acetylated.

Saloquinine. Quinine salicylate (tasteless substitute for quinine and salicylic acid). Pats. 8165, 11,783, and 16,968 of 1901. Obtained by the action of quinine on salol, salicylide, or a salicyl halogenide.

Sidonal. Piperazine quinate (uric acid solvent). Pat. 11,420 of 1899. A solution of equivalent quantities of piperazine and quinic acid in the minimum quantity of water is evaporated.

Somatose. Semi-digested protein (nutrient). Pats. 1897 and 3391 of 1898. Meat fibre, freed from fat and glue, is heated with a solution of oxalic acid or other acid for 15 hours at 70° C.; the product is neutralised with lime, boiled, and filtered, and the filtrate evaporated to dryness.

Sublamine. Mercuric sulphate-ethylenediamine (non-irritant disinfectant). Pat. 5981 of 1900.

An aqueous solution of mercuric sulphate and ethylenediamine is precipitated by alcohol.

Tannalbin. Albumin tannate (intestinal disinfectant). Pats. 6140 and 13,281 of 1896. Aqueous solutions of albumin and tannin are mixed and the precipitate is washed, dried, and heated at 110° to 150° C.

Tannigen. Diacetyltannin (used in diarrhoea). Pat. 1228 of 1891. A mixture of tannin, glacial acetic acid, and acetic anhydride is heated at 130° — 140° C. for 6 or 7 hours, the product is poured into water, and the resinous mass is washed with water until it is converted into a light yellow powder.

Tannobromin. Compound of dibromotannin and formaldehyde (disinfectant and astringent). Pat. 14,213 of 1900.

Tannopin or tannon. Hexamethylenetetramine-tannin (astringent and antiseptic). Pat. 10,790 of 1897. Prepared by the interaction of the components in presence of water.

Tarocol. Compound of gelatin and tannin (used in diarrhoea). Pat. 11,061 of 1898. The precipitate formed by adding 5% tannin solution to 1% gelatin solution, is dried at the ordinary temperature until its m. pt. is above 100° C., and finally dried at 100° C.

Tolypyrin. *p*-Tolyldimethylpyrazolone (antipyretic, and in rheumatism and neuralgia). Pat. 19,329 of 1892. *p*-Tolyldiazine is condensed with acetoacetic ester and the product methylated.

Tolysal. *p*-Tolyldimethylpyrazolone salicylate (antipyretic and antineuralgic). Pat. 19,329 of 1892. Tolypyrin is melted with salicylic acid on the water-bath.

Tussol. Antipyrine mandelate (for whooping cough). Pat. 11,774 of 1894. A mixture of antipyrin and mandelic acid is melted or a solution of the substances in alcohol, benzene, etc., is evaporated.

Urosin. Lithium quinate (for gout). Pat. 27,333 of 1898.

Validol. Menthyl valerate or a solution of menthol in menthyl valerate (carminative). Pat. 3706 of 1896.

Veronal. Diethylbarbituric acid (hypnotic). Pats. 1664, 1945, and 2054 of 1903; 11,014 of 1904; 5353 and 11,219 of 1905.

Xeroform. Bismuth tribromophenolate (internal antiseptic). Pats. 13,291 of 1892 and 15,361 of 1894. The sodium salt of tribromophenol is treated with bismuth nitrate in aqueous solution.

Yohimbine. Alkaloid of yohimbehé bark (aphrodisiac). Pat. 11,647 of 1900. The bark is extracted with dilute acetic acid, sodium carbonate is added to the solution, and the product is crystallised from alcohol.

Detection of small quantities of sugar by the production of formaldehyde, and the constituents of urine which give rise to formaldehyde. Salkowski. See XVII.

PATENTS.

Unsaturated hydrocarbons containing the conjugated double bond; Purification of —. F. E. Matthews and E. H. Strange, London. Eng. Pat. 6897, Mar. 18, 1914.

WHEN an unsaturated hydrocarbon with two double bonds is treated with sulphur dioxide, as described in Ger. Pat. 236,386 (this J., 1911, 1088) two sulphoxides are formed. The crystalline compound breaks up easily into sulphur dioxide and the initial hydrocarbon in a state of purity, but the amorphous compound is not easily decomposed and gives a poor yield of the hydrocarbon. If certain substances such as the halogen acids, iodine, and acid chlorides be added, the bulk of the sulphoxide formed is the crystalline compound. The details of the purification of isoprene by this method are given as an example.—B. V. S.

Civet; Preparation of a ketone with a musk-like odour from ——. E. Sack. Ger. Pat. 279,313, Jan. 3, 1912.

CIVET is treated with alkali and then distilled with steam, the residue is extracted with ether or other suitable solvent, and after evaporating off the solvent, the extract is treated with a small quantity of alcohol, filtered, and the ketone isolated from the filtrate in the form of its semicarbazone (m.pt. 187° C.) or by other known methods. An alternative process consists in distilling the civet with an alkali hydroxide solution of about 38° B. (sp. gr. 1.357), the alkali concentration being kept approximately constant during the distillation, and then isolating the ketone from the oil which distils over. By this method other constituents of civet, including one with an odour of jasmine, are also recovered. The ketone, zibethone, with a musk-like odour, boils at 204°–205° C. at 17 mm. pressure, solidifies at 32.5° C., and has the composition, $C_{17}H_{30}O$.—A. S.

Hydrohydrastinine and its homologues; Preparation of ——. E. Merck. Ger. Pat. 280,502, Jan. 23, 1913.

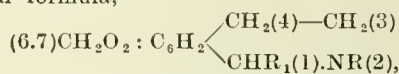
N-METHOXYMETHYLHOMOPIPERONYLAMINE or a 2- or 3-alkyl derivative of the general formula, $(3.4)CH_2O_2 : C_6H_3 \cdot CH_2(1) \cdot CHR_2 \cdot NR_1 \cdot CH_2 \cdot O \cdot CH_3$ (R_1 and R_2 = hydrogen or an alkyl group) is treated with a condensing agent such as phosphorus pentoxide, whereupon methyl alcohol is eliminated and an isoquinoline ring is formed. Hydrohydrastinine is obtained from N-methoxymethylhomopiperonylamine, and the corresponding homologues from N-ethylmethoxymethyl- and N-methoxymethyl-3-methylhomopiperonylamine.—A. S.

Tetrahydroisoquinoline derivatives [hydrastinine derivatives]; Preparation of ——. H. Decker. Ger. Pat. 281,213, Feb. 2, 1912. Addition to Ger. Pat. 270,859 (this J., 1914, 439).

N-ALKYL homologues of hydrohydrastinine or 1-alkyl or 1-aryl substitution products of hydrohydrastinine and of other N-alkyl derivatives of norhydrohydrastinine are obtained by treating 6.7-methylenedioxy-1.2.3.4-tetrahydroisoquinoline (norhydrastinine) with alkylating (with the exception of methylating) agents or by alkylating the 1-alkyl or 1-aryl substitution products of this base. —A. S.

N-Alkyl homologues of norhydrohydrastinine and their 1-substitution derivatives; Preparation of ——. Preparation of hydrohydrastinine. H. Decker. Ger. Pats. (A) 281,546, Feb. 2, 1912, and (B) 281,547, Dec. 4, 1913. Additions to Ger. Pat. 257,138 (this J., 1913, 507).

(A) HYDROHYDRASTININE derivatives of the general formula,



in which R = alkyl, R_1 = hydrogen, alkyl, or aryl, are obtained by condensing equimolecular proportions of N-monoalkyl derivatives of homopiperonylamine with aliphatic or aromatic aldehydes, and heating the products with compounds, such as hydrochloric, sulphuric, or hydrobromic acid, or phosphorus oxychloride, capable of exerting a catalytic action. Hydrohydrastinine may be obtained by heating homopiperonylamine with at least 2 mols. of formaldehyde in presence of acid, under pressure. (B) Hydrohydrastinine is prepared by heating homopiperonylamine or its N-monomethyl derivative with polymerised formaldehyde, in presence of acid, and with addition of an inert solvent or diluent, at atmospheric pressure.—A. S.

Pyrrolidine derivatives; Preparation of ——. Chem. Fabr. auf Actien, vorm. E. Schering. Ger. Pat. 280,971, Aug. 3, 1913.

ACIDYLATED esters of pyruvic acid are condensed in non-alcoholic solution with benzaldehyde and o-substituted anilines, with substituted benzaldehydes and aniline or substituted anilines, with benzaldehyde and heterocyclic compounds, or with heterocyclic aldehydes and amines. The products are of value for therapeutic purposes. Examples are 1-o-Tolyl-2-phenyl-3-acetyl-4.5-diketopyrrolidine from o-toluidine, benzaldehyde in ether, and acetylpyruvic acid ester; 1.2'-methoxyphenyl-2-phenyl-3-acetyl-4.5-diketopyrrolidine from anisidine, benzaldehyde in toluene, and acetylpyruvic acid ester; 1-phenyl-2-piperonyl-3-acetyl-4.5-diketopyrrolidine from aniline, piperonal in benzene, and acetylpyruvic acid ester, and 1-p-tolyl-2-p-dimethylaminophenyl-3-acetyl-4.5-diketopyrrolidine from p-toluidine, p-dimethylaminobenzaldehyde in benzene, and acetylpyruvic acid ester. —A. S.

Glucosides of the purine series and their derivatives; Preparation of ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 281,008, Aug. 14, 1913.

METALLIC salts of purine bases or their derivatives are heated with acidylhalogenoglucoses or corresponding derivatives of other sugars dissolved in an inert organic solvent, and the resulting acidylpurine-glucosides are saponified, e.g., with alcoholic ammonia. Theophylline-glucoside is obtained in this way from theophylline-silver and acetobromoglucoside. Chlorotheophylline-glucoside, theobromine-glucoside, tetra-acetyl-hydroxycaffeine-glucoside, and tetra-acetyltheophylline-galactoside have also been prepared. The new compounds exhibit diuretic properties similar to those of the purine bases from which they are derived, and possess the advantages over the latter of being more easily soluble, less poisonous, and more palatable.—A. S.

Peroxide compound [tetramethylenedi-urea diperoxide]; Preparation of an organic ——. C. von Girsewald. Ger. Pat. 281,045, Aug. 5, 1913. Addition to Ger. Pat. 263,459.

HYDROGEN peroxide is treated, in presence of an acid, with urea and formaldehyde, instead of with hexamethylenetetramine as specified in the chief patent (this J., 1913, 992). The new compound, which is a diperoxide of tetramethylenedi-urea, $[O \cdot CH_2 \cdot NH \cdot CO \cdot NH \cdot CH_2 \cdot O]_2$, is stable in presence of moisture and on exposure to the air. It may be used as a germicide.—A. S.

Tetrahydropapaverine and its derivatives; Preparation of condensation products from ——. A. Pictet. Ger. Pat. 281,047, Aug. 7, 1913.

TETRAHYDROPAVERINE or one of its nuclear substitution products is condensed with aliphatic or aromatic aldehydes, preferably in the form of the corresponding acetals, in presence of a mineral acid. The divalent aldehyde radicle enters the papaverine molecule between the nitrogen atom and a carbon atom of the veratryl residue, and a second hydropyridine ring is formed. The resulting tetracyclic bases are closely allied to certain natural alkaloids, such as the corydalis alkaloids, and some of them possess valuable therapeutic properties.—A. S.

Arsenic compounds of the aromatic series; Preparation of ——. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 281,049, July 24, 1913.

AROMATIC arsenic compounds, of value for therapeutic purposes or as intermediate products, are obtained by heating diarylamines of the benzene or naphthalene series with halogen compounds of arsenic.—A. S.

Methylglycocylamide (creatinine); Preparation of —. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 281,051, Dec. 16, 1913.

N-METHYLGLYCOCYAMINE (methylguanidoacetic acid) is converted quantitatively into creatinine by heating with an organic acid.—A. S.

2-Piperonylquinoline-4-carboxylic acid and its homologues; Preparation of derivatives [arylates] of —. Chem. Fabr. auf Actien, vorm. E. Schering. Ger. Pat. 281,097, May 30, 1913. Addition to Ger. Pat. 252,643 (this J., 1912, 1201).

ARYLIDES of 2-piperonylquinoline-4-carboxylic acid and of its homologues are prepared by the known methods. Their properties are similar to those of the amides (see Ger. Pat. 277,438; this J., 1915, 249).—A. S.

2-Piperonylquinoline-4-carboxylic acid and its derivatives; Preparation of esters of —. Chem. Fabr. auf Actien, vorm. E. Schering. Ger. Pat. 281,136, Jan. 14, 1913.

2-PIPERONYLQUINOLINE-4-CARBOXYLIC acid and its derivatives are esterified with alcohols or phenols in the usual way. The esters are tasteless and exhibit therapeutic properties similar to those of phenylquinoline-4-carboxylic acid, without causing an increased separation of uric acid such as is induced by the latter.—A. S.

2-Piperonylquinoline-4-carboxylic acid; Preparation of homologues and substitution products of —. Chem. Fabr. auf Actien, vorm. E. Schering. Ger. Pat. 281,603, July 9, 1912.

HOMOLOGUES or substitution products of aniline are condensed with piperonal and pyruvic acid. The products, e.g., 6-methyl-, 6-hydroxy-, and 8-methoxy-2-piperonylquinoline-4-carboxylic acid, are tasteless.—A. S.

Resorcinol monoacetate; Preparation of pure, almost odourless —. Knoll und Co. Ger. Pat. 281,099, May 8, 1914.

THE product obtained by acetylating resorcinol in the usual manner is purified by treatment with slightly superheated steam *in vacuo*. Under these conditions the ester is not decomposed.—A. S.

Catechol-o-carboxylic acid and its nuclear homologues; Preparation of —. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 281,214, Oct. 25, 1913.

YIELDS of up to 95% of the theoretical yields of catechol-o-carboxylic acid and its nuclear homologues are obtained by treating O-alkyl or O-aralkyl derivatives of these acids with saponifying agents, such as strong mineral acids or aluminium chloride.—A. S.

Isolation of the selenium dyestuff corresponding to Methylene Blue. Ger. Pat. 280,713. See IV.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Silver azide; Photographic behaviour of —. J. Bekh. Z. wiss. Phot., 1914, 14, 105. Z. angew. Chem., 1915, 28, Ref., 93.

WHEN a film prepared with a silver azide-gelatin emulsion is exposed, a latent image is produced just as with gelatinochloride and gelatinobromide emulsions, but the azide emulsion is very much less sensitive. An unmaturred silver azide emulsion has a relatively great sensitiveness to red rays. An aqueous solution of pyrogallol is used as developer; the usual alkaline developers reduce also the unexposed azide. Silver azide is of no practical value

for the production of negatives, but printing-out papers prepared with an emulsion containing citric acid, silver nitrate, and silver azide have a sensitiveness about equal to that of collodion paper, can be readily toned in a combined bath, and do not deteriorate on keeping.—A. S.

Photochemical formation of electrolytes. Boll. See VII.

PATENT.

Colour photography; Screens for — and for general photographic purposes. J. Rheinberg, London. Eng. Pat. 9929, April 22, 1914.

THE film which is finally to form the colour screen is covered with a resist of collodion, gelatin, albumin, casein, etc., or mixtures of these, rendered sensitive to light, before or after coating, preferably with ferric ammonium citrate or other iron salt, with which uranium salts may also be mixed. The choice of resist depends on the underlying film; both must be permeable to the dye solvent. In some cases it is preferable to interpose one or more films between the resist and the colour film. The choice of sensitiser is dependent on the dye solvent; the action of light must produce in the resist greater or less permeability to the solvent, either by altering the solubility of the sensitiser or by changing the medium itself. The composite film thus obtained is exposed behind a line or other desired screen, and then either treated with a solvent to abstract dye from unprotected parts of the underlying film, or with a dye solution to dye them. By washing and re-sensitising the resist, or by washing it off and re-coating, the process may be repeated to give any desired pattern. (See also Eng. Pat. 22,938 of 1913; this J., 1914, 1116.)—B. V. S.

XXII.—EXPLOSIVES; MATCHES.

Nitroglycerin-nitrocotton; The system —. D. Chiaraviglio and O. M. Corbino. I. Condensation of nitroglycerin on nitrocotton *in vacuo* at the ordinary temperature. II. Extraction of nitroglycerin from ballistite by distillation *in vacuo* at the ordinary temperature. Rend. della R. Accad. dei Lincei, 1915, 24, 247, 361. Annali Chim. Appl., 1915, 3, 270, 271.

1. THE vapour pressure of nitroglycerin, though extremely low at the ordinary temperature, is lowered in presence of nitrocotton, and some nitroglycerin condenses on the latter, although both substances are at exactly the same temperature. It is not clear whether the phenomenon is due to imbibition or whether there is a true isothermal reaction between the two substances; if liquid nitroglycerin be dropped on to nitro-cotton *in vacuo* there is a distinct development of heat.

II. If ballistite be kept, at the ordinary temperature, in a high vacuum produced by means of a Gaede pump, a considerable quantity of nitroglycerin separates from it. The separation is more rapid the greater the degree of subdivision of the ballistite, but is appreciable even when the explosive is used in its ordinary form. It is suggested that the phenomenon may prove serviceable in investigating the stability of explosives rich in nitroglycerin.—A. S.

PATENTS.

Nitroglycerin; Method for facilitating the separation of —. R. Weyel, Bürriegerheide, Assignor to Rheinische Dynamitfabr., Cologne, Germany. U.S. Pats. 1,138,916 and 1,138,917, May 11, 1915. Date of appl., Nov. 25, 1912.

SEE Eng. Pat. 14,586 of 1912; this J., 1913, 808.

Process of forming pyroxylin bodies. U.S. Pat. 1,135,026. See V.

XXIII.—ANALYTICAL PROCESSES.

Thermostat for accurate specific gravity determinations and a gas pressure regulator. K. C. Brown-
ing and C. T. Symons. Faraday Soc., May 11,
1915. [Advance proof.] 4 pages.

DETAILED particulars and a working sketch of the copper tank thermostat previously described (this J., 1914, 819) are given and also of a strong, portable gas pressure regulator capable of being rapidly set for any desired reduction of pressure.

—F. SODN.

Specific heats of liquids; Method for determining the —. E. J. Hartung. Faraday Soc., May 11,
1915. [Advance proof.] 5 pages.

A SEALED bulb of thin glass, enclosing a known weight of water and a roll of silver gauze, is brought to a steady temperature by immersion in mercury in a freezing apparatus, and is then rapidly transferred to a weighed quantity of the liquid, which is contained in a calorimeter suspended in a silvered Dewar tube. The specific heat is calculated from the fall of temperature observed, taking into account the water equivalent of the apparatus and the correction for radiation errors. The silver gauze ensures rapid melting of the ice and makes the bulb heavy enough to sink in a dense liquid. A determination may be made with about 60 c.c. of liquid.—F. SODN.

Interferometer; Use of the — in the analysis of solutions. L. H. Adams. J. Amer. Chem. Soc., 1915, 37, 1181—1194.

By means of the interferometer, the difference of refractive index between any two transparent liquids is measured, and if the composition of one liquid be known, that of the other can be calculated. Such comparisons and determinations can be carried out with ease, rapidity, and great precision by means of the Zeiss Water Interferometer. Light rays from a small electric lamp are converted into two interfering beams so as to form diffraction fringes observable through an eye-piece. The liquids to be compared are put into two separate compartments of a water chamber, and placed one in each path of light. The displacement of the fringes, due to the difference in refractive index, is compensated by tilting an inclined plate in the path of one beam, the tilt being measured by a micrometer screw. The instrument has been used successfully in the analysis of sea water and of colloidal solutions; it is also suitable for standardising volumetric solutions, and for analysing mixtures of sodium and potassium salts with rapidity and great accuracy.—E. H. T.

Ammonia; Precipitant for —. (Substitute for Nessler's reagent.) S. S. Graves. J. Amer. Chem. Soc., 1915, 37, 1171—1181.

WHEN mercuric chloride solution is made alkaline in presence of sodium chloride, a very soluble complex compound, Na_2HgCl_4 , is formed, which is stable in presence of large amounts of the sodium salt. This solution precipitates quantitatively very minute amounts of ammonia, producing a bluish white cloudiness, or a white precipitate with larger quantities of ammonia. By adding lithium carbonate the tendency of the precipitated particles to coalesce is prevented, and if the reagent be employed for nephelometric measurements (in certain biochemical nitrogen determinations), a little 1% soluble starch solution is also added to keep the particles in suspension. The proportions required are: 50 c.c. cold saturated mercuric chloride solution, 15 grms. sodium chloride, 35 c.c. saturated lithium carbonate solution, and 65 c.c. water. The water used

must be free from ammonia; if a cloudiness appears, the liquid can be easily filtered after shaking with powdered talc. The reagent is more stable than that of Nessler, but fully as sensitive, precipitating ammonia from ammonium sulphate diluted to 1:1,000,000. It should be useful in water analysis, and can be applied directly to ordinary and micro-Kjeldahl determinations, rendering them less tedious and obviating errors due to distillation.—E. H. T.

Oxalic acid; Colorimetric detection of — and of manganese. J. F. Sacher. Chem.-Zeit., 1915, 39, 319.

A SOLUTION of a manganese salt is treated with sodium or potassium hydroxide, and an aqueous solution of oxalic acid added, drop by drop, to the manganic hydroxide resulting from the atmospheric oxidation of the manganous hydroxide. A red coloration, which disappears on heating or on the addition of an excess of oxalic acid, is obtained, apparently through the formation of a double salt, possibly Kehrman's $\text{K}_2\text{Mn}(\text{C}_2\text{O}_4)_3 \cdot 3\text{H}_2\text{O}$ (Ber., 1887, 20, 1594). The test is capable of detecting 0.00025 gm. of oxalic acid in a neutral solution with a concentration of not less than 0.05%. Tannic and formic acids interfere with the coloration, and if they are present the oxalic acid should first be separated as calcium oxalate. For the detection of manganese (1:200,000), the acid solution is treated with alkali, heated, cooled, and tested with N/2 oxalic acid solution. The test is reliable even in the presence of a cobalt salt; when a large quantity of the latter is present the solution when heated yields a deposit of cobalt oxalate, while the supernatant liquid is decolorised.—C. A. M.

Iodometric titrations [of antimony]; Secondary reactions in —. A. Kolb. Chem.-Zeit., 1915, 39, 299—300.

ANTIMONIC acid liberates iodine from potassium iodide only in the presence of a strong acid. With acetic acid only a trace of iodine is liberated, with sulphuric acid more is set free, but concentrated hydrochloric or hydriodic acid is required to obtain the theoretical amount. The less hydrochloric acid present the more potassium iodide is required, and *vice-versa*, to obtain the same final equilibrium. The amount of iodine liberated is reduced by about 0.75% for each increase of 1° C. in the temperature. A slight excess of tartaric acid checks the separation, but ammonium, sodium, and potassium chlorides promote it. The reaction is reversible, and the iodine may be brought into combination again by antimony trioxide:— $\text{Sb}_2\text{O}_5 + 4\text{HI} \rightleftharpoons \text{Sb}_2\text{O}_3 + 2\text{H}_2\text{O} + \text{I}_2$. To prevent secondary reactions due to atmospheric oxidation the hydrochloric acid may be saturated with carbon dioxide.—C. A. M.

Vanadium; Determination of pentavalent — by means of sodium thiosulphate. G. O. Oberhelman. Amer. J. Sci., 1915, 39, 530—534.

THE following procedure is recommended for the determination of vanadium:—The solution (0.1—0.2 gm. V_2O_5) is made up to 400 c.c.: treated with 0.005 gm. of crystallised copper sulphate and 1.5 c.c. of concentrated hydrochloric acid (32% HCl), and N/10 thiosulphate run in slowly, with constant stirring, until there is an excess of 7.5 c.c.



When the colour of the solution has become sky blue after standing some time, potassium iodide (0.1 gm. per 100 c.c. of solution) is added and the excess of thiosulphate titrated with N/10 iodine in the presence of starch. When the amount of vanadate is unknown, a trial determination in

which 0.2 grm. of copper sulphate is used will give the information required for the proper adjustment of the excess of thiosulphate in an exact analysis to follow. No appreciable secondary decomposition of sodium thiosulphate takes place if the above quantities are used.—H. R. D.

Niobium in presence of tantalum; Determination of — and some reactions of tantalum compounds. A. G. Levy. *Analyst*, 1915, 40, 204—217.

A METHOD is described which is based on the fluoride method of Osborne (*Amer. J. Sci.*, 1885, 30, 328). The mixed oxides, together with 1 grm. of potassium fluoride, are dissolved in 7 c.c. of hydrofluoric acid, the solution is evaporated almost to dryness, and the residue then heated until a clear fused mass is obtained. This is transferred to a flask with the aid of 20 c.c. of water and 40 c.c. of concentrated hydrochloric acid, the niobium reduced by the addition of 10 grms. of zinc, the reduced solution diluted with a mixture of 270 c.c. of water, 10 c.c. of concentrated sulphuric acid, and 20 c.c. of a cold saturated solution of sodium phosphate, and then titrated with N/10 permanganate solution (1 c.c. = 0.00834 grm. Nb_2O_5). It is shown that large losses of tantalum are caused by dissolving tantalum oxide in hydrofluoric acid and igniting the residue obtained on evaporation to dryness, by igniting potassium tantalum fluoride with excess of potassium fluoride at a red-heat, and by igniting mixtures of tantalum oxide and ammonium fluoride.—W. P. S.

Recent progress in pyrometry. Darling. See I.

Fractional distillation with regulated stillheads. Rosanoff and others. See I.

Effect of different methods of grinding on the [determination of the] ash of coke. Eastaugh. See 11A.

New method for the determination of sodium and potassium in a mixture of their salts. Okada. See VII.

Titration of small amounts of halides. McLean and Van Slyke. See VII.

Oxidation of sulphides with potassium iodate. Dean. See VII.

Behaviour of certain hydrazine salts on decomposition by heat. [Detection of hydronitric acid (hydrazoic) acid in presence of sulphur dioxide.] Turrentine. See VII.

Practical methods for the determination of radium. I. Interchangeable electrocope and its use. Lind. See VII.

Value of the high-pressure steam test of Portland cement. Wig and Davis. See IX.

Determination of boron in iron. Lindgren. See X.

Simplified ferrous sulphate method for the determination of vanadium in steel. Dougherty. See X.

Technical analysis of ferrovanadium. Heinzelmann. See X.

Morro Velho method of assay of gold-bearing cyanide solutions. Levy and Jones. See X.

Rapid test for fineness of paint pigments. Holley and Brier. See XIII.

Use of types of tinted glass for grading rosin. See XIII.

Determination of sugar in bagasse. Deerr. See XVII.

Detection of small quantities of sugar by the production of formaldehyde. Salkowski. See XVII.

Determination of methyl alcohol in presence of ethyl alcohol. Jones. See XVIII.

Determination of fat [in animal substances, etc.]. Rosenthal and Trowbridge. See XIXA.

Determination of chlorides in cheese. Cornish and Golding. See XIXA.

Determination of carbon dioxide in baking powder and carbonates. Brubaker. See XIXA.

Colorimetric determination of nitrous acid [in water]. Ronijjn. See XIXb.

Detection and determination of arsenic in organic arsenic compounds alone or mixed with organic matters. Barthe. See XX.

Analysis of pills containing arsenious acid or sodium arsenate. Francois and Lasausse. See XX.

Colorimetric determination of uric acid in urine. Benedict and Hitchcock. See XX.

Colorimetric determination of uric acid in blood. Benedict. See XX.

Determination of mono-substituted amino groups of amino-acids by the formaldehyde titration method. Clementi. See XX.

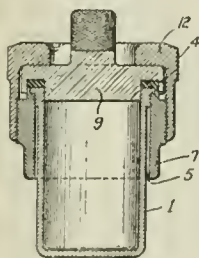
PATENTS.

Gas in the atmosphere of mines; Detecting, indicating, and recording the presence and proportion of [inflammable]—. H. R. Webster, Horsforth, Yorks. Eng. Pat. 9196, April 14, 1914.

THE porous vessel in the apparatus described in Eng. Pat. 29,094 of 1913 (this J., 1915, 131), is surrounded by a layer of cotton or glass wool, asbestos fibre, or the like, and an outer layer of caustic potash with or without quicklime, soda-lime, or calcium chloride and sodium carbonate, in order to neutralise the action of air currents and gases other than firedamp. Communication between the porous vessel and the atmosphere is afforded through a relief valve which is opened by screwing down an air-tight metal cap enclosing the porous vessel. A pressure-equalising passage leads from the underside of the diaphragm to the annular space between the cap and the porous vessel.—W. F. P.

Calorimetric apparatus. Calorimeter. Combustion device. S. W. Parr, Urbana, Ill. U.S. Pats. (A) 1,136,359, (B) 1,136,360, and (C) 1,136,361, April 20, 1915. Dates of appl., Feb. 27, May 6, and May 6, 1914.

(A) A COMBUSTION chamber, wider at the top than at the bottom, is immersed in a water container of oval cross-section, having a rotary stirrer at one end, and a thermometer at the other end of the oval. (B) A closed combustion chamber, in which the charge is ignited, is surrounded by a perforated casing immersed in the cooling liquid and forming an air jacket. The hot air escapes through the perforations when the temperature rises, and liquid is drawn in to cool the combustion chamber rapidly when the temperature falls. (C) The chamber, 1, containing the combustible mixture, is provided with a cover, 9, and a rubber gasket, 4, which is out of contact



with the hot combustion products. The collar, 12, is screwed to the bell, 7, which partly covers the chamber, 1, leaving a narrow annular space, 5. The charge is ignited by applying a flame to the lower part of the chamber, 1, which is then immersed in the cooling liquid.—W. F. F.

[Gas] calorimeter. C. E. Lucke, New York. U.S. Pat. 1,136,884, April 20, 1915. Date of appl., June 27, 1906. Renewed April 19, 1913.

MEASURED quantities of cooling water and of gas are passed continuously, at pressures having a constant ratio, to the calorimeter, where the gas is burnt. The rise in the temperature of the water actuates an indicator.—W. F. F.

Pyrometer. A. Onwood, London. Eng. Pat. 7597, March 25, 1914.

To compensate the error in a thermocouple pyrometer due to the varying temperature of the cold junction, an auxiliary couple is placed adjacent to the cold junction of the main couple, and is connected to it, and through a resistance to the galvanometer, so that its current, when added to the current from the main couple, produces the required correction.—W. F. F.

XXIV.—MISCELLANEOUS ABSTRACTS.

Reaction velocity in a viscous (heterogeneous) medium. R. H. Callow. Faraday Soc., May 11, 1915. [Advance proof.] 5 pages.

EXPERIMENTS on the hydrolysis of methyl acetate in gelatin-water mixtures, with hydrochloric acid as catalyst, yielded a series of values for the velocity constant which diminished as the gelatin concentration was increased; but a large change in the viscosity involved a comparatively small change in the constant, this being only about 10% less in a set jelly than when no gelatin was present. A curve showing the relation between viscosity and velocity constant is given.—F. SODN.

Alfalfa laccase. H. H. Bunzel. J. Biol. Chem., 1915, 20, 697—706.

ALFALFA, *Medicago sativa*, does not contain an oxydase capable of oxidising quinol, and the author shows that the accelerating effect of Euler and Bolin's "laccase" obtained from *Medicago sativa* (Z. physiol. Chem., 1908, 57, 80; 1909, 61, 72) on the rate of oxidation of quinol by atmospheric oxygen is due to the alkalinity of the salts contained in such preparations.—W. P. S.

Trade Report.

Prohibited exports. Order in Council, May 20, 1915.

(1) CRUDE coal tar is added to the list of goods the exportation of which is prohibited to all destinations.

(2) The heading "The compounds of aniline, except aniline salt," prohibited to be exported to all destinations under the heading "Coal tar products for use in dye manufacture, including aniline oil and aniline salt," by the Order of Council, March 18th, 1915, is deleted from the list of goods the exportation of which is prohibited to all destinations abroad other than British Possessions and Protectorates.

(3) The following are added to the list of goods the exportation of which is prohibited to all destinations abroad other than British Possessions and Protectorates: Chemicals, drugs, medicinal and pharmaceutical preparations: Magnesium

chloride, oxides and salts of cobalt, oxalic acid, phosphorus. Manufactures of aluminium.

(4) The heading "India-rubber, sheet, vulcanised" (prohibited to be exported to all destinations abroad other than British Possessions and Protectorates in virtue of the Order of Council of March 18th, 1915) in the list of goods the exportation of which is prohibited to all foreign ports in Europe and on the Mediterranean and Black Seas, other than those of France, Russia (except Baltic ports), Belgium, Spain, and Portugal, is deleted.

Competition with Germany and Austria-Hungary.

THE Board of Trade continue to receive a very large number of inquiries for the names of sellers or buyers of articles of which the sources of supply or markets have been interfered with by the war. Special arrangements have been made in the Commercial Intelligence Branch of the Board of Trade for dealing with these inquiries, and a weekly list of articles which inquirers desire to purchase, is issued and may be obtained by United Kingdom manufacturers and exporters of British goods. British firms interested, as suppliers, in any of the goods mentioned should communicate with the Director of the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, London, E.C.

* New Books.

[The Roman numerals in thick type refer to the similar classification of abstracts under "Journal and Patent Literature" and in the "List of Patent Applications."]

I. Batey, J.: Steam boilers and combustion. Narrow Crown 8vo. 220 pages. With 18 diagrams. Scott, Greenwood and Son. London. 1915. Net 4s.

IIA. Braunkohlenindustrie, Die deut. I. Bd. 19. u. 20. Lfg. Halle, Knapp. 1915. Each Lfg. M. 2.

IIscor, G. D.: Gas, gasoline and oil engines, including producer gas and its production. Revised and enlarged by V. W. Page. 21st ed. Royal 8vo. pp. 640. Constable, London. 1915. Net 10s. 6d.

Holde, D.: Examination of hydrocarbon oils and of saponifiable fats and waxes. 8vo. Chapman and Hall. 1915. Net 21s.

Kunerth, W.: Illuminating power of kerosenes; comparison of the illuminating power of kerosenes used in the state of Iowa, with their physical properties. Ames, Ia., State Coll. of Agric. and Mechanic Arts. 1914. 31 pp. Illus. diagrs. 8vo.

Webber, W. H. Y.: Gas supply in principle and practice. With numerous original illustrations and plates. Crown 8vo. Whittaker and Co. London. 1915. Net 3s. 6d.

Williams, R. Y., and Smith, H. E. Mine gases and safety lamps. Urbana, Ill., Univ. of Ill. 58 pp. Il. tabs. diagrs. 8vo. Pap. 1915.

IIIB. Gaster, L., and Dow, J. S.: Modern illuminants and illuminating engineering. With 204 illustrations. Med. 8vo. Whittaker and Co. London. 1915. Net 12s. 6d.

V. Balls, W. L.: Development and properties of raw cotton. Ill. Cr. 8vo. pp. 234. Black. London. 1915. Net 5s.

* Compiled by H. Grevel and Co., 33, King Street, Covent Garden, London, W.C., from whom all the works in the preceding list can be obtained.

Journal of the Society of Chemical Industry.

No. 12, Vol. XXXIV.

JUNE 30, 1915.

No. 12, Vol. XXXIV.

THE SOCIETY OF CHEMICAL INDUSTRY.

INCOME AND EXPENDITURE ACCOUNT FOR YEAR ENDING 31st DECEMBER, 1914.

EXPENDITURE.		£	s.	d.	£	s.	d.	INCOME.		£	s.	d.	£	s.	d.
To Journal—Editorial and Sundry expenses—								By Entrance Fees					164	17	0
Editor's Salary	542	16	0					Life Composition Fees					37	10	0
Do. Expenses	32	11	3					Annual Subscriptions					4852	15	0
Do. Assistant	156	0	0					Journal Advertisements	318	4	10				
Abstractors	628	8	9					Sales	885	4	10		1203	9	8
Sub-Editor's Salary	150	0	0					Collective Index—Subscriptions ..					6	19	0
Indexing Journal, &c.	131	6	0					Decennial Index—Sales					12	10	0
Foreign Journals, &c.	30	18	4					Dividends and Interest on Investments—							
Sundry Journals	2	14	9					£ s. d.							
French and U.S.A. Patents and Specifications	42	1	9					4476	9	2		Metropolitan 3%			
Insurance of Stock	6	18	0					Consolidated	126	0	10				
	£1723	14	10					1000	0	0		New Zealand 3%			
Publishing expenses—								(1945)	28	3	9				
General	1867	3	0					1277	4	8		New South Wales 3% (1935)	36	0	1
Postage on Copies	741	12	0					1231	0	10		Consols 2½%	28	17	8
	2548	15	6					600	0	0		Gas Light and Coke 3% Debentures ..	16	18	3
„ Sectional expenses—					4272	10	4	1084	13	4		North British 3% Consolidated ..	30	11	7
Boston	10	0	0					1696	0	0		Midland Rly. 2½% ..	39	17	8
Birmingham and Midland ..	42	4	2					1509	0	0		Great Eastern Rly. 4% Irredeemable ..	56	15	5
Canada	42	3	7					673	0	0		South Eastern Rly. 4½% Preference ..	28	9	1
Liverpool	85	14	3					1000	0	0		Metropolitan Water Board 3% "B" Debentures	28	3	9
London	101	17	3					200	0	0		Nottingham Joint Station 3%	5	12	11
Manchester	83	2	11					1250	0	0		Great Western Rly. 5% Guaranteed ..	58	15	10
Newcastle-on-Tyne	0	10	0					800	0	0		Great Northern Rly. 3% Debentures ..	22	11	6
New York	100	0	0					450	0	0		Nottingham and Grantham Canal 4½% Consolidated ..	17	5	5
Nottingham	26	19	4					724	8	0		India 3½%	23	16	0
Scotland	15	15	0					834	9	2		India 3%	23	10	1
Sydney	16	16	4					1400	0	0		Dominion of Canada —Canadian Pacific Rly. 3½% Land Grant Bonds 1938 ..	45	18	9
Yorkshire	23	1	4					700	0	0		Canada 4% (1940—1960)	26	6	2
„ Annual Meeting expenses					548	4	2	703	8	5		Western Australian Government 4% ..	13	2	7
„ Working expenses—					161	2	9	Interest on Deposit					36	3	0
Secretary's Salary	300	0	0										693	0	4
Assistant to Secretary and Editor	250	0	0												
Honorarium to Treasurer's Assistant and for Clerical Assistance	77	10	0												
Rent, Lighting and Cleaning Stationery and Binding	208	9	1												
Postages, Bank Charges, Telephone and Sundry expenses ..	59	10	0												
Medallist Portrait	167	14	0												
	31	5	6												
					1094	8	7								
„ Excess of Income over Expenditure ..					6076	5	10								
					894	15	2								
					£6971	1	0						£6971	1	0

Manchester Section.

Meeting held at the Grand Hotel on Friday, January 8th, 1915.

MR. JULIUS HÜBNER IN THE CHAIR.

AN IMPROVED METHOD FOR THE DETECTION OF COBALT BY MEANS OF α -NITROSO- β -NAPHTHOL.

BY F. W. ATTACK, M.Sc. TECH., B.Sc. LOND., A.I.C.

The use of α -nitroso- β -naphthol (β -naphthoquinone- α -oxime) in alcohol or acetic acid solution as a reagent for cobalt was first suggested by Ilinski and Knorre (Ber., 1885, 18, 699). The cobalti-compound so obtained is somewhat soluble in alcohol and in acetic acid, and the test does not appear to be one of great delicacy compared with the reagents for nickel which have been suggested by Tschugaev (Ber., 1905, 38, 2520)

and by Attack (Analyst, 1913, 38, 316). The exact composition of the reagent to be used is not stated by Ilinski and Knorre, but Chapin (J. Amer. Chem. Soc., 1907, 29, 1029) suggests the use of a solution of 8 grms. of α -nitroso- β -naphthol in 300 c.c. of cold glacial acetic acid, to which an equal volume of water is added, and the solution filtered. It is stated that the solution cannot be preserved for more than one month; the present author has found that the nitrosonaphthol is gradually precipitated from the 50% acetic acid solution. Using this solution it was found impossible to detect with certainty less than 0.1 mgrm. of cobalt in 1 c.c. of water (1:10,000) in presence of several drops of dilute hydrochloric acid. No mention is made by Chapin of the delicacy of the test, but the smallest amount of cobalt detected by Ilinski and Knorre (*loc. cit.*) appears to have been 0.00001 gm. in presence of 0.0105 gm. of nickel in 5 c.c. of water (1 part of cobalt in 100,000 parts of water). In presence of large amounts of nickel, the author has found it impossible to prevent the precipitation of the nickel salt, which masks the cobalt color-

THE SOCIETY OF CHEMICAL INDUSTRY.

BALANCE SHEET, 31st DECEMBER, 1914.

	£	s.	d.	£	s.	d.
To Sundry Creditors				755	15	
" Subscriptions received in advance				61	4	9
" Accumulated Fund—						
Balance 31st December, 1913 ..	20,344	4	7			
Add—Excess of Income over						
Expenditure, 1914	894	15	2			
				21,238	19	9

	£	s.	d.	£	s.	d.
By Sundry Debtors (Publishers, &c.) ..				464	18	0
" Arrears of Subscriptions (received up to 8th April, 1915)				35	0	0
" Cash at Bank on Deposit	400	0	0			
" Do. do. Current Account	138	4	3			
" Cash in hand (Secretary)	9	17	7	548	1	10
" Investments as last year—						
£ s. d.						
4476 9 2 Metropolitan 3%						
Consolidated	4163	2	1			
1000 0 0 New Zealand 3%						
(1945)	870	0	0			
1277 4 8 New South Wales 3% (1935)	1122	3	1			
1231 0 10 Consols 2½%	1031	15	4			
600 0 0 Gas Light and Coke Co. 3% Debentures	507	0	0			
1084 13 4 North British 3% Consolidated	900	5	6			
736 0 0 Midland Rly. 2½% Perpetual	1187	4	0			
960 0 0 Midland Rly. 2½% Guaranteed Preference						
1509 0 0 Great Eastern Rly. 4% Irredeemable	1629	14	5			
673 0 0 South Eastern Rly. 4½% Preference	747	0	7			
1000 0 0 Metropolitan Water Board 3% "B" Debentures	922	10	0			
200 0 0 Nottingham Joint Station 3%	166	0	0			
1250 0 0 Great Western Rly. 5% Guaranteed	1762	10	0			
800 0 0 Great Northern Rly. 3% Debentures	696	0	0			
450 0 0 Nottingham and Grantham Canal 4½% Consolidated	495	0	0			
724 8 0 India 3½%	700	0	0			
834 9 2 India 3%	700	0	0			
1400 0 0 Dominion of Canada (Canadian Pacific 3½% Land Grant Bonds 1938)	1372	4	0			
700 0 0 Canada 4% (1940-1960)	676	8	1			
	19,648	17	1			
Add—Purchased during 1914—						
703 8 5 West Australian Government 4%	698	3	0			
700 0 0 War Loan 3½% ..	661	0	2	21,008	0	3
				£22,056	0	1

£22,056 0 1

* Market value on Dec. 31st, 1914, £18,693 4 8.

We have examined the above Balance Sheet, dated 31st December, 1914, and have verified the investments and the balances at the Bank. In our opinion the Balance Sheet shows correctly the position of the Society at 31st December, 1914.

28, Basinghall Street, London, E.C.

28th April, 1915.

(Signed) FEASEY & CO.,

Chartered Accountants.

tion. even by the addition of a considerable amount of hydrochloric acid, which is stated by Chapin to decrease considerably the delicacy of the test. Moreover, the addition of the reagent to water alone produces a heavy yellow to brown precipitate.

It appeared to the author that a more stable solution of this oxime would be obtained in the form of its sodium salt, which, according to Hinski and Knorre (*loc. cit.*), gives on addition to a solution containing cobalt a salt in which the cobalt is only divalent. It has been found that such a solution provides a far more delicate test for cobalt than the acetic acid solution of the reagent. The solution recommended for use is much more dilute, a reagent of a convenient

strength for general use being prepared as follows: 0.1 grm. of α -nitroso- β -naphthol is boiled with 20 c.c. of water to which has been added 1 c.c. of dilute caustic soda, the solution filtered, and diluted to 200 c.c. A sample of the reagent has been preserved for a year, and there does not appear to be any reason to suppose that it cannot be kept indefinitely. In carrying out the test 1 c.c. of ammonium chloride and then 1 c.c. of the reagent are added to the neutral or slightly alkaline solution under examination. The production of an orange to claret coloration, or a red precipitate, unaffected by acidifying with dilute sulphuric acid, is characteristic of the presence of cobalt. 0.001 mgrm. of cobalt in

1 c.c. of water, or 1 part of cobalt in a million parts of water, may be detected readily by the test as now described, this amount giving immediately a claret coloration, and a slight red precipitate on allowing to stand. This method of carrying out the test with the sodium salt is hence far more delicate than the method originally proposed and now in general use; the test may be made even more delicate by using the reagent of one-fifth the concentration recommended above for general use, and comparing the test with a "blank." The colorations obtained with nickel, ferric, etc., salts are all destroyed on acidifying with sulphuric acid. It is immaterial whether the cobalt is present in the solution as nitrate or other salt, provided that it is in the cobaltous condition, whereas Hinski and Knorre (*loc. cit.*) state that it is necessary to have the cobalt present as chloride or sulphate in order that their method shall succeed.

The test is not affected by the presence of zinc or manganese salts in the solution. The presence of large amounts of nickel interferes with the intensity of the coloration, although it does not prevent the detection of the cobalt, a yellow coloration, and eventually a red precipitate, being obtained with a solution of a sample of nickel ammonium sulphate which contained cobalt, whereas solutions of samples of nickel nitrate and nickel chloride, containing the same concentration of nickel but free from cobalt, gave green solutions on acidifying the test solution with sulphuric acid. For the detection of cobalt in presence of large quantities of nickel, it is advisable to reduce the concentration of the nickel by precipitation with an alcoholic solution of dimethylglyoxime (Tschugaev, *loc. cit.*) or α -benzildioxime (Atack, *loc. cit.*). As the presence of either of these nickel reagents in excess gives rise to a cobalt salt which will not react with the nitrosonaphthol reagent, it is essential to separate the nickel partially only.

It is to be noted that this interference with the test by large amounts of nickel is an advantage in general analysis, as the amounts of cobalt present in commercially pure nickel salts do not give a precipitate, but only a coloration, with the new reagent at the concentrations usually employed in qualitative analysis, whereas such amounts are sufficient to give the test with the acetic acid solution in such a manner that, as Chapin remarks (*loc. cit.*), students report cobalt as present in every solution of nickel which they analyse.

The test is not affected by the presence of tartaric or citric acid, which may therefore be employed to keep in solution members of Group III. of the analytical classification; in this manner 0.001 mgrm. of cobalt was readily detected in presence of 1 mgrm. of iron (as ferric ammonium citrate).

The quantitative application of the method is under examination.

Meeting held at the Grand Hotel on Friday, April 9th, 1915.

MR. JULIUS HÜBNER IN THE CHAIR.

THE CONSTANTS OF THE FATTY ACIDS FROM SULPHONATED COD OIL.

BY L. G. RADCLIFFE AND C. W. PALMER.

It is well known that all saponifiable oils can be sulphonated with considerable ease and completeness; moreover, the process is largely carried out on the cheaper oils. A sulphonated oil has properties and constants which differ entirely

from the original oil, and it is therefore extremely difficult to identify an oil after it has been sulphonated.

It has been thought useful to sulphonate certain oils and then to hydrolyse the sulphonated product so as to remove completely the sulphonic groups and finally to prepare the fatty acids therefrom and compare their properties with those of the fatty acids from the unsulphonated oil, in the hope that the figures so obtained would prove of use in the analysis and identification of the original oil.

The cod oil used was a brown variety, having a sp. gr. of 0.931 at 15.5°C.; saponification value, 163.3; acid value, 17.6, corresponding to 8.9% of free fatty acid calculated as oleic acid; iodine value, 173.7%.

From this oil the free fatty acids were prepared by saponifying with strong potash and alcohol; the soap was boiled with water to remove the alcohol and the fatty acids precipitated by hydrochloric acid. The clear oil was well washed with water, separated, and heated until free from moisture. The fatty acids had a solidifying point (titer test), 22.8°C.; neutralisation value, 191; mean molecular weight, 289.4; iodine value, 178%; yield of hexabromides, 42%. The sulphonation was performed on 100 grms. of the oil in a suitable vessel cooled with a water-jacket and provided with a thermometer and a mechanical agitator driven by a hot air motor. To the oil 35 grms. of concentrated sulphuric acid was added drop by drop from a tap funnel and the reaction was carefully controlled so that the temperature did not at any time rise above 25°C.; no production of sulphur dioxide was noticed. After two hours stirring no further action was observed, and the darkened and thickened product was washed with a cold saturated solution of sodium sulphate until nearly all the free sulphuric acid was removed. The product dissolved in dilute ammonia to a clear solution. On heating the sulphonated oil in the water-oven a clear oil was obtained, and from this the fatty acids were prepared.

The sulphonated oil was saponified with aqueous caustic potash and alcohol in the same way as was the original oil, and after saponification the fatty acids were liberated as before, well washed, and dried in the water oven. The clear oily fatty acids were tested for sulphur with negative results. These acids were of much harder consistency than the acids from the unsulphonated oil and on examination gave the following data: Solidifying point (titer test), 25.7°C.; neutralisation value, 183; mean molecular weight, 308.6; iodine value, 114.4%; yield of hexabromides, 11.0%. These figures indicate a very extensive alteration in the chemical constitution of the fatty acids regenerated from the sulphonated oil as compared with those of the original cod oil.

The behaviour of other oils is being investigated and the further results will be communicated in a later paper.

DISCUSSION.

Mr. J. ALLAN said that the so-called commercial cod oils were mixtures of oils obtained from all kinds of fish, and usually of a dark brown colour, and in an advanced state of decomposition. Such oils were obtained not only from the liver of the fish but also from the entrails. Hence their characteristics were extremely variable. It was, therefore, difficult to understand how the authors could hope to find any means of establishing the origin of sulphonated oils which were of such diverse origin. The treatment of fatty glycerides with sulphuric acid inevitably resulted in the formation of hydroxy acids or stearylactones; the determination of the acetyl value of the oil before and after sulphonation, thus measuring

the extent of the introduction of hydroxyl groups into the molecules of the fatty acids, would, therefore, be likely to throw further light on the changes taking place on treating the oil with sulphuric acid.

Mr. L. E. VLIES thought that 8.9% of free acids was high and that the authors must have been working with "coast cod oil." In his experience maximum sulphonation would not be obtained with ordinary sulphuric acid under the conditions indicated; a longer action and the use of monohydrate being necessary. The power of the sulphonated product to emulsify mineral oil was a useful guide as to the progress of the sulphonation. The sulphonated, or more correctly sulphated, oil was easily hydrolysed by boiling with dilute mineral acid. He asked the authors if they had definitely established that the products of hydrolysis were hydroxylated compounds.

The CHAIRMAN asked whether it could be ascertained what kind of oil or what mixture of oils had been used in the manufacture of a Turkey-red oil. He noted that the fatty acid was different when recovered from the sulphonated oil. That seemed to be borne out by the fact that in dyeing, different shades were produced with different oils.

Mr. F. H. TERLESKI said that coast cod oil sometimes contained 50% of hydrocarbons. Mr. Vlies had stated that 8% of free fatty acids was rather high, but it was quite common to get as high a figure as 80% on the saponifiable matter.

Mr. RADCLIFFE said that he had carried out a considerable amount of research with regard to the acetylation value, and hoped to be able to communicate the results later. The present work had not been carried out with a view to identifying particular cod oils, so that it was immaterial for his purpose whether the oil was adulterated. In reply to Mr. Vlies, the sulphonic group could be eliminated partly by steam and completely by using dilute sulphuric or hydrochloric acid. So far as he had been able to observe, the products appeared to be hydroxyl compounds. He did not know of any method which would identify the original oils in a sulphonated mixture of oils.

THE METAL CONTENT OF SOME LINOLEATES AND ROSINATES.

BY L. G. RADCLIFFE AND C. W. PALMER.

A number of so-called rosins and linoleates are now offered for various purposes in connection with paints and varnishes, and these are usually made either by fusing an oxide of the metal with rosin, or by saponifying rosin with caustic soda or sodium carbonate, care being taken to avoid an excess of alkali, and then adding a solution of a metallic salt, generally the sulphate or the chloride. The precipitated rosinate, resinate, or sylvinate, as it is variously called, is then washed with water, pressed, and dried.

The precipitated rosins contain varying percentages of water, whilst those produced by the fusion method are anhydrous. Common rosin or colophony consists almost entirely of abietic acid, and although the metallic salts of this acid are much used in the lacquer and varnish industry as driers and to make substitutes for hard resins, little definite information has been published in regard to their chemical composition. Abietic acid, according to Maly, exists in rosin as the anhydride, but this view is discredited by the ease with which rosin in alcoholic solution can be titrated with alkalis. Mach has isolated a form of abietic acid by extracting rosin with 70% alcohol and then repeatedly recrystallising the product from 90% alcohol. The acid which he obtained was white, but melted indefinitely from

148° to 154° C.; he suggested for it the formula, $C_{19}H_{28}O_2$, and this was supported by Tschirch and Studer (Arch. Pharm., 1903, 241, 495). Fahrion obtained a similar acid from American rosin and called it sylvic acid. Various investigators have studied this acid obtained from rosin and have given various formulae and melting points for it, but the work of Bischoff and Nastvogel, now generally accepted, appears to settle the formula as $C_{20}H_{30}O_2$. It is not necessary to discuss the work of Vesterberg, Haller, Jean, and others on pimic acid.

Certain salts of abietic acid, described later, have been prepared in connection with a study of the relative efficiency of driers, and we are indebted to Dr. Knecht for a quantity of crystalline abietic acid prepared from French rosin. This acid melted between 149° and 156° C., and had a molecular weight of 304, corresponding to an acid $C_{20}H_{30}O_2$. Since abietic acid is monobasic, as shown by the presence of only one carboxyl group and the proportion of alkali required for its neutralisation, the composition of its metallic compounds can be represented by the formula $(C_{19}H_{28}.COO)_2 M$, where M represents a divalent metal.

The salts with cobalt, lead, and manganese were prepared by dissolving the abietic acid in alcohol, carefully neutralising with an alcoholic solution of caustic potash, and evaporating the mixture to dryness; the potassium salt was dissolved in water and a solution of cobalt chloride, or manganese chloride, or lead acetate, added until no further precipitate was formed. The precipitate in the case of cobalt was dark heliotrope in colour, the manganese salt faint pink, and the lead salt white. The precipitates were filtered and thoroughly washed with cold water, dried on a porous tile, and then in a water oven until of constant weight.

The cobalt salt was analysed by igniting until free from carbon and then reducing the residual oxide in dry hydrogen and weighing as metal. Calculated for $(C_{20}H_{29}O_2)_2 Co$, the percentage of cobalt is 8.98; found 9.08% Co.

The manganese salt was ignited and the residue determined as Mn_2O_3 . Calculated for $(C_{20}H_{29}O_2)_2 Mn$, the percentage of manganese is 8.3; found 8.5%.

The lead salt was ignited, the residue treated with strong nitric acid, then with strong sulphuric acid, and then weighed as lead sulphate. Calculated for $(C_{20}H_{29}O_2)_2 Pb$, the percentage of lead is 25.6; found 25.9%.

The linoleates are prepared from linseed oil by converting it into a soap and then adding a solution of the salt of the metal. It seems rational that such substances should be valued according to the content of metal and also that the loss, presumably of water, at 100°–104° C., should be determined, in the case of the precipitated rosins; therefore a number of commercial rosins and linoleates have been examined and the results are recorded herewith.

It may be of interest to describe briefly the different salts and some of the uses for which they have been suggested. Precipitated rosinate of zinc is a fine white powder, and the fused form is in rosin-like lumps. Both are used to harden ordinary rosin; the two are melted together at 180°–190° C., and the product is used to make a cheap varnish. Precipitated rosinate of calcium is a white powder and the fused form is in lumps, as is always the case with the products made by the fusion method. It is used with rosin and linseed oil, giving a product which, when thinned with turpentine, is a form of resin lacquer.

Rosinate of copper has only been examined in the precipitated form; it is a fine green powder used for preparing anti-fouling marine paints and also for wood impregnation.

Rosinate of magnesium is met with in both a precipitated and a fused form; they are practically colourless and are used in sealing wax compositions. They contain small quantities of iron, apparently as an accidental impurity.

Precipitated rosinate of manganese is an almost colourless powder, but the fused form is in dark, reddish-brown lumps. Both forms are important and efficient siccatives or driers, and usually about 2% dissolved in hot linseed oil is sufficient to produce an oil varnish, liquid driers, or the like. Rosinate of lead, in both forms, is also stated to be a very efficient drier, and it is used in about the same proportion and in the same way as the manganese salt.

Fused rosinate of cobalt is generally regarded as being the most efficient drier of the series, but it is rather expensive.

A mixed rosinate, containing both manganese and lead, is made in the fused and precipitated forms. Such a mixed salt is a very efficient drier, and it is stated that in order to obtain the best results the manganese and lead salts should be mixed in such proportions that the metallic lead and manganese, in the finished drier, should be as 5 to 1 respectively.

These rosins are soluble in linseed oil; the precipitated ones will generally dissolve in the cold oil, but the fused ones must be heated with the oil to about 120° C.; they are also soluble in turpentine. Several workers have examined commercial rosins; *vide* Amsel (*Z. angew. Chem.*, 1896, 9, 429), Meister (*Farbenzeit.*, 1907, 51, 1614), Hefelmann (*Chem. Rev. Fett- u. Harz-Ind.*, 1901, 8, 191).

TABLE I.
Metallic rosins.

Name.	Percentage of metal.	Loss at 100° to 104° C.
Zinc, precipitated	7.7	4.7
Zinc, fused	3.6	Nil
Calcium, precipitated	4.6	5.3
Calcium, fused	3.0	Nil
Copper, precipitated	7.8	2.3
Magnesium, precipitated	5.1	7.2
Magnesium, fused	0.7	Nil
Manganese, precipitated	3.5	6.8
Manganese, fused	2.3	Nil
Lead, precipitated	15.2	9.5
Lead, fused	16.7	Nil
Cobalt, fused	2.4	Nil
Manganese-lead, precipitated ..	Mn 2.3 Pb. 10.8	6.0
Manganese-lead fused	1.13 7.2	Nil

Manganese oxalate has also been examined, as it is used as a drier; the sample was in the form of a slightly pink powder and contained 30.9% Mn. This salt is prepared by adding manganese chloride solution to a solution of neutral sodium or potassium oxalate.

The linoleates are the metallic salts of linseed oil fatty acids, and can be made by the precipitation method, though sometimes the mixed fatty acids are heated with the oxide of the metal. Tungates made from the fatty acids of tung oil are also in use, but these have not been examined.

Two commercial acids, known respectively as linoleic acid and tung acid, may be mentioned here. Linoleic acid, in the form of a thick, semi-fluid yellow substance, has a characteristic odour: the acid value is 186.5 (corresponding to a mean molecular weight of 300 to 301), and the saponification value 202, *i.e.*, 15.5 mgrms. of potash was used to saponify some unchanged oil. Tung acid was in the form of strongly smelling yellowish semi-solid lumps, having an acid value of 181, a mean molecular weight of 309 to 310, and a saponification value of 213; this again indicates

the presence of some unchanged tung oil. Both these acids are used in varnish making.

The following is a brief description of some of the linoleates and their uses.

Manganese linoleate is in the form of yellowish lumps and is used as a drier in varnish. Lead linoleate in the form of yellowish lumps is used for quick drying varnishes. Both of these can be dissolved in warm linseed oil, and mixtures of the two are frequently used.

Copper linoleate is in the form of dark green lumps and is used in anti-fouling paints.

Cobalt linoleate is in the form of dark maroon coloured rather soft lumps and is a very powerful drier.

Aluminium linoleate is a sticky mass and is used for waterproofing fabrics. The zinc, calcium, and magnesium linoleates have also been examined.

In all the analyses of the rosins and the linoleates the materials have been carefully incinerated and the residue suitably dissolved, and precautions taken to ensure the use of a method and precipitant which would effectually separate the metal from any other substances. In no case has the ash been taken as a criterion of the metal content.

TABLE 2.
Metallic linoleates.

Name.	Percentage of metal.
Manganese	9.4
Lead	25.8
Copper	7.7
Aluminium	4.3
Cobalt	9.5
Zinc	9.0
Calcium	8.3
Magnesium	3.4

DISCUSSION.

Mr. J. ALLAN said that if it were possible to know the ratio of metal combined with an equivalent of the acid, say the abietic acid, and how much abietic acid was free in the mixture, a better comprehension of the combination of the materials mentioned would be obtained. The proportion of free and combined resin acids could be easily ascertained by determining the alkali saturation value and calculating how far the amount of lead found was in a definite ratio to the quantity of alkali taken up by the fatty acids.

Scottish Section.

Meeting held at Glasgow on Tuesday, 23rd February 1915.

MR. ROBERT HAMILTON IN THE CHAIR.

NOTES ON THE ANALYSIS OF GUARA AND GUARA EXTRACT.

BY THOMAS CALLAN, M.Sc., Ph.D.

Guara is a newly-introduced tanning material which, according to Eitner (*Gerber*, 1914, 40, 85—86) is identical with a material introduced 25 years ago under the name of Cascabotte. It was thought to be of interest to compare the material offered to British tanners as "guara" with the material described by Eitner. According to Eitner guara consists of the ground fruits of a variety of divi native to South and Central America, freed from seeds and woody husks. In agreement with this the samples of guara examined were found on microscopical examination to consist almost

wholly of fruit wall minus the outer husk. The most distinctive features in the microscopical appearance are the small brown plates showing a honeycomb structure and small brown plates furnished with stiff needle-shaped hairs, probably portions of outer epidermis and underlying tissue. According to Eitner (*loc. cit.*), guara contains a mixture of pyrogallol- and catechol-tannins, but practically all the reactions of guara tannin were found to agree with a pyrogallol-tannin closely resembling the tannins of sumach or myrobalans. Thus a dilute aqueous infusion of guara gives a violet-blue coloration with iron alum, no precipitate with bromine water, no phloroglucinol reaction with a deal shaving, a yellow precipitate turning green with lime water, a slight precipitate with formaldehyde and hydrochloric acid, a yellow coloration with sodium sulphite, an intense red or brownish-red coloration with an ammoniacal solution of potassium ferrieyanide in very dilute solution, a pink to purple coloration with Bennett's iodine test, and a deep orange-brown colour with nitrous acid. With concentrated sulphuric acid, however, a crimson-pink coloration changing to pink on dilution is obtained—a reaction given by most catechol-tannins.

A number of analyses of various samples of guara made during the past two years show that material of a remarkably constant quality is being supplied. The following are typical analyses, carried out according to the official method of the International Association of Leather Trades Chemists:—

	Tans.	Non-tans.	Insoluble.	Moisture.
	%	%	%	%
1.	43.5	23.8	22.0	10.7
2.	46.2	25.8	19.0	9.0
3.	48.4	23.2	17.7	10.7
4.	44.8	23.1	21.7	10.4

Mr. H. Lang, of the Gryfe Tannery, Ltd., kindly carried out for me a number of tanning experiments with guara and also made trials of this material on the large scale in conjunction with other tanning materials. According to these experiments, skins tanned entirely with guara gave a soft, well-filled leather, resembling a gambier tannage rather than a sumach or myrobalan tannage such as the presence of pyrogallol-tannins might lead one to expect. The well-nourished appearance of guara-tanned leather may therefore be largely due to the nature of the non-tannins present.

Guara is quite free from the liability to give excessive fermentation such as is characteristic of divi. However, its fine state of subdivision prevents guara from being readily leached, although the tanning matters are very readily soluble. Guara has been found excellent for developing acidity in the tan-liquors, and when used with untreated quebracho-extract has a very favourable influence on the colour of the leather. It has been found particularly useful mixed with quebracho extract in the paddle, as it does not draw the grain but gives a soft and mellow tannage. The most characteristic features of guara are its acid-forming properties and the light colour and mellowness of the tannage.

Guara extract. Only one sample of guara extract (solid) has been examined, as this material is no longer imported.

The analysis gave tans, 41.7%; non-tans, 30.0%; insoluble, 11.0%; moisture, 17.3%, agreeing closely with the analysis given by Eitner. Guara extract gives a very dark coloured infusion

and besides being actually weaker in tannin, is inferior in all respects to the natural product. The large amount of insoluble matter makes its filtration during analysis very difficult. It is reported by Eitner to make a dark-coloured and unsatisfactory leather, and as it has not been favourably received by British tanners it is no longer imported.

NOTE ON THE ANALYSIS OF TANNING MATERIALS.

BY THOS. CALLAN, M.Sc., Ph.D.

Whilst the experiments on guara described in the previous paper were in progress, there appeared a paper by H. G. Bennett (this J., 1914, 1182—1184) in which a modified method of tannin analysis was proposed.

Briefly stated, Bennett proposes to modify the present official method of the International Association of Leather Trades Chemists by (1) exactly neutralising the hide powder before the preliminary chroming, (2) using less hide powder, (3) diluting the solution to be detannised with an equal volume of water, (4) using a more basic chromium salt for chroming. The object of these modifications is to obtain lower tannin results and higher non-tannins, this being a step towards greater accuracy, as the chief objection to the present method is that the hide powder absorbs small quantities of non-tannins as well as tannins. To test this new method analyses were made of guara using (1) the present official method with American hide-powder of standard quality, (2) Bennett's method using American standard hide-powder, (3) Bennett's method using finely ground hide-powder obtained from the Deutsche Versuchsanstalt für Lederindustrie, Freiberg. Using the same tannin solution, the amount of non-tannins obtained by these three methods were, to give only one example, 23.1%, 28.1%, and 25.4% respectively. Repeat experiments gave similar results.

In each case 50 c.c. of the detannised filtrate was tested by the official test for tannin (the addition, drop by drop of a 1% gelatin-10% salt solution) when no turbidity or opalescence was obtained, indicating apparent complete detannisation. This would indicate that the most accurate result was No. 2 showing the least absorption of non-tannins. The correctness of this reasoning, however, depends entirely on the trustworthiness of the official gelatin-salt test. The non-tannin filtrates were therefore re-tested by the tannin test devised by Stiasny, which consists of adding 1 c.c. of a saturated salt solution, then 2 drops of 1% metaphosphoric acid solution, and finally 2 drops of 5% gelatin-5% salt solution to 3 c.c. of the solution to be tested. With this more sensitive test No. 1 and No. 3 showed no tannin, whilst No. 2 showed a distinct trace. The dried non-tannin residues after weighing were therefore dissolved in 15 c.c. of warm distilled water, filtered and 3 c.c. tested by Stiasny's test. No. 1 gave no reaction, No. 2 gave a heavy precipitate, whilst No. 3 gave a distinct opalescence, indicating a slight trace of tannin. From these experiments with guara, which were repeated several times with similar results, the only method showing perfect detannisation is the present official process, although the amount of tannin remaining unabsorbed in Bennett's method when the finely ground Freiberg powder is used, is very small. Although the present official method undoubtedly detannises very completely, this does not mean that it is the more accurate, as these experiments do not show how much non-tannin is also absorbed. A number

of experiments were then made to determine the approximate degree of accuracy of the present official tannin test. With a solution of guara and also of chestnut extract it was found that 50 c.c. containing 10 mgrms. of tannin gave a distinct reaction, whilst 6.5 mgrms. in 50 c.c. could not be detected, although Stiasny's test readily showed as little as 3 mgrms. in 50 c.c. when only 3 c.c. of solution was taken for the test. With quebracho extract the official test is more delicate, indicating distinctly 5 mgrms. but not 2.5 mgrms. of tannin in 50 c.c. It follows, therefore, that a solution apparently completely detannised when tested by the official method may still contain, with some tanning materials, up to 6.5 mgrms. of tannin in 50 c.c. This would correspond in the case of a tanning material containing about 50% tannin to nearly 2% tannin, whilst with Bennett's method, owing to increased dilution, it corresponds to about double this amount. Before conclusions as to the relative efficiency of different methods of detannising tannin solutions can be drawn, it is therefore necessary that a more stringent test than the present official tannin test be used. A sufficiently stringent test would be to concentrate 6 c.c. of the presumably detannised solution (or 12 c.c. if Bennett's method or other method involving solutions more dilute than the present limits be used) to 3 c.c. and apply Stiasny's test.

In the course of a number of analyses of various tanning materials it was found, as in the case of guara, that the non-tannin filtrates obtained in Bennett's method, using standard American hide powder, showed in many, though not all, cases distinct traces of tannin, even after shaking 20 minutes with hide powder, when tested by the more sensitive method after concentration, although no tannin was shown by the official test. It would appear therefore that the alteration in the various factors in this method, designed to reduce absorption of non-tannins, has been carried too far, and although in all probability the gain in accuracy owing to reduced absorption of non-tannins is more than the error introduced by the non-absorption of traces of tannin, the presence of this latter error will probably prove a strong objection to the method as it now stands.

In conclusion it may be noted that although Stiasny's test will give a positive reaction with gallic acid in sufficiently concentrated solution, it will not show 150 mgrms. of gallic acid in 50 c.c., which is about the maximum amount of gallic acid likely to be present in a detannised solution even after concentrating to half its volume.

Sydney Section.

THERMO-REGULATOR FOR THERMO-STATS.

BY C. W. R. POWELL.

Errata.

In the report of the author's reply to questions, on p. 900 of the Sept. 30th, 1914, issue of this Journal, for "within half a degree" read within "one twentieth of a degree," and for "3 litres" read "3 gallons."

Obituary.

HUGO MÜLLER.

Dr. Hugo Müller died suddenly, in his eighty-second year, at Camberley, Surrey, on May 23rd. He studied chemistry under Erdmann in Leipzig and Wöhler in Göttingen, where in 1853 he took the Ph.D. degree. He then went to Munich to act as assistant to Liebig, but soon came to England, on Hofmann's invitation, to assist Warren de la Rue in the investigation of Burmese naphtha: through the advice which he was able to give when consulted by Thos. De la Rue and Co. (in whose factory they had their laboratory) it became so obvious, after a time, that the services of a chemist would be of value, that he was induced to enter the firm, though originally he had intended to adopt a scientific career; he ultimately became a partner and a director when the business was made into a limited company. A man of wide knowledge, possessed of great technical skill and manipulative power, he contributed very largely to the development of the business, especially in the Stamp and Bank Note Departments in which his artistic as well as his scientific gifts were of peculiar value; he was one of the first to develop electrotyping and much improved lithographic and colour printing in this connexion; he was also a great authority on paper and the author of an important monograph on cellulose, the first to deal with the subject in any thorough manner. He retired in 1902 and then took up work in the Davy-Faraday Laboratory founded by Dr. Mond in connexion with the Royal Institution. During the past twelve years, he has been a constant attendant there, working long hours daily—not the short time which Professor Perkin recently deprecated, in his Presidential address, as customary among young students in the Oxford laboratory. Two investigations of superlative interest were carried out by him during this period—one relating to a substance (*Cocosite*) which he first met with in palm leaves but subsequently identified with the scyllitol separated from the dog-fish, an isomeride of inositol; the other to the peculiar bloom on the leaf and flower-stalk of many species of primula, which he identified with Flavone; this was previously unknown as a natural product, and the discovery is of special interest, as Flavone is the parent of a great group of yellow colouring matters present in plants. In execution, these two inquiries are models of method and remarkable as examples of the great technical skill of the school to which Dr. Müller belonged, which now unfortunately has so few followers.

Dr. Müller, at first an ardent mineralogist, through his love of Nature, gradually passed over to botany and to horticulture; during the past 30 years, he has been noted as a gardener, particularly for his knowledge of the habits of plants. He was a man who was greatly beloved by his circle of friends. He was elected a Fellow of the Royal Society in 1866. He entered the Chemical Society in 1859 and served it as Foreign Secretary from 1869 to 1885, when he became President. He was an original member of this Society.

Journal and Patent Literature.

PATENT SPECIFICATIONS may be obtained by post by remitting as follows:—

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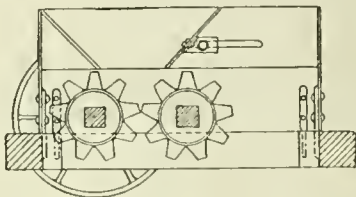
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I.—GENERAL PLANT; MACHINERY.

PATENTS.

Crushing apparatus. J. Russell, London. Eng. Pat. 29,175 of 1913. Date of appl., May 7, 1914.

THE cogs of the crushing apparatus have square



teeth which work point to point, as shown.
—W. H. C.

Crushers. A. W. Warsen, New York. Eng. Pat. 13,337, May 30, 1914.

To prevent damage to the machinery, the oscillating lever, which carries one of the jaws, is provided with an arm mounted resiliently on the lever, so that the latter remains immovable when an object of high resistance enters between the jaws.—W. H. C.

Filtering apparatus. W. E. Trent, Reno, Nev., U.S.A. Eng. Pat. 10,250, April 25, 1914.

FILTER trays are mounted round the periphery of a frame, which is rotated about a horizontal axis, so that they are free to oscillate. Each tray has a suitable filter medium and a perforated pipe for the supply of washing and flushing water; the space beneath the filter medium is connected by pipes to a vacuum pump. The trays are normally maintained in a horizontal position, and are filled in succession; the liquid portion is drained away, and the cake washed if necessary. The cake is then discharged by tilting each tray as it approaches the lowest position, and flushing water is supplied, if necessary, to detach the cake.—W. H. C.

Filter. M. Cole, Washington, D.C. U.S. Pat. 1,137,581, April 27, 1915. Date of appl., Sept. 5, 1914.

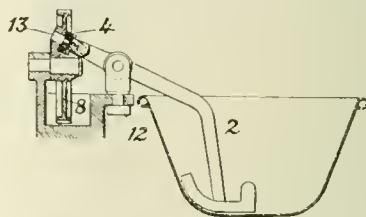
THE filter system comprises a vertical primary, a horizontal secondary, and a vertical final chamber, the final chamber being higher than the others. Each chamber is divided by a perforated partition into two compartments, of which only one contains filtering medium. The chambers are connected by piping, and a heating medium may be introduced for sterilising them.—W. H. C.

Mixing apparatus. R. B. Grey, London. Eng. Pat. 1890, Feb. 5, 1915.

A PROPELLER agitator, mounted and rotated on a central vertical shaft within the mixing tank, is raised and lowered by means of a cord and pulley driven from the shaft. A diverter blade is mounted in the tank near the centre of the upper part of the liquid to disturb the surface tension of the vortex caused by the propeller.—W. H. C.

Mixing and kneading machine. R. Herbst, Halle, Germany. U.S. Pat. 1,138,654, May 11, 1915. Date of appl., July 2, 1913.

THE kneading member, 2, pivoted in the rotating support, 12, is reciprocated by rotation of the



driving wheel, 8, through the medium of the inclined pin, 13, and ball bearing, 4.—W. F. F.

Dryer; Centrifugal—. C. A. Wendell, Joliet, Ill. U.S. Pat. 1,136,988, April 27, 1915. Date of appl., July 14, 1913.

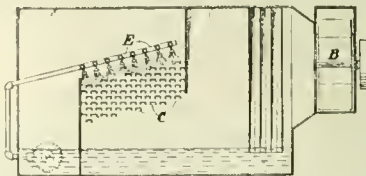
THE material to be dried is delivered into the basket from a spout, which is rotated about the same axis, and in the same direction as the basket, but at a different speed. The dried material is discharged by the centrifugal force through a trap in the bottom of the basket, which is opened at intervals.—W. H. C.

Desiccating apparatus. J. C. MacLachlan, Chicago, Ill. U.S. Pat. 1,138,769, May 11, 1915. Date of appl., March 16, 1914.

THE material is carried by a current of air into the upper part of a rectangular chamber at one end, and the solid particles are separated by inclined screens, which extend from the upper part of the sides to the centre line of the floor. The air passes through the screens and is discharged through exhaust ports in the side walls, near the opposite end. The separated material is removed from the chamber by a screw conveyor.—W. H. C.

Air washing and conditioning apparatus. W. H. Carrier, Assignor to Buffalo Forge Co., Buffalo, N.Y. U.S. Pat. 1,138,081, May 4, 1915. Date of appl., Jan. 21, 1910.

THE air or gas is drawn by the fan, B, downwards between the baffles, C, upon which the washing or



moistening liquid is sprayed from the nozzles, E.
—W. H. C.

Washing, cleaning, and cooling gases; Apparatus for—. H. E. Theisen, Munich, Germany. U.S. Pat. 1,139,385, May 11, 1915. Date of appl., Oct. 20, 1913.

THE apparatus is divided by a partition into a

central fan compartment and lateral washing compartments. The latter are provided with several concentric, annular disintegrator members, supported on and rotated by a disc, and a suitable washing fluid is directed against the disintegrators through perforations in the disc. Means are provided for preventing liquid passing from the washing to the fan compartment.—W. H. C.

Boiler for utilising waste heat [from regenerative metallurgical furnaces]. C. J. Bacon, Chicago, Ill. U.S. Pat. 1,138,346, May 4, 1915. Date of appl., Jan. 7, 1915.

HOT waste gases are passed successively through two communicating fire-tube boilers, placed in series, and water is fed into the cooler lower part of the second boiler.—W. H. C.

Corrosive fumes in gases; Apparatus for neutralizing —. T. E. Murray and E. B. Ricketts, New York. U.S. Pat. 1,139,053, May 11, 1915. Date of appl., Feb. 1, 1915.

THE current of gas is caused to impinge successively upon the surfaces of a number of vertical, perforated plates, contained in a casing. A film of suitable liquid trickles over the surfaces of the plates. The liquid absorbs the impurities and flows down to the bottom of the casing, from which it is continuously elevated to a reservoir in the upper part of the casing, and flows over the plates again.—W. H. C.

Kiln. S. P. Beebout, New Cumberland, W. Va., and T. E. Morgan, Columbus, Ohio. U.S. Pat. 1,139,327, May 11, 1915. Date of appl., May 1, 1914.

FURNACES are arranged at intervals around the annular wall of the kiln, and the fire-gases pass through openings in the wall into "bags" or chimneys which communicate at their upper ends with the interior of the kiln. The ware is supported on a grid floor above an annular flue encircling the kiln at the inner surface of the enclosing wall, this grid floor being spaced away from a lower floor, which is not perforated except for a central opening communicating with a chamber below. The central chamber is connected by radial flues with the annular flue and by a main flue with the stack; the radial flues slope downwards towards the central chamber, and the main flue is provided with a damper for controlling the draught. The top of the annular flue is perforated between the "bags," and the inner wall of the flue has openings communicating with the space between the two floors of the kiln, the size of the openings being greater the more distant they are from the "bags."—A. S.

Samples of liquids contained in receptacles; Apparatus for taking —. J. Acker, E. Schmitz, and L. Gourwitsch. Ger. Pat. 282,172, Feb. 19, 1914.

THE sample is collected in a hollow cylinder fitted with a piston, means being provided for lowering and raising the cylinder and, during the latter operation, simultaneously raising the piston within the cylinder. The mechanism is so arranged that the upward movements of the piston within the cylinder and of the cylinder within the receptacle are proportional to one another.—A. S.

Filters; Pressure —. E. J. Sweetland, Montclair, N.J., U.S.A. Eng. Pat. 9019, April 9, 1914. Date of appl., April 12, 1913.

SEE U.S. Pat. 1,083,305 of 1914; this J., 1914, 341.

Tube-mill. W. B. Easton, Chicago, Ill. U.S. Pat. 1,139,651, May 18, 1915. Date of appl., June 8, 1914.

SEE Eng. Pat. 14,234 of 1914; this J., 1915, 89.

II.A.—FUEL; GAS; MINERAL OILS AND WAXES.

Coal and coke production in Germany. Board of Trade J., May 27, 1915.

THE "Frankfurter Zeitung" of May 1st gives the following statistics of the production of coal, coke, etc., in Germany:—

	1913 Metric tons.	1914 Metric tons.
Coal	191,511,154	161,535,224
Lignite	87,116,343	83,946,906
Coke	32,167,716	27,324,712
Briquettes	27,241,755	27,397,529

Mineral oils; Optical activity of —. C. Engler and W. Steinkopf. Ber., 1914, 47, 3358—3362. J. Chem. Soc., 1915, 108, i., 205—206.

SPORADIC optical activity in mineral oils can be attributed to contact with optically active animal or vegetable matter, but universal activity is a strong argument in favour of an organic origin. In examining oils for optical activity they should be separated into as large a number of fractions as possible, and these frequently require to be redistilled; otherwise optically active constituents disseminated through the mass of the oil may escape detection, particularly if both dextro- and lævo-rotatory constituents are present. Mineral oils readily lose their activity, wholly or in part, when exposed to a high temperature; distillation should be effected, therefore, under the lowest possible pressure and from small vessels, superheating being avoided. The authors have found some portions with distinct optical activity in every mineral oil which they have investigated.

Electrical excitability and conductivity of liquid insulators [benzene, light petroleum, etc.]. D. Holde. Ber., 1914, 18, 3239—3257. J. Chem. Soc., 1915, 108, ii., 209—210.

IT is well known in laundry works that when woollen goods are moved about in benzene the former become positively and the latter negatively charged, and that, on approach of the hand, a spark discharge may occur, causing ignition of the liquid. To obviate this danger, Richter has proposed the addition of magnesium oleate, the action of which probably depends on an increase in the specific conductivity of the benzene. Liquid insulators, such as ether, light petroleum, and benzene, can acquire a charge amounting to several thousand volts when pumped through metal tubes, and to minimise the danger of fire in such cases Richter has proposed that the tubes, reservoirs, etc., should be earthed. These measures have been criticised by Dolezalek (this J., 1914, 1117), who considers that in the case of good insulators the charge cannot be dissipated sufficiently rapidly in this manner. The author's experiments show that the specific conductivity of different specimens of laboratory benzene and light petroleum is 10^{-14} to 10^{-15} . The degree of electrical excitement of a liquid of low electrical conductivity caused by passage under pressure through narrow metal tubes depends, other things being equal, on the conductivity of the liquid, which is influenced by temperature, and moisture and other impurities. The electrical charges acquired by liquid insulators (benzene or light petroleum) by passage through narrow tubes are instantly dissipated under the conditions of the experiments by earthing the receivers when the conductivity is not less than 10^{-15} . This effect does not appear to depend on the electrical conductivity of the liquid, but rather on the mechanical movement

experienced by the mobile benzene when forced into the receivers, and also on the convection currents, whereby all the charged particles are speedily brought into contact with the walls of the vessel. It is recommended that the discharge pipe should be brought close to the bottom or to the sides of the tank. The electrical excitability of liquid insulators can be diminished by addition not only of soap, but also of alcohol or acetic acid, which likewise increase the conductivity. (See also following abstract.)

Electrical conductivity of heavy hydrocarbon oils; Influence of soaps of naphthenic acids and of phenols on the —. D. Holde. Ber., 1915, 48, 14—19, 288. J. Chem. Soc., 1915, 108, ii., 136. (See preceding abstract.)

THE electrical conductivity of heavy petroleum hydrocarbons is raised considerably by addition of calcium soaps of naphthenic acids, whereas a corresponding amount of the free naphthenic acids produces only a slight effect. The conductivity of heavy tar oils is increased in a similar manner by the presence of phenols. Heavy tar oil free from phenols has a higher conductive power than heavy mineral oil.

PATENTS.

Fuel briquette. C. J. Schneider, New York. U.S. Pat. 1,138,016, May 4, 1915. Date of appl., Dec. 9, 1914.

A MIXTURE of molasses 15 galls., soap 15 lb., coal 1 ton, and alum 25 lb., is moulded into briquettes which are dried and then passed successively through a solution of soap and a solution of alum.—W. F. F.

Coke-producing plant. F. Tschudy, Birmingham, Ala. U.S. Pat. 1,139,088, May 11, 1915. Date of appl., June 17, 1911.

IN a by-product coke-producing plant comprising a number of regenerative reversible coke ovens, a single motor actuates the gas, air, and stack valves at both ends of each oven, so that the supply of gas to one side of each oven is discontinued simultaneously with the reversal of the air flow through it. A supply of gas is subsequently admitted from the opposite side of each oven.—W. F. F.

Vertical [gas] retorts. Drakes, Ltd., and W. A. Drake, Halifax. Eng. Pat. 8740, April 7, 1914.

THE combustion-chambers surrounding the retorts are provided with regenerative flues formed by pipes built into the walls, and with means for admitting heated air at various levels.—W. F. F.

Gas retorts; Vertical —. H. J. Toogood, and R. Dempster and Sons, Ltd., Elland, Yorks. Eng. Pat. 11,178, May 6, 1914.

TO support the coal charge in the carbonising zone, a table is carried by supports pivoted on the hinged bottom lid, so that on opening the lid it falls down upon a catch in such a position as to be clear of the retort mouth on the opposite side to the lid. The coke falls out between the supports of the table.—W. F. F.

Vertical [gas] retorts; Means for charging —. J. H. Taussig, Assignor to United Gas Improvement Co., Philadelphia, Pa. U.S. Pat. 1,140,340, May 18, 1915. Date of appl., Jan. 20, 1913.

A row of coal-hoppers, arranged upon a movable carriage and provided with devices for varying the volume of, and weighing, the contents of each, is disposed above a row of retorts with which connection is made by means of shoot-funnels; the latter fit the mouths of the retorts closely and have smaller discharge openings than the hoppers,

so that the funnels are sealed by the charge during operation.—W. F. F.

Gas; Method of manufacturing —. H. A. Carpenter, Sewickley, Pa., and D. D. Barnum, Worcester, Mass., Assignors to Riter-Conley Manufacturing Co., Pittsburgh, Pa. U.S. Pat. 1,140,113, May 18, 1915. Date of appl., July 24, 1913.

THE apparatus consists of several units, each comprising two vertical series of horizontal retorts separated by a vertical stand-pipe with which each retort is connected. The vertical pipes discharge into a common, horizontal main at the base of the apparatus, and the charging of the retorts is timed so that the gaseous stream in each vertical pipe is maintained practically uniform in temperature, volume, and composition.—W. F. F.

Gas producers, blast furnaces, or the like. T. Bairdow, Swansea. Eng. Pat. 18,381, Aug. 7, 1914.

IN gas producers, etc., of the pressure type, each of the access openings, through which the fire is stirred and the clinker broken, is provided with a circular steam-pipe having a number of horizontal slits, so that when the plug is removed and the steam turned on, the opening is sealed by divergent jets of steam having a fish-tail form and a downward direction. The circular pipe is protected by a recessed cover disposed around the access opening.—W. F. F.

Acetylene gas; Storing mass for —. G. Dalén, Stockholm. U.S. Pat. 1,140,124, May 18, 1915. Date of appl., June 17, 1912.

A POROUS mass consisting of charcoal, silicious earth, fibres of elastic material, and hydraulic cement not containing free oxides, is used for storing a solution of acetylene in acetone.

—W. F. F.

Gas-scrubber. W. M. Derby, Buchanan, N.Y. U.S. Pat. 1,138,460, May 4, 1915. Date of appl., Sept. 25, 1913.

GAS passes down through a vertical cylinder which contains a sprayer, and then up through the annular space between the inner cylinder and an outer concentric one. A spiral guide is arranged in the annular space, and the wall of the outer cylinder is provided with openings for the discharge of impurities, water, etc. The whole is contained in a casing.—W. F. F.

Gas; Purification of —. H. F. Smith, Lexington, Ohio. U.S. Pat. 1,140,198, May 18, 1915. Date of appl., Oct. 12, 1912.

THE gas is passed through a pervious medium, whereby the particles of tar are caused to coalesce; the coalesced particles are then removed from the pervious medium by the flowing gas and separated from the latter by gravity or inertia.—W. F. F.

Coke-oven gases and waste liquors containing salts of heavy metals; Purification of —. Hochofenwerk Lübeck A.-G. Ger. Pat. 280,849, Sept. 27, 1912.

COKE-OVEN gas is led into the waste liquor, whereby hydrogen sulphide is removed from the gas and the dissolved salts of heavy metals are converted into insoluble sulphides. In the case of solutions containing both copper and zinc salts, the copper is first precipitated as sulphide in acid solution, and then, after neutralising the acid, the zinc is precipitated.—A. S.

Tar separator. Berlin-Anhaltische Maschinenbau A.-G. Ger. Pat. 282,279, Sept. 6, 1913.

THE separator comprises a hood sealed below in the liquor and consisting of an inner and an outer

easing, the latter being connected to the cover of the hood and to the inner casing by means of press-clamps or the like, so that it can be easily and rapidly removed.—A. S.

Carbon monoxide; Removal of—from gaseous mixtures. Badische Anilin und Soda Fabrik. Ger. Pat. 282,505, Nov. 19, 1913.

CARBON monoxide is removed by absorption, preferably under pressure, in a solution of cuprous chloride containing more than 60 grms. of ammonia, in the form of free base or carbonate, per litre. Absorption is very rapid, and the solution does not attack parts of the apparatus made of iron.—A. S.

Mineral oils and residues; Treatment of—for the production of lower boiling hydrocarbons. C. White, London. Eng. Pat. 5434, Mar. 3, 1914.

THE oil or residue, with or without preliminary distillation, is distributed in a liquid state, and without the addition of steam, on to the surface of quicklime which has been heated to 500° to 600° C. in a retort or chamber. The vapours of lower boiling point thus produced may be drawn off by suction and fractionated. Crude paraffin oil thus treated yields 20 to 25% of hydrocarbons with flash-point and boiling point similar to those of petrol.—C. A. M.

Hydrocarbon oils; Process of treating—C. H. Washburn, Assignor to New Process Oil Co., St. Louis, Mo. U.S. Pat. 1,138,266, May 4, 1915. Date of appl., Mar. 24, 1913.

KEROSENE and petroleum products of 26° to 48° B. (sp. gr. 0.901—0.91) are transformed into a product of Baumé not exceeding 52° (sp. gr. 0.777) by heating with water in a retort at 650° to 950° F. (340°—510° C.), and condensing the vapours under a pressure of 3 to 5 atmos. which is maintained both within the retort and the condenser.—C. A. M.

Coal-gas-retort chambers and the like; Heating—J. M. Rusby, Assignor to The United Gas Improvement Co., Philadelphia, Pa. U.S. Pat. 1,140,337, May 18, 1915. Date of appl., June 27, 1914.

SEE Eng. Pat. 22,425 of 1914; this J., 1915, 413.

Gaseous mixture; Combustible—F. P. Peterson, Tulsa, Okla., U.S.A. Eng. Pat. 12,006, May 15, 1914. Under Int. Conv., Jan. 5, 1914.

SEE U.S. Pat. 1,094,861 of 1914; this J., 1914, 855.

II B.—DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Hardwoods; Yields from the destructive distillation of certain—L. F. Hawley and R. C. Palmer. Bull. U.S. Dept. Agric., No. 129, Sept. 10, 1914, 16 pages. (See also this J., 1914, 345).

THE gas-retort used in the tests had an oil-jacket and pyrometer tubes, and except that it was relatively small and the maximum temperatures obtained were low, the conditions of distillation were the same as in commercial practice. When arranged according to yield of wood alcohol the order was beech, maple, birch, beech being the best; for acetic acid the order was birch, beech, maple. The absolute yields were different for woods from different localities, but the relative order was the same. Chestnut gave the lowest yield of alcohol but was among the highest for acid; with hickory the alcohol yield was very high, the acid yield very low. The presence of bark reduced the yield of both acid and alcohol, but

maple bark gave very nearly as much alcohol as the wood itself. For yield of tar the order was: hickory, maple, birch, beech, oak, chestnut; for charcoal: chestnut, oak, beech, maple, birch, hickory. These results are calculated on the basis of percentage dry weight of wood distilled; on the commercial basis of yields per cord (90 cub. ft.) of wood, the positions of hickory and oak would be improved, and those of chestnut and the lighter woods correspondingly lowered.—E. H. T.

Emissivity of metals and oxides. II. Measurements with the micropyrometer. Burgess and Wallenberg. See XXIV.

PATENTS.

Distillation of coal or the like; Destructive—with addition of steam. A. Heckert. Ger. Pat. 282,355, March 6, 1914.

A HORIZONTAL retort is divided into three compartments by vertical partitions. Steam is introduced into the rear compartment, which is provided with baffles of refractory material. After being thus superheated, the steam passes through an opening at the bottom of the dividing wall into the next compartment, which is filled with graphite. In passing through this compartment the steam is decomposed, and the decomposition products pass through an opening at the top of the dividing wall into the third compartment, which is larger than the others and serves as carbonising chamber for the coal or the like.—A. S.

Surface combustion burner. E. J. Allen, Assignor to Rathbone, Sard, and Co., Albany, N.Y. U.S. Pat. 1,139,321, May 11, 1915. Date of appl., Feb. 10, 1915.

THE gas mixture passes from a mixing chamber through openings in a superposed firebrick hearth, and is burnt against inclined baffle plates mounted on the hearth. The entire surface of the hearth is thus rendered incandescent and yields heat by radiation to the object to be heated.—W. F. F.

Electrodes; Preparing arc-lamp—G. M. Little, Pittsburgh, and B. J. Gudge, Wilkinsburg, Pa., Assignors to Westinghouse Electric and Manufacturing Co. U.S. Pat. 1,138,674, May 11, 1915. Date of appl., April 21, 1910.

ROD-LIKE electrodes, containing a volatile binder, are baked by moving them into and out of a furnace, and simultaneously rotating them axially. A current of air is directed upon them to remove liberated carbonaceous gases.—B. N.

III.—TAR AND TAR PRODUCTS.

Isoquinoline in coal tar. R. Weissgerber, Ber., 1914, 47, 3175—3181. J. Chem. Soc., 1915, 108, i., 302—303.

ISOQUINOLINE occurs to the extent of less than 1% in the crude quinoline obtained from coal tar, and was isolated from this source by Hoogewerf and van Dorp by fractional crystallisation of the hydrogen sulphates. A process has now been devised for its extraction on the large scale. Isoquinoline is more basic than quinoline, and by shaking a benzene solution of the crude oil with enough 20% sulphuric acid to combine with about one-sixth of the base, the extract is considerably enriched in isoquinoline. The enriched base, recovered from the acid solution, is fractionated, and the quinoline fraction is separated by the old method. Apparently, the two quinolines are the only tar bases the sulphates of which are precipitated in alcoholic solution; so that the original

crude tar-oil bases may be treated in this way with advantage, without first isolating the crude quinoline. α -Isoquinolinesulphonic acid is easily isolated by adding the crude sulphates (above) to cold sulphuric acid containing 50% of the anhydride. It seems impossible to convert this into isoquinoline, however. When it is fused with potassium hydroxide, α -hydroxyisoquinoline is produced at 200°–250° C., but a dihydroxyisoquinoline is formed if the fusion is carried out at 300° C. This compound is no longer basic, but dissolves in sodium carbonate and gives orange-red azo dyes. It forms pale yellow needles from water, m. pt. 273° C. (decomp.).

Sulphonic acids: Conversion of aromatic—into phenols. F. Willson and K. H. Meyer, Ber., 1914, 47, 3160—3163. Bull. Soc. Chim., 1915, 18, 144.

WHILST dilute alkali hydroxides only partially transform benzenesulphonic acid into phenol above 300° C., good yields of the pure naphthols are obtained from α - and β -naphthalenesulphonic acids by treatment with 10 % sodium hydroxide at 300° C. Benzenedisulphonic acid gives under similar conditions *m*-phenolsulphonic acid, whilst *o*- and *p*-phenolsulphonic acids yield phenol, and also, in the former case, traces of catechol. From both chlorobenzenesulphonic acid and dichlorobenzenesulphonic acid one halogen atom is eliminated, the sulpho group being unattacked, and phenolsulphonic acid and chlorophenolsulphonic acid respectively being formed. The alkaline-earths and sodium carbonate act very feebly on the sulphonic group.—G. F. M.

Alkylated p-phenylenediamines and derivatives.
Quinoneimide-ammonium compounds. R. Meldola
 and W. F. Holley. Chem. Soc. Trans., 1915,
 107, 610—622.

ACETYLATED unsymmetrical dialkylated *p*-phenylenediamines of the type $C_6H_5O.NH.C_6H_4.N.a.b$ were prepared from alkylated anilines by converting these into their nitroso derivatives and subsequently reducing and acetylating. Methyl-ethylacetyl-*p*-phenylenediamine, silky needles, m. pt. $92^\circ C.$, readily combines with alkyl iodides to form crystalline quaternary ammonium iodides; the free quaternary bases are syrupy liquids, which rapidly absorb carbon dioxide from the atmosphere. The propyl and allyl compounds containing an asymmetric nitrogen-atom form non-crystallisable syrups with optically active acids. Dimethyl-acetyl-*p*-phenylenediamine, m. pt. $132^\circ-133^\circ C.$, and benzylmethylacetyl-*p*-phenylenediamine, m. pt. $110^\circ-111^\circ C.$, were prepared from dimethylaniline and benzylmethyl-*p*-nitroaniline respectively. Only the dimethyl compound gave quaternary ammonium compounds, and its methiodide was converted through the nitrate into a quinonoid-imide-ammonium compound by the action of nitric acid. This compound, to which the structure $NH:C_6H_4(NO)_3:N(CH_3)_3$ is assigned, forms golden scales, m. pt. $200^\circ-220^\circ C.$ (with decomp.). It gives a colourless dihydrochloride. All the above-mentioned dialkylacetylphenylenediamines are converted on nitration into 3,5-dinitro-1-acetylamino-phenyl-4-methylnitrosamine, $C_6H_5O.NH.C_6H_3(NO)_2.N(CH_3)NO$, m. pt. $152^\circ-153^\circ C.$, which on boiling with phenol is transformed into dinitromethylacetyl-*p*-phenylenediamine, scarlet needles m. pt. $196^\circ-197^\circ C.$ The de-acetylated diamine forms purple needles, m. pt. $186^\circ C.$ —G. F. M.

Electrical excitability and conductivity of liquid insulators [benzene, light petroleum, etc.]. Influence of soaps of naphthalenic acids and of phenols on the electrical conductivity of heavy hydrocarbon oils. Holde. See 11A.

PATENTS.

Aromatic amines; Preparation of—, Farb-
vorm. Meister, Lucius, und Brüning. Ger. Pat.
282,492, Oct. 2, 1913.

NITRO-COMPOUNDS are volatilised with steam and the mixture is passed together with hydrogen over catalysts heated to a temperature considerably below the boiling-point of the nitro-compound. For example, nitrobenzene is heated to 120° C. and a mixture of steam and hydrogen passed through the liquid; the mixture is passed through a long tube half-filled with finely divided nickel, and the vapours are condensed. The yield of aniline is almost theoretical.—F. W. A.

Aromatic carboxylic acids chlorinated in the nucleus ;
Preparation of—. Farbw. vorm. Meister,
Lucius, und Brüning. Ger. Pat. 282,133, July
10, 1913.

AN aromatic sulphonic acid or one of its salts, containing methyl groups in the ring, is heated above 200° C. with thionyl chloride, with or without an indifferent solvent. According to the temperature mono-, di-, or tri-chloro derivatives are obtained, which form acids on heating with warm water, alkalis, or acids; for example, *o*- or *p*-toluenesulphonic acid gives an excellent yield of *o*- or *p*-chlorobenzoic acid in a high state of purity.

2,5-Diaminodiarlylmonosulphones and 2-amino-5-mono- or di-alkylaminodiarlylmonosulphones; Preparation of—. Anilinfarben-u. Extrakt.-Fabr. vorm. J. R. Geigy. Ger. Pat. 282,214, Aug. 3, 1913.

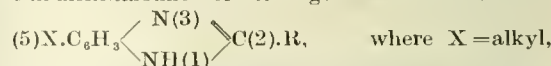
ONE mol. of an aromatic *p*-diamine or of its asymmetric N-mono- or di-alkyl derivatives is oxidised with 1 mol. of an aromatic sulphinic acid; the products may be diazotised for use in the preparation of azo-dyestuffs.—F. W. A.

Unsaturated acids of the anthraquinone series;
Preparation of —. Farbenfabr. vorm. F. Bayer
und Co. Ger. Pat. 282,265, Dec. 7, 1913.

ANTHRAQUINONE-2-ALDEHYDE, ω -dihalogen-2-methylantraquinone, or a derivative of either, is condensed with an acetate. In this manner anthraquinonyl-2-acrylic acid has been prepared for the first time.—F. W. A.

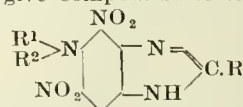
Amino-derivatives of substituted benziminazoles;
Preparation of—. D. Maron. Ger. Pat.
282,374, Feb. 25, 1913.

BENZIMINAZOLES of the general formula :



Basic condensation products of the benziminazole series; Preparation of—, D. Maron. Ger. Pat. 282,375, Aug. 14, 1913.

THE 4,6-dinitro-5-halogen-benzimidazoles, obtained as described in the preceding abstract, are condensed with primary or secondary aliphatic amines or primary aromatic amines or their substitution products to give compounds of the type:



where R = hydrogen, alkyl, OH, or NH₂; R¹ = alkyl, C₆H₅, C₆H₄OH, C₆H₄COOH, C₆H₄NH₂,

[illegible]

(C_6H_4S), $C_6H_4SO_3H$; and R^2 hydrogen, or alkyl when R^1 also is alkyl. The products may be used in the preparation of dyestuffs and pharmaceutical products.—F. W. A.

N-Anthraquinonylisatins; Preparation of —. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 282,490, Feb. 27, 1914.

ACID chlorides, such as benzoyl chloride, acetyl chloride, chlorocarbonic acid ester, phosgene, etc., have no action on *N*-monoarylaminoanthraquinones, but oxalyl chloride gives characteristic products on addition of condensing agents such as aluminium chloride, ferric chloride, or phosphorus pentoxide. The products are *N*-anthraquinonylisatins, which are valuable in the preparation of dyestuffs.

—F. W. A.

Hydrogenation [reduction of aromatic nitro-compounds]; Process of —. A. Brochet, Paris. Eng. Pat. 22,523, Oct. 6, 1913. Under Int. Conv., Oct. 8, 1912. Addition to Eng. Pat. 16,936 of 1913, dated July 27, 1912.

SEE Addition of Oct. 8, 1912 to Fr. Pat. 458,033 of 1912; this J., 1914, 18.

IV.—COLOURING MATTERS AND DYES.

Indigo; The "wilt" disease of Java —. Rept. on the Progress of Agriculture in India for 1913-14.

THE disease known as "wilt," to which Java indigo is subject, and which has caused a reduction by nearly 80% in three years in the area under this variety in Bihar, has been investigated at Pusa and found to be due to a continued wet condition of the soil. By sowing Java indigo for seed early in August on well-drained land, the disease has been avoided.

Indigo in China; Production of natural —. Board of Trade J., May 27, 1915.

THE United States Consul-General in Hongkong states that the shortage of the supply of synthetic indigo has led to a revival of the production of indigo in various parts of China. Indigo production is one of China's oldest industries. It is unlikely, however, that there will be any of the product available for export, for the time being at least.

Diazo-oxides (diazo-phenols); Constitution of internal —. G. T. Morgan and J. W. Porter. Chem. Soc. Trans., 1915, 107, 645-659.

FROM a survey of existing evidence it is concluded that the internal diazo-oxides probably possess the

cyclic diazo-oxide structure, $C_6H_4 \begin{smallmatrix} \diagup O \\ \diagdown N \end{smallmatrix}$. The

non-formation of internal *meta*-diazo-oxides from *m*-hydroxydiazonium salts, whilst *ortho*-, *para*-, and *peri*-diazo-oxides are readily produced, excludes the diazonium structure, which represents them as internal salts; such salts should be formed by *meta*-compounds with equal facility. The influence of a nitro-group on the diazo-oxide formation was studied in the nitroaminophenols. 2-Nitro-4-aminophenol and 5-nitro-2-aminophenol yielded on diazotisation their respective diazo-oxides even in acid solution, whilst diazotised 3-nitro-4-aminophenol gave no oxide even on neutralising with sodium bicarbonate, but the product was obtained by treating the aminophenol with nitrous fumes in ethereal solution. The above diazo-oxides form yellow or red crystals which explode violently when heated. They combine readily with β -naphthol or resorcinol giving red azo derivatives. The sparingly soluble metallic

salts of 4-nitro-2-hydroxybenzeneazo- β -naphthol, prepared by adding an aqueous solution of the metallic salt to an alcoholic solution of the azo compound and neutralising with ammonia, are intensely coloured lakes; the alkali salts are blue; magnesium, crimson; zinc, blue; calcium, purple; lead, bluish green; chromic, bluish grey; nickel, purple, and cobalt, dark green.—G. F. M.

Arylamides of m-nitrobenzenesulphonic acid; Molecular rearrangements among —. O. N. Witt and H. Truttwin. Ber., 1914, 47, 2786-2795. Chem.-Zeit., 1915, 39, Rep., 126.

p-TOLYLNITROBENZENESULPHAMIDE was prepared from *m*-nitrobenzenesulphochloride and *p*-toluidine. Subsequent treatment with dimethyl sulphate gave the methyl derivative, which in presence of concentrated sulphuric acid changed to the intensely coloured nitro-sulphone. This was acetylated with acetic anhydride and sulphuric acid and reduced to the corresponding amine by means of stannous chloride and hydrochloric acid. An orange-red azo-colour was produced by diazotising the amine and combining with *R*-salt. Alkaline reducing agents converted the above nitro-sulphone, $(3)NO_2 \cdot C_6H_4 \cdot (1)SO_2(6) \cdot C_6H_3(CH_3) \cdot NH \cdot CH_2(4,1)$, into the intensely yellow azoxy-compound, which was readily reduced further with stannous chloride and hydrochloric acid. The resulting base was isolated from the almost insoluble tin double salt; upon diazotising and combining with *R*-salt it yielded a violet dye. The uncombined tetrazo-compound gave a dimethyl-di-*p*-tolylidiphenylsulphone when heated with ethyl alcohol and copper sulphate.—J. R.

Orazine group; Synthesis in the —. F. Kehrman and A. A. Neil. Ber., 1914, 47, 3102-3109. J. Chem. Soc., 1915, 108, i., 303-304.

$\beta\beta$ -NAPHTHOPHENOXAZINE was prepared by heating an intimate mixture of *o*-aminophenol and 2,3-dihydroxynaphthalene gradually to 200° C. in a current of carbon dioxide; steam was evolved at 140°-150° and the mass solidified at 160°-170° C. The powdered product was boiled with small volumes of very dilute hydrochloric acid as long as the filtrate deposited crystals, when the dried residue was crystallised from a mixture of benzene and alcohol. $\beta\beta$ -Naphthophenoxazine (benzo-2,3-phenazoxine) forms colourless leaflets, m.pt. 302° C., which give a magenta solution in concentrated sulphuric acid. The other product of the reaction, deposited from the filtrate is *o*-hydroxy-phenyl-3-hydroxy- β -naphthylamine, $HO \cdot C_{10}H_6 \cdot NH \cdot C_6H_4 \cdot OH$; it crystallises in colourless needles, m.pt. 155°-156° C., and is produced in greater quantity if the temperature of the reaction is moderated. When it is heated above 200° C. ring condensation takes place. The naphthophenoxazine is also formed if the hydrochloric acid solution is exposed to the air. The acetyl derivative of $\beta\beta$ -naphthophenoxazine, m.pt. 151° C., was nitrated by fuming nitric acid in ice-cold glacial acetic acid; a dark red, explosive tetranitro- $\beta\beta$ -naphthophenoxazine separated from the reaction mixture (solution in very dilute alkali hydroxide, violet; in concentrated sulphuric acid, blood-red), whilst the mother liquor deposited an orange-yellow substance on dilution. The latter was repeatedly warmed with very dilute alcoholic sodium hydroxide, which dissolved polynitro-compounds with a violet colour, and left a hydrolysed mononitro-derivative. The latter, probably 2-nitro- $\beta\beta$ -naphthophenoxazine, formed very long, dark brownish-red, glistening needles, m.pt. 222°-223° C. (decomp.).

Catechol and *o*-aminophenol only condense to a slight extent when gently boiled together in an open vessel, but good yields of phenoxazine may be obtained by heating catechol and *o*-aminophenol with a little of the hydrochloride of the latter,

or even by heating *o*-aminophenol with its own hydrochloride at 240°C. The colourless mother liquors of many phenoxazines as obtained by the old condensations regularly developed violet colours and then deposited much more of the phenoxazine than mere evaporation would warrant. This is now explained by the presence in the mother liquors of intermediate products analogous to the above *o*-hydroxyphenyl-3-hydroxy-2-naphthylamine.

Adsorption [of dyes, alkaloid salts, etc.] from aqueous solution; Influence of the nature of the adsorbent in —. H. Freundlich and A. Poser. *Kolloid-Chem. Beihefte*, 1914, 6, 297—328. *J. Chem. Soc.*, 1915, 108, ii., 233—234.

COMPARATIVE experiments were made on the adsorption of basic and of acid dyes, and of salts of the alkaloids and certain other organic bases by alumina, bole, and animal charcoal.

In nearly every case the variation of the quantity of adsorbed substance with the concentration of the aqueous solution can be represented by means of the usual adsorption equation. The quantity of strychnine nitrate taken up from solution by bole and animal charcoal is, however, nearly independent of the concentration, and the adsorption equation is not applicable in this case. The assumption that a positive adsorbent will adsorb only acid dyes and a negative adsorbent only basic dyes is at variance with the results obtained. There is undoubtedly a preferential adsorption in the above sense, but basic dyes are adsorbed by positive alumina to quite an appreciable extent. The negative colloid arsenious sulphide is adsorbed by positive alumina; the positive colloid ferric hydroxide is similarly adsorbed by negative bole, and both colloids are adsorbed by neutral charcoal. In all three cases, the quantity of adsorbed colloid is independent of its concentration in the aqueous layer. Some experiments were also made with aqueous solutions of benzoic and of salicylic acid, and with solutions containing both these acids. Each acid is adsorbed from the mixed solutions in accordance with an exponential equation, and the total acid adsorbed is practically equal to that which would be adsorbed from a solution of either of the acids the concentration of which is equal to that of the mixture.

Tales and kaolins: Adsorption capacity of — [for dyes]. P. Rohland. *Kolloid. Zeits.*, 1914, 15, 180—182. *J. Chem. Soc.*, 1915, 108, ii., 234.

THE adsorption power of tales and kaolins may be employed in differentiating between crystalloid and colloid dyes, the adsorption increasing with the colloid character of the dyestuff. Since the adsorption capacity of the kaolins, as well as the plasticity and the readiness with which they adhere to vegetable fibres, are dependent on the colloid character of the kaolin, their behaviour towards organic dyes may be employed in forming an estimate of the suitability of the kaolins for use in the ceramic and paper industries.

Colour and constitution of the monoamines derived from phenylisonaphthophenazonium. VI. Quinoximide dyes. F. Kehrman, R. Speibel, and E. Grandinougine. *Ber.*, 1914, 47, 3363—3369. *J. Chem. Soc.*, 1915, 108, i., 316—317.

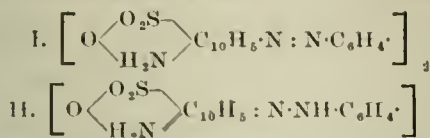
THE authors have examined the seven known isomeric monoamines derived from phenylisonaphthophenazonium, each of which forms three series of salts. The first group comprises such amines as contain the NH_2 group in the benzenoid nucleus of the naphthalene. The di-acidic salts are orange-yellow, resembling the mono-acidic salts of the parent substance; the tri-acidic salts are brownish-red. The mono-acidic salts and the

bases show marked differences; the former are yellowish-green in the case of the 6-amine, bluish-green (7-amine), and intensely violet (8-amine). The parent base and the 6- and 8-amines yield comparatively stable, lemon-yellow ψ -bases when treated with an excess of alkali, whereas the 7-amine gives a blue base, probably amphiquinonoid in character, which passes into a greenish-yellow ψ -base. Spectroscopically, the mono-acidic salts of the parent substance and the di-acidic salts of the three amines behave identically, and an ortho-quinonoid structure is indicated. The second group contains the 2- and 9-amines which contain the amino-group in the para-position to the quinquevalent nitrogen atom. The di-acidic salts are green or blue; the tri-acidic salts are brownish-purple red (9-amine) and violet-brown (2-amine). Comparison of their spectra in both the visible and invisible region with those of the di-acidic salts of the parent substance indicates an ortho-quinonoid structure. The colour changes observed during the conversion of the mono- into the di-acidic salts point to a para-quinonoid structure for these series, but spectroscopic determinations indicate an ortho-quinonoid formula. The 3-amine, which contains an amino-group in the para-position to the trivalent nitrogen atom of the azine nucleus, gives a red imino-base, soluble in ether, the shade of which is somewhat yellower than that of the violet-red mono-acidic salt, a green di-acidic salt, and a violet-brown, ortho-quinonoid tri-acidic salt. The 10-amine behaves as an ortho-quinonoid amine, giving a greenish-yellow mono-acidic, an orange-yellow di-acidic, and a violet-brown tri-acidic salt, as well as a lemon-yellow pseudo-base soluble in ether.

Congo dyes; Blue and red —. Theory of indicators. A. Hantzsch. *Ber.*, 1915, 48, 158—167. *J. Chem. Soc.*, 1915, 108, i., 321—322.

THE usual assumption that the Congo-red salts are azo-compounds, whilst the blue acid is a quinonoid substance, is not a complete explanation of the colour change when the dye is used as an indicator, for a red acid, optically identical with the alkali salts, may actually be isolated. The existence of this red acid accounts for the peculiar behaviour of Congo Red when used as an indicator in the presence of alcohol or acetone. An aqueous solution of Congo Red is rendered blue by carbon dioxide, but an alcoholic solution is only gradually changed, through brown tones to blue, by relatively excessive addition of a mineral acid. Conversely, when alcohol or acetone is added to a solution just rendered blue by a mineral acid, the colour reverts to red. Under certain conditions the change from red to blue may be followed like a time reaction, and Congo Red is, therefore, in no sense of the word an indicator, except in pure aqueous solutions. Within certain limits, all these solutions, red salt, red acid, and blue acid, can be obtained optically empty, as revealed by the ultra-microscope. Moreover, the change into the colloidal condition is not accompanied by a distinct change of colour, but only by gradual shading, due no doubt to the stronger reflexion of the macroscopic particles. Indicator changes are, therefore, purely chemical in their origin, that is, due to isomerism. The isomeric Congo-acids are in equilibrium in solution, and this equilibrium is dependent first of all on the nature of the solvent, and only secondly on the concentration of the hydrogen or hydroxyl ions. In aqueous solutions, one chromo-isomeride is "alkali-stable," the other "acid-stable," but in presence of alcohol the equilibrium is not so quickly displaced in favour of either form. The absorption curves of the two acids are much the same in the ultra-violet, but absolutely different in the visible

spectrum. The difference in constitution of the two isomerides must therefore be fundamental, and the red acid (I.), like the salts, is most probably azoid, whilst the blue acid (II.) is quinonoid.



The blue Congo-acid may be precipitated by ether from the red solutions in alcohol or acetone. The red Congo-acid is prepared by dissolving the blue acid in pyridine and heating the red, microcrystalline pyridine salt at 120°–130° C., when the base is expelled. There is no change in weight either in forming the red acid from the blue by this means or during the reversion to the blue acid, which is effected by a trace of hydrochloric acid. Small quantities of the red acid may be obtained more conveniently by evaporating alcoholic or acetone solutions. Two isomeric acids may also be isolated from benzopurpurin.

Helianthins and aminoazobenzene salts; Isomerides of—A. Hantzsch. Ber., 1915, 48, 167–180. J. Chem. Soc., 1915, 108, i., 322–324.

On evaporating alcoholic solutions of helianthin with about 10% of its sodium salt in platinum or silica vessels, the Methyl Orange so depresses the hydrogen-ion concentration of the helianthin that the yellow form is prevented from changing into the red. The brownish-yellow helianthin is considerably more soluble than the red modification and decomposes about 35° lower, namely, at about 200° C. Many other helianthins have been examined. With two exceptions, their red forms are stable and the yellow are either labile or unknown. The exceptions are the simplest helianthin, namely, anilineazobenzenesulphonic acid and dimethyl-*o*-toluidineazobenzenesulphonic acid. In these cases, the stable form is yellow and the red form is labile. The red modifications are obtained by rubbing the yellow forms, but, whereas the red aniline derivative becomes yellow when merely breathed upon, the *o*-toluidine derivative has to be left in contact with water to bring this about.

A third class of chromo-isomeric helianthins consists of graphite-black products, which, like the corresponding aminoazobenzenes contain free amino-hydrogen atoms. Such are the monomethyl-, monomethyl-, monoamyl-, and monobenzyl-helianthins. They change into the red or yellow forms in the appropriate solvents.

All yellow helianthin solutions are optically similar, in alcohol or alkalis, and the absorption curves are quite distinct from those of azo-compounds. Most of the red helianthin solutions show bands like those of magenta, that is, the red forms are quinonoid. The absorption curves are, moreover, very similar to those of the yellow helianthins. These red and yellow modifications must therefore be chemically similar, and are regarded as valency isomerides.

The abnormal red modifications are those derived from dimethyl-*o*-toluidine, namely, dimethyl-*o*-toluidineazobenzene, C₁₅H₁₇N₃, m.pt. 98° C., and the corresponding sulphonic acid; they have an azoid structure.

The common Methyl Orange itself exists in two chromoisomeric forms. The orange salt becomes deep red on rubbing, but changes again to orange when the substance is breathed upon. They may also be valency isomerides.

It is therefore established that there are four different solid isomerides of the helianthins, three of which exist in solution, namely, an azoid form,

a black quinonoid form, and the orange-yellow and red quinonoid, valency isomerides.

Stilbeneazinic acids and their derivatives. Karrer. See XX.

PATENT.

Colour takes from vegetable substances containing the dyestuff as glucoside; Process for the production of—E. Hagen. Ger. Pat. 281,423, Nov. 19, 1912. Addition to Ger. Pat. 250,387 (see Fr. Pat. 438,563, of 1911; this J., 1912, 650).

DYESTUFF glucosides are decomposed in the usual manner by heating with acids or by enzymes, and the dyestuff is separated and converted into a lake by heating with alkaline-earth or metallic salt solutions. An alternative method is to treat the glucoside direct with an organic aluminium salt or with aluminium hydroxide, at the ordinary or a higher temperature. The lakes produced at the ordinary temperatures do not possess pronounced colouring properties. Lakes obtained by the first process are unaffected by organic acids, but this is not the case with lakes obtained by the alternative method.—F. W. A.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Cellulose; Hysteresis of the extent of hydration of—Adsorption. XI. A. V. Rakovski. J. Russ. Phys. Chem. Soc., 1915, 47, 18–21. J. Chem. Soc., 1915, 108, ii., 235.

THE author has investigated, by van Bemmelen's method ("Die Adsorption," Dresden, 1910), the chemical hysteresis of cotton-wool, filter-paper, flax, and hemp at 19° C. the last two having been previously washed successively with water, alcohol, ether, alcohol, and water. The curves connecting vapour pressure with the proportion of water present are almost coincident for filter-paper and cotton-wool, but at pressures exceeding 12 mm. the former contains rather more water than the latter. For the conditions employed, the velocity of adsorption is greater than for starch, the attainment of equilibrium occupying five to seven days, or, for pressures above 14 mm., three to five days; in a desiccator containing 1% sulphuric acid solution the establishment of equilibrium is doubtful. In general, dehydration proceeds more slowly than hydration. The hysteresis exhibits a maximum of 1.8% of water, and is somewhat less than with starch. Separate calculation of the hydration and dehydration results obtained by Masson and Richards (this J., 1907, 89) for cotton-wool and filter-paper shows them to be in very fair agreement with those obtained by the author.

Paper-making materials; The Empire's resources in—S. C. Phillips. J. Roy. Soc. Arts, 1915, 63, 613–632.

GREAT Britain itself does not offer much in the way of fibrous materials capable of development as new sources of supply for paper-making. Marram grass gives a fibre similar to esparto, but the yield is low. Attempts to utilise peat fibre have proved commercially unsuccessful. In Canada the total area of forest land is estimated at 500–600 million acres, about half being of commercial value. The Canadian statistics for 1914 show the manufacture of pulp from 834,538 cords of spruce, 314,183 of balsam fir, 45,246 of hemlock, 24,715 of jack pine, and 3845 of poplar, a total of 1,222,527 cords. Of this 52.6% was used for the manufacture of mechanical pulp, 33.1% for sulphite, 14% for sulphate, and 0.3% for soda pulp. Conservation and regulation of the timber

resources are receiving attention. Experiments have been made with "milkweed," which furnishes a long, fine and glossy bast fibre and a woody portion from which useful paper-pulp can be made (see Neish; this J., 1913, 72). Newfoundland forests cover over 10,000 sq. miles, with an average yield of 10 cords of pulp wood per acre; in the year ending June 30, 1913, 57,500 tons of pulp and 44,400 tons of paper were exported; the rate of increase latterly has been very rapid. In India the development of bamboo as a source of cellulose pulp has every prospect of success as soon as the limitations of the world's supply of pulp-wood produce the demand. Locally certain grasses, such as baib or sabhai, are in steady use and many other species are available. Other Indian materials capable of development are *Hedyclium coronarium*, Moya grass, and cotton-seed hull fibres. In Trinidad, sugar-cane bagasse, bamboo, and Para grass have been worked on a small scale. In Australia, one mill is producing sulphate pulp from a species of pine, and proposals have been made for utilising bagasse, prickly pear, various rushes, "black-boy," eucalyptus wood, etc. New Zealand possesses a plentiful supply of suitable timber; waste from the manufacture of Phormium fibre is also available. In Africa, the papyrus and many grasses of cane-like habit are found, e.g., tambookie grass, elephant grass, and Spanish reed (*Arundo donax*). In the Malay States,alang grass is abundant and has been approved on investigation; other fibres, such as those from pineapple and nipa palm, have been studied, with promising results.—J. F. B.

Adsorption capacity of talcs and kaolins [for dyes]. Rohland. See IV.

PATENTS.

Paper stock; Method of removing ink from—. M. Cline and C. F. Rhodes, Glens Falls, N.Y., Assignors to International Paper Co., New York. U.S. Pat. 1,138,085, May 4, 1915. Date of appl., Nov. 27, 1911.

WASTE newspaper or book stock is pulped and about 2% of caustic soda is added to "lift" the ink. About 2% of an aluminium silicate, such as fullers' earth, kaolin, etc., or magnesium silicate, such as talc, soapstone, etc., is added to absorb the "lifted" ink, and is subsequently washed out of the stock.—W. H. C.

Wood fibre; Process of preparing—. J. H. Thickens, Buffalo, N.Y. U.S. Pat. 1,138,907, May 11, 1915. Date of appl., Jan. 21, 1914.

Wood is steamed under pressure in a digester until it is heated throughout; a large quantity of alkaline liquor at a temperature below the boiling point is then admitted rapidly through the bottom of the digester; the steam in the pores of the wood is thereby condensed, and the alkaline liquid drawn into the wood; the excess of liquid is then drained off and the wood is again steamed until it acquires an acid reaction. The process of alternate chilling with alkaline liquid and steaming may be repeated until the material is sufficiently digested.—J. F. B.

Cellulose; Treatment of wood and similar fibrous materials with solutions of bisulphites, especially alkaline-earth bisulphites, for the production of—. C. G. Schwalbe. Ger. Pat. 282,050, June 14, 1913.

THE fibrous material is impregnated with the bisulphite solution, preferably *in vacuo*, the liquid is removed, and the material is steamed, with or without addition of gaseous sulphur dioxide. According to the working conditions either cellulose or half-stuff is obtained. The yield is higher than

by the boiling process, and a smaller quantity of waste lye is produced.—A. S.

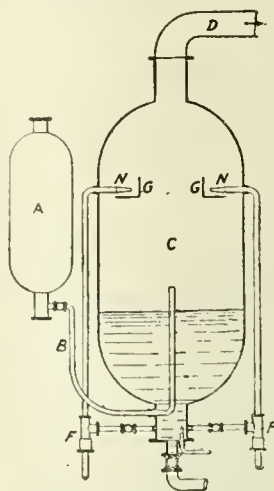
Waste [wood-pulp] liquor; Process of recovering the soda content of—. Method and means for treatment of waste liquor. H. K. Moore, Berlin, N.H. U.S. Pats. (A) 1,137,779, and (B) 1,137,780, May 4, 1915. Dates of appl., Mar. 6 and Aug. 14, 1913.

(A) WASTE liquor from wood-pulp is mixed with a "carbonaceous carrier" and sodium sulphate, the mixture is dried by the gases from the combustion of a previous quantity, burned in a smelting furnace, and the smelted soda recovered. (B) An intensely hot flame is produced by the incomplete combustion of fuel in the lower part of a retort, and the waste liquor from wood-pulp is sprayed with an air-blast through the flame in the upper part of the retort in order to evaporate the liquid therefrom during transit. The residue is accumulated on the sloping floor of the retort and burnt by injecting a blast of air into the upper portion of the heap; the soda is smelted in a reducing atmosphere and withdrawn from the retort in a molten state.—J. F. B.

Waste sulphite liquor; Process of reducing— to a powder. F. H. Kennard, Newton, Mass. U.S. Pat. 1,138,118, May 4, 1915. Date of appl., Jan. 2, 1914.

THE waste liquor is concentrated to a viscous state *in vacuo* and the product is applied in the form of a thin film to a heated surface also *in vacuo*, being retained thereon until it is dry.—J. F. B.

Sulphite-cellulose waste lyes; Concentration of lyes, especially—. E. Lehmann. Ger. Pat. 282,950, Dec. 12, 1912.



THE hot waste lye is discharged under pressure from the boiler, A, through the pipe, B, into the vessel, C, where a lower pressure prevails. The steam evolved escapes at D, and the residual liquor is drawn into the steam injectors, E, and discharged, together with the steam, through nozzles, N, against baffles, G. The lye is thus atomised, and a high degree of concentration is attained.

—A. S.

Rolling process. M. A. Adam, London, and W. J. Fernie, Dromara, Ireland. U.S. Pat. 1,140,296, May 18, 1915. Date of appl., Jan. 9, 1905.

SEE Eng. Pat. 745 of 1914; this J., 1915, 545.

[Paper] pulp, sluff, and the like; Apparatus for refining—. T. H. Nash, St. Paul's Cray. U.S. Pat. 1,140,181, May 18, 1915. Date of appl., July 24, 1914.

SEE Eng. Pat. 6876 of 1914; this J., 1914, 640.

Production of new compounds of unsaturated hydrocarbons, and of solutions and compositions containing the same. Eng. Pat. 11,635. See XIII.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Primuline; Dyeing with —, and substantive cotton dyeing. R. Haller. *Färber-Zeit.*, 1914, 25, 301, 321. *Chem.-Zeit.*, 1915, 39, Rep., 98.

ULTRAMICROSCOPIC examination of a Primuline solution shows that the dyestuff is present in particles of very different degrees of dispersity. The particles showing the highest degree of dispersity pass through a membrane, and give the dialysate an intense blue fluorescence; this portion shows no dyeing properties, but recovers them on addition of electrolytes or on evaporation. Other substantive dyestuffs, *e.g.*, Diamine Pure Blue, Congo, and Chrysophenine, show the same behaviour, but this is not the case with Carbazole Yellow and Cotton Yellow. The following explanation of substantive dyeing, based on Nägeli's micellary theory, is suggested: on introducing material into the dye-bath, the fibre is penetrated by the finely dispersed particles of dyestuff, and at the same time adsorption occurs, which soon prevents further penetration of the fibre by the highly dispersed particles of dyestuff. Addition of electrolytes, such as salt, leads to a decrease in the degree of dispersity to a stage at which the dyeing properties again make their appearance; at the same time some flocculation takes place. This view accounts for the fact that substantive dye-baths are never completely exhausted.—F. W. A.

Fastness of dyeings to light; Improvement of the —. K. Gebhard. *Färber-Zeit.*, 1914, 25, 393, 405. *Chem.-Zeit.*, 1915, 39, Rep., 87.

THE fastness to light of a dyestuff is not an absolute property, but is dependent in a high degree on the substratum. Malachite Green dyeings on cotton mordanted with Turkey red oil fade during the first week of exposure to light; on cotton mordanted with tannin and tartar emetic, in the middle of the second week; on wool and on cotton mordanted with tannin and tartar emetic, after-treated with thiourea, after more than eight weeks; and after-treated with sodium metaphosphate and glucose or with ammoniacal copper oxide and Turkey red oil, or as lake, after more than twelve weeks. The photochemical alteration of dyestuffs is considered to be due to an autoxidation process resulting in the formation of very labile dyestuff peroxide hydrates, which are stabilised by urea, and better by thiourea. The reactivity of the dyestuff may be destroyed by suitable methods of dyeing or after-treatment. The groups which become reactive in light may be made inactive by substitution or condensation with suitable substances, or by suitable after-treatment with metallic salts, hydroxy-acids, urea, thiourea, sodium molybdate, phosphotungstate, phosphite, metaphosphate, thiosulphate, or nitrite.—F. W. A.

Adsorption [of dyes, alkaloid salts, etc.] from aqueous solution. Freundlich and Poser. See IV.

Electrical excitability and conductivity of liquid insulators [benzene, light petroleum, etc.]. Influence of soaps of naphthenic acids and of phenols on the electrical conductivity of heavy hydrocarbon oils. Holde. See IIA.

PATENTS.

Alkali-free detergent for scouring and dyeing. J. Barrington, Boston, Mass. U.S. Pat. 1,139,326, May 11, 1915. Date of appl., June 2, 1914.

A NEUTRAL vegetable oil soap, *e.g.*, a coconut oil soap, is boiled with sulphonated castor oil and water until dissolved, a solution of an aniline

colour, adapted to dye both vegetable and animal fibres, is added, and the mixture boiled.

—H. R. D.

Bleaching of cotton, artificial silk, and other goods; Process for —. A. Lehmann. Ger. Pat. 279,993, Oct. 5, 1913.

COTTON, artificial silk, half-silk (artificial silk and cotton), jute, ramie, hemp, sisal, half-linen, wood, and muslin are bleached with bleaching powder or electrolytic bleach solution to which has been added malt or malt preparations (diastase) to increase the activity of the solution, and hence effect bleaching in half the time with half the usual amount of bleaching agent.—F. W. A.

Vat preparations; Process for producing concentrated —. Farb. vorm. Meister, Lucius, und Brüning. Ger. Pat. 281,353, Sept. 19, 1913. Addition to Ger. Pat. 251,569.

IN addition to the extraordinary solvent action exerted by Turck oil, Monopole soap, etc., on concentrated alkali salts of leuco-compounds of halogenated indigo or indigoid dyestuffs, these substances have been found to exert the same effect on the corresponding compounds of the quinone vat dyestuffs. Anthraquinone vat dyestuffs, such as Indanthrene, do not behave in this manner. The solutions obtained have many advantages over the coarse paste, which is difficult to reduce, and may be used direct by the wool dyer, alone or in combination with an indigo or other vat.—F. W. A.

Multicolour effects in spun yarn or textile goods; Production of —. A. Heinzel, jun. Ger. Pat. 280,369, Mar. 27, 1914. Addition to Ger. Pat. 277,497 (this J., 1915, 223).

IN carrying out the process described in the main patent, an alkaline bath not containing an oxidising agent is used, and the cerium compounds deposited on the artificial fibres are oxidised by air or other oxidising agent only after the fibres have been spun or spun and woven. The artificial fibres, after being impregnated with the cerium salt solution, may be treated with a vegetable or animal oil or fat, saponified or emulsified with alkali; the soap or emulsion may be applied simultaneously with the gelatin finish mentioned in the chief patent. The spun yarn or tissues made from the treated fibres are dyed at the lowest practicable temperature, for example 20° C.—F. W. A.

Dyeing apparatus; Spools and like tubular supports for use in —. J. G. Masson. Woonsocket, R.I., U.S.A. Eng. Pat. 18,500, Aug. 10, 1914.

SEE U.S. Pat. 1,120,398 of 1914; this J., 1915, 75.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Lactic acid; Analysis of —. L. Balderston. J. Amer. Leather Chem. Assoc., 1915, 10, 242—251.

THE following methods are recommended for adoption by the American Leather Chemists' Association. Volatile acid is determined by the distillation of a solution containing approximately 15 grms. of lactic acid per litre. A long-necked 300 c.c. flask fitted with a vertical condenser is used, the total height from the top of the condenser to the bottom of the flask being 20—24 inches. 150 c.c. of the dilute acid is distilled so that 125 c.c. of distillate comes over in 47 to 53 mins., the residue is diluted with 125 c.c. of water, and the distillation repeated. The two distillates are united, titrated with N/2 sodium hydroxide, and the result calculated to acetic acid.

To estimate free sulphuric acid, 50 grms. of the sample is dissolved in neutral 95% alcohol, the solution heated to 60° C., and allowed to stand over-night in a warm place. The solution is filtered, and the residue washed with alcohol. After evaporating the alcohol, the filtrate is diluted with water, and acidified with hydrochloric acid. Sulphuric acid is estimated in the usual way. Anhydride is determined by Besson's method (this J., 1910, 440). After titrating for total free acid, a further amount of $N/2$ sodium hydroxide is added and the solution allowed to stand for 15 mins. A definite excess of $N/2$ sulphuric acid is added, and the solution is heated to boiling and titrated back with alkali. The alkali used by anhydride is found by subtraction and calculated to lactic acid. Methods by which the solution is heated with the excess caustic soda give too high results for anhydride.—F. C. T.

Formic acid formation; Chemical kinetics of —. G. Bredig. Z. Elektrochem., 1914, 20, 489—494. J. Chem. Soc., 1915, 108, i., 211—212.

THE formation of formates by the action of carbon monoxide on strong bases such as sodium hydroxide, potassium hydroxide, tetramethylammonium hydroxide, and tetra-ethylammonium hydroxide at 50°—80° C. and pressures up to 40 atmos., was studied and also the action on weak bases such as piperidine, diethylamine, and isobutylamine. In all cases satisfactory figures can be obtained only if the reaction constant is calculated on the hypothesis that both hydroxyl ions and undissociated bases are concerned in the reaction. The constant for the action of the hydroxyl ions, k_{OH} , is independent of the nature of the base, the following figures being obtained for k_{OH} at 80° C.: NaOH, 0.0684; KOH, 0.0690; $N(CH_3)_3OH$, 0.0730; $Ba(OH)_2$, 0.0720; piperidine, 0.0810; diethylamine, 0.0730; and isobutylamine, 0.0710. If k_m represents the reaction constant of the undissociated molecules, then the ratio $k_m:k_{OH}$ for the bases investigated is given by the figures KOH, 2.2; $N(CH_3)_3OH$, 1.9; NaOH, 1.1; $Ba(OH)_2$, 0.68; piperidine, 0.0039; diethylamine, 0.0045, and isobutylamine, 0.0026. The results show that with strong bases the action of the hydroxyl ions and undissociated molecules is of about the same dimensions, whereas with weak bases the action of the undissociated molecules is very much less.

Sulphuric acid and potassium, especially in potash salts; Determination of —. W. Vaubel. Z. öfentl. Chem., 1914, 20, 426—434; 1915, 21, 1—6. Z. angew. Chem., 1915, 28, Ref., 159.

THE author recommends determination of the sulphuric acid by the benzidine method and of potassium by the cobaltinitrite method. The acid sulphate solution is diluted till it contains 0.1—0.2% H_2SO_4 , and precipitated with an equal volume of a solution of benzidine hydrochloride prepared by dissolving 6.7 grms. of the base in 20 c.c. of hydrochloric acid of sp. gr. 1.12, and diluting to 1 litre. The solution should not contain more than 10 mols. HCl, 15 mols. HNO_3 , 20 mols. CH_3CO_2H , 5 mols. alkali salts, or 1—2 mols. ferric iron per mol. H_2SO_4 ; when one or more atoms of sulphur are present per atom of ferric iron, reduction to the ferrous state is not necessary. For the determination of potassium Zaleski's method (see this J., 1914, 1172) is recommended, using a reagent prepared by pouring a solution of 30 grms. of cobalt nitrite in 1 litre of water and 250 c.c. of nitric acid of sp. gr. 1.2 into a solution of 300 grms. of sodium nitrite in 1 litre of water, the mixture being agitated, allowed to stand for 24 hours, and filtered.—A. S.

Calcium chloride; Importation of — into India. Board of Trade J., June 3, 1915.

NOTIFICATION No. 3950—28 (Customs Circular No. 5 of 1915), dated 15th April, states that the Government of India have sanctioned the proposal to exempt calcium chloride from the payment of Customs duty, when imported by the owner of a cotton weaving mill and shown to the satisfaction of the Collector of Customs to be intended for use in the weaving of cotton or the baling of woven cotton goods. The above sanction is subject to reconsideration after the war.

Phosphoric acid in limestone; Concentration method for the determination of small quantities of —. F. Hinden. Z. anal. Chem., 1915, 54, 214—216.

TWENTY-FIVE grms. of the powdered limestone is mixed with 100 c.c. of water and 120 c.c. of dilute nitric acid (1:1), the mixture is boiled for 10 mins., and the insoluble portion then collected on a filter and washed. The filtrate is heated to boiling and ammonia is added until the solution just becomes turbid owing to the precipitation of iron and aluminium hydroxides (if the limestone does not contain iron or aluminium compounds, a small quantity of ferric chloride should be added); 0.5 gm. of calcium carbonate is now added, the mixture boiled for 5 mins., and the precipitate, consisting of calcium carbonate, ferric carbonate, and aluminium hydroxide, and containing the whole of the phosphoric acid, is collected, washed, dissolved in dilute nitric acid, and evaporated to dryness. Any silica which separates is filtered off, and the phosphoric acid is then determined in the filtrate by the molybdate method.—W. P. S.

Carbon dioxide in minerals; Determination of —. L. H. Borgström. Z. anal. Chem., 1914, 53, 685—687. J. Chem. Soc., 1915, 108, ii., 281.

IN the estimation of carbon dioxide in minerals, such as scapolite, etc., the addition of a small quantity of hydrofluoric acid to the hydrochloric acid used for the decomposition accelerates the rate at which the mineral is dissolved, and the carbon dioxide is evolved completely in about fifteen minutes. The results obtained are higher and more concordant than when hydrochloric acid is used alone; the hydrofluoric acid attacks the flask to some extent, but the same flask may be used for a considerable number of estimations.

Calcium thiosulphate; Some reactions of — from the standpoint of the law of mass action and the phase rule. R. Kremann and H. Rodemund. Monats. Chem., 1914, 35, 1061—1113. Z. angew. Chem., 1915, 28, Ref., 147.

CALCIUM thiosulphate, obtained by Mond's process from the waste calcium sulphide of the Leblanc process, is usually converted into sodium thiosulphate by treatment with sodium carbonate or sulphate. An investigation of the reaction from the standpoint of the law of mass action showed that the maximum yields attainable are 2—3% lower than the theoretical yields, probably because the reacting salts are prevented from coming into effective contact by the precipitated calcium carbonate or sulphate. The yields were higher at 25° C. than at lower temperatures, and in some cases sodium sulphate gave better results than the carbonate. Attempts to use sodium nitrate instead of the carbonate or sulphate did not prove successful; below 20.2° C. the solid phase invariably consisted of silky needles of the triple salt, $CaS_2O_3 \cdot Na_2S_2O_3 \cdot NaNO_3 \cdot 11H_2O$, which decomposed into its components at higher temperatures.—A. S.

Tartrates; An adulterant of crude and refined —. P. Carles. Ann. Falsif., 1915, 8, 125—128. THE calcium tartrate from wine lees, etc., is

frequently converted, in the manufacturing process, into potassium bitartrate by boiling with potassium bisulphate. The presence of calcium tartrate in the mixed tartrates is also sometimes masked by an addition of bisulphate. The addition may be detected by shaking the powder with 50% alcohol, when the filtrate will show excessive acidity and give a precipitate with barium chloride if bisulphate be present. To avoid an excessive quantity of water in the industrial extraction of potassium bitartrate, it is suggested that the material should be treated with sodium hydroxide solution, which will convert the sparingly soluble bitartrate into the readily soluble (100 in 120 of water at 15°C.) neutral tartrate of sodium and potassium. The alkaline solution is then treated with sulphuric acid to separate the bitartrate. If the material consists of the mixed tartrates of potassium and calcium, the process is reversed, the sulphuric acid being used first, and the acid solution neutralised with potassium hydroxide. Limits of 0.75% total sulphates as K_2SO_4 and 0.25% of calcium sulphate are suggested for such bitartrate powders.—C. A. M.

Cuprous carbonate. P. Carles. Bull. Soc. Chim., 1915, 17, 163—164.

IN the preparation of ammoniacal copper solution by circulating air and ammonia solution alternately through a tower containing copper, the metal becomes coated with blue cupric carbonate, which may be removed by violent agitation with water. When kept for several weeks in a stoppered flask in contact with the metal and ammonia solution, the cupric carbonate was reduced to cuprous carbonate, which is a sea-green powder insoluble in water or ammonia and fairly stable in air.—J. R.

Carbon-free compounds; Optical activity of.—The asymmetric cobalt atom. XII. A. Werner. Ber., 1914, 47, 3087—3094. J. Chem. Soc., 1915, 108, ii., 264—265.

AFTER many unsuccessful searches after purely inorganic compounds which exhibit optical activity, it has been found that the dodecamminehexotetracobaltihaloids, $\{Co[(OH)_2Co(NH_3)_4]_3\}X_6$, may be resolved by means of the silver bromocamphor-sulphonates. The active bromides were prepared by dissolving the bromocamphorsulphonates in just sufficient aqueous acetone (50%), adding small quantities of sodium bromide until the precipitate had a marked activity, and then diluting the mother liquor with absolute alcohol. The *d*- and *l*-bromides crystallised as reddish-grey powders with $21H_2O$. The salts exhibit most abnormal rotation-dispersion. The highest rotations observed were $[\alpha]_{560} = +4446^\circ$ and -4500° in 50% aqueous acetone.

Sulphur; Formation of free sulphuric acid from —. W. Zänker and E. Färber. Färber-Zeit., 1914, 25, 343, 361. Chem.-Zeit., 1915, 39, Rep., 110.

POWDERED sulphur always contains some free sulphuric acid, and cannot be completely freed from it by washing for days with cold or hot water. If cotton is impregnated with sulphur which has been precipitated from alkaline solutions, and is then repeatedly dried at 140—160°C. and exposed to the air between these operations, it becomes superficially carbonised. The presence of a trace of sulphuric acid in sulphur accelerates the formation of further quantities.—J. H. L.

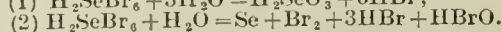
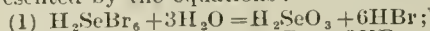
Sulphur molecule; A third and fourth variety of —. IV. Engel's sulphur. A. H. W. Aten. Z. physik. Chem., 1914, 88, 321—379. J. Chem. Soc., 1915, 108, ii., 254—255. (See also this J., 1914, 1087.)

IN addition to S_8 , ordinary rhombic sulphur, and S_m , insoluble amorphous sulphur, two other

varieties of sulphur exist which are different from the foregoing either in molecular size or in molecular constitution. S_7 is formed when sulphur is heated above its melting point and then rapidly cooled, or by warming solutions of S_8 in sulphur chloride; in other solvents, such as carbon bisulphide, the rate of formation of S_7 from S_8 is very slow. Solutions of S_7 differ from solutions of S_8 in their strong yellow colour. S_ϕ (Engel, this J., 1891, 639) is obtained when a strong solution of hydrochloric acid at 0°C. is added to a cold solution of sodium thiosulphate and the aqueous solution shaken with toluene. From the toluene solution S_ϕ crystallises after a short time. It is characterised by its orange-yellow colour, and also by its crystal form. Its solutions are yellow, but not so strongly coloured as those of S_7 . The difference of S_7 and S_ϕ is definitely proved by the solubility of the two forms. S_8 is S_8 , S_ϕ is S_6 , S_7 is probably S_4 . Solutions of S_7 and S_ϕ are stable in the dark, but the addition of S_m causes a separation of S_m . The quantity of S_m which separates is proportional to the quantity of S_m added and to the quantity of S_7 and S_ϕ present in the solution. The deposition takes place more slowly at 0° than at 25°C., and is slower from a solution of S_ϕ than from one of S_7 . The separation is much slower from carbon bisulphide than from toluene solutions. S_7 and S_ϕ are converted partly into S_m and partly into S_8 on shaking their solutions with potassium hydroxide solution. The same change occurs with ammonia, and the change takes place four times as quickly with S_ϕ as with S_7 . If a solution of ammonia in toluene is used, practically no S_m is formed, but only S_8 . Solid S_ϕ changes slowly in the dark and more rapidly in the light into S_m and S_8 ; the amount of S_m formed is practically the same in both cases, but the amount of S_8 is much greater in the light. When a solution of S_ϕ is submitted to light, a small deposition of S_m occurs, but no formation of S_8 . On the other hand S_7 is rapidly converted into S_8 on being submitted to light. The density, viscosity, and refractive index of solutions of S_8 , S_7 , and S_ϕ differ only slightly from one another. On allowing the three forms to act on silver and mercury, S_8 acts most rapidly and S_ϕ more slowly, and the presence of S_7 retards the action of S_8 . During the action on the metals, S_ϕ is transformed into S_8 , and S_7 into S_8 , but more slowly.

Selenium; New method for the preparation of colloidal —. A. Gutbier and F. Engeroff. Kolloid. Zeits., 1914, 15, 193—201, 210—216. J. Chem. Soc., 1915, 108, ii., 255—256.

THE decomposition of hydrogen selenium hexabromide, H_2SeBr_6 , by water may be conveniently employed in the preparation of a colloidal solution of selenium. Hydrogen selenium hexabromide is obtained by adding bromine slowly to a mixture of finely divided selenium and hydrobromic acid of sp. gr. 1.45, which is kept cool during the reaction. On keeping for some hours, the hexabromide separates in the form of dark red crystals, which dissolve in hydrobromic acid, forming a solution which is quite stable in the absence of light. On dilution of this solution, selenium separates in a colloidal form. The changes taking place may be represented by the equations:



The colloidal solution of selenium thus obtained may be purified by dialysis. By the addition of 1% of gum arabic its stability is greatly increased.

Monazite sands of Travancore. G. H. Tipper. Rec. Geol. Survey, India, 1914, 44 [3]. Ch. of Comm. J., 1915, 34, 205.

MONAZITE is widely distributed over the state of

Travancore, but there are only a few places where concentration has given rise to deposits of sufficient richness to be called monazite sands. These places are all in the vicinity of the sea-coast. No concentrates seem to occur in any of the rivers. The deposits are usually black, due to the presence of magnetite and ilmenite. They are sometime red when garnets are in excess. Where there is abundance of quartz or calcite, a grey sand is produced. Excess of monazite gives a yellowish tinge. The monazite occurs as small rounded grains varying from 0.1 to 0.2 mm. in diameter. In colour it resembles amber, and its specific gravity is 5.191. A specimen free from zircon or any other mineral likely to complicate the analysis was found to contain 6.0% of thoria. In other analyses the amounts of thoria present in two samples of magnetically separated sand were respectively 8.5 and 10.08%, whilst other tests gave 10.22 and 8.65% of thoria in two samples of Travancore monazite, isolated from concentrates.

Radium D; Preparation of — in visible amounts, and its chemical identity with lead. G. von Hevesy and F. Paneth. Ber., 1914, 47, 2784—2786. Chem.-Zeit., 1915, 39, Rep., 134.

The emanation from 1 grm. of elementary radium was sealed up in a quartz tube; after several weeks, during which the emanation decayed, the contents of the tube were washed out with nitric acid. The resulting solution upon electrolysis yielded either radium D or its peroxide. Radium D thus obtained was chemically identical with inactive lead, and if both are present in a solution the sum of the two concentrations must be used in applying the law of mass action.—J. R.

Radio-clements; Adsorption and precipitation of the —. F. Paneth. Physikal. Zeits., 1914, 15, 924—929. J. Chem. Soc., 1915, 108, ii., 205—206. (See this J., 1915, 281.)

IN *N/1* hydrochloric acid barium sulphate adsorbs 88% of radium sulphate, but silver chloride does not adsorb radium chloride at all.

German Polish Syndicate; Sales of the —. Pharm. J., June 12, 1915. (See also this J., 1915, 175, 352, 422.)

SINCE the prohibition of exports two or three months ago, the oversea export trade has entirely ceased, but the embargo does not affect deliveries to Austria-Hungary. Deliveries have also been permitted to Scandinavia and Holland and to Italy to a limited extent for a time until they were finally discontinued. The result of the veto on the export trade is shown by the circumstance that, as contrasted with the first four months in 1914, the total exports in the same months this year have declined from £4,226,000 to £2,487,000.

PATENTS.

Hydrochloric acid and normal potassium sulphate; Production of — from sodium bisulphate and potassium chloride. Gewerkschaft Amélie. Ger. Pat. 282,253, Sept. 19, 1913.

SODIUM bisulphate is converted into potassium-sulphate by roasting with more than the theoretical quantity of potassium chloride, and the double salt is converted into potassium sulphate by dissolving it in water, or preferably in a dilute solution from another stage of the process, and treating the solution with excess of potassium chloride; the solution should contain 70—75 grms. Na_2SO_4 per litre.—A. S.

Acetic acid; Process for the concentration of dilute —. Akt.-Ges. f. Anilinfabr. Ger. Pat. 282,263, Jan. 25, 1914.

CONCENTRATED acetic acid is obtained by distilling the dilute acid with metaphosphoric acid. The residue is reconverted into metaphosphoric acid by heating.—F. W. A.

Potash salts; Apparatus for the continuous decomposition and dissolving of —. R. Fleischer. Ger. Pat. 282,252, June 1, 1913.

THE apparatus comprises a fixed trough along the bottom of which extends a shaft provided with helical agitating blades. The devices for lifting the solid material consist of trough-shaped pieces fixed between adjacent agitating blades at an angle to the shaft, so that the material lifted is discharged in the direction of movement of the solution through the trough. The shaft is hollow and serves as an inlet main for a heating agent, which passes to sets of heating tubes arranged parallel to the shaft and connected with it by straight or curved connecting tubes.—A. S.

Crystallisation of hot-saturated saline solutions, especially solutions of potassium salts. G. Sauerbrey Maschineneufabr. A.-G. Ger. Pat. 282,566, Aug. 30, 1913. Addition to Ger. Pat. 271,246 (this J., 1914, 484).

AIR from the ventilating shafts is used as cooling agent.—A. S.

Alkali chlorides; Apparatus for electrolysis of —. K. Ochs, Berlin-Charlottenburg, Assignor to Siemens und Halske A.-G., Siemensstadt, Germany. U.S. Pat. 1,138,400, May 4, 1915. Date of appl., Nov. 13, 1914.

A CONTAINING vessel fitted with a horizontal porous diaphragm has positive electrodes above, and negative electrodes below the diaphragm. Vertical partitions, adjacent to the upper surface of the diaphragm and submerged in the liquid between it and the positive electrode, are of such a height and distance apart that bodily motion of the liquid near the diaphragm is prevented.—F. SODN.

Sodium silicate; Process of dissolving —. W. H. Stanton and J. G. Vail, Chester, Pa., Assignors to Philadelphia Quartz Co. U.S. Pat. 1,138,595, May 4, 1915. Date of appl., March 6, 1913.

WATER is heated with an excess of substantially anhydrous sodium silicate in a vessel surrounded with steam, in such manner that circulation of the liquid is minimised and retardation of solution by hydrolysis prevented.—F. SODN.

Sodium bisulphite crystals; Drying —. H. Howard, Brookline, Mass. U.S. Pat. 1,138,658, May 11, 1915. Date of appl., June 24, 1913.

THE wet crystals are heated and agitated in a current of hot sulphur dioxide gas passing through a closed chamber. The moisture from the effluent gas is removed and condensed, and the gas again returned to the chamber after heating.—H. R. D.

Sand; Process for bleaching —. J. G. A. Rhodin, London. Eng. Pat. 8495, April 3, 1914.

SAND, discoloured by iron compounds or the like, is mixed with about 2½% by weight of common salt in a moist state and heated in a furnace to 1100°—1200°C. for one or two hours. After cooling, the mass is lixiviated.—H. R. D.

Aluminate solutions; Process of treating —. H. Howard, Brookline, Mass. U.S. Pat. 1,137,860, May 4, 1915. Date of appl., May 24, 1913.

SILICA is removed from the solution by diluting it until the concentration does not exceed 30° B.

(sp. gr. 1.263) and subjecting the hot liquid to the action of the residues from the treatment of bauxite with alkali. Aluminium hydroxide may be produced by digesting bauxite with an alkaline aluminate solution, diluting the resulting liquid, and removing silica by further heating in presence of the undissolved residue.—H. R. D.

Zinc chloride solutions; Method of treating ferruginous —. S. H. Lawton, Assignor to American Vulcanized Fibre Co., Wilmington, Del. U.S. Pat. 1,137,871, May 4, 1915. Date of appl., June 21, 1913.

A PRECIPITANT for iron is introduced into zinc chloride solutions containing dissolved ferric salts (the iron being in excess of 1% of the zinc), and the solution is concentrated until the precipitate is converted into anhydrous ferric oxide. Claim is also made for a method of dehydrating ferric compounds by treatment with concentrated zinc chloride solutions.—H. R. D.

Nitrogen; Process for fixing atmospheric —. J. E. Bucher, Coventry, R.I., Assignor to Nitrogen Products Co., Providence, R.I. U.S. Pat. 1,138,190, May 4, 1915. Date of appl., July 17, 1913.

A MIXTURE of nitrogen and the vapour of an alkali or alkaline-earth metal is brought into intimate contact with a heated mass of catalytic material containing carbon in solution, so as to form a cyanogen compound of the metal, and fresh carbon is supplied to the catalytic surface as the amount in solution is diminished by the reaction.—F. SODN.

Ammonia and the like; Method of producing —. J. E. Bucher, Coventry, R.I., Assignor to Nitrogen Products Co., Providence, R.I. U.S. Pat. 1,138,191, May 4, 1915. Date of appl., Jan. 8, 1914.

NITROGEN is brought into contact with a mass of catalytic material (e.g., a metal) containing carbon in solution, which is heated to about 725° C. The dissolved carbon combines simultaneously with the nitrogen and with a metal present as the base of an oxy-compound, to form a cyanogen compound, which immediately reacts with steam to give ammonia and the metallic oxy-compound again.—F. SODN.

Base-exchanging substances; Method of manufacturing —. R. Gans, Grünwald-Berlin, Germany. U.S. Pat. 1,140,262, May 18, 1915. Date of appl., Oct. 27, 1913.

SEE Eng. Pat. 1039 of 1914; this J., 1914, 549.

Calcium cyanamide; Process of producing —. Dettifoss Power Co., Ltd., and J. H. Lidholm, London. Eng. Pat. 3545, Feb. 11, 1914. Under Int. Conv., Feb. 18, 1913.

SEE Fr. Pat. 469,045 of 1914; this J., 1914, 962.

Purification of coke-oven gases and waste liquors containing salts of heavy metals. Ger. Pat. 280,849. See IIa.

Method of operating an electrolytic cell [for the production of chlorine]. U.S. Pat. 1,139,389. See XI.

VIII.—GLASS; CERAMICS.

Glass suitable for X-ray bulbs; Soft soda —.

THE Glass Research Committee of the Institute of Chemistry find that a glass such as that made from formula No. 10, recently published (see this J., 1915, 424), and recommended for X-ray bulbs,

does not give a green phosphorescent glow, but a slight blue glow, if it is made from approximately pure materials. The green phosphorescence preferred by users of X-ray tubes, is due to the presence of manganese, and such a glass as No. 10 will give this green glow if manganese dioxide is added to the batch mixture in the quantities frequently used to correct the colour due to iron.

Clay and kaolin suspensions; Action of alkali silicates on —. P. Rohland. Kolloid. Zeits., 1914, 15, 158—159. J. Chem. Soc., 1915, 108, ii., 240.

IF a small quantity of a solution of an alkali silicate is added to a suspension of raw kaolin, the particles of quartz and sand separate out very quickly. Various observations show that this cannot be attributed to the influence of the colloidal silicic acid or the hydroxyl ions which are formed as a result of the hydrolysis of the silicate, but must be ascribed to the action of the undissociated alkali silicate in the colloidal state. This action results in an increase in the degree of dispersity of the kaolin particles, and the settling out of the quartz and sand particles is a consequence of this physical change.

Adsorption capacity of tales and kaolins [for dyes]. Rohland. See IV.

PATENTS.

Glass articles; Machines for working and blowing —. J. Gray, London. From Empire Machine Co., Portland, Me., U.S.A. Eng. Pat. 9452, April 16, 1914.

THE machine is constructed to gather a variable quantity of glass on the blow rod and automatically to chill the glass locally by means of a groove, so that only the requisite amount of glass is permitted to elongate for the final blowing. Any superfluous glass of the gather may be forced back on the blow rod so that it does not enter into the production of the finished article. One or more marverers and grooving blocks and a gauge cup are moved mechanically in proper sequence into contact with the gather on the rod. The faces of the marvering blocks are inclined to the axis of the rod. A mechanically driven carrier holds the gather on the blow rod in a fixed relation to the marvering device, and both are rotated in unison.—W. C. H.

Glass-melting tank-furnace. G. E. Howard, Butler, Pa., Assignor to The Pittsburgh Plate Glass Co., Pittsburgh, Pa. U.S. Pats. (A) 1,138,110 and (B) 1,138,111, May 4, 1915. Dates of appl., Aug. 15 and Nov. 15, 1913.

(A) THE melting tank is in constant communication with a chamber provided with a discharge opening. A hood is arranged within the chamber and communicates freely with it, so that normally the height of the glass is the same in the tank, chamber, and hood. The opening between the tank and the chamber is smaller than that between the chamber and the hood, in order to oppose the return of the glass from the chamber to the tank. An air suction and pressure apparatus is connected with the hood, by which the glass in the hood can be sucked up above its normal level and then by the air-pressure can be caused to flow more rapidly out of the discharge opening. (B) A separate delivery reservoir is combined with a stationary glass-melting tank, and has a discharge opening which can be moved or tilted from a position on a level with the glass in the tank to a point below that level. Glass is transferred from the tank to the delivery reservoir by a siphon. The siphon connection can be broken when the delivery reservoir requires cleaning or repairing. Means are provided for regulating the height of glass in the siphon, which

is of sufficient sectional area to convey more glass in a given time than would be melted in the tank, in order to maintain the level of the glass in the delivery reservoir during the discharging period.

—W. C. H.

Glass-drawing apparatus. H. F. Hitner, Mount Vernon, Ohio. Assignor to The Pittsburgh Plate Glass Co., Pittsburgh, Pa. U.S. Pat. 1,138,870, May 11, 1915. Date of appl., July 6, 1911. Renewed Oct. 15, 1914.

THE glass-drawing apparatus is combined with a furnace which has a vertically movable top stone, provided with a glass-drawing opening. One or more cables are attached to the top stone, the upper ends of the cables being secured to a lateral arm connected to a crank which can be rotated by suitable means. The throw of the crank is adjusted to give the required range of movement to the top stone, which is lifted during one half, and lowered during the other half of the forward rotation of the crank. An indicator, actuated by the rotation of the crank, gives a signal when the top stone reaches its lower position. The cover of the top stone is provided with two cables, one of which extends vertically upwards, and the other diagonally upwards towards the side to which the cover is to be shifted. The upper ends of these cables are fastened to a pair of cranks, so that during one half of the rotatory movement of the cranks, the cover is raised and shifted laterally, and during the other half of the movement it is shifted back to position over the top stone.

—W. C. H.

Kiln. U.S. Pat. 1,139,327. See I.

Process for bleaching sand. Eng. Pat. 8495. See VII.

IX.—BUILDING MATERIALS.

Concrete; Permeability tests of — M. O. Withey. Western Soc. Engineers (U.S.A.), 1914. Engineering, 1915, 99, 589—592.

DETAILS are given of an investigation made with 294 specimens of concrete composed of Portland cement, pit sand, and gravel in the proportions of 1:1½:3, 1:2:4, and 1:3:6 by volume and 1:5.1:7, and 1:9 (cement:aggregate) by weight. Three forms of test-piece were used, that most commonly employed consisting of a cylindrical concrete core surrounded by a shell of 1:1 mortar, both cast at the same time. Mixing was effected mechanically and by hand, and the specimens were tested by means of water under air-pressures up to 43 lb. per sq. in. Permeability decreased rapidly with the age of the specimens for the first month, after which the change was slight. Specimens in which the weight ratio of cement to aggregate exceeded 1:9 exhibited no visible sign of dampness at pressures less than 40 lb. per sq. in.; but, with the same method of mixing and curing, impermeability was not increased proportionately when the weight ratio was raised to more than 1:7. To produce good concrete it was found important to grade the sand and gravel into different sizes and re-combine these to obtain the maximum density; most of the more impervious mixtures used in the tests contained 40—46% of fine material, and impermeability generally increased with density. Concrete, 1:9 by weight and practically impervious to water at pressures below 40 lb. per sq. in., was obtained by using sand and gravel graded in accordance with Fuller's curve (Trans. Amer. Soc. Civil Eng., 1907, 59, 67), but required special care in manufacture and curing. With 1:1½:3 concrete,

the time of mixing (¾ to 5 mins.) had no effect on permeability, but with 1:3:6 concrete greater strength and impermeability were obtained by mixing for 2 than for ¾ or 5 mins. in a No. 0 Smith mixer run at 28—30 revs. per min. As showing the effect of consistency on permeability, mixtures which would barely flow were the most efficient, especially in the case of lean concretes; density and impermeability were decreased by the use of too much water, but an excess of the latter was less harmful than too little. Permeability was most affected by the method of curing: the average leakage through concrete air-dried for 27 days after setting, was 140 times that through similar specimens sprinkled with water for the same period; and it was found advisable, in the case of sections up to 6 or 8 in. thick, to keep the set concrete damp for a month if lean and for at least two weeks if rich. The permeability of properly cured, lean concrete was increased by complete desiccation, but rich concrete was not much affected. Lean concrete appeared to be less permeable in the direction of pouring than normal to this direction. Although none of the concretes tested was absolutely water-tight (if continuous flow into the specimens be taken as evidence of permeability), the majority were practically so, since no visible evidence of flow appeared. In nearly all the 1:7 or richer mixtures employed, the rate of flow for a period of 54 hours at a pressure of 40 lb. per sq. in. was less than 0.0001 U.S. gallon per sq. ft. per hour, the minimum flow for which leakage was visible being 0.00011 U.S. gallon per sq. ft. per hour.—W. E. F. P.

PATENTS.

Porous substances [wood]; Process for coating — J. W. Aylsworth, East Orange, Assignor to Condensite Co. of America, Glen Ridge, N.J. U.S. Pat. 1,139,470, May 18, 1915. Date of appl., April 10, 1912.

WOOD is dried for several hours at 220° F. (105° C.), and coated, while hot, with a mixture of "a phenol resin, a methylene-containing hardening agent, and a substance adapted to render the mass fluid at a relatively low temperature," the mixture being at a lower temperature than the wood. The coated wood is baked below 220° F. until the coating is converted into a hard, infusible product.—W. E. F. P.

Wood-preservative. J. A. De Cew, Montreal, Canada. U.S. Pat. 1,140,127, May 18, 1915. Date of appl., June 25, 1913.

SEE Eng. Pat. 5411 of 1912; this J., 1913, 535.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Foundry pig iron; Export of — Board of Trade J., June 3, 1915.

THE War Trade Department notifies that arrangements have been made whereby the prohibition against the export of foundry pig iron from the United Kingdom will in future be regarded as including only such foundry pig iron as contains (1) less phosphorus than 0.1%, or (2) less silicon than 1.5% together with less sulphur than 0.9%. It is proposed that certificates to the effect that the foundry pig iron is of a quality which may be exported without licence shall be issued by either of the two following committees:—(1) representing the Cleveland Iron Masters' Association (Secretary, Mr. J. T. Atkinson); (2) representing the Scottish Iron Masters' Association (Secretary, Mr. J. C. Bishop).

Iron alloys ; Thermo-electric force of certain —.
T. S. Fuller. Amer. Electrochem. Soc., April,
1915. Met. and Chem. Eng., 1915, 13, 318—319.

THE results of the measurement of the thermo-electromotive force of certain iron alloys against copper for the interval 0°—100° C. are given in millivolts in the table.

Iron-nickel.			Iron-chromium.			Iron-cobalt.		
Fe	Ni	E.M.F.	Fe	Cr	E.M.F.	Fe	Co	E.M.F.
100	—	+0.86	90	10	1.20	90	10	—0.64
83	17	—0.64	82	18	1.04	80	20	—3.70
80	20	—0.55	80	20	0.43	70	30	—3.50
70	30	—0.52	76.5	23.5	0.32			
18.8	81.2	—2.45						
7	93	—1.90	70.5	29.5	0.31			
—	100	—2.38						

Iron-nickel-chromium.				Iron-nickel-manganese.			
Fe	Ni	Cr	E.M.F.	Fe	Ni	Mn	E.M.F.
79	17	4	—0.12	87	10	3	—1.09
70	20	10	—0.46	86	12	2	—1.02
35	55	10	0.00	81	17	2	—1.50
25	60	15	0.07	80	17	3	—0.79
25	50	20	0.07	76.5	17.5	6	—0.73
20	55	25	—0.08	76	22	2	—1.84
4	89.6	5.65	1.70	50	44	6	—0.59

—W. R. S.

Steels ; Hardness and brittleness of —. Gard.
Int. Zeits. Metall., 1914, 5, 179—185. Chem.-
Zeit., 1915, 39, Rep., 71.

IN determining hardness by the Brinell method, when a load of 3000 kilos. is used, the surface of the indentation produced by the ball may not be smooth, and it will then be necessary to measure the height of the protuberance in order to ascertain the true surface area of the indentation. For exact work the load should be applied for at least 5 mins. The ratio of the Brinell hardness number to the tensile strength does not vary much for carbon steels, ranging from 0.318 to 0.360 according to the composition and previous heat treatment of the steel. Some indication of the nature of the previous heat treatment may be gained by comparing the hardness numbers of a test specimen before and after annealing.—A. S.

Passivity of iron ; Influence of substances of different chemical nature on the —. F. Flade and H. Koch. Z. physik. Chem., 1914, 88, 307—320. J. Chem. Soc., 1915, 108, ii., 218—219.

WHEN an iron electrode is placed in a N/10 sulphuric acid solution and anodically polarised, a stationary condition sets in, in which a constant current passes, and the iron has a definite potential. If now the polarising potential is gradually changed, the electrode potential suddenly falls at a definite point, the value which it reaches representing a sharp transition from the active to the passive condition (this J., 1911, 694). Strong surface-active substances (amyl alcohol, isobutyl alcohol, and isopropyl alcohol) are without influence on the stationary potential and the transition potential, from which it follows that the existence of the passive layer is independent of the surface forces. The addition of weak acids, including butyric, valeric, heptolic, oxalic, malonic, succinic, benzoic, and phosphoric acids, causes the transition potential to move to the more positive side, that is, there is less tendency for the iron to become active in the presence of these acids. The oxidising agents, chromic acid and permanganic acid, either entirely prevent the iron from becoming active, or

by changing the transition potential render it less likely to become active. The reducing agents, sulphurous acid and phosphorous acid, tend to convert passive iron into the active form, whereas hydroxylamine, hydrogen sulphide, and hydrogen cyanide are without influence. Hydrogen peroxide increases the current strength at the stationary point, and thus acts as a reducing agent. This effect is at first strong, but decreases with time. Hydrogen peroxide causes the transition potential to move to the more positive side, and in this respect it behaves as an oxidising agent. The influence of halogen ions, added in the form of hydrochloric, hydrobromic, and hydriodic acids, is to cause passive iron to become active under conditions which normally would ensure its remaining passive. The change from passive iron to active iron in these cases is preceded by an induction period.

Electrolytic and pure chemical processes ; Relationship between —. [Action of a mixture of sulphuric acid and hydrogen peroxide on metals.] D. Reichenstein. Z. Elektrochem., 1914, 20, 406—417. J. Chem. Soc., 1915, 108, ii., 245—246.

IN a previous communication it was shown (J. Chem. Soc., 1914, 106, ii., 23) that passivity of metals is analogous to those chemical reactions which, with increasing concentration of one of the reacting substances, at first show an increasing velocity of reaction, and then a steadily decreasing reaction velocity. A number of such reactions are considered in the present paper, and a mathematical representation of the rate of solution of metals in a mixture of sulphuric acid and hydrogen peroxide is deduced. It is shown that the action of such a solution on nickel is to be regarded as taking place in the four stages : (a) adsorption of hydrogen peroxide, (b) $\text{H}_2\text{O}_2 \rightarrow \text{HO}_2 + \text{O}$, (c) $2\text{O} \rightarrow \text{O}_2$, and (d) $\text{Ni} + \text{O} + 2\text{H}^+ \rightarrow \text{Ni}^{++} + \text{H}_2\text{O}$. The reaction b takes place slowly ; its velocity is of the same order as that of c and d. The reaction c leads to the accumulation of oxygen in the electrode volume. With small concentrations of acid both b and c bring about a slowly increasing passivity of the metal. In a solution containing 0.970N- H_2O_2 and 0.045N- H_2SO_4 nickel becomes passive in ninety minutes, whereas in 0.423N- H_2O_2 and 0.057N- H_2SO_4 one hundred and seventy minutes is necessary. The constant velocity of solution of nickel, which is independent of the time, can also be reached from the passive side.

Gold-platinum-palladium lode in Southern Nevada.
A. Knopf. J. Wash. Acad. Sci., 1915, 5, 370.

THE main ore shoot at the Boss gold mine, Clark Co., averages Au 3.46, Ag 6.4, Pt 0.70, and Pd 3.38 oz. per ton. The precious metals are associated with plumbogjarosite, $\text{Pb}[\text{Fe}(\text{OH})_6](\text{SO}_4)_4$, pockets of this mineral carrying about 100 oz. Pd and Pt and several hundred oz. Au per ton. With the exception of the New Rambler deposit, Wyoming, this is the only important primary deposit in which platinum metals are constituents of predominant value.—W. R. S.

Cyanide solutions ; Notes on the practical testing of working —. E. H. Croghan. J. Chem., Met., and Min. Soc., S. Africa, 1915, 15, 271—276.

THE results of the determination of free and total cyanide and alkalinity in a number of working solutions by different methods are tabulated, attention being called to the diversity of results obtained with solutions containing zinc. It is suggested that a uniform mode of testing be adopted.—W. R. S.

Bornite as silver precipitant. C. Palmer. J. Wash. Acad. Sci., 1915, 5, 351—354.

THE composition of a pure specimen of massive

bornite was found to correspond to the empirical formula, Cu_3FeS_4 . The finely ground mineral was digested with silver sulphate solution, with which it reacted as follows: $\text{Cu}_{10}\text{Fe}_2\text{S}_8 + 10\text{Ag}_2\text{SO}_4 = 10\text{Ag} + \text{Ag}_{10}\text{Fe}_2\text{S}_8 + 10\text{CuSO}_4$. This proved that the whole of the copper was present in the cuprous state, and that the mineral has the constitution, $5\text{Cu}_2\text{S}\cdot\text{Fe}_2\text{S}_3$.—W. R. S.

Electric furnaces for re-heating, heat treatment, and annealing. T. F. Baily. Proc. Eng. Soc. W. Pa., 1915, 31, 255—272.

THE advantages of electric over fuel furnaces for re-heating are: more accurate temperature control, non-oxidising atmosphere, saving in space, elimination of blast and stack, uniformity of temperature throughout the heating space, and smaller loss of heat. The thermal efficiency varies greatly with the size and capacity: a furnace of 60 kilowatts capacity heating 250 lb. of steel per hour to 1200°C . has an efficiency of 50%; in annealing work (900°C .) a 600-kilowatt 3-ton furnace has an efficiency of 90%. Re-heating furnaces are constructed of fire-brick surrounded by insulating material within a steel shell. Foundry coke crushed to pea-size is used as resistor between the carbon electrodes; the metal to be heated is placed directly over the coke but not in contact with it. Electrically heated soaking-pits compare favourably with gas-fired ones as regards heating cost, and eliminate surface defects in the ingots as well as 2% metal loss due to oxidation. For heat-treating and annealing, the great advantage of the electric furnace lies in the accurate control and uniformity of temperature essential for securing uniform results from day to day. In the automatic continuous furnace the material, on reaching the required temperature at the discharge end, is tipped into the quenching-tank by mechanism controlled by a pyrometer.—W. R. S.

[Ore] flotation; Recent progress in —. O. C. Ralston and F. Cameron. Eng. and Min. J., 1915, 99, 937—940.

IN American ore flotation plants the concentrates and tailings from the first "rougher" machines are usually re-treated in "cleaner" machines. Drag devices for removing froth from the tailing pulp are also much used. Froth in the concentrates may be broken up by spraying with water, but preferably the concentrates are passed direct into a pressure-filter. Mixed sulphide concentrates are run over tables after breaking the froth. Four American plants have adopted processes for selectively floating galena in presence of zinc blende (see Eng. Pats. 16,141 and 16,302 of 1913, and 9049 of 1914; this J., 1914, 869; 1915, 497). In the re-treatment of tailings a further quantity of oil is usually added. Pine oil, eucalyptus oil, or wood creosote is generally used for lead and zinc sulphides, and petroleum products for copper ores. The use of acid in the mill water often improves flotation by removing films of oxide, but in some cases may be harmful. A better grade of concentrate can often be obtained by heating to about 50°C . In Fields' process, flotation is caused by bubbles of hydrogen produced electrolytically in the pulp suspension. Experimental work is being done on the flotation of oxidised copper ores by converting them into sulphide by the action of soluble sulphides.—W. R. S.

Arsenic; Separation of — from tungsten [vanadium, and molybdenum]. T. Dieckmann and S. Hilpert. Ber., 1914, 47, 2444—2446. Chem.-Zeit., 1915, 39, Rep., 121.

THE mass obtained by fusing the finely powdered tungsten, vanadium, or molybdenum ore with sodium hydroxide and sodium peroxide is extracted with water and the residue washed with dilute sodium hydroxide solution, after which arsenic is

determined by neutralising the concentrated filtrate and distilling with a mixture of phosphoric and hydrochloric acids.—J. R.

Arsenic in lead; Determination of — by hypophosphorous acid. L. Brandt. Z. öffentl. Chem., 1915, 31, 66—71. J. Chem. Soc., 1915, 108, ii., 280. (See this J., 1914, 28, 504.)

THE metal is dissolved in hydrochloric acid containing bromine, the excess is expelled by heating the solution, and, after cooling, 20 c.c. of hypophosphorous acid of sp. gr. 1.15 and 50 c.c. of concentrated hydrochloric acid are added. The mixture is heated nearly to boiling for ten minutes, then boiled, the precipitated arsenic collected on a filter, washed with hot dilute hydrochloric acid, then with water, and its quantity estimated by titration with iodine solution. In samples containing a small quantity of arsenic a relatively large weight of the sample may be taken for the estimation, and the greater part of the lead separated as sulphate before the arsenic is precipitated by hypophosphorous acid.

Manganese-gold alloys. N. Parravano. Gaz. Chim. Ital., 1915, 45, I., 293—303.

THE curve representing the solidifying points of manganese-gold alloys falls from 1064°C ., the melting point of gold, to 990°C . at 10.5% Mn, then rises to 1225°C . at 21.8% Mn, falls to 1080°C . at 46% Mn, and then rises to 1247°C ., the melting point of manganese, with a horizontal portion at 50—57.5% Mn, corresponding to a region of partial miscibility in the liquid state. With up to 10.5% Mn the alloys consist of solid solutions; from 10—14% there is an eutectic in addition to the primary crystals. The maximum at 1225°C . corresponds to the compound AuMn. Alloys with 14—30% Mn are composed of a single constituent—either AuMn or a solid solution; from 30 to 46% Mn there is an eutectic in addition to the primary crystals. The saturated solid solution at the manganese end of the series contains about 25% Au. The compound AuMn is represented by a minimum on the curve showing the hardness of alloys containing up to 35% Mn.—A.S.

Alloys of mercury with thallium. P. Pavlovitch. J. Russ. Phys. Chem. Soc., 1915, 47, 29—46. J. Chem. Soc., 1915, 108, ii., 262—263.

THE author has investigated the complete melting-point diagram of the system Hg—Tl, the electrical conductivity of the alloys containing 0—40% Tl, and the hardness, by Brinell's method, of the alloys containing 90—100% Tl. The existence in the fusion diagram of an irrational maximum, not corresponding with simple atomic proportions of the constituent atoms, is confirmed; the composition at this maximum is 29—30 atoms % Tl. The curve of conductivity shows a maximum at 26—28 atoms % Tl, and the potential curve a re-entrant angle at 27—28.4 atoms % Tl, both of these being also irrational points. This irrationality may be explained by the existence of the dissociating compound, Hg_3Tl , which forms with the components solid solutions within the limits 21—31 atoms % Tl. According to Stepanov's rule, the magnitude of the temperature-coefficient of resistance, which approximates to that for pure metals (0.004), indicates the existence of a chemical compound in the α -phase. Within the limits 86—100% Tl, the latter forms with mercury β -solid solutions, characterised by enormously increased hardness.

Palladium and hydrogen. II. A. Sieverts. Z. physik. Chem., 1914, 88, 451—478. J. Chem. Soc., 1915, 108, ii., 268—269. (Compare this J., 1914, 751.)

THE relationship between the quantity of hydrogen

absorbed and the partial pressure was investigated between 138° and 821° C. and at hydrogen pressures between 1 and 760 mm., using the same palladium and the same apparatus as previously employed. With both commercial and pure palladium wire, between the temperature limits mentioned, the quantity of hydrogen absorbed, L_p , by unit weight of palladium is not strictly proportional to the square root of the hydrogen pressure p . The experimental results are better expressed by the equation, $L_p = k_1 p^{1/2} + k_2 p$, in which k_1 and k_2 are constants depending on the temperature; the equation is not true for higher pressures. This expression can be regarded as representing that the hydrogen molecules are in equilibrium with hydrogen atoms, both in solution in the palladium and in the gas phase, and that Henry's law holds strictly for both atoms and molecules. The dissociation constant of hydrogen is 25 at 138°; 109 at 315°; 112 at 619°; and 102 at 821° C. The quantity of hydrogen absorbed by unit weight of palladium depends only on the pressure and temperature, and is entirely independent of the surface area of the metal; consequently, the absorption of hydrogen by palladium is to be regarded as a true solution phenomenon. The isothermals of palladium-black and palladium-sponge are similar to those of compact palladium, but the actual curves are different with different specimens, and are apparently dependent on the nature of the palladium. The similarity of the absorption isothermals in all cases indicates that in palladium-black and palladium-sponge the absorption is mainly due to solution of the hydrogen, at least at temperatures above 100° C. At lower temperatures it is, however, likely that surface adsorption accounts for a large portion of the hydrogen taken up. The above results are in strict accord with the statement (*loc. cit.*) that palladium-black and palladium-sponge are made up of varying quantities of amorphous and crystalline palladium. Both modifications appear to act as solvents for hydrogen with different powers of solution.

Metals; The passage of electricity through — J. J. Thomson. *Inst. of Metals*, May, 1915. *Engineering*, 1915, 99, 577—579.

The limitations of the "free-electron" theory of conduction are considered, and an analogy is established between the passage of an electric current through a metallic conductor under an applied electromotive force and the "flow" of magnetism through a bar of soft iron under a magnetomotive force. According to this hypothesis, all bodies are built up of "dipoles" analogous to the elementary magnets of the iron bar, each consisting of a positive and a negative charge separated by a small distance; the function of the electric force is to cause the dipoles to point in one direction and thus form chains of doublets, the maintenance of which depends on the intensity of the intermolecular collisions or thermal agitations occurring in the material. The dipoles of metals part with electricity much more easily than those of other materials, the pull of adjacent dipoles on each other being resisted in the case of non-conductors, but resulting in the passage of a definite number of electrons per second through any given metal. On this theory the phenomena of dielectric polarisation (Maxwell's displacement current) and the super-conductivity of pure metals at low temperatures (4° C. absolute, obtained by means of liquid helium), observed by Onnes, are satisfactorily explained.—W. E. F. P.

PATENTS.

Iron; Process and furnace for obtaining metallic — from friable ores. Eisenwerk Jagstfeld Ges. m. b. H. Ger. Pat. 282,574, March 13, 1913.

The ore is reduced to spongy iron by carbon

monoxide in a rotary kiln, sintering being avoided, and the reduced iron is transferred to a low shaft furnace, where it is melted with the aid of low-grade fuel and an air blast of low pressure. Part of the carbon monoxide produced by combustion of the fuel is used in the first stage of the process.—A. S.

Iron and steel alloys containing tantalum; Manufacture of — Siemens und Halske A.-G. Ger. Pat. 282,575, March 4, 1913.

TANTALUM is added to the iron or steel in the form of a nickel-tantalum alloy. An alloy of 80 parts of iron or steel with 10 of nickel and 10 of tantalum, for example, possesses great strength, elasticity, and hardness.—A. S.

Furnaces; Metal melting — I. Hall, Birmingham. Eng. Pat. 3035, Feb. 25, 1915. Addition to Eng. Pat. 5664, March 6, 1914 (this J., 1914, 869).

THE valve of the melting pot is actuated and controlled by means of a vertical hand-screw engaging with one extremity of the pivoted lever.—W. E. F. P.

Furnace; Ore-smelting — G. P. Gibson, Braddock, Pa. U.S. Pat. 1,138,651, May 11, 1915. Date of appl., Aug. 6, 1914.

THE apparatus consists of two groups of vertical blast-furnace units arranged, one on either side, above a closed, horizontal melting furnace into which they discharge; the hearth of the latter slopes downwards from the sides to a central metal pit. Each furnace is heated independently.—W. E. F. P.

Crucible-furnace. E. Hallgren, Bellevue, Pa. U.S. Pat. 1,138,866, May 11, 1915. Date of appl., Nov. 14, 1914.

THE melting chamber has an open lower end, stationary side-walls, and a solid roof. The lower end may be closed by a bottom which can be moved vertically by a plunger. Means are also provided for moving the bottom horizontally below the melting chamber out of the path of the vertical movement.—T. ST.

Zinc furnaces; Briquettes for use in — G. S. Brooks, Depue, Ill. Assignor to The New Jersey Zinc Co., New York. U.S. Pat. 1,137,835, May 4, 1915. Date of appl., Nov. 28, 1913.

THE briquettes are composed of 4 parts of ore and 1—1½ parts of coal of the usual fineness, together with 1 part of more finely powdered material, *e.g.*, ore, coal, or zinc oxide. The mixture is formed into a plastic mass with salt solution, briquetted, and slowly dried so as to bring the salt towards the surface, where it forms a protective coating. The briquettes may be made to conform in cross-section to the interior of the retort.—W. R. S.

Ores; Process of leaching — J. A. McCaskell, Salt Lake City, Utah. U.S. Pat. 1,137,874, May 4, 1915. Date of appl., June 2, 1914.

CHLORINE gas is produced electrolytically from saturated sodium chloride solution in a cell, the anode compartment of which is separated from the cathode compartment by a layer of mercury, which absorbs the sodium. The ore is agitated with the chlorine under pressure, and the filtered liquor is then electrolysed in the cathode compartment, the dissolved metal being deposited and sodium chloride regenerated in contact with the mercury.—W. R. S.

Wires, bands, etc.; Process of producing and protecting insulating-coverings of oxide on—. E. W. Küttner, Berlin. U.S. Pat. 1,137,980, May 4, 1915. Date of appl., Sept. 2, 1910.

THE surfaces of coils of wire containing aluminium are oxidised and simultaneously treated with a solution which, after the evaporation of the solvent, will yield a mechanically strong coating on the wires, thereby protecting the oxidised surfaces against damage by pressure. The solution is introduced into the interior of the coil and between the individual turns, the coil being subsequently heated an optional number of times.—T. St.

Case-hardening compound. A. O. Blaich, Chicago, Ill. U.S. Pat. 1,138,073, May 4, 1915. Date of appl., Oct. 18, 1913.

THE compound consists of charred leather impregnated with a small percentage of a sodium salt and of calcium carbonate.—T. St.

Metallurgical apparatus. H. B. Faber, Brooklyn, N.Y. U.S. Pat. 1,138,284, May 4, 1915. Date of appl., Jan. 16, 1905.

PARTS of metallurgical apparatus are formed of such dissimilar metals (hard lead, bronze, etc.) as are capable of resisting corrosion in the presence of a dissociating solvent, and an "iron-glass insulator" is interposed between the parts so as largely to prevent galvanic action.—W. E. F. P.

Metallic compound [alloy]. H. B. Coho, Mount Vernon, N.Y. U.S. Pat. 1,138,845, May 11, 1915. Date of appl., Sept. 22, 1914.

AN alloy of lead and copper containing "needles antimony" (antimony sulphide).—W. E. F. P.

Metals; Recovering—by electrolysis. L. Addicks, Douglas, Ariz. U.S. Pat. 1,138,921, May 11, 1915. Date of appl., Nov. 5, 1914.

METALS, such as copper, are reduced electrolytically in the presence of a depolariser having a solvent action upon the metal, the action being carried out in the presence of a salt, such as aluminium sulphate, which will counteract the solvent action. The salt is present in amount sufficient to reduce materially the action on the cathode, and yet insufficient to deaden its effect.—B. N.

Amalgamator. C. W. Patten, Lynn, Mass. U.S. Pat. 1,139,067, May 11, 1915. Date of appl., Jan. 17, 1914.

A RECEPTACLE of larger diameter at the top than at the bottom contains mercury in its lower portion. Above the mercury is a central vertical shaft carrying a screw-propeller with inclined horizontal blades, the lowest of which are just above the surface of the mercury, and the upper above the overflow edge of the receptacle. A mixture of ore and water is forced through the mercury from below its surface, the ore being elevated and discharged at the overflow edge by the rotation of the propeller.—W. R. S.

Gold-separating mechanism. F. W. Stevens, Newton, Mass., Assignor to A. Hopewell, Wellesley, Mass. U.S. Pat. 1,139,143, May 11, 1915. Date of appl., Jan. 23, 1914.

MERCURY is contained in a receptacle having a bottom sloping downwards towards the centre, and gold-bearing gravel is fed in by means of a screw conveyor through a feed pipe passing up through the centre of the bottom to just above the surface of the mercury. A rotary disc, with inwardly inclined feeding surface partially submerged in the mercury, discharges the gravel at the periphery.—W. R. S.

Amalgamator. F. P. Arnold, Carbondale, Pa., and G. F. Wedeman, Washington, D.C. U.S. Pat. 1,139,324, May 11, 1915. Date of appl., May 23, 1914.

THE amalgamator consists of a receptacle having a narrow open top with means for feed and discharge on opposite sides, and provided with several endless chains, placed vertically, which travel in a direction opposite to the flow of pulp, and act as agitators. The wall of the receptacle on the feed side is parallel to one flight of the agitators, whilst the discharge side is inclined to the other. A vertical partition depending from the centre extends across the vessel, and is shallower than the agitators. The lower part of the receptacle serves as a mercury chamber.—H. R. D.

Ore-separator. H. H. McGovern, Oak Grove, Oreg. U.S. Pat. 1,139,206, May 11, 1915. Date of appl., July 8, 1914.

IN a centrifugal apparatus consisting of two nested bowls, spaced apart and adapted to rotate together about a vertical axis, the inner bowl is open at the bottom and is provided with a central, vertical funnel through which ore-pulp is fed into the lower part; the rims of the bowls have overlying flanges between which means are provided for adjusting the spacing. The pulp is thus divided into two portions, each of which is concentrated and discharged separately.—W. E. F. P.

Ores; Apparatus for treating—. B. MacDonald, South Pasadena, Cal. U.S. Pat. 1,139,428, May 11, 1915. Date of appl., May 6, 1914.

A TANK in which ore is treated with solution is provided with a perforated conical false bottom, forming with the real bottom a receptacle into which the solution flows after percolating through the ore. Means are provided for forcing the solution from this receptacle up a vertical pipe to be discharged again over the ore in the tank. The receptacle is also provided with a pipe for running the solution into a precipitation tank, and with a pipe communicating with a gas chamber. At the base of the false bottom is a shoot for the removal of treated ore.—T. St.

Fusible material [metal]; Coating with—. C. F. Jenkins, Washington, D.C. U.S. Pat. 1,139,291, May 11, 1915. Date of appl., Dec. 16, 1914.

SMALL quantities of the fusible metal are melted successively by the passage of an electric current, and each small quantity is projected violently against the article to be coated by successive actions of highly explosive agents. The expansion due to the partial volatilisation of the metal also has a propulsive and disintegrating action on the molten metal.—T. St.

Tin scrap; Apparatus for detinning—. H. Goldschmidt, Essen, Germany, Assignor to Goldschmidt Detinning Co., New York. U.S. Pat. 1,139,410, May 11, 1915. Date of appl., Dec. 24, 1906.

AN alkaline electrolytic bath is provided with electrodes movable in a circuit into, and out of, the bath. The anodes carry baskets containing the articles to be detinned. The cathodes on leaving the bath are stripped of the spongy tin deposit, and the latter is collected and compressed by insulated rollers.—W. R. S.

Tin; Furnace for the recovery of— from sweepings or residues. Gebr. Karges. Ger. Pat. 280,465, Feb. 28, 1914.

THE roof of the fire-chamber slopes downwards on both sides from the middle and forms the floor of the removable melting chamber above. The

melting chamber is surrounded by an outer casing, and the fire-gases pass upwards through the intermediate space and also through a vertical pipe in the centre of the melting chamber. The tin melts and is tapped off through openings at the bottom.

—A. S.

Zinc, cobalt, and other constituents from the waste liquors obtained in the extraction of copper; Electrolytic recovery of —. J. P. A. Larson and G. K. L. Helme. Ger. Pat. 280,525, Nov. 24, 1912.

ZINC is recovered electrolytically from the waste liquor, and a suitable agent, *e.g.*, a metal, metallic oxide or hydroxide, or a salt capable of being converted into a higher stage of oxidation, is added to prevent the liberation of free acid or chlorine during electrolysis. When electrolysis is complete the solution is diluted to precipitate iron compounds and render it suitable for discharge into streams. The deposited zinc contains some iron, copper, and cobalt, and in the subsequent refining the copper and cobalt are recovered.—A. S.

Bearing metal: Production of a — by spraying W. A. Guertler. Ger. Pat. 280,752, June 18, 1913.

A BEARING metal composed of a soft ground mass of which the chief constituent is lead, with particles of a hard material consisting essentially of iron embedded therein, is produced by spraying the components in the liquid state or in the form of very fine powder, and if necessary with simultaneous or subsequent thermal or mechanical treatment of the product. The lead may be mixed or alloyed with small quantities of zinc, aluminium, tin, antimony, bismuth, phosphorus, or silicon, and the iron may be alloyed with small quantities of nickel, copper, cobalt, manganese, chromium, tungsten, molybdenum, vanadium, titanium, silicon, or carbon.—A. S.

Nickel alloys of high chemical resistance and which can be worked mechanically. W. and R. Borchers. Ger. Pat. 281,784, May 30, 1914. Addition to Ger. Pat. 278,903.

IN order to increase the resistance to high temperatures of the alloys described in the chief patent (this J., 1915, 235), the proportion of gold, or, preferably, of a metal of the platinum group, is increased, *e.g.*, up to 40%.—A. S.

Ores and solid salts; Treatment of — by electrochemical reduction. A. A. M. Hanriot, Paris. Eng. Pat. 11,950, May 14, 1914. Under Int. Conv., May 22, 1913.

SEE Fr. Pat. 469,516 of 1913; this J., 1915, 36.

Zinc and other metallic vapours; Condensation of —. C. V. and J. M. J. Thierry, Paris. Eng. Pat. 13,702, June 5, 1914.

SEE Fr. Pat. 472,879 of 1914; this J., 1915, 558.

Aluminium and aluminium alloys; Compound for welding —. E. Thaulow, Frederiksberg, Denmark. U.S. Pat. 1,139,923, May 18, 1915. Date of appl., March 4, 1914.

SEE Eng. Pat. 5356 of 1914; this J., 1915, 286.

Bismuth; Process for separating — from copper. W. Thum, Hammond, Ind., U.S.A. Eng. Pat. 12,135, May 16, 1914.

SEE U.S. Pat. 1,098,854 of 1914; this J., 1914, 794.

Boiler for utilising waste heat [from regenerative metallurgical furnaces]. U.S. Pat. 1,138,346. See I.

Gas producers, blast-furnaces, or the like. Eng. Pat. 18,381. See IIA.

Method of treating water [and utilising slag]. U.S. Pat. 1,139,618. See XIXb.

XI.—ELECTRO-CHEMISTRY.

Electrochemical reactions caused by passage of a current across the boundary of a gas into an electrolyte. F. Haber and A. Klemenc. Z. Elektrochem., 1914, 20, 485—488. J. Chem. Soc., 1915, 108, ii., 212—213.

TO determine the rôle of the electrode in the oxidation or reduction of depolarisers, sulphuric acid of various strengths was electrolysed in a vessel so constructed that it could be exhausted, and one electrode could be fixed a few mm. above the liquid. Experiments were carried out at a series of temperatures, using in all cases a voltage of 600. When the cathode was in the gas more hydrogen was obtained than the Faraday law demands, whilst persulphuric acid and Caro's acid were formed in the solution. The formation of these substances and of hydrogen peroxide was more noticeable when the anode was in the gas. The concentration of active oxygen (Caro's acid, persulphuric acid, and hydrogen peroxide) increases with increasing concentration of the sulphuric acid up to 45%, when it begins to fall off, and at 75% sulphuric acid there is no formation of these substances. A considerable cooling diminishes the amount of these substances, although the amount produced is still in excess of that demanded by Faraday's law. If oxygen is led into the anode chamber up to a pressure of 131 mm. there is also a decrease in the amount of active oxygen. Increase in the length of time or in the current strength has no marked effect. The results lead to the view that at the electrode a strongly oxidising product is formed from the water. This is taken up by the solution, and is sufficiently stable to oxidise the sulphuric acid, forming persulphuric acid, Caro's acid, and hydrogen peroxide.

Leclanché cells; Depolarisation in —. M. de K. Thompson and E. C. Crocker. Amer. Electrochem. Soc., April, 1915. Met. and Chem. Eng., 1915, 13, 319.

THE greatest depolarising efficiency of mixtures of manganese dioxide and carbon was attained with 55—60% of pyrolusite and with particles of uniform size (0.08—0.1 sq. in. aperture). Depolarisation due to hydrogen was entirely prevented by the manganese dioxide; that due to ammonia was largely overcome by the addition of zinc chloride to the solution.—W. R. S.

Relationship between electrolytic and pure chemical processes. [Action of a mixture of sulphuric acid and hydrogen peroxide on metals.] Reichenstein. See X.

PATENTS.

Storage battery. Electrolyte. R. Hurley, Assignor to J. C. Farr, jun., Hoboken, N.J. U.S. Pats. (A) 1,138,220 and (B) 1,138,221, May 4, 1915. Dates of appl., Dec. 28, 1912.

(A) THE battery is composed of two copper shells, the inner surface of the outer one being coated with zinc amalgam, so that it acts as a negative electrode. The outer and inner surfaces of the inner shell are coated with mercury and zinc amalgam respectively, thus forming positive and negative electrodes. A lead plate in the inner shell acts as a positive electrode. (B) A mixture of lead and zinc sulphates, sulphuric acid, and water.—B. N.

Negative-pole plate for alkaline storage batteries. Electrolyte for secondary batteries. W. Morrison, Des Moines, Iowa. U.S. Pats. (A) 1,139,213 and (B) 1,139,214, May 11, 1915. Dates of appl., Aug. 6, 1913, and Sept. 11, 1914.

(A) AN insoluble zinc-titanium compound, obtained by mixing solutions of a zinc salt and a

soluble titanate, is mixed with a mercury compound and applied as a paste to an electrode support. The mixture is reduced electrolytically in an alkaline electrolyte. (B) Titanic acid is dissolved in sulphuric acid.—B. N.

Electrolytic cell: Method of operating an — [for the production of chlorine]. E. E. Werner, Indianapolis, Ind. U.S. Pat. 1,139,389, May 11, 1915. Date of appl., Aug. 3, 1914.

CHLORINE is generated electrolytically from a salt solution, by continuously introducing into the cathode chamber, at the surface of the electrolyte, a specifically lighter liquid, which dissolves the solid waste products formed in the chamber. The liquid containing the dissolved products is discharged continuously from the chamber at a point above the normal surface of the electrolyte.—B. N.

Insulating material. W. J. Longmore, Bellevue, Pa., Assignor to Westinghouse Electric and Manufacturing Co. U.S. Pat. 1,138,676, May 11, 1915. Date of appl., Feb. 16, 1912.

A SHOWER of mixed mica flakes and finely powdered, dry binding material is distributed upon a heated plate within a chamber, heat and pressure being applied subsequently to the upper surface of the material in the chamber, so as to compress it into an insulating sheet. The process is then repeated, heated plates being used to separate the successive layers of material.—B. N.

Mica insulation: Producing —. J. R. Sanborn, Pittsburgh, Pa., Assignor to Westinghouse Electric and Manufacturing Co., Pa. U.S. Pat. 1,138,691, May 11, 1915. Date of appl., Aug. 10, 1910.

MICA flakes and powdered insulating binding material, in suitable quantities, are projected into the upper portion of a chamber, which is restricted laterally but elongated vertically, and the deposited mass is heated and compressed to convert it into a sheet.—B. N.

Carbon articles [electrodes, etc.]: Manufacture of —. Gebr. Siemens und Co. Ger. Pat. 282,106, Feb. 11, 1914.

COLLOIDAL graphitic acid is used as binding medium for the carbon, and the shaped object is heated to a temperature at which the graphitic acid decomposes, with separation of carbon.—A. S.

Apparatus for electrolysis of alkali chlorides. U.S. Pat. 1,138,400. See VII.

Electrochemical process of treating waters, liquids, and sewage. U.S. Pat. 1,139,778. See XIXb.

Water-purifying apparatus. U.S. Pats. 1,139,969 and 1,139,970. See XIXb.

XII.—FATS; OILS; WAXES.

Fats; Preparation of optically active —. II. *Synthesis of optically active monobromohydrin, epihydrin alcohol, aminopropanediol, and propionin.* E. Abderhalden and E. Eichwald. Ber., 1914, 47, 2880—2888. J. Chem. Soc., 1915, 108, i., 210—211.

THE optically active epibromohydrins (see this J., 1914, 700) were converted into the corresponding monobromohydrins by the action of formic acid and saponification of the resulting formyl-monobromohydrins. Elimination of hydrogen bromide from the monobromohydrins gave rise to the corresponding epihydrin-alcohols, and

these yielded the corresponding aminopropanediols, $\text{NH}_2\text{CH}_2\text{CH}(\text{OH})\text{CH}_2\text{OH}$, by the action of aqueous ammonia. By the prolonged action of propionic acid on *d*-epihydrin-alcohol, a dextro-rotatory ester, mono- or di-propionin, was obtained, which is the first synthetic, optically active fat.

Palm-kernel oil. A. Heiduschka and A. Burger. Z. offentl. Chem., 1914, 20, 361—369. Z. angew. Chem., 1915, 28, Ref., 97—98.

THE following average values are given for palm-kernel oil:—Saponif. value, 253.4; Reichert-Meissl value, 6.6; Polenske value, 9.4; iodine value (Hübl), 15.02; mean molec. weight of non-volatile fatty acids, 228.2. The non-volatile fatty acids consisted of 17.75% oleic acid, 23.27% myristic acid, and 58.98% lauric acid. The total volatile acids, soluble and insoluble (5.20%), contained capric, caprylic, and caproic acids. No stearic, palmitic, linolic, or linolenic acid was found. Fachini and Dorta's method of separating insoluble fatty acids, by treatment of their potassium salts with acetone, is useful as a qualitative test, whilst Heintz's method of fractional precipitation with magnesium acetate gives good results when the quantity of fatty acid is not less than 0.05 gm. —C. A. M.

Fats; Constituents of animal —. *Fat of Equus caballus [horse fat]*. J. Klimont, E. Meisl, and K. Mayer. Monats. Chem., 1914, 35, 1115—1127. Z. angew. Chem., 1915, 28, Ref., 187—188.

FOUR commercial samples of horse fat of about the same consistence were purified and then gave the following values:—Iodine value, 74.9—78.1; acid value, 1.40—2.91; saponification value (3 samples), 193.1—200.4. The sp. gr. was 0.9373 and 0.9461 at 15° C. for two samples and 0.9148 and 0.9184 at 27° C. respectively for the others; the m. pts. were 20—41° C., 22—38° C., 29.5° C., and 33° C. respectively; the fatty acids from two samples melted in both cases at 37—39° C. In the liquid portion of the fat oleic, linolic, and linolenic acids were detected. The solid portion when crystallised repeatedly from acetone to which one-twentieth of its volume of chloroform was added, yielded a glyceride of m. pt. 60° C. and saponification value 197. The fatty acid separated from this glyceride was identified as heptadecylic acid (margaric acid), m. pt. 57—57.5° C., neutralisation value, 208. The fatty acid from goose fat, described as an eutectic mixture of stearic and palmitic acids, also actually consists of heptadecylic acid.—A. S.

Prunus domestica; The oil and amygdalin content of the seed kernels of —. G. Kassner and K. Eckelmann. Arch. Pharm., 1914, 252, 402. Chem.-Zeit., 1915, 39, Rep., 162.

PLUM-STONE kernels from trees grown on well manured soil yielded 42.92% of a pale yellow, fatty oil of mild taste similar to almond oil, having sp. gr. at 15° C., 0.916, acid value 1.44, saponification value 188.1, ester value 186.66, iodine value 104. The kernels contained 1.82% of amygdalin. —T. C.

Strophanthus seeds; Oil of —. H. Matthes and L. Rath. Arch. Pharm., 1914, 252, 683—693. Z. angew. Chem., 1915, 28, Ref., 163.

THE oil from *Strophanthus Kombé* seeds contains 21% of solid saturated and 73% of unsaturated fatty acids. The saturated acids contain 30% of stearic acid and 70% of palmitic acid. The liquid fatty acids are a mixture of 80% of oleic acid and 20% of linolic acid. *Strophanthus* seed oil only contains one phytosterol, sitosterol (m. pt. 137°; acetate, m. pt. 127—128° C.), and does not contain arachidic acid.—F. W. A.

Strophanthus seed oil; Unsaponifiable constituents of —. A. Heiduschka and R. Wallenreuter. Arch. Pharm., 1914, 252, 704—708. Z. angew. Chem., 1915, 28, Ref., 163.

STROPHANTHUS seed oil contains 1-12% of unsaponifiable constituents of which 0.501% is sitosterol. (See also preceding abstract.)—F. W. A.

Dihydroxy- and tetrahydroxy-stearic acid; Separation of —. H. Matthes and L. Rath. Arch. Pharm., 1914, 252, 699—703. Z. angew. Chem., 1915, 28, Ref., 163.

By the oxidation of the liquid fatty acids of *Strophanthus* seed oil with potassium permanganate, 20% of tetrahydroxy- and 80% of dihydroxy-stearic acid were obtained, separation being effected with ether in a Soxhlet apparatus.—F. W. A.

Oils; Action of chlorine on —. L. Meunier and L. Wierzchowski. Collegium, 1914, §10. Z. angew. Chem., 1915, 28, Ref., 98—99.

CHLORINE acts upon oils, forming at 90° C. both substitution and addition compounds. After 9 hours' chlorination a sample of cod liver oil had increased in sp. gr. from 0.9258 to 0.9950; in viscosity at 50° C. from 3.12 to 7.46; had absorbed 12.80% Cl, and contained 6.95% oxidised fatty acids. The emulsifying properties of the oil increased with the degree of chlorination. At the ordinary temperature the chlorinated oil lost only a trace of hydrochloric acid in 3 days. When boiled for three hours with water, 0.72% of the chlorine was replaced by hydroxyl groups. Linseed oil gave the following results when treated with chlorine:—

Duration, hours.	Sp. gr.	Viscosity at 50° C.	Chlorine, %	Increase in weight, %
0	0.9325	2.90	0	0
5	0.9722	4.86	6.88	7.7
10	1.0137	8.00	12.23	14.36

—C. A. M.

Phytosterol in animal fats; Detection of — by precipitation with digitonin. B. Kühn and J. Wewerinke. Z. Unters. Nahr. Genussm., 1914, 28, 369—379. Z. angew. Chem., 1915, 28, Ref., 11.

SEPARATION of the phytosterol and cholesterol by precipitation with digitonin yields more satisfactory results than are obtained by Bömer's method, but the precipitation should be made from the fatty acids and not directly from the glycerides. (See also this J., 1914, 651.)—W. P. S.

Palmitates; Physico-chemical studies of solutions of —. K. Arndt and P. Schiff. Kolloid-Chem. Beihefte, 1914, 6, 201—230. J. Chem. Soc., 1915, 108, ii., 237.

THE authors investigated the electrical conductivity and the viscosity of N/10 and N/100 solutions of sodium and potassium palmitate between 25° and 85° C. Observations were also made in order to elucidate the nature of the coagulation process. The coagulated soap consists of a mixture of acid and normal palmitate, the composition of the mixture varying with the concentration of the solution. Coagulation consists in the reversible transformation of the sol into the gel form, but equilibrium is only attained very slowly. The coagulation temperature depends, not only on the concentration of the solution, but also on the nature of the cation. For the sodium salt, the temperatures are about 30° C. higher than for equally concentrated solutions of the potassium salt. Differences are also found

in the effect produced by the addition of the corresponding chlorides, in that the addition of an equivalent quantity of sodium chloride to N/10 sodium palmitate solution raises the coagulation temperature by 7° C., whilst the addition of potassium chloride to a solution of potassium palmitate has no appreciable effect.

Composition and effects of lupin seeds [due to enzymes]. [Detection of lupin seeds in admixture with castor oil seeds.] Muenk. See XVIII.

Value of sludge from town sewage as a source of fat. Holde. See XIXb.

PATENTS.

Unsaturated organic [fatty] material; Hydrogenating —. C. Ellis, Montclair, N.J. U.S. Pat. 1,138,201, May 4, 1915. Date of appl., April 24, 1912.

THE fat, etc., is mixed with nickel carbonyl and hydrogen and heated to decompose the carbonyl and cause the nickel and hydrogen to act upon the fat, the hydrogenation being then completed at a lower temperature.—C. A. M.

Alkali-free detergent for scouring and dyeing. U.S. Pat. 1,139,326. See VI.

Process of obtaining a substitute for linseed oil or varnish. Ger. Pat. 282,306. See XIII.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Red lead specifications. Oil, Paint, and Drug Rep., May 17, 1915.

THE U.S. Navy Department issued on April 1, 1915, specification No. 52L2a, for red lead, as follows:—Red lead, dry, shall contain not less than 91% of true red lead (Pb_3O_4), the remainder to be practically pure lead monoxide (PbO). It shall not contain more than 0.1% of metallic lead, 0.1% of alkali as Na_2O , and 0.05% of total impurities which include all substances other than lead oxides. It must be of such fineness that not more than 0.5% remains after washing with water through a No. 21 silk bolting cloth sieve. It shall be of good bright colour and equal to the standard sample in freedom from vitrified particles and in other respects. When mixed with pure linseed oil, petroleum spirit, and drier, as per standard formula, viz.: Red lead, dry, 20 lb.; raw linseed oil, 5 pints; petroleum spirit, 2 gills; drier, 2 gills, and applied to a smooth, vertical iron surface, it must dry hard and elastic without running, streaking, or sagging.

Linseed oil varnish; Approximate determination of non-volatile unsaponifiable substances in —. F. Barany. Z. anal. Chem., 1914, 53, 684—685. J. Chem. Soc., 1915, 108, ii., 293.

THE presence of appreciable quantities of mineral oil or rosin oil may be detected and the amount estimated by boiling 10 grms. of the varnish for 20 mins. with 30 c.c. of alcohol and 5 c.c. of aqueous 50% potassium hydroxide solution. The solution is then diluted with alcohol to 50 c.c., shaken with 100 c.c. of light petroleum, and, after addition of 100 c.c. of water, again shaken gently; 50 c.c. of the light petroleum layer is withdrawn, evaporated, and the residue dried at 100° C. and weighed.

Mangostin: a crystalline substance allied to the resins. J. R. Hill. Chem. Soc. Trans., 1915, 107, 595—601.

THE dried skins of the fruit of the mangosteen tree

(*Garcinia mangostana*) contain about 10% of a resin of which about half consists of mangostin, $C_{23}H_{24}O_6$, a colourless, tasteless substance crystallising in small, flat, pale yellow needles, m. pt. 181° — 182° C., possessing many of the physical characteristics of the resins. Mangostin is insoluble in water and in alkali carbonates but readily soluble in most organic solvents and in alkali hydroxides. It contains two phenolic groups, one methoxy group, and one or more amyl groups, and on methylation with methyl sulphate and dilute caustic potash solution yields dimethylmangostin, m. pt. 123° C., crystallising in long silky needles. Mangostin is converted by hydriodic acid into a monohydroxy compound, m. pt. 180° — 181° C., giving a methyl and an acetyl derivative of m. pt. 216° and 218° — 219° C. respectively. Mangostin in alcoholic solution gives a greenish-brown coloration with ferric chloride. Oxidation with nitric acid or potassium permanganate solution converts it largely into oxalic acid.—T. C.

PATENTS.

Oil paints; Preparation of—. W. J. Randall, Bristol. Eng. Pat. 1441, Jan. 29, 1915.

A SOLUTION of a solid mineral hydrocarbon, such as those of the paraffin or olefine series, with or without a solution of a vegetable wax, is added to the usual ingredients of oil paints. The following are two examples of such paint compositions drying with a "flat" and a glossy finish respectively:—(1) Zinc oxide or sulphide, 320 lb.; barium sulphate, 40 lb.; china clay, 40 lb.; and 200 lb. of the following mixture:—a solution prepared by dissolving 1 lb. solid mineral hydrocarbon, with or without $1\frac{1}{2}$ oz. of vegetable wax, in 1 gallon of oil of turpentine at 130° — 140° F. (54° — 60° C.); copal varnish, 1 gall.; oil of turpentine, 1 gall.; Dutch "stand" oil, $\frac{3}{4}$ gall.; driers, $\frac{1}{4}$ gall.; ground calcined borax, 2 oz. (2) Red oxide powder, 400 lb.; boiled linseed oil, 100 lb.; and 150 lb. of a mixture of 1 lb. solid mineral hydrocarbon, with or without $1\frac{1}{2}$ oz. of vegetable wax, dissolved in $\frac{1}{2}$ gallon of oil of turpentine at 130° — 140° F. (54° — 60° C.); copal varnish, 1 gall.; boiled linseed oil, 24 galls.; and driers, $\frac{1}{4}$ gall.—E. W. L.

White pigment [lithopone]; Inalterable—and process of making same. R. B. Llopert, Cordoba, Argentina. U.S. Pat. 1,139,427, May 11, 1915. Date of appl., Feb. 19, 1915.

AQUEOUS solutions of pure zinc sulphate and barium sulphide are mixed, and the precipitate is dried and calcined out of contact with air at about 500° — 700° C. The calcined product is cooled rapidly by immersing in water and changing the water until the lithopone is cold, when it is ground, washed in water, heated to about 80° — 100° C., pressed, and rapidly dried below 100° C.—T. Sr.

Unsaturated hydrocarbons; Production of new compounds of—and of solutions and compositions containing the same. F. E. Matthews and H. M. Elder, London. Eng. Pat. 11,635, May 11, 1914.

COMPOUNDS of sulphur dioxide with unsaturated hydrocarbons are produced by direct combination. This may be effected, for instance, by exposing the mixed liquids to sunlight or ultra-violet light, or in some cases by heating. The examples given are the compounds with pseudo-butylene ($C_4H_8SO_2$), propylene, amylene, and ethylene. The butylene product is a horny or glassy, clear white solid, soluble in chloroform or tetrachloroethane, and not easily inflammable. It can be used for making varnishes, transparent films, etc., and may be mixed with celluloid by first softening both with acetone; it renders the celluloid less inflammable.—B. V. S.

Linseed oil or varnish; Process of obtaining a substitute for—. E. F. Waentig. Ger. Pat. 282,306, June 1, 1912. Addition to Ger. Pat. 272,465.

IN the preparation of a substitute for linseed oil or varnish from animal or fish oils according to the process described in the chief patent (this J., 1914, 604), distillation is effected *in vacuo* at 270° — 285° C., and unsaturated fatty acids or resin acids or their esters are added to the contents of the still when the greater part of the saturated acids has been removed. The treatment with highly superheated steam is stopped before the saturated fatty acids have been completely removed, and distillation is completed with steam at 315° C.—A. S.

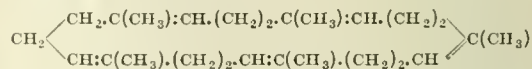
Production of colour lakes from vegetable substances containing the dyestuff as glucoside. Ger. Pat. 281,423. See IV.

Process for coating porous substances [wood]. U.S. Pat. 1,139,470. See IX.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Caoutchouc and allied compounds; Constitution of—. C. Harries and E. Fonrobert. Annalen, 1914, 406, 173—226. J. Chem. Soc., 1915, 108, i., 277—279.

PARA caoutchouc was converted into its hydrochloride and the latter heated with anhydrous pyridine at 125° — 145° C. The regenerate I. thus obtained had the same composition as, but was not identical with, the original caoutchouc. By ozonisation in ethyl acetate solution, it yielded an ozonide, by the decomposition of which by water at about 125° C. the following substances were produced, the percentage being given in brackets: oxygen (0.068), hydrogen (0.044), carbon monoxide (0.183), carbon dioxide (0.845), hydrogen peroxide (1.04), laevulaldehyde (about 9.0), *n*-heptane- β,γ -dione (8.7), undecanetrione (0.9), penta-decanetetraone (0.06), unidentified ketonic fraction (8.29), resinous ketonic fraction (9.3), formic acid (about 18.3), laevulinic acid (about 12), succinic acid (1.5) [not formed in every case], hydrochelidonic acid (1.7), methylcyclohexenone-acetic acid (1.7), unidentified acid fraction (20), resinous acid fraction (6.4), resin from the ozonide (31.00). The production of the heptaredione by the decomposition of the ozonide is well in harmony with the cyclo-octadiene formula of caoutchouc, but not so that of the triketone and the tetraketone; these must be fission products of a larger ring. Moreover, since the heptanedione and the undecanetrione appear to be produced always in a definite ratio, both substances are probably generated by the oxidation of one and the same cyclic structure. Regarding the size of this structure, attention is called to the fact that the molecular weight in benzene of caoutchouc ozonide is 535 ($C_{25}H_{40}O_{15}$ requires 580). Guided by this, and assigning to the natural caoutchouc molecule a C_{20} -ring, the necessity of a formula containing a repetition of the isoprene skeleton leads to the following formula for natural caoutchouc:—



The ozonide corresponding with this will yield only laevulaldehyde and laevulinic acid by its decomposition, but when the caoutchouc is converted through its hydrochloride into the regenerate I. a redistribution of the double linkings may occur; by a shifting of two or more of the double linkings of the preceding formula of caoutchouc, the formation of the di-, tri-, and tetra-ketones, and of hydro-

chelidonic acid is readily explicable. Regenerate I. can be converted through its hydrochloride into regenerate II.; the ozonide of the latter yields by decomposition with water a very much larger proportion of products of high b. pt. (compare Lichtenberg, following abstract) than does the ozonide of regenerate I. Consequently, in regenerate II., a renewed shifting of the double linkings must have occurred. In connection with the new formula of natural caoutchouc, it is noteworthy that the ozonide of "sodium isoprene caoutchouc," although exhibiting in freezing acetic acid a molecular weight corresponding with the formula $C_{16}H_{16}O_8$, yields amongst its products of decomposition acids of the formula $C_{16}H_{22}O_{10}$ and $C_{25}H_{34}O_{10}$, and consequently must have a molecular formula at least $C_{25}H_{40}O_{15}$. A second phenomenon which is unfavourable to the C_8 -ring formula of caoutchouc is the thermal dissociation of caoutchouc hydrochloride. When this compound is heated at $100^\circ C.$ *in vacuo*, it loses hydrogen chloride until the percentage of chlorine has fallen to a value which remains constant at about 12.3. This value is of the same order of magnitude as that required if caoutchouc hydrochloride lost all but one of its mols. of hydrogen chloride.

Caoutchouc hydrogen halides; Transformation products of— and their thermal dissociation. O. Lichtenberg. *Annalen*, 1914, 406, 227—239. *J. Chem. Soc.*, 1915, 108, i., 279—280. (Compare preceding abstract).

THE regenerate I. obtained from gutta-percha is not only very similar in external appearance to regenerate I. from caoutchouc, but its ozonide by decomposition with water yields formic acid, levulinic acid and its aldehyde, and *n*-heptane- β -dione in proportions quite similar to those obtained in the case of the ozonide of regenerate I. of caoutchouc. Caoutchouc-regenerate I. forms a hydrochloride, $C_{16}H_{16} \cdot 2HCl$, pale brown mass, decomp. 145° — $185^\circ C.$, a bromide, $C_{25}H_{40}Br_2$, colourless powder, decomp. 80° — $145^\circ C.$, and a nitrosite, $C_{16}H_{15}O_7N_3$, yellow powder. Regenerate Ia, obtained by heating with pyridine the partly dechlorinated caoutchouc hydrochloride (preceding abstract), is pale brown, transparent, and very elastic. Caoutchouc-regenerate II., obtained from regenerate I. through its hydrochloride, is an elastic, violet-black substance, which is distinctly more soluble than caoutchouc in benzene and forms a hydrochloride, brown powder, decomp. 135° — $185^\circ C.$, bromide, brownish-white substance, decomp. 115° — $145^\circ C.$, nitrosite, yellow powder, decomp. 130° — $135^\circ C.$, and ozonide, golden-yellow, viscous oil. The decomposition of the last compound by water yields formic and levulinic acids, levulaldehyde, and *n*-heptane- β -dione, together with a large quantity of unidentified substances of high b. pt. By prolonged boiling in toluene or xylene, caoutchouc undergoes a change of some sort, but still forms a hydrochloride.

Caoutchouc; Swelling of—in organic liquids. D. Spence and G. D. Kratz. *Kolloid. Zeits.*, 1914, 15, 217—226. *J. Chem. Soc.*, 1915, 108, i., 280.

THE capacity to swell in contact with organic liquids is not common to all kinds of caoutchouc, but is limited to the raw material. Para caoutchouc, which has been washed, dried and rolled, is no longer capable of swelling, and this change in properties appears to be brought about even when the rolling has been continued for a very short period. Different samples of raw Para caoutchouc also exhibit considerable variations in swelling power. Circular discs of Para caoutchouc were immersed in various liquids and from time to time the change in dimensions of the discs and also the increase in weight were determined. If the

liquids are arranged in decreasing order according to the volume of liquid which is absorbed by 1 gm. of caoutchouc when the maximum swelling has been attained, the following series is obtained: (1) carbon tetrachloride and chloroform, (2) carbon bisulphide, (3) benzene, toluene, and xylene, (4) ether. Trichloroacetic acid in less than 1% concentration and acetic acid in less than 10% have no appreciable influence on the maximum swelling or on the velocity of the process, but at higher concentrations trichloroacetic acid increases both the maximum swelling and the velocity, and this effect increases with increasing concentration of the acid.

Rubber; Depolymerisation of raw—. A. van Rossem. *Rubber Industry*, London, 1914, 149—151.

ONE per cent. solutions of plantation Hevea crêpe in xylene were heated at $130^\circ C.$ in a vessel connected with Hempel burettes, so that an absorption of gas could be measured accurately. The apparatus was so designed that a certain amount of gas could be passed through the solution while the total amount of gas in the apparatus remained constant. Samples of the solution could be withdrawn at any moment without air entering the apparatus. It was found that the viscosity of the solutions decreased considerably, but that no oxidation (indicated by absorption of gas) took place until after several hours heating. There is a "critical viscosity limit"—*viz.*, about 1.6—1.3 viscosity-units for solutions of 1% concentration—at which oxidation of the solution begins. Reduction of viscosity proceeds more rapidly in an atmosphere of oxygen than in one of carbon dioxide. It is concluded that oxidation of rubber is always a secondary process, being preceded by depolymerisation, and that depolymerisation is accelerated catalytically by oxygen.—E. W. L.

Vulcanisation; The mass action of sulphur in—. H. Skellon. *Rubber Industry*, London, 1914, 172—177. (See this J., 1913, 876, 1022.)

MIXINGS of Para rubber and sulphur, containing the proportions of the latter indicated in the table, were vulcanised at $140^\circ C.$ for various lengths of time, and the combined sulphur in the vulcanised products was determined by extracting in a Soxhlet apparatus for 20 to 60 hours and oxidising the dried rubber residue with fuming nitric acid. The figures given in the table show parts of combined sulphur per 100 parts of rubber:—

Vulcanisation, hrs.	3% S	5% S	10% S	20% S	30% S	40% S	50% S
1/2	0.37	0.46	0.70	0.74	0.79	0.85	0.96
1	0.47	0.66	1.19	1.31	1.36	1.38	1.52
1 1/2	0.72	1.11	1.84	2.05	2.10	2.20	2.30
3	1.46	2.17	3.72	5.09	5.14	5.22	5.62
6	—	3.03	6.86	14.16	16.66	18.22	20.44
9	—	—	9.73	21.65	34.43	42.5	50.0

Curves drawn by plotting total sulphur content against combined sulphur per 100 of rubber exhibit first an ascending portion and then a more or less flat portion, the points of inflexion corresponding to maxima in curves plotted with total sulphur content against combined sulphur per 100 of mixing. Up to these maxima the curves indicate that the amount of combined sulphur is proportional to the concentration of sulphur in the rubber. Beyond the maxima the rubber is saturated.—E. W. L.

Rubbers; Use of nitric acid as a solvent for compounded and vulcanised—. H. W. Jones. *Rubber Industry*, London, 1914, 189—190.

THE author suggests the use of nitric acid of sp. gr.

1.42 as a means of separating carbon-black from rubber, and of obtaining an indication of the presence of "hydrocarbons."—E. W. L.

Bitumen in rubber mixings; Determination of——. B. D. Porritt and E. Anderson. Rubber Industry, London, 1914, 181—188.

NEITHER pyridine nor carbon bisulphide gives sufficiently trustworthy results when used as solvent for the determination of bitumen in rubber mixings. Attempts were made to effect a separation of the bitumen based upon the observation that it is apparently unaffected by heating with nitric acid (sp. gr. 1.355 at 19.1° C.) for 15 minutes at 100° C. A portion of the bitumen, however, is rendered insoluble in solvents by the action of the acid, and the method fails, partly, at least, for this reason.—E. W. L.

Rubber goods;] Method of determining small amounts of carbon dioxide [in —], in presence of sulphides. H. W. Jones. Rubber Industry, London, 1914, 191—192.

THE separated insoluble portion of the rubber sample is heated in a flask with 10 c.c. of hydrochloric acid and 10 c.c. of water. A current of air, free from carbon dioxide, is aspirated through the flask, and the carbon dioxide is collected in two flasks, the first containing 30 c.c. and the second 15 c.c. of the following reagent:—Barium chloride, 30 grms. in 180 c.c. of water; ammonia (sp. gr. 0.880) 36 c.c.; water "sufficient to measure 300 c.c." In this reagent sulphides are held in solution. The precipitated barium carbonate is rapidly collected, dissolved in hydrochloric acid, and converted into barium sulphate.—E. W. L.

Mineral matter in vulcanised rubbers; A simple method for the determination of——. H. W. Jones. Rubber Industry, London, 1914, 199—201.

Two grms. of the sample is heated with 40—50 c.c. of nitrobenzene in a 200—300 c.c. flat bottom flask, connected to a reflux air-condenser. When solution of the rubber is complete the flask is allowed to cool, the contents diluted with acetone, stirred with a glass rod, and allowed to stand. The mineral matter is deposited rapidly and is separated by decantation, transferred to a weighed filter-paper, and washed well with acetone. In some cases it is advantageous to wash further with alcohol and chloroform, and then to moisten the filter with water so as to obtain a moist and uncaked residue for further examination. Little or no carbon dioxide is eliminated from calcium or magnesium carbonate by boiling for one hour in nitrobenzene.—E. W. L.

Rubber mixings; Determination of the mineral matter in——. B. D. Porritt and R. Wheatley. Rubber Industry, London, 1914, 193—199.

OZONE was passed over dry, powdered vulcanised rubber in a flask, which was shaken repeatedly in order to expose a fresh surface; the sample was then extracted with acetone, and the ash determined in the extracted residue. It was not found possible to render the whole of the organic matter soluble, and in many instances the mineral matter was chemically altered.—E. W. L.

PATENTS.

India-rubber goods; Manufacture of vulcanised — embodying a foundation fabric. W. E. Muntz, London. Eng. Pat. 3158, Feb. 6, 1914.

VULCANISED rubber goods, either before or after the formation of acids due to oxidation of the sulphur, are treated with an alkaline gas or vapour, either generated independently or from substances present in the goods. For example, the goods are immersed in gaseous or liquefied ammonia in a

closed vessel at about 17° C. and 7—15 atmospheres pressure for upwards of 5 minutes. The vessel is preferably exhausted before introducing the gas, and pressure applied afterwards. (See also Fr. Pat. 468,493 of 1914; this J., 1914, 974.) —E. W. L.

Rubber, gutta-percha, and balata; Process for the separation of — from their latices. H. Colloseus. Ger. Pat. 280,848, Nov. 13, 1913. Addition to Ger. Pat. 259,253 (see Eng. Pat. 22,255 of 1912; this J., 1913, 298).

THE latex is treated with such substances as will interact to form insoluble precipitates, a small amount of alkali being added simultaneously or subsequently if the substances added are neutral. The serum which separates from the coagulated rubber, etc., may be used to coagulate fresh portions of latex. Salts of alkaline-earth metals may be used and carbon dioxide employed for the precipitation.—C. A. M.

Polymerisation products of butadiene, its homologues and analogous compounds; Process for the preparation of——. Badische Anilin und Soda Fabrik. Ger. Pat. 281,966, Aug. 2, 1913.

AN elastic compound, which swells up but is only sparingly soluble in the usual solvents, is obtained by polymerising the hydrocarbons at the ordinary or slightly increased temperature by the action of alkali metals or their mixtures or alloys, in the presence of metallic hydroxides or organic hydroxy compounds.—C. A. M.

XV.—LEATHER; BONE; HORN; GLUE.

Tannin, and the synthesis of similar substances. E. Fischer and K. Freudenberg. Ber., 1914, 47, 2485—2504. Chem.-Zeit., 1915, 39, Rep., 125.

TRUTHFUL tannin, prepared from dark Aleppo galls, contains ellagic acid and is much less homogeneous than Chinese tannin. The so-called glucogallic acid, or monogalloylglucose, isolated from Turkish tannin by Feist and Haun (this J., 1912, 1044), is a mixture of gallic acid and tannin; the Turkish tannin examined by the authors gave relatively more dextrose and less gallic acid upon hydrolysis with sulphuric acid, the proportions obtained pointing to the possible existence of a pentagalloylglucose in the tannin. A synthetic pentagalloylglucose was obtained by combining pure β -glucose with the chloride of tricarboethoxygallic acid.—J. R.

Tannins; Biological detection and valuation of——. R. Kobert. Ber. deuts. Pharm. Ges., 1914, 24, 470—495. Z. angew. Chem., 1915, 28, Ref., 155.

A SUSPENSION of red blood corpuscles washed free from serum was treated with solutions of tannin from gall-nuts. It was found that with a suitable quantity of tannin this was adsorbed practically completely from solution, and the blood corpuscles were agglutinated and settled to the bottom; on filtering, the blood corpuscles were retained on the filter, and the filtrate was colourless. When the tannin was recovered by treating the agglutinated blood corpuscles with hot alcohol, part was found to be converted into gallic acid. The latter has no agglutinating action, and the hydrolytic action of red blood corpuscles on tannin can be utilised to determine the tannin content of gall-nuts. With a 1% suspension of red blood corpuscles, complete agglutination was effected by pure tannin at a concentration of 1:25,000 and by the tannin of oak bark at 1:20,000. With Neradol the lowest concentration at which agglutination could be observed was 1:3300.—A. S.

Analysis of lactic acid. Balderston. See VII.

PATENTS.

Di- and poly-hydroxybenzenes; Preparation of water-soluble condensation products of—. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 282,313, Nov. 19, 1913.

A di- or poly-hydroxybenzene, or a homologue or halogen substituted product, in which a *para*-position to a hydroxyl group is free, is dissolved in an indifferent solvent, and treated with acetaldehyde or its derivatives at a low temperature, with addition of acid or basic condensing agents. Water-soluble, syrupy products are obtained which tend to form crystalline substances, and combine with diazo-compounds. The products are of value as tanning materials and for the preparation of therapeutic substances.—F. W. A.

Drying [glue and like materials]; Apparatus and process for—. W. J. Grosvenor, Grantwood, N.J. U.S. Pat. 1,438,751, May 11, 1915. Date of appl., April 9, 1909.

THE air used as drying medium is circulated in a closed cycle, at one part of which it is purified by refrigeration, compression, and impingement against moist surfaces. At another point, the cool and moist air, at less than atmospheric pressure, impinges on the under surface of the glue to form a skin, and at another point, a horizontal current of drier air at a higher temperature and pressure passes over the glue, which is afterwards removed at a point where the pressure is above atmospheric.—W. F. F.

Leather; Artificial—, and process of making the same. L. Lilienfeld, Vienna. U.S. Pat. 1,140,174, May 18, 1915. Date of appl., July 11, 1911. SEE Fr. Pat. 456,261 of 1913; this J., 1913, 953.

Hides or skins; Method for preserving, stripping, and cleaning—. R. Vidal, Asnieres, France. Eng. Pat. 12,952, May 26, 1914.

SEE Addition of Aug. 21, 1913, to Fr. Pat. 435,047 of 1911; this J., 1915, 501.

XVI.—SOILS; FERTILISERS.

Soils; Determination of the sulphur-transforming power of—. P. E. Brown and E. H. Kellog. J. Biol. Chem., 1915, 21, 73—89.

SODIUM sulphide or free sulphur is added to the soil, the moisture content is adjusted to the optimum, and the mixture is incubated for 5—10 days at the ordinary temperature. Sulphates are then extracted by shaking the soil for 7 hours with water, precipitated with barium chloride, and their quantity determined by means of the sulphur photometer. The oxidation of sulphides and sulphur in the soil is brought about mainly by the action of bacteria; sulphides are slightly oxidised when shaken with water for 7 hours, but sulphur shows no change. The sulphur-transforming power of the soils tested varied with the treatment which they had previously undergone. Addition of manures increased the power, and, in general, soils poor in organic matter were low in sulphur-transforming properties. The water content of the soils also influenced the rate of oxidation of sulphur; the oxidation increased with increasing moisture until the optimum, or 50% of the amount necessary for saturation, was reached; further addition of water decreased the oxidation. Aeration up to a certain point, and admixture of sand up to 50%, increased the oxidation of sulphur but the addition of carbohydrates to the soil resulted in a decrease in the oxidation.—W. P. S.

Manganese compounds; Transformations of— in the soil under the influence of micro-organisms. N. L. Söhngen. Zent. Bakt., 1914, [11], 40, 515. Chem.-Zeit., 1915, 39, Rep., 162.

THE formation of mangani- from manganese compounds in the soil depends on the microbiological oxidation of salts of organic acids to bicarbonates, and on the catalytic action of the salts of hydroxy-acids derived from the aerobic decomposition of carbohydrates. Manganic oxides are always converted into manganese compounds when hydrogen sulphide, nitrous acid, peroxides, oxydases, peroxydases, and reductases, or hydroxy-acids are also present. Hydroxy-acids are only produced from cellulose by aerobic decomposition, so that manganese-cellulose discs can be used to determine the number of organisms decomposing cellulose aerobically, which are present in soils. Filter paper is coated with manganic oxide by dipping in manganese sulphate solution and then in permanganate solution. The cellulose-decomposing organisms are thus shown as white spots on the brown background of manganic oxide. Manganic oxides, including finely ground natural manganese minerals, assist aerobic conditions in agricultural soils by removing hydrogen sulphide. In acid soils they convert nitrous acid into the readily assimilable manganese nitrate, destroy deleterious peroxides, etc. The fixation of nitrogen by azotobacter in presence of cellulose is to be attributed to the effect of the calcium salts of hydroxy-acids rather than to the presence of fatty acids.—T. C.

Manganese in soils; Determination of—. B. von Horváth. Z. anal. Chem., 1914, 53, 581—593. J. Chem. Soc., 1915, 108, ii., 285.

THE colorimetric method described by Marshall, depending on the oxidation of manganese salts to permanganate by ammonium persulphate in the presence of silver nitrate (compare Schowalter, this J., 1914, 570), is recommended for the estimation of manganese in soils. The hydrochloric acid extract of the soil is twice evaporated to dryness with nitric acid to expel chlorine and destroy organic substances, the residue is then heated with sulphuric acid to remove the nitric acid, and the process proceeded with as described. Gravimetric and volumetric methods were found to be untrustworthy for the purpose.

Soil bacteria; Culture media for use in the plate method of counting—. H. J. Conn. New York Agric. Expt. Stat., Bull. No. 38, Nov., 1914. 34 pages.

AN ideal culture medium should allow a maximum number of bacteria to develop, should permit of a differentiation between different kinds, and should contain materials of definite composition, thus ensuring uniformity in the counts. A new soil-extract gelatin medium fulfils the two first conditions, and a new sodium asparaginate agar medium complies with the first and third. The former contains 100 parts of soil-extract, 120 of gelatin, 1 of dextrose, and 900 of distilled water, and its reaction should be 0.5% N/1 acid, using phenolphthalein as indicator. The agar medium is composed of 12 parts of agar, 1 of sodium asparaginate, 1 of dextrose, 0.2 of magnesium sulphate, 1.5 of mono-ammonium phosphate, 0.1 each of calcium and potassium chlorides, and 1000 of water. The dextrose and asparaginate are added immediately before sterilisation. Clarification is best effected by steam-heating for 30 mins. and decanting through cotton-wool. The product should require 0.8—1.0% of N/1 acid. The incubation periods are 7 days and 10—14 days respectively, and the temperature 18° C. for both. The agar medium gave quantitative results fully

equal to those of other agar media usually employed. For qualitative work gelatin media are preferable. —E. H. T.

Soil; Bacteria of frozen —. H. J. Conn. New York Agric. Expt. Stat., Bull. No. 35, July, 1914. 20 pages.

THE number of bacteria in a silty clay loam soil was found to increase appreciably when the soil had been frozen for 15 days or more. As the soil was in pots, the increase was not due to bacteria from subsoil. The same effect of frost was observed in the soil in the field. A rise in moisture content was usually followed by a rise in the bacterial number in aerated or non-aerated, frozen or unfrozen soils. Soil that had been recently aerated contained many more bacteria than un-aerated soil. —E. H. T.

Fertiliser soils; Absorption of — by Hawaiian soils. W. McGeorge. Hawaii Agric. Expt. Stat., Bull. No. 35, Aug. 24, 1914. 32 pages.

THE soils of Hawaii are of a strongly basic nature, and the concentration of the highly basic soil solution depends upon the absorptive power of the soil, not upon the solubility of the mineral constituents nor upon the amount of fertiliser added. The absorptive power is influenced greatly by the presence of accumulated humus. Tests were made with a sandy soil rich in magnesia and low in organic matter, a yellow clay, a poor sandy soil, a very productive light soil, and a heavy, red, highly ferruginous clay which is very abundant in the islands. The absorptive powers of these soils were determined by adding mineral solutions to 100 grms. of each, confined in glass tubes of 1-inch diameter, fitted with rubber stoppers and pinchcocks to regulate the flow. The absorption of phosphoric acid from monopotassium and monocalcium phosphate was very great, and the former had a decided deflocculating effect on the clay. The fixation of potassium was marked but less than that of phosphoric acid; it was largely influenced by the amounts of calcium and potassium present. These same factors also controlled the absorption of ammonium-nitrogen. The heavy red clay soil absorbed considerably less phosphate, potash, and ammonium-nitrogen than the other soils. Only highly organic soils exerted any absorbent effect upon nitrogen present as nitrate, but a fresh soil absorbed better than an air-dried soil. Phosphoric acid and ammonium-nitrogen were fixed better by a fresh soil, and potassium by an air-dried soil. Except in the case of nitrates the absorption in the subsoil was better than in the surface soil. Solutions of mixed fertilisers percolated more rapidly than solutions of single fertilisers, hence the application of mixed artificial fertilisers is wasteful. Heat and antiseptics did not influence the absorption to any marked extent. —E. H. T.

Humus; Acids and colloids of —. G. Fischer. Kühn-Arch., 1914, 4, 1—136. J. Chem. Soc., 1915, 108, i., 217.

COLLOIDAL substances were isolated from peat and from cultivated black soil by extracting with cold or hot water, filtering the solution through hardened paper filters, concentrating it *in vacuo* at 30° C., and purifying it by dialysis through parchment. The total ash amounted to 8.6—23.3% of the dry matter of the colloidal substance. The mineral substances present were iron, calcium, potassium, and sodium, and small amounts of magnesium and phosphorus; alumina, manganese, and silica were absent. Unlike the reversible organic colloids, the humus colloids were found to be without protective action on gold hydrosols.

Soil analysis; Vegetation experiments and —. O. Lemmermann. Landw. Versuchs-Stat., 1914, 85, 147—151. J. Chem. Soc., 1915, 108, i., 361.

Two different soils yielded, in three weeks, carbon dioxide corresponding with 13% and 3.5% respectively of the carbon content of the soil. When the soils were mixed with sand so that both mixtures contained the same amount of organic matter, the amounts of carbon dioxide produced were 19% and 15%. The different rates of decomposition depended, therefore, on the character of the soils rather than on the nature of the organic matter. The best method of extracting soils, for estimating solubilities, seems to be continuous percolation of the solvent. This should be possible even with heavy soils, if these are mixed with sand.

Phosphoric acid in soil extracts [containing titanium]; Determination of —. L. G. den Berger. Intern. Mitt. Bodenk., 1914, 4, 16. J. Chem. Soc., 1915, 108, ii., 278.

AN aliquot portion of the hydrochloric acid extract is diluted, boiled, and treated with a slight excess of ammonia. The precipitate is washed twice with hot water, dried on the filter, ignited in a platinum crucible, and fused with 2—4 parts of anhydrous sodium carbonate. It is then extracted with cold water, filtered, and washed until 20 drops of the filtrate gives no residue when evaporated. The residue contains ferric oxide, and all the titanium in the form of sodium hydrogen titanate. The filtrate, which may be turbid owing to ferric oxide passing through, is acidified with nitric acid until the alumina at first precipitated re-dissolves, evaporated down, and the phosphoric acid estimated in the usual manner.

Phosphoric acid in vegetable products and soils; Iodometric determination of —. J. Preisinger and F. Frodl. Z. landw. Versuchs. Oesterr., 1914, 17, 92. J. Chem. Soc., 1915, 108, ii., 278—279.

THE substance (10—20 grms. of hay or straw, etc.) is left overnight with fuming nitric acid (20—25 c.c.), and then heated with strong sulphuric acid (10—15 c.c.) until all the brown fumes are expelled. Nitric acid is then added until the solution is colourless, or slightly yellow. The solution is diluted to 200 c.c., and after the silica has settled, 20—25 c.c. is withdrawn, diluted to 40—50 c.c. with nitric acid, sulphuric acid, and water, so as to contain 1—1.5 c.c. of strong sulphuric acid and 10 c.c. of strong nitric acid, and precipitated by Lorenz's method. The precipitate is left, according to the amount, for two to eighteen hours, filtered, and washed with tap-water until free from sulphuric acid, and is then transferred, along with the filter, to somewhat diluted bromine containing a little $N/2$ sodium hydroxide, rubbed with a glass rod, and diluted to 200—300 c.c. Sodium acetate (5 grms.) and potassium iodide (0.5—1 gm.), followed by a few c.c. of $N/1$ sulphuric acid to precipitate the iodine, are then added, after which the iodine is titrated with thiosulphate solution in presence of starch solution. One c.c. of $N/10$ thiosulphate = 0.000761 gm. P_2O_5 . The bromine solution is prepared by adding 1400 c.c. of bromine water to a cooled $N/1$ sodium hydroxide solution (500 c.c.). The titration can be done by artificial light.

Farmyard manure. R. A. Berry. West of Scotland Agric. College, Bull. No. 65. J. Board Agric., 1915, 22, 131—135.

DURING the winter months in the west of Scotland, the average loss in weight of 8-ton heaps of farmyard manure was 20.6% in the open and 17.5% under cover. Unprotected manure lost 8% more nitrogen than protected, and over 20% of the phosphoric acid and potash, the loss of these in

manure kept under cover being negligible. The average difference of crop-increase for potatoes and turnips was 7% in favour of the manure stored under cover. The loss in weight of exposed cow, pig, bullock, and horse manure (with straw and with peat-moss litter) was 22.3% for the whole; it was much less for horse manure with peat-moss than with straw. The average losses during rotting were: nitrogen 29.6%, phosphoric acid 12.2%, potash 33.5%, organic matter 32%. The effect of rotting was to lower the value of the manures regarded as plant-food, and the crop results showed that the fertilising values were accurately indicated by the chemical analyses. Gypsum and sodium bisulphate were most effective in fixing the ammonia, whereas superphosphate, kainit, and calcium carbonate increased the loss. Farmyard manure applied in the drills to potatoes and turnips in spring, gave a crop-increase of 56% when fresh, 42% when rotted; 9% of these gains was due to the manner of application. Applied broadcast in autumn, the crop-increase was 25%. Ploughing-in in autumn on the turnip field gave a gain of 5% as against broadcasting. On the other hand, the residual value of the manure applied in autumn was greater than that used as a spring-dressing, and it was greater for potatoes than for turnips. When the land was spring-dressed, 18% of the nitrogen was recovered in the crops, but with autumnal dressing only 9%.—E. H. T.

Farmyard manure; Storage of —. F. Löhnis and J. H. Smith. *Fühlings Landw. Zeit.*, March 1, 1914. *J. Board Agric.*, 1915, 22, 158.

To conserve the full nutrient value of farmyard manure, the solid and liquid portions should be collected and stored separately, the latter preferably in peat-moss. The value of the dung and straw fraction is due to its high bacterial content and richness in humus; its nitrogen is but slowly mineralised. The nitrogen of the separated liquid portion is as readily available as that in ammonium sulphate or sodium nitrate. Ordinary farmyard manure often exerts a better effect than the urine-free manure, but the advantage does not persist beyond the first year, and it is more than neutralised by the loss during storage and the incomplete utilisation of the fertilising constituents of the urine.—E. H. T.

Horse manure; Destruction of house-fly larvae in —. F. C. Cook, R. H. Hutchison, and F. M. Seales. *Bull. U.S. Dept. Agric.*, No. 118. July 14, 1914. 26 pages.

THE most effective, economical, and practical means of destroying incipient fly life in horse manure (and other habitats), is by treatment with borax and water. For 10 cub. ft. (8 bushels) of manure, 0.62 lb. of powdered borax is applied around the outer edges of the heap, which are then sprinkled with 2–3 gallons of water, the treatment being repeated when fresh manure is added to the heap. Although killing over 99% of the fly larvae, the treatment does not permanently affect the bacteria in the manure; it causes an increase in the water-soluble nitrogen and the ammonia. As borax-treated manure has not been tested on all crops, its application in dressings of over 15 tons to the acre is not recommended. The cost of treatment is about 4d. per horse per day. Calcined colemanite (crude calcium borate), being much less soluble, is also less effective; it kills many larvae, but, unlike borax, it does not destroy the eggs. Ferrous sulphate is larvicidal but injures the manure. The other substances investigated, *e.g.*, kerosene, copper sulphate, cyanide, Paris green, cyanamide, were either of too poisonous a nature or ineffective.—E. H. T.

Potash; Saw-mill waste as a source of —. C. T. Gillingham. *J. Board Agric.*, 1915, 22, 146–148.

IN some mills wood-scrap, sawdust, and shavings are used as fuel, either alone or mixed with coal, but a very large amount is still available for conversion into ash. Analyses of ash samples show that dust from boiler-flues and chimneys, which is dry and in good mechanical condition, contains the most potash (up to 10% K_2O), whilst ordinary coarse ash contains less (5–7% K_2O). On the basis of the normal price of kainit, these ashes would fetch from 25 to 50s. per ton, and timber-merchants would profit by erecting plant to burn their scrap.—E. H. T.

Vanillin; Field test with a toxic soil constituent —. J. J. Skinner. *Bull. U.S. Dept. Agric.*, No. 164. Jan. 30, 1915. 9 pages. (See also this J., 1914, 1161.)

A POT culture of clover sown in a moderately fertile loam soil containing added vanillin, attained a healthy but very stunted appearance, the weight of the green crop being less than one-half that of the control. The harmful effect of vanillin on wheat in pots was very marked in two cases where the soil was poor, but was not observed in the case of a productive loam. The growth and yields of cowpeas, string beans, and garden peas, tested under field conditions in a silty clay loam soil of an acid nature, were much inferior to those of similar plants grown in untreated soil, the crops of cured hay, marketable beans, and peas, showing a reduction of 39, 69, and 20% respectively. Vanillin was detected in the soil of each crop six months after application. The three soils were then used again for similar plants cultivated in the greenhouse for 26 days. The relative growths were 71, 71, and 94% of plants grown in normal soil. Wheat plants cultivated in the same three soils showed an average reduction in green weight of 73%.—E. H. T.

Phosphoric acid; Use of sodium citrate for the determination of reverted —. A. W. Bosworth. *New York Agric. Exp. Stat.*, *Tech. Bull.* No. 31, May, 1914, 10–12.

THE use of a solution of sodium citrate instead of neutral ammonium citrate for the determination of reverted phosphoric acid in phosphates is recommended. Sodium citrate solution gives more concordant results than ammonium citrate, and the latter suffers also from the disadvantage that loss of ammonia occurs during the determination.

—A. S.

Determination of sulphuric acid and potassium, especially in potash salts. Vaubel. *See VII.*

Quassia as a contact insecticide. Parker. *See XIXB.*

PATENT.

Mono-calcium phosphate; Process of producing —. R. Stewart, Logan, Utah. *U.S. Pat.* 1,137,806, May 4, 1915. Date of appl., June 17, 1914.

PHOSPHATE rock is submitted to the action of smelter fumes in the presence of steam in a rotary furnace. The solution containing mono-calcium phosphate and calcium bisulphite thus obtained, is oxidised electrolytically to convert the bisulphite into calcium sulphate and sulphuric acid, and the solution is concentrated to recover the acid phosphate.—H. R. D.

XVII.—SUGARS; STARCHES; GUMS.

Sugar maple: Organic acids from the sap of the —. E. O. von Lippmann. Ber., 1914, 47, 3094—3095; 1915, 48, 288. J. Chem. Soc., 1915, 108, i., 362.

THE scale which forms on the walls of the evaporating pans in the manufacture of maple sugar (so-called "sugar sand") was found to contain *l*-malic, *d*-tartaric, and tricarballylic acids. (See also this J., 1911, 980; 1914, 508.)

Sugar, dextrin, and starch solutions: Effect of clarification with lead tannate in the polarimetric examination of —. J. Grossfeld. Z. Unters. Nahr. Genussm., 1915, 29, 51—56. Z. angew. Chem., 1915, 28, Ref., 223.

SOLUTIONS of sugar and of dextrin can be clarified for polarimetric examination by means of tannin and lead acetate; the polarisation of sugar solutions is not appreciably affected by the treatment; dextrin is adsorbed by the precipitate to some extent, but the error thus caused is negligible in the case of concentrated solutions, provided only a small quantity of clarifying agent is used. The method is not applicable to starch solutions, as a considerable quantity of starch is absorbed by the lead tannate precipitate.—A. S.

PATENTS.

Sugar juices: Centrifugal device for filtering —. L. G. G. Dibbets. Caguas, Porto Rico. U.S. Pat. 1,138,608, May 4, 1915. Date of appl. Apr. 6, 1914.

THE casing of the centrifugal has two diametrically opposed discharge openings, and means are provided for tilting the casing so that the liquid may be discharged through either of the openings.—J. F. B.

Syrup; Production of a high-grade —. O. Giess. Ger. Pat. 282,810, Nov. 9, 1913.

A SYRUP in which the ratio of sucrose to invert sugar is 5:2, does not crystallise or become turbid on keeping.—A. S.

XVIII.—FERMENTATION INDUSTRIES.

Yeast: Influence of organic acids on —. I. Buromsky. Zentr. Bakt., II. Abt., 1914, 42, 530—557. Z. angew. Chem., 1915, 28, Ref., 150—151.

WHEN yeast is grown in a mineral nutrient solution to which peptone and an organic acid are added, no zymase is formed, but the quantity of oxidising enzyme increases, especially when succinic acid is used. After continued cultivation in such media, the yeast becomes acclimatised and then multiplies more rapidly than at first. If the yeast now be transferred to a medium containing sugar it multiplies more rapidly than in the acid medium, and after 1—3 days it begins to ferment the sugar, though only very slowly at first. In other words the loss of fermenting power extends to several generations but is ultimately regained; hence there is no mutation of the kind specified by De Vries. The rate of multiplication of the yeast in the acid media and in presence of sugar, and the speed with which fermenting power is regained, both vary according to the acid used, being greatest with quinic acid and least with tartaric acid.—A. S.

Yeasts: Influence of organic acids on —. II. Zikes. Allgem. Zeits. Bierbrau., 1915, 43, 1—4. Z. angew. Chem., 1915, 28, Ref., 151.

THE author has shown previously that a potato-water-gelatin medium to which considerable

quantities of acid are added, may be used to separate yeasts from bacteria. Thirty different yeasts and eighty different kinds of bacteria were examined, and all of the former were capable of withstanding 2% of free lactic acid, whereas the latter were scarcely capable of withstanding 0.25%. Lactic acid at a concentration of 0.2—1% acts as a stimulant to yeast, as also do small quantities of tartaric acid, especially towards typical wine yeasts. Yeasts are much less resistant to butyric acid. Acetic acid gives different results according to the kind of yeast: beer yeast is relatively very sensitive, whereas *Mycoderma* are capable of directly assimilating the acid. The effect of acetic acid on wine yeasts can be diminished by vigorous aeration. Formic acid at 0.4% concentration has an injurious action on beer yeast in wort media. Oxalic acid in 1% solution inhibits the fermenting power of yeast within 24 hours, and in 10% solution kills the yeast within 5 minutes.—A. S.

Reductase of yeast. S. Lvov. Biochem. Zeits., 1914, 66, 440—466. J. Chem. Soc., 1915, 108, i., 357—358.

THE relationship between the amount of methylene blue reduced, and the amount of carbon dioxide evolved under various conditions of fermentation, was investigated. The methylene blue was determined by titration with titanium chloride. It was found that for every two mols. of phosphate added to the fermentation mixture, one additional molecular equivalent of methylene blue was reduced. It is suggested that the withdrawal of two atoms of hydrogen from the fermentation mixture under the influence of the reductase converts the complex organic phosphorus compounds, to which the reduction is due, into another product, which is not in the position to bring about reduction. It is not yet decided whether it is the primary organic phosphorus compound formed in the fermentation mixture before the conversion of the hexose into alcohol and carbon dioxide, or the secondary product, the hexose phosphate, which acts as the reducing agent. The addition of sugar in the experiments with dried yeast caused in the first hours of fermentation a doubling of the amount of reduction, which was not observed when maceration juice was employed. This is due probably to the presence of free phosphates in the maceration juice and their absence in the dried yeast. The experiments indicate generally the importance of the reductase in the fermentation process. The two factors, which are necessary for fermentation, and which are removed by dialysis or washing of the yeast, are also necessary for the reduction process.

Invertase. III. Influence of temperature on the "invertase content" of yeast. J. Meisenheimer and L. Semper. Biochem. Zeits., 1914, 67, 364—381. J. Chem. Soc., 1915, 108, i., 358.

TEMPERATURE plays an important part in the enrichment of the invertase in yeast when the organism is allowed to grow in sugar solutions. After twenty-four hours in the beer mash at 25° C., the "invertase-content" is increased four- to five-fold. The optimum temperature for the increase in the mash is about 30° C., but in pure sugar solutions it is about 25° C. A similar increase is not observed when the yeast is kept in water at 25° C., nor is it observed to any extent when kept in sugar solutions at low temperatures. The increase in invertase-content is more or less independent of the strength of the sugar solution, and is thus independent of the growth of the organism. Yeast grown on levulose showed a larger increase in the invertase than that grown on dextrose.

Fermentation of dextrose; Influence of certain acids of biological importance (pyruvic, lactic, malic, and tartaric acids) on the —. C. Neuberg and L. Czapski. *Biochem. Zeits.*, 1914, 67, 51—55. *J. Chem. Soc.*, 1915, 108, i., 359.

The inhibitory action of the above acids on fermentation of the sugar with various races of yeast is in all cases less than that of acetic acid.

Carboxylase in the juice of top yeasts. C. Neuberg and L. Czapski. *Biochem. Zeits.*, 1914, 67, 9—11. *J. Chem. Soc.*, 1915, 108, i., 355.

It is possible to prepare from top yeasts a juice containing a carboxylase which will act both on pyruvic and oxalacetic acids. In the experiments, a commercial dried yeast known as "Florylin," was employed.

Life and fermenting power; Chemical means of separating —. T. Bokorny. *Allgem. Brauer-u. Hopfenzeit.*, 1913, 53. *J. Chem. Soc.*, 1915, 108, i., 360.

The zymase of yeast cells is more resistant to poisons than the plasma. In 0.1—0.5% sulphuric acid yeast cells are killed, but not the zymase. Similar results were obtained with 1% iron sulphate. Potassium chlorate (2—5%) inhibits growth, but not fermentation. Separation of life and fermenting power was also obtained with ammonium fluoride (1—0.1%), potassium and ammonium oxalates (1—0.1%), and formaldehyde (0.1%).

Formaldehyde; Conversion of — into methyl alcohol. Phytochemical reductions. VIII. C. Neuberg and E. Welde. *Biochem. Zeits.*, 1914, 67, 104—110. *J. Chem. Soc.*, 1915, 108, i., 355—356.

The formation of methyl alcohol from formaldehyde when the latter is added to a fermenting mixture of sugar and yeast is confirmed. A yield of about 15% was obtained, the methyl alcohol being estimated in the mixture of methyl and ethyl alcohols by oxidation and colorimetric determination of the formaldehyde formed. The reduction of the aldehyde to the alcohol appears to take place only in the presence of the living yeast.

Enzyme action; Surface tension and —. E. Beard and W. Cramer. *Roy. Soc. Proc.*, 1915, 88B, 575—583.

The inversion of 20% sucrose solutions by small quantities of invertase was found to be perceptibly retarded by the presence of a number of small glass beads in the liquid, i.e., by increasing the surface of the system. The retardation is attributed in part to the fact that the enzyme is "surface active" and therefore tends to concentrate at the surfaces, whereas the sugar remains uniformly distributed throughout the liquid. Preliminary experiments indicate that the phenomenon is not confined to invertase.—J. H. L.

Amylase of potatoes. Plant enzymes. II. G. Doby. *Biochem. Zeits.*, 1914, 67, 166—181. *J. Chem. Soc.*, 1915, 108, i., 362—363.

AMYLASE is always present in the juice of the resting tuber, but the amount is less than that in cereal seeds. The optimum temperature of its action is 40° C., which is less than that of many other plant amylases. Sodium fluoride is a good activator. Sodium chloride and mono- and di-potassium phosphates exert an inhibitory action. Potassium nitrate is without action. Hydrogen and hydroxyl ions in small concentrations activate, but in large concentrations inhibit the enzyme action. The

boiled potato juice has also an activating action. Juice which has been filtered through porcelain loses its activity. The activity is inhibited by sugars in the following (increasing) order: mannose, galactose and sucrose, arabinose, levulose and lactose, dextrose and maltose. The fission products of the enzyme possess, therefore, the greatest power of inhibiting its activity. (See also this J., 1915, 568.)

Tartaric acid in beverages, especially in wines; Determination of —. E. P. Häussler. *Z. anal. Chem.*, 1914, 53, 512—560. *J. Chem. Soc.*, 1915, 108, ii., 291.

EXAMINATION of various methods showed that Halenke and Moslinger's method (*Z. anal. Chem.*, 1894, 34, 279) yields trustworthy results, but in the case of beverages containing but little, if any, tartaric acid, the correction of 0.225 gm. of tartaric acid is misleading. Villiers and Collins' modification of Berthelot and Pleurieu's method (precipitation of the tartaric acid by the addition of potassium bromide and alcohol, and titration of the resulting potassium hydrogen tartrate) is also trustworthy, even in the case of slightly plastered wines. The racemate method (this J., 1910, 451; 1912, 951) was only applied in a few cases, and its accuracy was not definitely ascertained; it appears to be tedious and costly.

Methyl alcohol in brandies; Origin of —. T. von Fellenberg. *Mitt. Schweiz. Ges.-Amt*, 1914, 5, 172. *Chem.-Zeit.*, 1915, 39, Rep., 67.

BRANDIES prepared from grape juice fermented in presence of the marc contain more methyl alcohol than those from juice fermented after removal of the marc. It is concluded that the pectin and protopectin contained in the marc produce methyl alcohol, under the influence of pectase, during fermentation. In an investigation of a number of cellulosic drugs (*Membranindrogen*) methoxy-groups were found only in the celluloses (ligno- and pecto-membranins) containing polysaccharides and in gum tragacanth; those drugs which contained no polysaccharides were free from methoxy-groups.—J. H. L.

Tannins for liqueurs; Adulteration of —. F. Repton. *Ann. Falsif.*, 1915, 8, 118—123.

TANNINS extracted with alcohol or ether from galls are used in the preparation of vermouth and other liqueurs. They contain 82 to 86% tannic acid and 12 to 14% moisture, and are soluble in 95% alcohol. A commercial sample treated with 95% alcohol left a crystalline deposit, which was identified as sucrose. The hide-powder method is recommended for the determination of tannic acid.—C. A. M.

An adulterant of crude and refined tartrates. Carles. See VII.

PATENT.

Mash-filter plate. J. Schaefer, Frankfort, Germany. U. S. Pat. 1,138,251, May 4, 1915. Date of appl., July 30, 1913.

IN a mash filter-press composed of grains-cake frames and water-chamber frames, the filter cloths are supported by bars extending upwards from the base of each water-chamber frame in divergent planes, so that the cakes of grains have a trapezoidal cross section, thicker at the base than at the top, the bottom portion extending into the water-chamber frames beyond the limits defined by the edges of the frames. The grains-cake frames are constructed with a triangular prismatic floor forming a groove in the bottom of the cakes to facilitate their removal.—J. F. B.

XIXA.—FOODS.

Milk of cows ; Cause of acidity of fresh —, and a method for the determination of acidity. L. L. Van Slyke and A. W. Bosworth. New York Agric. Exp. Stat., Tech. Bull. No. 37, Dec., 1914, 4—6.

IN the determination of the acidity of whole milk by titration with alkali in presence of phenolphthalein, the calcium should first be precipitated by treating 100 c.c. of the milk with 2 c.c. of a saturated solution of neutral potassium oxalate; otherwise high results are obtained because dicalcium phosphate, present in the milk and formed during titration, is hydrolysed to form calcium hydroxide and phosphoric acid, and the calcium hydroxide reacts with more dicalcium phosphate to form tricalcium phosphate. If whole milk be titrated direct, about twice as much alkali is required as when the serum obtained by filtering the milk through a porous porcelain filter is titrated. This discrepancy is due, not, as is ordinarily assumed, to the acidity of milk casein, but to retention of dicalcium phosphate by the filter; casein is present in fresh milk as a calcium caseinate neutral to phenolphthalein.—A. S.

Milk ; Effect of sodium citrate in preventing curdling of — by rennin. A. W. Bosworth and L. L. Van Slyke. New York Agric. Exp. Stat., Tech. Bull. No. 34, May, 1914, 3—9.

THE curdling of milk by rennin is retarded or prevented by addition of sodium citrate. No curdling takes place when the quantity of sodium citrate reaches 0.4 gm. per 100 c.c. (1.7 grains per oz.), and with smaller quantities, the softness of the curd increases with the quantity of citrate. The effect is due to a reversible reaction between the sodium citrate and the calcium caseinate of the milk, with formation of calcium-sodium caseinate, which latter yields a soluble calcium-sodium paracaseinate by the action of rennin.—A. S.

Casein ; Action of rennin on —. A. W. Bosworth. New York Agric. Exp. Stat., Tech. Bull. No. 37, Dec., 1914, 10—11.

SPECIMENS of pure paracasein, prepared from fat-free milk by the action of rennin and of trypsin respectively, were found to have the same percentage composition, identical with that of pure casein (this J., 1914, 609). This proves that in the production of 2 mols. of paracasein from 1 mol. of casein by hydrolysis, there is no cleavage of any of the elements contained in the original casein molecule. It is probable that the cleavage of nitrogen, phosphorus, and calcium, stated by Harden and Macallum (Biochem. J., 1914, 8, 90) to occur when caseinogen is converted into casein by enzyme action, follows rather than accompanies this conversion.—A. S.

Clotted cream. W. Sadler. J. Board Agric., 1915, 22, 105—116.

THE addition of water to the milk before the pans are set to separate the cream, is found to act adversely on the flavour, texture, and keeping quality, and it does not affect the fat-content or add to the actual weight of the cream. The value of the scald milk is also lowered, and the amount of sediment remaining in the pan is not diminished. With a suitable rich milk, clotted cream can be made in any locality, due care being taken to maintain during scalding a uniform temperature of 180°—185° F. (82°—85° C.) for a uniform time (25—30 min.). The yield is about 1 lb. of cream from 20.5—23 lb. of milk. The flavour and keeping quality are mostly determined by bacteriological factors. Cream with a characteristic flavour is made by scalding for 1½—2 hours over the glowing embers of a peat fire. Samples of

clotted cream investigated kept well for 36, 48, and 60 hours respectively after skimming.

—E. H. T.

Milk ; Alcohol reaction of —. A. Auzinger. *Molk. Zeit.*, 1914, 28, 457. *J. Chem. Soc.*, 1915, 108, ii., 293. (See this J., 1914, 1106.)

NORMAL milk to which a small amount of fresh rennet has been added, gives a precipitate at once with 68% alcohol, indicating that rennet causes an immediate change in milk, liberating calcium salts. The greater the amount of soluble calcium salt present, the sooner is coagulation produced by alcohol. Most single samples of milk fail to coagulate with alcohol after being boiled, if the acidity is normal. Addition of various substances, such as sodium fluoride, ammonium oxalate, formaldehyde, etc., interferes with the alcohol test; substances which precipitate calcium prevent coagulation, whilst soluble calcium salts increase coagulation. The milk of cows fed with calcium phosphate is coagulated with alcohol of lower concentration than milk from control cows. Alcohol of 70% by vol. is recommended.

Lecithin in milk ; Methods of determination of —. N. A. Brodrick-Pittard. *Biochem. Zeits.*, 1914, 67, 382—390. *J. Chem. Soc.*, 1915, 108, ii., 293—294.

BUROW's method (*Z. physiol. Chem.*, 1900, 30, 495) of determining lecithin in milk consists in dropping the sample into a mixture of equal parts of alcohol and ether acidified with acetic acid, evaporating the filtrate at a low temperature, extracting with dry ether, and determining the phosphorus in the ethereal extract. The process is liable to give inaccurate results if the evaporation residue is not dried before extraction; drying is conveniently effected with anhydrous sodium sulphate.

Cheese ; Ripening of Neufchâtel —. O. Laxa. *Z. Unters. Nahr. Genussm.*, 1914, 28, 387—392. *Z. angew. Chem.*, 1915, 28, Ref., 12.

THE ripening of Neufchâtel cheese is brought about by practically the same kind of aerobic organisms that cause the ripening of Camembert cheese; the growth of the organisms on the surface of the cheese is accompanied by the formation of enzymes which pass into the interior and hydrolyse the proteins. Casein is the principal protein attacked, and it is converted into albumoses, peptones, ammonia, and volatile acids; in the inner portions of the cheese albumoses and peptones predominate and only small quantities of amides are found. Ammonia is distributed uniformly throughout the cheese. The greater decomposition which takes place in the outer layer of the cheese causes an increase in the quantities of fat and ash in this portion.—W. P. S.

Lupin seeds ; Composition and effects of — [due to enzymes. Detection of lupin seeds in admixture with castor oil seeds.] G. Muenk. *Landw. Versuchs-Stat.*, 1914, 85, 393—416. *Bull. Agric. Intell.*, 1915, 6, 443—444.

BESIDES a diastatic enzyme and others which respectively decompose glucosides and peptones and produce changes in urea, lupin seeds contain an enzyme, hitherto unknown, which converts starch and certain sugars into lactic acid. Blue lupin seeds also contain a non-toxic, agglutinating enzyme which is rapidly destroyed at 70°—75° C. This fact may be utilised to detect their admixture with castor-oil seeds, since the ricin of the latter is not affected at this temperature.—E. H. T.

An adulterant of crude and refined tartrates. Carles. *Sec VII.*

PATENTS.

Milk; Condensed — [containing other food substances]. J. M. C. L. Renard, Blois, France. Eng. Pat. 10,588, April 29, 1914.

MILK, before or after concentration, is mixed thoroughly at 100° C. with a suitable proportion of coffee, chocolate, tea infusion, Japan glue, or gelatin, and the mixture is sealed in tins. Flavouring substances, such as vanilla, almond, or lemon, may also be added. (Reference is directed to Eng. Pats. 897 and 1596 of 1876, 3087 of 1877, 1315 of 1882, and 15,387 of 1885).—W. P. S.

Milk; Method of pasteurising —. H. Feldmeier and C. B. Dalzell, Assignors to D. H. Burrell and Co., Little Falls, N.Y. U.S. Pat. 1,138,097, May 4, 1915. Date of appl., June 9, 1911.

MILK is passed rapidly in a stream of small cross-sectional area through a heater where it is heated to a pasteurising temperature, then flows slowly through a pasteurising apparatus, and afterwards through a cooling apparatus.—W. P. S.

Milk powder; Process of producing soluble —. G. D. Harris and J. S. Pollard, Bayonne, N.J., Assignors to General Dehydrator Co., New York. U.S. Pat. 1,138,380, May 4, 1915. Date of appl., Sept. 28, 1912. Renewed Oct. 14, 1914.

MILK at 37° C. (98° F.) is sprayed into dry air heated to 37° C., and the air carrying the milk in suspension is expanded and mixed with further quantities of dry air whilst passing through a chamber in which its temperature is maintained at about 37° C.—W. P. S.

Milk and other liquids easily decomposed by heat; Sterilisation of —. O. Lobeck. Ger. Pat. 282,027, Feb. 21, 1913.

THE milk or other liquid is first passed over a surface heated to above the sterilising temperature, and then kept in contact for the requisite time with a surface heated to the sterilising temperature. By thus heating the liquid suddenly to the requisite temperature sterilisation can be effected more rapidly and at a lower temperature than by the usual methods.—A. S.

Meat products; Preparation of predigested —. H. Watkins-Pitchford, Weybridge, Surrey. Eng. Pat. 19,087, Aug. 26, 1914. (See also Eng. Pat. 19,431 of 1912; this J., 1913, 956).

LEAN minced meat is washed with warm water to remove salts and extractives, and digested with papaw fruit juice, papain, pepsin or other enzyme for 3 hrs. at 40° C. The mixture is then boiled for 30 mins., filtered, and the filtrate evaporated *in vacuo* to a syrup which is mixed with 20% of glycerin or other excipient. The product may be dried *in vacuo*. The fluid obtained may be combined with other food materials, such as cod liver oil, milk, wine, etc.—J. H. J.

Organic substances; Process of conserving —. H. Goslar, Aachen, Germany. U.S. Pat. 1,138,602, May 1, 1915. Date of appl., Aug. 6, 1914.

FLESH, blood, animal glands and juices, fruit juices, or vegetables are mixed with fibrin- and gluten-containing substances, and the mixture is moistened, and rolled into thin sheets, which are dried quickly at a low temperature.—W. P. S.

XIXB.—WATER PURIFICATION; SANITATION.

Water; Determination of dissolved oxygen in —. L. W. Winkler. Z. anal. Chem., 1914, 53, 665—672.

THE following modification of the author's well-known method is described for the determination

of dissolved oxygen in water containing both nitrites and organic substances. A bottle is filled with the water, manganous chloride solution and sodium hydroxide solution (free from potassium iodide) are added in the usual way, and a current of carbon dioxide is then passed into the water. The manganous hydroxide is thus converted into manganous carbonate and bicarbonate; about 10 minutes' treatment with carbon dioxide is sufficient. The precipitate is collected on a filter, washed with 2% potassium bicarbonate solution, then dissolved in dilute hydrochloric acid containing potassium iodide, and the liberated iodine titrated with thio-sulphate solution. The manganous carbonate is not oxidised by atmospheric oxygen during the filtration.—W. P. S.

Reducing power of natural waters; Determination of the —. L. W. Winkler. Z. anal. Chem., 1914, 53, 561—564. J. Chem. Soc., 1915, 108, ii., 287—288.

THE following procedure is recommended for waters containing nitrites, ferrous salts, and manganese salts: 100 c.c. of the water is treated with 1 c.c. of 10% sodium hydroxide solution, and set aside for five minutes; ferrous and manganous salts are thus oxidised by the dissolved oxygen in the water. Ten c.c. of *N*/100 alkaline potassium permanganate solution is added, and after the lapse of twenty-four hours the mixture is acidified with 25% phosphoric acid solution (this is preferable to sulphuric acid as it prevents the action of the ferric salts on potassium iodide), potassium iodide is added, and the iodine titrated with thio-sulphate. Another portion of the water is also treated with sodium hydroxide solution to oxidise the ferrous and manganous salts, permanganate solution is then added, and the excess titrated after two minutes' contact. The nitrites are thus oxidised, whilst the organic matter is not appreciably attacked; the result is a measure of the substances, other than organic matters, which reduce permanganate.

Sludge from town sewage; Value of — as a source of fat. D. Holde. Seifensieder Zeit., 1914, 41, 1151—1153. Z. angew. Chem., 1915, 28, Ref., 13—14.

THE sludge is subjected to a preliminary treatment with acid and extracted with a solvent; the extracted sludge is pressed to remove the greater part of the water and, when mixed with one-fourth of its weight of coal, serves as a fuel, or it may be used directly as a fertiliser. The crude fat, separated from the solvent, is dark brown in colour; on distillation it yields a product consisting of about equal parts of stearine and oleine, about 20% of pitch remaining in the retort. The stearine, separated from the oleine by pressure, has m. pt. 45.3° C. and contains 6.1% of unsaponifiable substances; the dark brown oleine contains 19.4% of unsaponifiable substances.—W. P. S.

Quassia as a contact insecticide. W. B. Parker. Bull. U.S. Dept. Agric., No. 165. Dec. 31, 1914. 8 pages.

A SOLUTION of quassia containing 0.4 gm. in 2000 c.c. of water was found to be only slightly inferior to a 40% solution of nicotine sulphate in exterminating the hop aphid (*Phorodon humuli*, Schrank) and the prune aphid (*Hyalopterus pruni*, Fab.) in a moist district of California. The cost of the materials for 100 gallons of spray is given as 24 cents (1s.).—E. H. T.

Destruction of house-fly larvæ in horse manure. Cook and others. See XVI.

PATENTS.

Filters [; *Sand* —]. F. H. Desrumaux. Paris. Eng. Pat. 13,481, June 2, 1914.

IN a sand filter which is cleaned by reversal of the current, the scraper for the filtering material is operated through reducing gear by a turbine in a central compartment, which can be worked either by the unfiltered water, or by the filtered water when the flow is reversed.—W. F. F.

Detritus; *Process for separating* — *from liquids*. J. M. Davidson. Assignor to W. B. Scaife and Sons Co., Pittsburgh, Pa. U.S. Pat. 1,138,634, May 11, 1915. Date of appl. Jan. 7, 1914.

THE mixture is filtered through a bed of granular material, a current of air being passed upwards through the bed to prevent the choking of the surface by a layer of the detritus. When filtration is finished, the detritus on the surface is dried by reversing the current of air or by substituting a heated gas. Instead of air, a fluid lighter than the liquid being filtered may be passed upwards through the filter and subsequently passed downwards to dry the deposited cake; or for the latter purpose, a current of steam may be used.—J. H. J.

Sewage or other wastes; *Process of purifying* — *and apparatus therefor*. L. C. Frank. Washington. D.C. U.S. Pat. 1,139,024, May 11, 1915. Date of appl. April 2, 1915. (Dedicated to the public.)

THE sewage is led down by a pipe to the bottom of the central chamber of a tank and flows upwards. Air is admitted, also at the bottom, and oxidises the sewage, which overflows at the top of the chamber into two V-shaped side chambers where settling takes place; the deposited solids fall through openings at the bottom of the side chambers into the central chamber, while the clear liquid passes to the effluent channel.—J. H. J.

Sewage disposal; *Apparatus for* —. J. M. Davidson. Assignor to W. B. Scaife and Sons Co., Pittsburgh, Pa. U.S. Pat. 1,139,402, May 11, 1915. Date of appl. Nov. 29, 1912. Renewed April 9, 1915.

A CLOSED horizontal tank has a filtering layer of sand in its lower portion through which sewage is forced by pressure. The sludge collected on the surface is dried by forcing air through it, and is removed through manholes in the side of the tank at the sand level.—J. H. J.

Waters, liquids, and sewage; *Electrochemical process of treating* —. C. P. Landreth. Philadelphia, Pa. U.S. Pat. 1,139,778, May 18, 1915. Date of appl. Oct. 12, 1914.

THE putrescent liquid is treated with sufficient calcium hydroxide to render it distinctly alkaline and to produce a flocculent precipitate. An electric current is passed through the mixture, producing nascent oxygen, which acts on the putrescent material, so that a non-putrescent effluent charged with oxygen is obtained.—J. H. J.

Water; *Method of treating* — [and utilising slag]. W. H. Williams, Sharpsburg, Pa. U.S. Pat. 1,139,618, May 18, 1915. Date of appl. May 4, 1914.

MOLTEN slag is run into the water in a tank and is disintegrated, whilst certain of the mineral constituents dissolve in the water. The solution is drawn off from time to time and used for industrial purposes, the tank being supplied with more water.—J. H. J.

Water-purifying apparatus. H. B. Hartman, Assignor to Electric Water Sterilizer Co., Scottdale, Pa. U.S. Pats. (A) 1,139,969 and (B) 1,139,970, May 18, 1915. Dates of appl. Aug. 12, 1913, and June 11, 1914.

(A) THE apparatus comprises a coagulation

chamber and a filter chamber, containing a filter bed with a screen above the material, which is washed by reversing the flow of water. (B) The water is first electrolysed and then passed through the coagulation and filter chambers. The precipitate produced in the electrolysing chamber is mixed with water from the coagulation chamber and is then passed to the filter bed.—J. H. J.

Animal-dip; *Preparation of a concentrated* —. R. M. Chapin, Washington, D.C. U.S. Pat. 1,137,844, May 4, 1915. Date of appl. May 28, 1914. (Dedicated to the public.)

TEN lb. of arsenious oxide is dissolved in a solution of 4 lb. of caustic soda in one gallon of water, the mixture being stirred continuously, whereby the temperature is maintained at near the boiling point; 10 lb. of crystallised sodium carbonate is added and the mixture diluted to 5 gallons. This concentrated solution may be diluted to an appropriate extent. There is then added to it a mixture of 0.5 lb. of caustic soda, 1 quart of water, and 1 gallon of pine tar.—J. H. J.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Pareira root; *Alkaloids of the* —. M. Scholtz and O. Koch. Arch. Pharm., 1914, 252, 513—536. Z. angew. Chem., 1915, 28, Ref., 163.

PAIREIRA root contains mainly bebeerine, or sometimes β -bebeerine. Bebeerine, isobebeerine, and β -bebeerine are isomeric compounds. Iso-bebeerine is an isoquinoline derivative and an isomeride of codeine. As the free hydroxyl group is phenolic in character, isobebeerine resembles morphine in its behaviour towards several reagents. Iso-bebeerine is not a febrifuge, but is a narcotic.—F. W. A.

Kombé strophanthin. D. H. Brauns and O. E. Clossou. Arch. Pharm., 1914, 252, 294—341. Chem.-Zeit., 1915, 39, Rep., 131.

GENUINE Kombé strophanthin seeds contain a crystalline, glucoside strophanthin, $C_{40}H_{56}O_{15} \cdot 3H_2O$, and a closely related amorphous strophanthin of probably double the molecular weight. The former is converted by water into an amorphous, monobasic, acid derivative, which, like both strophanthins, is hydrolysed to strophanthidin, $C_{27}H_{34}O_7 \cdot H_2O$, m. pt. 169°—170° C., by dilute acids. Crystalline Kombé strophanthin does not contain a pentose or a rhamnose, but yields a disaccharide and methyl alcohol on acid hydrolysis. Amorphous strophanthin appears, however, to contain a pentose. The crystalline strophanthin and its acid derivative act as heart tonics, the latter having the weaker effect.—T. C.

Harmine and harmaline; *Therapeutic value of* —. Chem. and Drug., June 5, 1915.

EXPERIMENTS on prisoners in Lahore Central Gaol have shown that harmine and harmaline (from the seeds of *Peganum Harmala*, L.) are not so effective as quinine in the treatment of malaria, and further they produce nausea and giddiness. (Compare this J., 1915, 570.)

Anhydrogitalin and a by-product of the manufacture of digitoxin. H. Killian. Ber., 1915, 48, 334—349. J. Chem. Soc., 1915, 108, i., 281—282. (See also this J., 1914, 216, 1071.)

ANHYDROGITALIN is prepared by the addition of ether to a solution of gitalin in methyl alcohol and chloroform (equal volumes). It has m. pt. 255°, after sintering at 250° C. Analyses agree with

former case an acylhydrazine is first formed, which is partly oxidised by the available oxygen atom of the unchanged peroxide to the corresponding azo-compound; in the latter case, larger quantities of other products are formed.

The preparation of the peroxides is generally effected by the action of oxygen under slight pressure on a solution or suspension of the hydrazone in benzene or petroleum.

Secondary amides; New method for the preparation of —. K. Brunner. Ber., 1914, 47, 2671—2680. J. Chem. Soc., 1915, 108, i., 224—225.

POTASSIUM cyanate reacts with acetic anhydride diluted with benzene or ether, in accordance with the equation



The nitrogen compound (probable constitution $\text{CH}_3\text{CO}.\text{OC}(\text{CH}_3) : \text{N}.\text{COCH}_3$) is a colourless liquid, b. pt. $86^\circ\text{--}90^\circ\text{C}$. at 11 mm., solidifying to rectangular leaflets, m. pt. $7^\circ\text{--}8^\circ\text{C}$.; when heated under ordinary pressure it yields diacetamide and a carbonaceous residue. Diacetamide is also produced when the new substance is exposed to the atmosphere for a short time, and in the absence of special precautions, diacetamide is the usual product of the interaction of potassium cyanate and acetic anhydride. Good yields of secondary amides can be obtained in a similar way from propionic, butyric, and isobutyric anhydrides, but with benzoic anhydride the yield of dibenzamide is very poor, small quantities of tribenzamide and benzonitrile also being obtained. Potassium thiocyanate exhibits similar behaviour to the cyanate towards acetic anhydride, giving diacetamide. Semicarbazide hydrochloride is a convenient reagent for distinguishing secondary from primary amides. With the latter class of compound no appreciable change is obtained in aqueous solution with this substance to which a little potassium acetate has been added, whereas diacetamide under these conditions gives a deposit of hydrazoformamide.

Methylenediamine. P. Knudsen. Ber., 1914, 47, 2698—2701. J. Chem. Soc., 1915, 108, i., 220.

DIFORMOMETHYLENEDIAMIDE, $\text{CH}_2(\text{NH}.\text{COH})_2$, was prepared by heating together 60 grms. of trioxymethylene and 180 grms. of formamide for 4—5 hours under a reflux condenser; yield, 77 grms. Hydrolysis of this by concentrated hydrochloric acid gave rise to 57 grms. of methylenediamine dihydrochloride, colourless, hygroscopic prisms. By hydrolysis with nitric acid, the nitrate was obtained in prismatic crystals which on heating melt and then explode; the sulphate, small crystals, was obtained by hydrolysis with sulphuric acid of 50% concentration. It was not found possible to isolate the free base; solutions in such solvents as alcohol are fairly stable and have an ammoniacal odour. The hydrochloride decomposes rapidly in aqueous solution, producing formaldehyde; when heated with formaldehyde solution the hydrochloride reacts, forming methylamine hydrochloride and carbon dioxide.

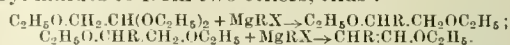
Formaldehyde and ammonia; The Plöchl reaction between —. P. Knudsen. Ber., 1914, 47, 2694—2698. J. Chem. Soc., 1915, 108, i., 220—221.

THE reaction between formaldehyde and ammonia or amines discovered by Plöchl, which has been used for the preparation of trimethylamine (Eschweiler, Berichte, 1905, 38, 880; Koeppen, Ber., 1905, 38, 882) and of methylamine (Brochet and Cambier, Comptes rend., 1895, 120, 449), can be applied also to the preparation of dimethylamine by distillation of a solution of ammonium

chloride in a sufficient excess of formaldehyde solution under ordinary pressure; the distillate from 100 grms. of ammonium chloride and 1 kilo. of 40% formaldehyde solution contained 5.7 grms. of ammonium chloride with 11.3, 66.1, and 44.4 grms. respectively of the hydrochlorides of methylamine, dimethylamine, and trimethylamine.

Aldehydes; New syntheses of —. I. E. Späth. Monats. Chem., 1915, 36, 1—12. J. Chem. Soc., 1915, 108, i., 262—263.

ETHOXYACETAL reacts with magnesium alkyl or aryl halides to form two ethers, thus:



These ethers are readily hydrolysed to the same aldehyde, and the method offers a convenient synthesis even of sensitive aldehydes. Several substituted phenylacetaldehydes are described; they all possess fragrant odours. Ethoxyacetal, b. pt. $57^\circ\text{--}58^\circ\text{C}$. at 11 mm., was prepared from bromoacetal (Freundler and Ledru, Comptes rend., 1905, 140, 794) by heating it with a cold concentrated solution of sodium ethoxide, and was purified by boiling with sodium. The aldehydes were prepared by adding ethoxyacetal to the Grignard reagent, heating the mixture under a reflux condenser (allowing the solvent ether to escape), decomposing the product by dilute hydrochloric or acetic acid, isolating and distilling the mixed ethers, and allowing these to drop into boiling, about 50% sulphuric acid at such a rate that the products distilled over in the steam. The aldehydes were isolated from the ethereal extract of this distillate by means of sodium bisulphite, and the unchanged ethers submitted to hydrolysis again.

Attempts were also made to prepare chlorohydrins by the interaction of chloroacetaldehyde with magnesium alkyl or aryl halides and to convert these into glycol ethers and then into aldehydes, but in most cases ethylene oxides were obtained.

Tautomeric, isomeric, and polymeric substances; Method of distinguishing — from polymorphic substances. N. V. Sidgwick. Chem. Soc. Trans., 1915, 107, 672—678.

WHEN a substance occurs in several modifications this may be due either to a difference in the structure of the molecules (tautomerism, dynamic isomerism, or polymerism) or in the arrangement of the molecules in the crystal (polymorphism). In the latter case the difference disappears when the substances are dissolved or vaporised. If a substance occurs in two forms and a quantity of the less soluble form be added to a saturated solution of the more soluble form, the total concentration will not increase, but may possibly diminish, if the substances are polymorphic, whereas if the two forms are tautomeric, the less soluble form will dissolve in the solution, irrespective of the presence of the more soluble form (unless the tautomeric change is very rapid), and the concentration will increase. The change in concentration is readily ascertained by determining the freezing point of the pure solvent, adding successively small quantities of the finely powdered, more soluble modification until the solution is saturated, shown by the freezing point remaining constant, and then adding successive small quantities of the finely powdered, less soluble form until the freezing point is again constant. A lowering of the freezing point on the addition of the less soluble form (corresponding to an increase of concentration) indicates that the two forms are tautomeric or isomeric. If only a small depression of the freezing point is obtained on the addition of the less soluble modification, the depression given by this alone

in the pure solvent should be determined. By this method, using benzene as the solvent, it was found that the two phthalylphenylhydrazides, m. pt. 181° C., are polymorphic, whilst the third form, m. pt. 216° C., is isomeric or tautomeric; the two phthalylphenylmethylhydrazides, white and yellow, the two forms (needles and stout prisms) of *p*-bromoacetanilide and 2,4-dibromoacetanilide, the yellow *p*-nitrophenol insensitive to light and the yellow form sensitive to light, are in each case polymorphic, whilst the keto and enol forms of benzoylcamphor and the dextro and levo forms of camphoric anhydride behave as tautomeric or isomeric compounds.—T. C.

Ethyl acetate: Analysis of—. P. Szeberényi. Z. anal. Chem., 1914, 53, 683. J. Chem. Soc., 1915, 108, ii., 292—293.

THE ester-content is found by saponification. A quantity of 25 grms. of the acetate is then saponified with aqueous alkali solution, distilled, and the alcohol estimated in the distillate; the quantity of alcohol thus found represents that present both in the combined and free state in the sample, and the amount of free alcohol is calculated. The quantity of water present in the sample is found by difference. The total amount of alcohol may also be found by oxidising the sample directly with potassium bichromate solution in the presence of sulphuric acid. One c.c. of *N*/2-potassium bichromate solution corresponds with 5.7625 mgrm. of ethyl alcohol. In this estimation the combined alcohol is oxidised as well as the free alcohol, if the latter is present, whilst the acetic acid liberated is not attacked.

Salicylates of lead and copper. W. O. de Coninck. Bull. Soc. Chim., 1915, 17, 163—164.

NORMAL lead salicylate dihydrate was obtained by gradually dissolving lead carbonate in an aqueous solution of the acid at 70° C. and cooling slowly. Mixtures of basic salts from which no homogeneous salt could be isolated resulted when the above salt was warmed with ammonia under varying conditions. Normal cupric salicylate dihydrate was prepared by mixing strong aqueous solutions of normal calcium salicylate and copper sulphate, adding alcohol, and cooling rapidly; it is readily resolved into basic salt and free acid when warmed with water, alcohol, or ether. The normal salicylates of divalent metals are considered to be molecular complexes of the basic salts with salicylic acid; the less stable members are decomposed in the manner exemplified by the cupric salt, while the more stable members are resolved at the temperature of decomposition of salicylic acid into basic salt, phenol, and carbon dioxide.—J. R.

Mercurial powder. P. G. Unna. Dermatol. Wochensh., 1915, 337. Chem. and Drug., 1915, 86, 50.

WHEN mercury is triturated with turpentine oil and lycopodium, a dry, uniform, yellowish-grey powder is obtained almost immediately, in which the mercury remains completely divided. A powder containing 33% of mercury can be prepared in this way. The product can be worked up readily into mercurial ointment and plasters.

Citral in concentrated oil of lemon: Determination of—. E. Böcker. J. prakt. Chem., 1914, [ii], 90, 393—404. J. Chem. Soc., 1915, 108, ii., 294.

CONCENTRATED oil of lemon is adulterated principally by addition of citral derived from lemon-grass oil. Such addition does not increase the content of volatile, oxygenated compounds, on which the value of the oil as a perfume depends. The citral-content of these oils may be determined

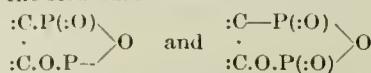
with a considerable degree of accuracy by the sodium sulphite method devised by Burgess (this J., 1901, 1178); methods in which sodium bisulphite is used give erroneous results. The proportion of citral present is not sufficient to indicate addition of citral, but, taken in conjunction with the hydrocarbon-content of the oil (compare this J., 1914, 275), it will show if the proportion added is large. The highest percentage of citral found in oil of lemon free from terpenes and sesquiterpenes is 66, the content varying inversely with the hydrocarbons present. Consequently, if an oil of lemon contains either no hydrocarbons and more than 66% of citral, or 50% of hydrocarbons and more than 33% of citral, addition of the latter must have occurred. Since, however, the genuine hydrocarbon-free oil usually contains less than 66% of citral, the above method gives no more than the minimal value of the adulteration, and may, unless the latter amounts to about 20%, not detect it at all.

Vanillin: Reactions of—. E. P. Häussler. Z. anal. Chem., 1914, 53, 691—695. J. Chem. Soc., 1915, 108, ii., 294. (Compare this J., 1914, 612; 1915, 573.)

WHEN albumin, casein, peptone, or fibrin is treated with a small quantity of dilute alcohol and evaporated with the addition of vanillin, a yellow coloration is obtained which changes to violet when treated with hydrochloric acid and again evaporated. Blue or violet colorations are obtained by subsequent treatment with ammonia and then with hydrochloric acid. Urea yields a yellow coloration when evaporated with vanillin and the residue treated with hydrochloric acid, and a red coloration after treatment with ammonia and hydrochloric acid. The colorations obtained under similar conditions with gelatin are brown.

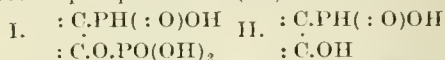
Unsaturated compounds: Behaviour of—towards phosphorus and oxygen. Oxidation catalysis. II. R. Willstätter and E. Sonnenfeld. Ber., 1914, 47, 2801—2814. J. Chem. Soc., 1915, 108, i., 326—328.

IT has been shown previously (J. Chem. Soc., 1913, 104, i., 1200) that osmium facilitates the oxidation of unsaturated compounds by gaseous oxygen, and colloidal osmium has now been found to be much more effective than the ordinary powder. The behaviour of phosphorus is essentially different from that of osmium, in that the phosphorus enters into the composition of the product. In the experiments with phosphorus, this element was used in a finely divided condition, obtained by shaking with warm water and then cooling; benzene, light petroleum, and cyclohexane were used as solvents. The formation of the new phosphorus compounds can be easily observed by introducing the phosphorus together with a solution of the olefine into a test-tube and allowing access of air through a calcium chloride tube, when colourless needles appear in a few hours. Analysis of the products, together with measurements of the ratio, oxygen absorbed: olefine consumed: phosphorus consumed, prove the addition of the grouping P_2O_4 at the double bond. By checking the absorption at an intermediate point products containing the added group P_2O_3 can be obtained. These two classes of compounds, from their analogy in composition to the nitrosites and nitrosates of the terpenes, are termed phosphorites and phosphorates, and their behaviour suggests the structures



respectively. The phosphorates are very hygroscopic, colourless or pale yellow solids, vigorously

decomposed by water, giving an ester acid (I.) which further undergoes hydrolysis into phosphoric acid and a phosphinic acid (II.).



The decomposition of the phosphorates by water is so vigorous that flame may ensue, due to the formation of phosphine from the phosphinic acid, and to this source is also due the phosphine odour observable with the phosphorates and still more with the phosphorites.

Cyclohexene phosphorate, $\text{C}_6\text{H}_{10}\text{P}_2\text{O}_4$, is a hygroscopic, pale yellow, crystalline powder with an odour of phosphine due to the action of moisture; when heated it decomposes generally near 160°C . Menthe phosphate, $\text{C}_{10}\text{H}_{18}\text{P}_2\text{O}_4$, yellowish-white powder, pinene phosphorate, $\text{C}_{10}\text{H}_{16}\text{P}_2\text{O}_4$, and trimethylethylene phosphorate were also prepared. Allyl alcohol behaved exceptionally, yielding a colourless, crystalline substance of the composition, $(\text{C}_3\text{H}_5\text{O})_3\text{P}_2\text{O}_6$. Unsaturated acids and esters also yield phosphorates; thus, oleic acid gave an amorphous phosphorate, $\text{C}_{17}\text{H}_{32}\text{O}_2\cdot\text{P}_2\text{O}_4$, olive oil gave an amber-like resin, whilst poppy oil produced a gelatinous compound.

The inhibitive effect of ethylenic compounds on the luminous oxidation of phosphorus, attributed by Schönbein to their effect on the ozone which acts as a positive catalyst, is explained by the authors as due to the formation of a thin film of resinous substances arising from the action of moisture on the primarily formed phosphorate. Attention is drawn to the formation of phosphorates in the so-called "phosphorated oils," such as a solution of phosphorus in olive oil, and their possible influence on the medicinal properties.

Arsenic; New method for the introduction of—into organic compounds. G. Roeder and N. Blasi. Ber., 1914, 47, 2748—2752. J. Chem. Soc., 1915, 108, i., 331.

CONTRARY to the observation of Michaelis (Annalen, 1902, 320, 271; 321, 141), the chloromercuri-compounds of the type R.HgCl , easily derivable from unsaturated substances in many cases, supply an easy method of producing organic dichloro-arsines by the reaction $\text{R.HgCl} + \text{AsCl}_3 = \text{HgCl}_2 + \text{RAsCl}_2$. Such groups as the carboxyl, hydroxyl, and amino-radicles which react with arsenic trichloride must be suitably protected in order to avoid the formation of hydrogen chloride, and the method is also limited by mercuration of a substituted benzene generally yielding only ortho- and para-compounds, of which the latter are alone capable of reacting readily with the arsenic trichloride. This characteristic difference between the substituent chloromercuri-groups in the ortho- and para-positions renders possible the production of a new class of compound containing both mercury and arsenic, the therapeutic value of which may be considerable. The following are given as examples. A mixture of 100 c.c. of pure benzene with 50 c.c. of an acetic acid solution of mercuric acetate was heated in a closed flask in boiling water for five hours. The benzene filtrate and washings were evaporated to a small bulk and treated with an alcoholic solution of calcium chloride, when chloromercuribenzene separated. When 30 grms. of chloromercuribenzene was heated on the water-bath with 100 grms. of arsenic trichloride for four to five hours, crystals of mercuric chloride separated, and the supernatant liquid on distillation yielded phenyldichloroarsine, $\text{C}_6\text{H}_5\text{AsCl}_2$, b. pt. $250^\circ\text{--}255^\circ\text{C}$., a pungent liquid which could be converted by the action of chlorine and water into phenylarsinic acid, m. pt. 158°C . Bromomercuribenzene and iodomercuribenzene were

also prepared in a similar manner, and reacted satisfactorily, as also did the acetoxymercuri-compound, with arsenic trichloride. By interaction of chloromercuri-anisole with arsenic trichloride in the same proportions and under the same conditions as for the corresponding benzene compound, amisyldichloroarsine was obtained, and was further converted into amisyarsinic acid, m. pt. $179^\circ\text{--}180^\circ\text{C}$.

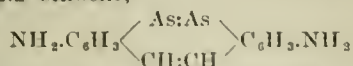
Arsinic acids; Secondary atipathic-aromatic—and their reduction products, especially 3.3'-diamino-4.4'-dihydroxydiphenyldimethyldiarsine. A. Berthelm. Ber., 1915, 48, 350—359. J. Chem. Soc., 1915, 108, i., 331—332.

THE reaction of alkyl halides with aromatic arsenic oxides in the presence of alkali (compare Ehrlich and Berthelm, Berichte, 1910, 43, 917), leading to the formation of alkyl-aryl-arsinic acids, has been found to be of general application. Iodides are more reactive than chlorides, but the hydriodic acid formed interferes with the isolation of the arsenic acid and must be removed either by precipitation with silver nitrate followed by precipitation of the silver salt of the arsenic acid, or by treatment of the reaction mixture with freshly precipitated silver chloride. The secondary arsenic acids are well crystallised substances, which, like cacodylic acid, have an amphoteric character; they are extraordinarily resistant to oxidation by nitric acid. 3.3'-Diamino-4.4'-dihydroxydiphenyldimethyldiarsine, $\text{As}_2(\text{CH}_3)_2[\text{C}_6\text{H}_3(\text{OH}).\text{NH}_2]_2$, is colourless and forms crystalline salts; its toxicity is greater, and its therapeutic action less, than that of salvarsan. Phenylmethylarsinic acid, $(\text{C}_6\text{H}_5)(\text{CH}_3)\text{AsO.OH}$, white, silky needles, m. pt. 179.5°C , after previous softening, is prepared by the action of methyl iodide on a solution of phenylarsine oxide in alcohol and 10N-sodium hydroxide, and is purified through the silver salt, $\text{C}_6\text{H}_5\text{O}_2\text{AsAg}$. Its aqueous solution is acid to litmus, but not to methyl orange. It yields a hydrochloride and a crystalline nitrate. Phenylethylarsinic acid crystallises in colourless, four-sided prisms combined with pyramids, m. pt. 108°C . (after previous softening) when rapidly heated. Phenylisoamylarsinic acid, prisms, melts at 108°C , after previous softening. *p*-Aminophenylmethylarsinic acid is a crystalline powder, m. pt. 201°C , after previous softening. The corresponding acetyl derivative is prepared from *p*-acetylaminophenylarsine oxide, and forms needles, m. pt. 260°C . (decomp.) after previous softening. Phenylbenzylarsinic acid, shining needles, m. pt. $206^\circ\text{--}207^\circ\text{C}$, after previous softening, is decomposed by hot concentrated hydrochloric acid into benzyl chloride and phenylarsine oxide or dichloride. 3-Nitro-4-hydroxyphenylmethylarsinic acid melts at $232^\circ\text{--}233^\circ\text{C}$. (decomp.). Sodium hydrosulphite reduces it to the amino-derivative, needles, m. pt. $206^\circ\text{--}207^\circ\text{C}$. (decomp.) after previous darkening, and this when treated with hypophosphorous acid of sp. gr. 1.136 and hydriodic acid of sp. gr. 1.7, yields the hypophosphite of 3.3'-diamino-4.4'-dihydroxydiphenyldimethyldiarsine.

Stilbene-arsinic acids and their derivatives. Aromatic arsenic compounds. IX. P. Karrer. Ber., 1915, 48, 305—315. J. Chem. Soc., 1915, 108, i., 333—334.

THE author has prepared a number of arseno-stilbene derivatives in which the phenyl radicles are joined by two bridges. 5-Nitro-2-methylphenylarsinic acid is transformed by moderately-concentrated sodium hydroxide into dyes of the type of Mikado brown, which on reduction in

alkaline solution yield 5,5'-diamino-2,2'-stilbene-diarsinic acid, from which 5,5'-diamino-1,1'-arseno-2,2'-stilbene,



is obtained by means of hydrosulphite. 5,5'-Diamino-4,4'-dihydroxy-1,1'-arseno-2,2'-stilbene is obtained by condensation of 4-chloro-5-nitro-*o*-tolylarsinic acid to 4,4'-dichloro-5,5'-dinitro-2,2'-stilbenediarsinic acid. The chlorine of the latter is replaced by hydroxyl by the action of concentrated sodium hydroxide, and the resulting compound reduced to the required stilbene derivative. The physiological properties of the substances are disappointing. *o*-Tolylarsinic acid, needles, m. pt. 160° C., is best prepared by the addition of sodium arsenite to a diazotised solution of *o*-toluidine, removal of excess of arsenic by hydrogen peroxide, and purification by means of the magnesium salt. It is converted by a mixture of concentrated sulphuric acid and nitric acid of sp. gr. 1.49 into 5-nitro-*o*-tolylarsinic acid, needles, which darken at 230° and melt at 261° C. The latter is converted by sodium hydroxide into a complex mixture of dinitroso-, azoxy-, and azo-stilbenediarsinic acids, which is transformed by treatment with sodium hydroxide and zinc dust into sodium 5,5'-diamino-2,2'-stilbenediarsinate, $\text{C}_{11}\text{H}_{11}\text{O}_6\text{N}_2\text{As}_2\text{Na}_2\cdot 4\text{H}_2\text{O}$, from which the corresponding acid is readily obtained. Energetic reduction of the latter gives 5,5'-diamino-1,1'-arseno-2,2'-stilbene. 5,5'-Dinitro-2,2'-stilbenediarsinic acid is obtained by oxidation of the corresponding phenylarsinic acid by sodium hypochlorite and forms white crystals. 3,5-Dinitro-4-hydroxy-*o*-tolylarsinic acid, yellow needles, is prepared by nitration of 4-hydroxy-*o*-tolylarsinic acid; with concentrated sodium hydroxide solution it gives a stilbene dye. 4-Chloro-*o*-tolylarsinic acid, needles, m. pt. 199° C. after softening at 195° C., is formed by the addition of sodium arsenite to a diazotised solution of *p*-chloro-*o*-toluidine, and is nitrated by concentrated sulphuric and nitric acids at 30°–40° C. to 4-chloro-5-nitro-*o*-tolylarsinic acid, leaflets, m. pt. 215° C. The latter yields a stilbene dye when treated with sodium hydroxide, in which, however, the chlorine atom is still present. 4,4'-Dichloro-5,5'-dinitro-2,2'-stilbenediarsinic acid, white, crystalline powder, is obtained by the action of sodium hypochlorite on an alkaline solution of 4-chloro-5-nitro-*o*-tolylarsinic acid, and is converted by further treatment with sodium hypochlorite and sodium hydroxide into 5,5'-dinitro-4,4'-dihydroxy-2,2'-stilbenediarsinic acid, from which, by reduction, 5,5'-diamino-4,4'-dihydroxy-1,1'-arseno-2,2'-stilbene is isolated.

Esters of silicic acid. G. Pollini. *Gaz. Chim. Ital.*, 1915, 45, 1, 380–385.

By the interaction of suitable proportions of *l*-borneol and silicon tetrachloride dissolved in petroleum spirit, the author obtained tetra-*l*-bornyl silicate, $(\text{C}_{10}\text{H}_{17}\text{O})_4\text{Si}$, tri-*l*-bornyl monochlorosilicic ester, $(\text{C}_{10}\text{H}_{17}\text{O})_3\text{SiCl}$, di-*l*-bornyl dichlorosilicic ester, and mono-*l*-bornyl trichlorosilicic ester. The first two are crystalline solids, melting at 291°–292° and 215°–218° C. respectively, and easily soluble in petroleum spirit, benzene, and toluene. The dichloro-compound is solid below 20° C. and boils at 203°–205° C. at 10 mm. pressure. The trichloro-compound boils at 140°–142° C. at 760 mm., and when dissolved in anhydrous ether and heated with silver oxide, is converted into the normal *l*-bornyl ester of dimetasilicic acid, $(\text{C}_{10}\text{H}_{17})_2\text{Si}_2\text{O}_5$; this separates from ether in glassy scales which soften at about 92° C. but have no definite melting point.—A. S.

Colloidal medicinal substances. T. Paul, *Münchener Pharm. Ges.*, June 24, 1914. *Chem.-Zeit.*, 1914, 38, 1050.

The objectionable taste of iron salts is a property of the ferrous and ferric ions and hence is missing in colloidal iron preparations. In aluminium acetate and acetotartrate solutions most of the aluminium is present in the form of colloidal basic salt and probably, also, of colloidal hydroxide; hence the astringent action due to aluminium ions is relatively feeble and the solutions do not cause irritation when applied to wounds. So-called colloidal silver preparations always contain substances which in aqueous solution lead to the formation of silver ions, and it is probable that the therapeutic action of the preparations is due to these ions. The quantity of silver ions, though small, is sufficient, for example, to saturate blood, owing to the relatively high concentration of chlorine ions therein. In some silver preparations, e.g., protargol, the concentration of silver ions decreases with decreasing concentration of the preparation; in others, e.g., sophol, it remains approximately constant; and in others, e.g., argentamin, lysargin, collargol, and silver-ammonia compounds, it increases.—A. S.

Adsorption [of dyes, alkaloid salts, etc.] from aqueous solution. Freundlich and Poser. See IV.

Oil and amygdalin content of seed kernels of Prunus domestica. Kassner and Eckehmann. See XII.

Oil of strophanthus seeds. Matthes and Rath. See XII.

Unsaponifiable constituents of strophanthus seed oil. Heiduschka and Wallenreuter. See XII.

Organic acids from the sap of the sugar maple. von Lippmann. See XVII.

Origin of methyl alcohol in brandies. [Methoxy-groups in cellulosic drugs.] Von Fellenberg. See XVIII.

Chemical detection of blood. Ganassini. See XXIII.

Determination of the non-protein nitrogen in blood. Greenwald. See XXIII.

PATENTS.

Quinoline compounds, and process of producing the same. A. B. Davis, Assignor to Eli Lilly and Co., Indianapolis, Ind. U.S. Pat. 1,138,936, May 11, 1915. Date of appl. Feb. 21, 1913.

By boiling a solution, in absolute alcohol, of pyruvic acid, vanillin, and an aromatic amine, a derivative of quinoline-4-carboxylic acid is formed having in the 2-position of the quinoline ring a *p*-hydroxy-*m*-methoxyphenyl group, and having another hydrogen of one of the CH-groups of the quinoline ring replaced by an organic radical. The position and nature of the latter are determined by the aromatic amine used, *p*-toluidine, for example, giving the 6-methylquinoline derivative.—B. V. S.

Quinoline compounds, and process of producing same. A. B. Davis, Assignor to Eli Lilly and Co., Indianapolis, Ind. U.S. Pat. 1,138,937, May 11, 1915. Date of appl. May 20, 1914.

By condensing an ester of *p*-aminobenzoic acid, an aromatic aldehyde, and pyruvic acid, an ester of quinoline-4,6-dicarboxylic acid is produced, having the hydrogen in the 2-position replaced by an aryl group, e.g., an ester of 2-phenylquinoline-4,6-dicarboxylic acid. The condensation may be effected by boiling a solution of the components in absolute alcohol.—B. V. S.

Iodine and bismuth compounds of hydroxyquinolines, their homologues, and substitution products; Preparation of —. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 282,455, Sept. 16, 1913.

HYDROXYQUINOLINES or their substitution products are boiled with bismuth oxyiodide for several hours in aqueous suspension and the precipitate is extracted with alcohol and ether. The products are highly antiseptic, combining the valuable therapeutic properties of hydroxyquinolines, bismuth, and iodine, without exerting any harmful action on the skin.—F. W. A.

Ketones of the quinoline and isoquinoline series; Preparation of —. A. Kaufmann. Ger. Pat. 282,457, June 20, 1913. Addition to Ger. Pat. 276,656 (see Fr. Pat. 456,254; this J., 1913, 959).

THE process described in the chief patent is also applicable to other nitriles of the quinoline and isoquinoline series in which the nitrile group in the pyridine ring is in the *ortho*-position to the nitrogen. The products, e.g., quinolyl-2- and isoquinolyl-1-alkyl ketones, are useful in the preparation of medicinal products and in perfumery.—F. W. A.

Hypophysis; Separation of the active constituents of —. F. Hoffmann-La Roche und Co. Ger. Pat. 282,002, Jan. 30, 1913.

THE powder obtained by triturating the extract of hypophysis (pituitary gland) or the glands themselves with sodium carbonate, is extracted with chloroform, an alcoholic solution of hydrochloric acid added, and the solution evaporated to dryness. On evaporating the aqueous extract a very small amount of a crystalline residue is obtained, which has the pharmacological action on the intestines ascribed to hypophysis extracts. The portion of the extract which affects the blood pressure and exerts the peculiar action of the extract on the uterus, is insoluble in chloroform, but may be extracted by alcohol. On evaporating the neutralised alcoholic extract to dryness, a considerable amount of a nitrogenous substance is obtained.—F. W. A.

Oleum cadinum [oil of cade; juniper lar oil]; Separation of the constituents of —. I. Bugarsky, L. Török, and Chinoi Gyogyszer es Vegyeszeti Termekek Cyavara R. T. (Kereszty und Wolf). Ger. Pat. 282,108, May 17, 1914.

MEDICINAL preparations are obtained by separating the high-boiling fractions of *Oleum cadinum* by fractional solution in methyl alcohol, with or without subsequent fractional distillation, into hydrocarbons and compounds containing oxygen. The final fraction, almost insoluble in methyl alcohol, forms on distilling over sodium a clear liquid of strong reducing properties, and of the composition, $C_{20}H_{30}$.—F. W. A.

Chloroformic acid esters; Preparation of —. A. Hochstetter. Ger. Pat. 282,134, June 21, 1913.

GOOD yields of chloroformic acid esters are obtained by the action of phosgene, dissolved in a solvent immiscible with water, on an alcohol or phenol distributed between the solvent and a layer of water in contact with it. A solvent with a suitable partition coefficient is chosen, or inert salts are dissolved in the aqueous layer, so that a considerable proportion of the alcohol or phenol is present in the layer containing the phosgene. The non-aqueous layer may be composed of the chloroformic ester which is being prepared or of liquefied phosgene.—A. S.

Pyrazolone derivative; Preparation of a —. I. Abelin, E. Bürgi, and M. Perelstein. Ger. Pat. 282,264, May 18, 1913.

4-DIMETHYLAMINO-1-PHENYL-2,3-DIMETHYL-5-PYRAZOLONE gives with the ω -methylsulphonic

acid of the *p*-aminophenyl ester of salicylic acid a compound, $C_{22}H_{20}O_2N_4S$, which is strongly antiseptic and disinfecting, and is more effective as an anæsthetic and as a narcotic but less toxic than the original pyrazolone.—F. W. A.

*Salt of the ω -methylsulphonic acid of the *p*-aminophenyl ester of salicylic acid; Preparation of [the hexamethylenetetramine] —.* I. Abelin, E. Bürgi, and M. Perelstein. Ger. Pat. 282,412, May 18, 1913.

HEXAMETHYLENETETRAMINE combines with the ω -methylsulphonic acid of the *p*-aminophenyl ester of salicylic acid to form a compound, $C_{20}H_{25}O_4N_5S$, in which the therapeutic properties of a salol derivative and of hexamethylenetetramine are combined. The compound has higher disinfecting properties than hexamethylenetetramine, and acts as an anæsthetic without any unpleasant subsidiary effects.—F. W. A.

Amyl acetate; Preparation of —. Farb. vorm. Meister, Lucius, und Brüning. Ger. Pat. 282,266, Dec. 25, 1913.

THE action of aluminium amylate on acetaldehyde in amyl alcohol solution does not give ethyl acetate (compare Kremann, Monatsh. Chem., 26, 783; 29, 23), but amyl acetate and ethyl alcohol; the products can be separated by fractional distillation.—F. W. A.

Chloral and butylchloral; Preparation of compounds of — with an acid amide. A. Liebrecht. Ger. Pat. 282,267, Nov. 14, 1913.

A CHLORINATED aldehyde or its hydrate (1 mol.) is warmed with isovaleramide (1 mol.) in presence or absence of a solvent. The products are sedatives without having the disadvantages of chloral.—F. W. A.

Mercurous salts of basic purines; Preparation of —. L. Rosenthaler and A. Abelmann. Ger. Pat. 282,376, Dec. 31, 1913.

AQUEOUS solutions of mercurous salts (e.g., the nitrate) are allowed to react with basic purines, e.g., caffeine, theobromine, or theophylline, in acid (e.g., nitric acid) solution. The compounds obtained give the usual reactions of mercurous salts, and are of particular interest, as purines have been shown to prevent the harmful effect of mercury compounds.—F. W. A.

Mercury compounds of basic purines; Preparation of —. L. Rosenthaler and A. Abelmann. Ger. Pat. 282,377, Dec. 31, 1913.

ACID solutions of theobromine or theophylline are treated with mercuric acetate, or an aqueous suspension of theobromine or theophylline is warmed with mercuric oxide in presence or absence of alkalis. The mercury is combined in another form to that in the known N-mercury trioxypurines and the products are more stable. The theobromine compound is prepared with freshly prepared mercuric oxide in the dark, the excess of theobromine being extracted by chloroform. The compounds do not give the usual reactions of mercuric salts.—F. W. A.

Arsenic compounds from phosphatides or substances containing them; Preparation of —. F. Hoffmann-La Roche und Co. Ger. Pat. 282,611, March 6, 1914.

PHOSPHATIDES or substances or extracts containing them are dissolved in organic solvents and treated with arsenic acid, and the arsenic compounds thus formed are separated by methods similar to those used for the isolation of lecithin and other phosphatides. The products, which are soluble in ether, fats, and oils, and can be readily emulsified, are useful for therapeutic purposes.—A. S.

Bacteria; Preparations for staining —. E. Beintker. Ger. Pat. 282,755, Feb. 4, 1914.

By substituting sugar or other substance capable of absorbing water for the alcohol present in the usual staining preparations, solid products are obtained from which staining solutions can be prepared as required by addition of water.—A. S.

Preparation of water-soluble condensation products of di- and poly-hydroxybenzenes. Ger. Pat. 282,313. See XV.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Mercury compounds; Sensitiveness to light of pure —. J. M. Eder. Z. wiss. Phot., 1914, 14, 172—176. J. Chem. Soc., 1915, 108, ii., 199—200.

According to Winther (this J., 1909, 746), a solution of mercuric oxalate completely free from iron would be photochemically inactive. Experiments with carefully purified substances show, however, that the photochemical sensitiveness of solutions of mercuric oxalate (mercuric chloride and ammonium oxalate) is not dependent on the presence of traces of ferric salts, but is also exhibited by the pure mercuric compound. The decomposition of the mercuric salt is mainly determined by the ultra-violet rays, but the relative activity of the visible rays is increased if the solution contains small quantities of iron.

Ferric salts; Sensitiveness to light of —. C. Winther and H. Oxholt-Howe. Z. wiss. Phot., 1914, 14, 196—212. J. Chem. Soc., 1915, 108, ii., 200.

SOLUTIONS of various organic salts of iron were prepared by mixing equimolar solutions of ammonium oxalate, succinate, tartrate, citrate, and acetate with measured volumes of ferric chloride solutions of varying concentration, and the mixtures were exposed to the action of monochromatic light of wave-length $\lambda=436, 405, 366, \text{ and } 313 \mu$. The rate at which the ferric salt is reduced remains approximately constant during the course of the reaction. For a given concentration, the sensitiveness (measured by the ratio of the amount of substance transformed to the quantity of incident radiation) increases as the absorption-coefficient diminishes. It is suggested that the solutions contain at least two substances which absorb the incident rays. One of these is photochemically sensitive, and the other not, and the latter is responsible for the major part of the absorption.

Asphalt; Colloid chemistry of —. A. Rosinger. Kolloid. Zeits., 1914, 15, 177—179. J. Chem. Soc., 1915, 108, ii., 200.

ASPHALTS which dissolve in benzene, chloroform, and hydrocarbons become insoluble in these liquids after being subjected in thin layers to the action of light. If solutions of asphalt in benzene or in a mixture of benzene and chloroform are poured on to glass plates and the solvent allowed to evaporate, the asphalt becomes insoluble even in the absence of light action. This suggests that the apparent sensitiveness of asphalt to light depends on the oxidation of the material in contact with air. In presence of sensitisers, such as safrol and eugenol, the product obtained differs from that formed in the oxidation process, and it is suggested that the action of the light in these circumstances consists in the formation of gels by adsorption of the sensitising agents in the asphalt.

Thio-indoxyl development and its bearing on the theory of the latent image. R. E. Crowther. Phot. J., 1915, 55, 186—197.

If thio-indoxyl is used for the development of a

photographic negative a composite image of silver and red thio-indigo is obtained, from which the silver may be removed, leaving only the colour-image (compare Homolka; this J., 1907, 487). If a plate is exposed so as to give a long range of exposures, and then developed with thio-indoxyl, reversal occurs with the colour image exactly as with the silver image, but re-reversal, or the formation of a second negative, occurs only with the silver image. If such an exposed plate is carefully watched during development with a slow developer, the formation, and subsequent disappearance, of an image, may be seen where reversal is finally obtained; in some cases, where there is a print-out image, its disappearance, or partial disappearance, may be seen. There is some variation in this latter point with different plates, some showing the first steps of the print-out image on the normal negative stage, others on the reversal stage. The author uses these facts in support of his theory of the latent image and the cause of reversal. Only a very small proportion (of the order of one molecule per grain) of the silver halide is directly affected by normal exposures, the affected part serving as starting point for the reduction of unaffected halide, and a nucleus for the deposition of silver. During exposure, halogen is split off from the silver halide and up to a certain point absorbed by the gelatin, any excess being given off from the plate. The gelatin halogen complex so formed is decomposed by the developer with the formation of an oxidised compound and a halide. In sufficient concentration this mixture of oxidised developer and halide will convert metallic silver to the halide. Where exposure has been very prolonged the amount of gelatin-halogen complex is sufficient to determine the reaction in the opposite direction to normal development and the result is a partial or total reversal. Where exposure has been sufficiently prolonged to form a print-out image, this is partly or wholly re-converted into halide during development, the residue forming the re-reversal, or second negative stage; there is no evidence of any re-reversal except that due to the print-out image. Reversal is thus a function partly of exposure and partly of development.—B. V. S.

Development; Acceleration and retarding of — by neutral salts. Lüppo-Cramer. Kolloid-Zeits., 1914, 15, 164—166. Z. angew. Chem., 1915, 28, Ref., 190.

THE action of a very dilute quinol developer is greatly accelerated by addition of neutral salts, such as potassium nitrate, acetate, and oxalate, and sodium sulphate and nitrite. An analogous action in the case of rapid developers, such as *p*-aminophenol, is observed only if potassium bromide has been added previously. The action of a pyrogallol developer to which bromide has been added, is retarded by addition of potassium nitrate, oxalate, or citrate. It is suggested that the accelerating action may be due to the coagulation of colloidal silver by the neutral salts, the different effect in the case of pyrogallol being explained by the fact that its oxidation products are of a colloidal nature, and hence capable of protecting colloidal silver from coagulation. The action of catechol is accelerated by potassium nitrate, but strongly retarded by potassium oxalate.—A. S.

PATENTS.

Colour photography. Hudson and Kearns, Ltd., London. From Frey und Söhne, Zürich, Switzerland. Eng. Pat. 22,771, Nov. 19, 1914.

In taking negatives for use in colour printing, the subject is illuminated with light of the desired colour, instead of a colour screen being used in the camera. One method is to enclose the illuminant in a case having an opening on the side next the

subject in which can be fitted a double transparent container, having a liquid filter in one compartment and a cooling liquid in the other.—B. V. S.

Restoratives for blemished moving-picture films. Compositions for restoring the pictures on films. F. W. Hochstetter, New York, Assignor to P. M. Pierson, Scarboro'-on-the-Hudson, N.Y. U.S. Pats. 1,139,679—1,139,683, May 18, 1915. Dates of appl. (A) Nov. 20, 1912, (B) May 27, 1913. (C) June 4, 1913, (D) and (E) Oct. 7, 1913.

(A). A MIXTURE of petrolatum, 6 oz.; spirits of camphor, 2 oz.; sulphuric ether, 0.5 oz.; and glycerin, 1 oz. (B). Fatty base, 6 oz.; camphor, 5 drms.; alcohol, 2 oz.; sulphuric ether, 0.5 oz.; and glycerin, 1 oz. (C). Oil, 6 oz.; spirits of camphor, 2 oz.; sulphuric ether, 0.5 oz.; and glycerin, 1 oz. (D). Fatty base, 6 oz., and alcohol, 2 oz. (E). Fatty base, 6 oz., and sulphuric ether, 1 oz.—B. V. S.

Colour photography. P. D. Brewster, East Orange, N.J., U.S.A. Eng. Pats. 3435, Feb. 10, 1914, and 2465 of 1915, date of appl., Feb. 10, 1914. Under Int. Conv., Feb. 11, 1913.

SEE Fr. Pat. 468,297 of 1914; this J., 1914, 986.

XXII.—EXPLOSIVES; MATCHES.

Explosion; Circumstances attending an —, which occurred on April 3, 1915, in a mixing house of the factory of Nobel's Explosives Co., Ltd., at Ardeer, Ayr. H. Coningham, H.M. Inspector of Explosives. No. CCXIII.

THREE men were killed through the explosion of 3486 lb. of thin jellies of nitroglycerin and nitro-cotton in a light wooden building, 57 ft. by 33 ft., in which were eight mixing machines. The general arrangement of the building was similar to that of the mixing house in which the explosion of Feb. 20, 1914, occurred (this J., 1914, 668). Since that accident, however, the dry nitro-cotton has been weighed in a separate building, and the main shafting for the incorporating machines is kept low down and external to the building. This had the desired effect of preventing the distribution of heavy debris, for the shaft was still in position after the explosion. Each incorporating machine had two vertical gun-metal stirring shafts, each carrying 16 blades in four sets of four, so arranged that there was about one inch between the blades when revolving, and between the ends of the blades and the bottom of the mixing pan. The pan had a jacket containing water at 60° to 62° C. and was connected by means of pipes with a barrel of water at about 65° C. The house was heated by steam radiators, and between these and the interior of the building were wire gauze screens. The explosives had been left in the warmed building overnight, and the explosion occurred when work was being started in the morning. No other building in the factory was exploded, but two expense magazines, 60 and 70 yards away respectively, were wrecked, apparently through the pressure caused by the explosion upon their roofs, rather than from its suction effect. Other buildings up to a radius of about 133 yards were also damaged. It is possible that the explosion may have been caused by a screw from the defective lid of a box falling into the jelly, but the most probable explanation is that the only lead saddle in the building may have been accidentally knocked into a mixing pan, where its contact with the stirrers generated sufficient heat to explode the contents of the pan. It is suggested that it might be possible to fill the pans with the thin jelly without the stirrers revolving, and then to start the machine and add the dope. Since the

saddle is not used while the dope is being added, the danger of starting the stirrers in a thick mass of dope and explosive would be obviated. This method of mixing is to be tried.—C. A. M.

Explosion of nitro-cotton; Circumstances attending an —, which occurred on April 16, 1915, at the works of Cogswell and Harrison, Ltd., Poyle, Middlesex. H. Coningham, H.M. Inspector of Explosives. No. CCXIV.

Two persons were killed and three injured as the result of an explosion of 68 lb. of dry nitro-cotton in a compartment in a building (80 ft. by 40 ft.) of corrugated iron lined with match-boarding. The other compartments comprised a store containing about 2 tons of wet nitro-cellulose, which was not connected with the explosion nor ignited by the subsequent fire, an engine and annealing room, a dynamo and mechanical shop, and stores. The dry nitro-cotton had been placed in six galvanised iron bins, 20 in. by 16 in., with removable lids, and the compartment also contained two copper granulating pans, a mixing pan, a hydro-extractor, a sifting apparatus, a cooling tank, and an incorporating mill, with a cast-iron pan and cast-iron edge runners. Only about 7 lb. of wet nitro-cotton was in the pan and no explosion had occurred in or quite close to it. The explosion may have been caused by the heat produced by friction in removing the lid from one of the bins, or a lid may have been dropped accidentally on to an open bin containing dry nitro-cotton. The presence of dry nitro-cotton in this compartment was a breach of the terms of the licence, and it is pointed out that galvanised iron bins were quite unsuitable receptacles for it. The damage done to other buildings was trifling.—C. A. M.

PATENTS.

Explosives. W. Rintoul, N. Picton, and D. H. Peacock, Stevenston, N.B., and Nobel's Explosives Co., Ltd., Glasgow. Eng. Pat. 16,692, July 13, 1914.

NITRATED furoxans of benzene, naphthalene, their homologues, and similar cyclic compounds may be used as explosives in detonators, shells, torpedo-heads, etc. Dinitrodinitrosobenzene, for example, prepared from *o*-nitroaniline by treatment with sodium hypochlorite in suspension in alcoholic potash, and subsequent nitration of the dinitrosobenzene (benzofuroxan) thus formed, is suitable for use in detonators to replace part of the mercury fulminate, and in other cases where tetranitroaniline, trinitrotoluene, etc., are used. The salt-like compounds formed from nitro-furoxans and potash, soda, etc., may be used in complete substitution for mercury fulminate. Two formulæ are given for the preparation of blasting explosives, one containing 9% dinitrobenzofuroxan, together with potassium perchlorate (42.8%), nitroglycerin (31.5%), a liquid nitro-compound such as nitro-toluene (13.5%), nitro-cotton (1%), and wood-meal (2.2%); the other containing 20% dinitrobenzofuroxan and 80% ammonium nitrate.

—B. V. S.

Explosive. G. Burgschmiet, Mordern, Canada. U.S. Pat. 1,139,339, May 11, 1915. Date of appl., Jan. 12, 1914.

A MIXTURE of about 80% of ammonium nitrate, 18% of dinitrotoluene, and 2% of charcoal and wood meal.—C. A. M.

Match-heads; Composition for —. W. C. Pierson, Cleveland, Ohio. U.S. Pat. 1,138,146, May 4, 1915. Date of appl., Oct. 28, 1912.

THE composition contains nitrocellulose or other nitrated carbohydrate, a metallic nitrate, potassium chlorate, potassium bichromate, plaster of Paris, powdered glass, and glue.—C. A. M.

XXIII.—ANALYTICAL PROCESSES.

Iron ; Volumetric determination of — in hydrochloric acid solution by the bichromate method, using diphenylcarbohydrazide as indicator. L. Brandt. *Z. anal. Chem.*, 1914, 53, 729—745. *J. Chem. Soc.*, 1915, 108, ii., 285.

In the method described previously by the author (this J., 1914, 44) sulphuric acid alone may be used in place of the manganese solution containing sulphuric and phosphoric acids. Arsenic, if present, must be oxidised previous to the titration of the iron. The correction for the amount of bichromate consumed by the indicator is quite small ; it cannot be determined by a control titration of the indicator itself, but if this titration is made and a second quantity of the indicator added and titrated, the amount of bichromate used in the second titration will approximate to that used by the indicator in the titration of the iron.

Selenium ; Gravimetric determination of —. A. Gutbier and F. Engeroff. *Z. anal. Chem.*, 1915, 54, 193—205.

SELENIUM dioxide is reduced quantitatively to selenium by hydrazine sulphate, or hydrazine hydrate, in dilute nitric acid solution ; the hydrazine solution should be added to the cold selenium dioxide solution and the mixture then heated gradually. In this way, there is no danger of the spray formed by the escaping nitrogen carrying off finely-divided selenium (see Meyer, this J., 1914, 335). The nitric acid solution containing the selenium dioxide may be evaporated to dryness without loss of selenium, but a small loss occurs when the residue is heated further for 1 hour.

—W. P. S.

Palladium and tin ; Separation of — by means of dimethylglyoxime. A. Gutbier and C. Fellner. *Z. anal. Chem.*, 1915, 54, 205—208.

PALLADIUM is precipitated by dimethylglyoxime from acid solutions whilst tin remains dissolved. 150 c.c. of the solution, containing hydrochloric acid but no free chlorine, is heated on a water-bath, and treated with a 1% dimethylglyoxime solution until a turbidity is no longer produced. Heating is continued for 1 hour more, the mixture is cooled, the precipitate collected on a filter, washed with dilute (not more than 2%) hydrochloric acid, and ignited at first in contact with air and then in an atmosphere of hydrogen. The tin may be determined in the filtrate. —W. P. S.

Palladium from tin ; Separation of — by electrolytic deposition of the palladium. A. Gutbier, C. Fellner, and R. Emslander. *Z. anal. Chem.*, 1915, 54, 208—213.

A SOLUTION containing the two metals is poured into a mixture of 25 c.c. of 2*N*-sulphuric acid and 500 c.c. of water ; after some time, the mixture is heated to 65° C. and submitted to electrolysis at this temperature. A current of 1.25 volt and 0.25 ampere is employed ; the cathode consists of a semi-circular piece of platinum gauze and the anode of a platinum spiral. The electrolyte is stirred by a glass screw rotated between the electrodes at 2500 revolutions per minute. After the palladium has been deposited, the solution is boiled, with addition of ammonium nitrate, and the tin oxide is collected. (See also Anberg, this J., 1904, 667 ; Wöhler and Sprengel, 1911, 386.)

—W. P. S.

Phosphorus ; Determination of lipid and acid-soluble — in small amounts of serum. I. Greenwald. *J. Biol. Chem.*, 1915, 24, 29—36.

ONE c.c. of the serum is diluted to 10 c.c. with a solution containing 1% each of acetic acid and picric

acid, and after two hours the mixture is filtered. The filtrate is evaporated to 1 c.c., heated with 1 c.c. of sulphuric acid until all picric acid has been expelled, and the oxidation then completed by the addition of nitric acid and further heating. The solution is diluted to a definite volume and aliquot portions are mixed with nitric acid, diluted, and treated with 2 c.c. of molybdic acid-strychnine reagent. The coloration obtained is compared with that produced by known quantities of phosphoric acid. The residue remaining on the filter is also oxidised with sulphuric and nitric acids and the phosphoric acid determined in a similar way. The reagent is prepared by dissolving 95 grms. of molybdic acid and 30 grms. of sodium carbonate in 600 c.c. of warm water, cooling, adding 141 c.c. of concentrated nitric acid, and diluting to 1 litre ; 10 c.c. of this solution is mixed with 1 c.c. of a 2% strychnine sulphate solution and the mixture is used immediately. The amount of phosphorus not precipitated by the acetic acid-picric acid mixture usually varies between 2 and 6 mgrms. per 100 c.c. of serum. The lipid phosphorus lies between 5 and 13 mgrms.

—W. P. S.

Blood ; Chemical detection of —. D. Ganassini. *Boll. Chim. Farm.*, 1914, 53, 777—781. *J. Chem. Soc.*, 1915, 108, ii., 295.

THE author has investigated Baccchi's test for blood (*Arch. Int. Méd. Légale*, 1913, 4, 163), which is carried out as follows. Two c.c. of an aqueous alizarin-S-blue solution diluted to a mahogany-yellow colour is mixed with about one-half the volume of 3% hydrogen peroxide solution. A little of the liquid to be tested is then poured slowly down the wall of the test-tube. If blood is present, gentle shaking rapidly renders the liquid intensely blue, the blue colour slowly fading and giving place to a red colour, which is moderately stable. This reaction is stated to give a positive result with 1 part of blood in 20,000, and to answer well with blood which has undergone alteration and become insoluble in water, the blood being then first dissolved in alcohol acidified with hydrochloric acid.

Blood ; Determination of non-protein nitrogen in —. I. Greenwald. *J. Biol. Chem.*, 1915, 24, 61—68.

THE blood is diluted to 10 times its volume with a 2.5% solution of trichloroacetic acid and the mixture is filtered after 30 minutes. The lipids are precipitated completely with the proteins, and added amino-acids may be recovered in the filtrate ; the latter may contain a small quantity of protein which can be removed by shaking with kaolin. This filtrate contains all the soluble, non-protein constituents of the blood. The normal amount of non-protein nitrogen appears to be about 30 mgrms. per 100 c.c. of blood. Methyl alcohol cannot be used as a precipitant for the proteins since it is not a good solvent for certain amino-acids, and at the same time it dissolves a quantity of lipid. —W. P. S.

Colloids ; Measurement of the protective action of —. J. Gröhl. *Z. physik. Chem.*, 1914, 88, 414—418. *J. Chem. Soc.*, 1915, 108, ii., 239.

THE rates of decomposition of hydrogen peroxide by colloidal platinum with and without the addition of a protecting colloid were determined. The following results were obtained for the action of gelatin : unprotected colloid decomposed 50% of the hydrogen peroxide in thirty minutes, and addition of 0.001% gelatin increased the time to 131 minutes ; 0.01% gelatin, 138 minutes ; 0.05% gelatin, 186 minutes ; and 0.10% gelatin, 295 minutes. In alkaline solution the protective

action was not so marked, the rate of decomposition being reduced only about one-third. Comparative measurements were made of the protective action of gelatin, gum arabic, and dextrin. The order of protective action was that given above, and it persisted for all concentrations from 0.1% to 0.0001%, the relative values being approximately the same as those found by Zsigmondy by means of the gold numbers.

Analysis of lactic acid. Balderston. See VII.

Determination of sulphuric acid and potassium, especially in potash salts. Vaubel. See VII.

Blue and red Congo dyes. Theory of indicators. Hantzsch. See IV.

Isomerides of helianthins and aminoazobenzene salts. Hantzsch. See IV.

Concentration method for the determination of small quantities of phosphoric acid in limestone. Hinden. See VII.

Determination of carbon dioxide in minerals. Borgström. See VII.

Determination of arsenic in lead by hypophosphorous acid. Brandt. See X.

Separation of arsenic from tungsten [vanadium, and molybdenum]. Dieckmann and Hilpert. See X.

Practical testing of working cyanide solutions. Croghan. See X.

Detection of phytosterol in animal fats by precipitation with digitonin. Kühn and Wewerinke. See XII.

Separation of dihydroxy- and tetrahydroxystearic acid. Matthes and Rath. See XII.

Approximate determination of non-volatile unsaponifiable substances in linseed oil varnish. Bárány. See XIII.

Determination of bitumen in rubber mixings. Porritt and Anderson. See XIV.

Use of nitric acid as a solvent for compounded and vulcanised rubbers. Jones. See XIV.

Determination of small amounts of carbon dioxide [in rubber goods] in presence of sulphides. Jones. See XIV.

Determination of mineral matter in vulcanised rubber. Jones. See XIV.

Determination of mineral matter in rubber mixings. Porritt and Wheatley. See XIV.

Biological detection and valuation of tannins. Kobert. See XV.

Determination of the sulphur-transforming power of soils. Brown and Kellog. See XVI.

Determination of manganese in soils. von Horváth. See XVI.

Vegetation experiments and soil analysis. Lemmermann. See XVI.

Determination of phosphoric acid in soil extracts. Den Berger. See XVI.

Iodometric determination of phosphoric acid in vegetable products and soils. Preisinger and Frodl. See XVI.

Use of sodium citrate for the determination of reverted phosphoric acid. Bosworth. See XVI.

Effect of clarification with lead acetate and tannin in the polarimetric examination of sugar, dextrin, and starch solutions. Grossfeld. See XVII.

Composition and effects of lupin seeds [due to enzymes]. [Detection of lupin seeds in admixture with castor oil seeds. Muenk. See XIXA.

Determination of tartaric acid in beverages, especially in wines. Häussler. See XVIII.

Alcohol reaction of milk. Auzinger. See XIXA.

Determination of lecithin in milk. Brodrick-Pittard. See XIXA.

Cause of acidity of fresh milk of cows, and a method for the determination of acidity. Van Slyke and Bosworth. See XIXA.

Determination of dissolved oxygen in water. Winkler. See XIXB.

Determination of the reducing power of natural waters. Winkler. See XIXB.

Transformation of antipyrine into diantipyrine-methane. [Detection of antipyrine in pyramidone.] Astre. See XX.

Determination of citral in concentrated oil of lemon. Böcker. See XX.

Reactions of vanillin. Häussler. See XX.

Analysis of ethyl acetate. Szeberényi. See XX.

PATENT.

Apparatus for taking samples of liquids contained in receptacles. Ger. Pat. 282,172. See I.

XXIV.—MISCELLANEOUS ABSTRACTS.

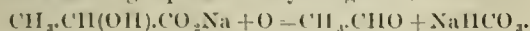
Metals and oxides; Emissivity of —. II. Measurements with the micropyrometer. G. K. Burgess and R. G. Waltenberg. Bull. Bureau of Standards (U.S.A.), 1914, 11, 591—605.

THE monochromatic emissivity of various metals and oxides may be rapidly determined, both in the solid and liquid states, by means of the micro-pyrometer (this J., 1913, 162) between 900° and 3000° C. The results are accurate to about 1% and may be obtained with as little as 0.01 mgrm. of the substance. Platinum is taken as the standard substance and tables of measurements are given, chiefly for red and green light of wavelengths 0.650 μ and 0.547 μ , of the emissivity of 23 metals in hydrogen and 12 oxides in air. Most solid metals showed a practically negligible temperature coefficient of emission between 20° C. and the m. pt. Nickel oxide showed a negative coefficient. The discontinuity in emissivity for $\lambda=0.650 \mu$ at the m. pt. was marked in the cases of gold, copper, and silver, and was appreciable for platinum and palladium. The emissivity characteristic of liquid palladium may persist for a time after solidification. The increase in red brightness when platinum melts amounts to about 15%; it therefore appears that the Vielle unit of light, depending upon the luminous radiation from the surface of platinum at its m. pt., cannot be regarded as a definite standard.—J. R.

Alkali carbonates; Formation of — from neutral salts in the light. Biochemistry of the action of rays. III. C. Neuberg and W. H. Peterson. Biochem. Zeits., 1914, 67, 63—70. J. Chem. Soc., 1915, 108, i, 212.

WHEN sterilised solutions of potassium malate, succinate, citrate, or lactate or potassium sodium tartrate were exposed to light and air in the

presence of a catalyst, such as ferrous, ferric, uranyl, or manganous sulphate, or sodium anthraquinone-2,7-disulphonate, or 9,10-dichloroanthracene-2,7-disulphonate, an increase in the alkalinity of the solution was observed. As an example of the method of formation of the alkali, the following equation may be given :



Trade Report.

Contraband of war.

A ROYAL Proclamation, dated May 27th, 1915, declares that "Toluol, and mixtures of toluol, whether derived from coal-tar, petroleum, or any other source, will be treated as absolute contraband." Also that in the Proclamation of Dec. 23rd (see this J., 1914, 1230), the words "all other metallic acetates" (after "calcium acetate") shall be omitted, and that linseed oil will be treated as conditional contraband.

Prohibited exports.

By an Order in Council dated June 2nd, 1915, the exportation of the following goods is prohibited to all destinations abroad other than British Possessions and Protectorates:—Hydrochloric acid, oxides and salts of nickel, oxides and salts of tungsten; mineral and vegetable wax, ground nuts, earth nuts, or pea nuts (Arachides), hempseed, palm nuts and palm kernels, poppy seed, rape or colza seed, sunflower seed; tungsten filaments for electric lamps. Among the articles added to the list of goods the exportation of which is prohibited to all foreign ports in Europe and on the Mediterranean and Black Seas, other than those of France, Russia (except Baltic ports), Spain, and Portugal, are arsenic and its compounds, ground nut or earth nut cake and meal, hempseed cake and meal, husk meal, locust bean meal, meat meal, palmit cake and meal, poppyseed cake and meal, rapeseed or colza seed cake and meal, sesame seed cake and meal, soya bean cake and meal, sunflower seed cake and meal.

Prohibited exports.

AUSTRIA-HUNGARY.—According to a decree of May 8th the following articles have been added to the list of prohibited exports: Ammonia, chloral hydrate, dionine, digalen, menthol, perhydrol, peppermint oil, pilocarpine, ippecacuanha, liquorice-root, rhubarb, valerian-root, salicylic acid and its salts, tannalbin, theobromine and its derivatives, and hexamethylenetetramine.

GERMANY.—According to a decree of the Imperial Chancellor, dated May 20th, the exportation of wood-vinegar (crude acetic acid), oil-varnishes, spirit-varnishes, and shellac-preparations is prohibited. The prohibition of the exportation of natural magnesium carbonate (magnesite) has been revoked.

Books Received.

THE CHEMISTS' YEAR BOOK, 1915. Edited by F. W. ATACK, M.Sc.Tech. In two vols. Sherratt and Hughes, 31, Cross Street, Manchester. 914 pages. 6½ × 1 in. Price 10s. 6d.

ADVANTAGE has been taken of the cessation of the supply of the German pocket-books and annuals, to produce a similar work in the English language, which it is intended to revise each year. The Editor is to be congratulated on the results of his labours, which should form a most useful addition

to the chemists' library. The first volume contains a calendar for the year and a large number of analytical notes, conversion tables, logarithms, and mathematical constants. The second volume includes tables of physical constants of elements, their compounds, and various solutions, together with notes on mineralogy and a large range of chemical-technological subjects.

THE LEATHER TRADES' YEAR BOOK, 1915. Edited by M. C. LAMB and J. GORDON PARKER. The Anglo-American Technical Co., 112, Tower Bridge Road, London, S.E. 212 pages. 9 × 6 in.

THIS Year-Book is the official organ of the United Tanners' Federations of Great Britain and Ireland. The first part of the book is devoted to information concerning the various Federations, and to statistical and other matters of interest to the tanner and leather chemist. The remainder of the book is occupied by an interesting series of papers on a variety of subjects pertaining to the industry; these include contributions by such authorities as H. R. Procter, E. Nihoul, J. T. Wood, and M. C. Lamb.

POTASH SALTS AND OTHER SALINES IN THE GREAT BASIN REGION. By G. J. YOUNG. U.S. Dept. of Agriculture, Bulletin No. 61. Government Printing Office, Washington. 92 pages. 9½ × 6 in. Price 15 c.

THIS Bulletin embodies the results of investigations carried out in co-operation with the U.S. Geological Survey and the Mackay School of Mines, Reno, Nev., to determine the sources of potash in the basin region. The area under consideration covers practically the whole of Nevada, the southern part of Oregon, the western part of Utah, and certain parts of eastern and south-eastern California. The chief result of the investigations is to show that, of the basins examined, Searles Lake is the only one where the concentration of potassium in the residual brines is sufficient to offer prospects of commercial success.

* New Books.

[The Roman numerals in thick type refer to the similar classification of abstracts under "Journal and Patent Literature" and in the "List of Patent Applications."]

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X. *Backert*, A. O.: Ed. The A B C of iron and steel; with a directory of the iron and steel works and their products of the United States and Canada. Cleveland, O., Penton Pub. c. 15+ 338 p. 11. pers. plans fold. pls. tabs. diagrs. 14°. 1915. \$5.

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White, C. H.: Methods in metallurgical analysis. 106 illustrations. N.Y., Van Nostrand. c. 9+356 p. (3½ p. bibl.) D. 1915. \$2.40 n.

XII. Ingle, H.: Manual of oils, resins, and paints, for students and practical men. In three vols., each volume complete in itself and sold separately. Vol. I. Analysis and valuation. With diagrams by the Author and J. A. L. Sutcliffe. Cr. 8vo. Griffin and Co. London. 1915. Net 3s. 6d.

XIII. Underwood, N., and Sullivan, T. V.: Chemistry and technology of printing inks. N.Y., Van Nostrand. c. 139 p. il. O. 1915. \$3 n.

XIV. Lock, R. H.: Rubber and rubber planting. (N.Y., Putnam.) 1914. 11+245 p. il. pls. 12mo. 1915. \$1.50 n.

XV. Stickleberger, E.: Versuch e. Geschichte der Gerberei. (95 S. m. z. Tl. eingelebten Abbildgn.) 8vo. Berlin. Springer. 1915. M. 8.

XVII. Pages, G.: Le sucre et l'utilisation de ses sous-produits à la ferme, fig. (VIII.—88 p.) in-16. carl. Hachette. Paris. 1915. Fr. 1.50.

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* Compiled by H. Grevel and Co., 33, King Street, Covent Garden, London, W.C., from whom all the works in the preceding lists can be obtained.

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ALLOTROPY AND METASTABILITY OF METALS.

BY ALFRED HOLT, M.A., D.SC.

(The greater part of this paper is based on the communications of Cohen, Smits, and their co-workers to the *Zeitschrift für Physikalische Chemie* and the *Koninklijke Akademie van Wetenschappen* te Amsterdam, but individual references to these papers as well as to those of other authors are too numerous to be given.)

The knowledge that the properties of metals sometimes change as a function of temperature dates back to classical times, for it is recorded by Theophrast and Plutarch that under extreme cold lead sometimes melted, and copper disintegrated, while the grey and white allotropes of tin had been unmasked by Aristotle, but the intensive study of these phenomena is of quite recent date. Though the two varieties of tin have been so long familiar, the general extension of observations to other metals is largely due to Cohen and his co-workers at the van't Hoff Laboratory at Utrecht, while Smits at Amsterdam has put forward a general theory of allotropy applicable to both the solid and liquid phases of a substance. The conclusion which results is that all metals, as we ordinarily know them, are not composed of similar molecules or molecular associations, and that consequently their properties as determined up to the present are really those of mixtures or solid solutions. This opens an enormous field to the chemist and physicist to isolate each form and to determine its properties, while to the metallurgist it offers a possible explanation of many problems concerning hardening and passivity of metals, etc. Consequently I felt justified in attempting to give a brief outline of both the kind of experimental work on which it is based, and some of the phenomena to which allotropy affords at least a plausible explanation.

At the outset let us assume that in any single pure form of a metal the molecules be alike in both structure and complexity, so that the properties of any one specimen must be identical with those of any other specimen of such a metal, and further that such properties can only vary as a function of temperature. Now reference to chemical literature shows that this is not really the case. The density of all specimens of a pure metal is not an absolute constant, nor is the coefficient of expansion, electrical conductivity, etc., an exact temperature function, but they are found to vary with the previous history of the specimen under investigation. It is true that the variations are usually of a small order of magnitude and might perhaps often be attributed to experimental error or impurities in the specimen, but work carried on with the greatest of modern accuracy and care only confirms earlier irregular results. Thus any investigation on allotropy must partake of the nature of an inquiry into the

influence of past treatment on such characters as melting point, solidification point, transition point, density, specific heat, electrical conductivity, chemical reactive power, etc., and also the examination of these characters as a temperature function. It is clear that this represents far too wide a field to be covered in detail here, but a few particular examples, typical of much that has been done, may be of interest.

(1) *Density measurements.* The case of cadmium may be taken as an example. Two samples of the metal (A and B) after reduction to fine turnings gave densities 8.633 and 8.643 respectively. After heating (A) for about four days at 150° C. in dry CO₂, the density showed no change, but when (B) was heated for the same time at 100° C. in a solution of cadmium sulphate and then chilled, its density dropped to 8.633 (the same as A). B was then heated to 60°—70° C. in cadmium sulphate solution for about 12 hours, when its density was found to have diminished still further to 8.620. On reheating for a day at 40° C. it regained its original value, 8.643, whilst further treatment at 60°—70° C. again caused a reduction to 8.632.

The case of zinc is also worth mentioning. Two specimens of the metal, melted and then chilled, gave densities 7.130 and 7.129. On heating at 100° C. in zinc sulphate solution a progressive diminution in the density of each specimen took place, so that at the end of a fortnight the values had become 7.102 and 7.109 and the change was still incomplete. The true value is probably about 6.922, for this was obtained by Kahlbaum for the metal which during a distillation condensed nearer the hottest part of the tube and would consequently be stable on slow cooling. With density changes of the order mentioned above it follows that there must be marked alteration in the specific volume, the practical results of which will be the gradual break up of objects made of the metal. This has actually been observed in the case of thin protective films of zinc which have gradually broken up into a fine powder.

It is not easy, if indeed it is not impossible, to fix the transition point between two allotropes by means of density measurements, and consequently the more delicate method of the dilatometer has been employed.

(2) *Dilatometric measurements.* A dilatometer for this purpose consists essentially of a bulb with a capillary tube attached to it and bent at right-angles, so that when the bulb is in the thermostat the changes in volume of the metal under examination may be observed by the movement of the meniscus of the liquid contained in the dilatometer along the horizontal part of the capillary stem. In using the dilatometer two conditions are especially important. One is that the instrument be placed in a thermostat the temperature of which can be easily raised or lowered at will over a considerable range, and can at the same time be kept constant for hours or days at a time. This condition is easily satisfied by electric heating, the thermostat being virtually a low temperature oven. The other condition is that the least volume of liquid possible be employed in the dilatometer so as to diminish to the greatest extent the complication due to expansion or contraction of the liquid. This is achieved by filling the liquid dead space of the instrument with fine glass beads. Under these conditions transition temperatures in metals can be very accurately determined, as will be seen from the following table, which represents an experiment with fine copper turnings from

electrolytically deposited metal which had been melted and chilled.

Temp. ° C.	Movement of liquid in mm. per hour along tube of dilatometer.
25.0	— 1090
45.0	— 500
69.6	— 444
71.5	— 3
72.0	+ 2.5
72.5	+ 4
73.0	+ 12
75.7	+ 36
80.9	+ 75

It will be noticed that the movement of the liquid changes its direction at a temperature of about 71.7° C. which represents the transition point between the allotropes. As has just been mentioned, these figures are representative of finely divided copper. In more massive condition, however, the result is different, for a specimen of the same metal as was used in the last experiment when melted and cast into rods showed practically no change after a fortnight at 25° C. The velocity of transformation of β to α copper is thus so greatly retarded that the β form appears to be stable. It is for this reason that copper vessels fall to pieces so slowly. The effect of reducing the metal to powder in accelerating the transformation will be referred to later.

(3) *Changes in E.M.F.* The irregular behaviour of the Hulett cell, electrolytic cadmium, cadmium sulphate solution, 12.5% cadmium amalgam, may be taken as an example. These cells are supposed to give an E.M.F. of 0.0505 volt at 25° C. and to remain constant, but experience with many of them shows that not infrequently the E.M.F. gradually drops to 0.0480 or 0.0475. On the other hand fresh cells occasionally have an initial E.M.F. of 0.04817 volt, but in this case the value drops fairly rapidly (in a few days) to 0.04750 as before.

Cells prepared at about 50° C. have a voltage of 0.05022, or 0.04745 at 25° C. and 0.05026 and 0.05225 at 0° C. The difference in voltage has therefore increased as the temperature becomes more distant from 50° C.

Now if a cell which originally had an E.M.F. 0.0505 but had dropped to 0.0475 (A) be combined with one which was stable at 0.0480 (B) (using a common amalgam electrode) and the E.M.F. determined at various temperatures, curious results are obtained.

At 25° C. A gave 0.04741	Again at 25° C. A gave 0.04741
B " 0.04815	B " 0.04806
At 65° C. A " 0.04020	
B " 0.03979	

From these results the conclusion is drawn that there are three allotropes of cadmium, γ at high temperature alone being stable, whilst α would be the stable form below 50° C., for by analogy with tin salts the form deposited by electrolysis is that one which is stable at high temperatures, and is γ -tin. The explanation of the above differences in E.M.F. is therefore as follows. γ -Cadmium gives an E.M.F. of 0.0505. If no germs of the other varieties are present it remains constant, but otherwise it drops to 0.0480 characteristic of β metal or 0.0475 for the α form. As the E.M.F. is determined at temperatures more remote from the transition point the difference in voltage increases between α and β or α and γ metal, but above the transition point, the reverse occurs as indicated by the figures given above.

An ordinary piece of cadmium must be supposed to contain all three allotropes, for when the E.M.F. is measured between it and either electrolytic cadmium, or electrolytic cadmium at 50° C., the value is zero.

These conclusions have been completely confirmed by dilatometric measurements.

(4) *Electrolytic experiments.* Lead acetate solution electrolysed between lead plates produces a lead tree, but after the experiment if the plates are allowed to remain in the solution they are found in time to have lost all softness and ductility and to have become brittle. A new plate can then be inoculated by contact with the brittle material, and if now placed in the solution it, too, becomes brittle, though the same change may occur spontaneously at a much reduced rate. Further, a lead tree can be grown between two lead plates without passing a current. The explanation is that allotropes exist, and that there is a difference of potential between them. On passing the current one form is deposited as the tree. This form used to inoculate a new plate causes electrolytic action to take place, converting the whole plate into the brittle form. But ordinary lead must contain both forms, for there is sufficient potential to bring about unaided electrolysis and produce a tree and brittle plates.

(5) *Thermal changes on heating and cooling.* These are so well known to all metallurgists that it is needless to make more than one or two remarks. A very typical case is that of α and γ iron. Structural changes in the metal may, however, be so retarded that starting at a low temperature and rising to one above the transformation point and then returning to the original temperature may produce a closed curve instead of a single one. Repeated heating and cooling, however, accelerates the change and diminishes or destroys the closed curve effect, but because in a single experiment no transition point is observed, it is by no means certain that there may not really be one, only masked by the retardation of structural change. So great may this retardation be that, for example, in some nickel steels the transformation point on cooling is roughly 650° C. lower than that observed on heating, while in certain manganese steels the difference exceeds 750° C. This extreme retardation, which will be referred to again, is the source of many of the abnormal properties possessed by these steels.

(6) *Evidence from chemical behaviour.* Under this heading is included those cases where chemical behaviour appears to vary with the past history of the metal and where the hypothesis of allotropy affords the easiest explanation, though no allotropes can be isolated, nor are their transition temperatures determined. The case of hydrogen and palladium may be taken as an example. Here, except with finely divided palladium black, the volumes of gas occluded by the metal seem to vary with its past history, and the power of rapid occlusion dies away with time. Further, the rates at which gas is absorbed by or diffuses through the metal at constant pressure yield curves showing a discontinuity. The absence of these peculiarities in the case of palladium black suggests that here one is dealing with a single state of the metal, transformation from which is extraordinarily slow owing to absence of any other allotrope in molecular contact to act as inoculator.

Distinctive chemical action is also exhibited in the change of solubility of carbon in iron at different temperatures, and in the etching action of nitric acid on iron plates. In the former case the transition from α to γ iron accompanies a great increase in solubility of carbon, while nitric acid produces a meta-stable surface convertible into the ordinary stable condition by a blow, magnetic field, etc.

Having thus reviewed the kind of evidence adduced in favour of allotropy in metals, we may consider allotropy from a more theoretical aspect. Different types of allotropy are now recognised. In monotropic allotropy one form is always meta-stable, for ever tending to assume the stable state. Such a condition is realised in the so-

called "explosive" antimony obtained by electrolysis of the chloride. Monotropic allotropic is irreversible, for the transition temperature lies above the melting point of the stable form.

Enantiotropic allotropic is a far more common case. Here the different states of the metal are converted one to another reversibly by merely changing the temperature. Grey and white tin, or α and γ iron are familiar examples. The case is not, however, quite so simple as it might appear, for a sharp transition temperature is frequently not realised. There are, indeed, four possible subdivisions of enantiotropic allotropic. Consider the change of any property with temperature. In an ideal case, at the transition point, the discontinuity in the curve representing the change of any particular property with temperature is absolutely abrupt. This, however, can only be realised if the two modifications are absolutely insoluble in each other, a view not usually held nowadays when truly insoluble substances are scarcely believed in. The more usual case is partial solubility. If, for example, the β variety is somewhat soluble in the α form, but the α is insoluble in the β one, the curve for the α variety becomes modified, the change seeming to begin somewhat before the true transition temperature, whereas if both are mutually soluble to a slight extent it changes to a more nearly continuous curve. The transition temperature is still well marked, but the change, instead of being absolutely abrupt, appears now to begin somewhat before the critical temperature and to end after it, the change having its greatest velocity at the critical temperature itself. When the two varieties are completely soluble in each other to form solid solutions, no distinct break at all occurs and the curve becomes continuous, the characters of one form merging into those of the other.

Either monotropic or enantiotropic allotropic as described above supposes the existence of pure forms in which all molecules or molecular associations are alike. The molecules, or complex groups of them, differ in the two forms, so that, in theory at any rate, there must be an intervening unordered condition—an amorphous phase. So we may form the following picture of the change from the metastable to the stable condition in, say, a plate of metal. Let the whole plate be metastable at the temperature of the experiment except for a portion in the centre which is stable. Then the change will proceed outwards in every direction from the centre, but as there should also be an amorphous phase it can only be imagined as a sort of wave front sweeping through the metal, like the spreading ripple produced in water by a falling drop. Yet for the change to be enantiotropic we must suppose sufficient unchanged molecules to remain to act as nuclei, around which the amorphous film can crystallise as it sweeps back in the reverse change, for it has been postulated above that one ordered molecular arrangement cannot pass to another one without momentarily becoming amorphous. The amorphous condition would thus represent the phase stable at the lower temperature in a state of fusion, with subsequent crystallisation stopped.

Some experiments on the magnetic properties of iron do not entirely harmonise with this idea of an amorphous phase, so it may be well to mention them briefly before passing on to the third type of allotropic. It is usually supposed that hardening of iron is the result of the production of an amorphous and vitreous phase, and since strained iron is harder than unstrained, it follows that straining must produce this condition. Iron, however, is dimorphous, therefore if this intermediate phase is due, as already mentioned, to the break up of the molecular structure, to be truly amorphous it must possess the same characters from whichever

allotrope it has been produced. Now straining does not diminish the magnetic intensity of α iron, and γ -iron is hardly magnetic. It should, therefore, follow that strained γ -iron should be magnetic. Such, however, is not the case. It appears difficult from these observations to regard this intervening phase as truly amorphous.

Dynamic allotropic is the third type now recognised. The fundamental assumption has thus been put by Smits:—Every phase of a system which behaves as an unary one is built up of at least two sorts of molecules in internal equilibrium, and must be taken as components of a pseudo-system.

This is a totally different view from that which has already been described, since it postulates that in no substance are all the molecules or associations alike. The transition point must now be regarded, not as the more or less abrupt passage from one distinct form to another, but as the splitting up of a homogeneous solid solution of two modifications. This view of allotropic not only accounts for changes of the types already described in this paper where one is dealing only with solid phases, but many interesting deductions can be made from it, and have in most cases been shown experimentally to be correct. The fundamental assumption of Smits already quoted says nothing about the condition of the phase, *i.e.*, whether it be liquid or solid. The separation of tautomeric forms from a liquid is evidence of the complex character of the liquid state, and so we are led to regard a liquid metal as containing two kinds of molecules in equilibrium, the number of each present varying with the temperature. Suppose the liquid metal to be at such a temperature that it consists almost entirely of one kind of molecule. Then on rapid crystallisation a solid would be obtained consisting mainly of one form, provided the establishment of equilibrium in the solid was not too fast. But if by any method the liquid could be made to contain both kinds of molecules, the solid would also contain them and would in fact exhibit differences in its physical properties, such as density, melting point, etc., from that containing mainly one form. Thus the melting point, etc., of a solid separating from even a pure liquid need not theoretically always be a constant. This condition has actually been realised in the case of tin, phosphorus, and one or two other substances. Extremely pure tin sometimes solidifies as a pure substance, sometimes as a complex mixture, while the melting point of phosphorus may vary as much as 1° C. In general, of course, it follows that as raising the temperature tends to shift the equilibrium in one direction, so a hot metal suddenly quenched or a liquid one rapidly crystallised would tend to assume a form metastable at ordinary temperatures. Experiment shows that prolonged heating and slow cooling are essential if the metal separated from the liquid is to be in a stable condition, for the equilibrium conditions of the solid and liquid phases are probably different, and owing to the great internal viscosity of the solid, equilibrium conditions are thus only very slowly established.

The different kinds of molecules would possess somewhat different reactive power, and so one arrives at a possible explanation of passivity. The surface of a metal must be assumed to be in a condition of equilibrium which becomes disturbed by chemical action, since its constituents possess different chemical reactivity. Treatment with an acid may preferentially remove one constituent leaving a highly metastable surface, and it all depends on the time taken to re-establish equilibrium whether anything further happens. The ease of the action of nitric acid on iron has been cited by Smits, who suggests that the following sequence of events may represent what happens.

One allotrope is easily dissolved, leaving the other, but as the oxygen arising from the reaction is partially absorbed in the metal it may act as a negative catalyst towards restoring the internal equilibrium of the surface, and consequently chemical action ceases, the metal being then described as passive. Removal of the oxygen, hammering, a magnetic field, etc., restores the surface to its equilibrium condition and permits further action. There are, of course, very many other theories of passivity, but this, even at its lowest estimate, is at any rate not unreasonable.

At an earlier period in this paper mention was made of the fact that the dilatometric measurements in the case of copper did not succeed unless the metal was in a state of fine sub-division, while all changes of volume and density are found to acquire a more definite transition point if the metal has previously been in contact with an electrolyte—one of its own salts.

In the case of finely divided metal the ratio of surface to mass is great, and as changes in the internal surface equilibrium are far more rapidly established than in the mass with its high internal viscosity, it is but natural to find that increase in surface accelerates the production of equilibrium and so tends to make any changes of character dependent on such an equilibrium condition more immediately visible. The case of the action of the electrolyte requires closer examination and has, as a matter of fact, received more than one explanation. One may take as an example grey and white tin, the latter form being metastable at ordinary temperatures. If we do not accept the fundamental assumption of Smits, we must suppose that to enable white tin to change at all, germs of grey tin must be present in it.

When such an inoculated piece of white tin is put into a solution of a tin salt the white tin dissolves, only to be re-deposited in the stable form on the germ cells of that variety. Thus, though the tin content of the solution would remain constant, the metal would apparently pass from the metastable to the stable state far more rapidly than in the absence of the solution. If each phase, however, consists of a mixture of the two varieties other considerations come in. White tin at ordinary temperatures is not in a condition of equilibrium. But some of the metal passes into solution and there must be a state of equilibrium in solution between the two varieties just as in the solid or liquid state. Equilibrium in solution is probably established rapidly—far faster at any rate than in the metal—but it is not necessarily the same as in the solid phase. The solution will, however, be too rich in grey tin to be in equilibrium with the white phase, and will contain too much white tin to be in equilibrium with the grey pseudo system. Consequently white tin must be dissolved and grey tin deposited till such a condition is reached that, for the particular temperature of the experiment, an equilibrium is established between the three pseudo systems, grey tin, white tin, solution.

A natural corollary from this is that metal ions in solution are not all the same, a conclusion quite at variance with the views held only a few years ago. As the molecules are of more than one kind in the metal, some of each kind must be supposed to dissolve and form ions, rapidly reaching an equilibrium condition. Now suppose two plates from the same specimen of metal are placed in a solution of one of its salts as an electrolyte. Then the molecules M_1 and M_2 are in the same equilibrium in both plates, and the corresponding ions M_1^+ and M_2^+ are also in equilibrium in the solution, though the relation of the amount of M_1^+ to M_2^+ is different to that in the solid. There will be no E.M.F. between the two plates. Now pass a current through the system. What happens?

Consider first the plate from which metal passes into solution. Both M_1 and M_2 molecules are removed from it in the ratio in which they are present in the solution equilibrium. But this is not the same as in the solid, so that the plate becomes richer in one or other variety. Now at the other pole M_1^+ and M_2^+ ions are being discharged in the ratio in which they were present in the solution. But this being different from that of the plate on which they are deposited as molecules, the plate becomes richer in one type. If the condition of equilibrium before any current was passed was that the ratio of M_1 to M_2 was greater in solution than in the solid, what has resulted from passing a current? The anode becomes richer in M_2 molecules since a greater number of M_1 than M_2 have to pass into solution. The metal that is deposited contains more M_1 than M_2 , and hence the deposit contains an excess of M_1 . Now since M_1 and M_2 are different kinds of molecules it is only reasonable to suppose that they carry different charges. Therefore, after passing a current, since one pole is too rich in M_2 molecules and the other in M_1 , there should be an E.M.F. between them. This has actually been shown to be the case. It also follows that as the establishment of equilibrium between the two sorts of molecules in the solid is extremely slow, at any rate compared to the solution, a condition of non-electrical equilibrium becomes established in each plate, so that even after the current is cut off unaided electrolysis may take place about each pole. An actual example of this has been cited in the case of the lead tree.

It has been said above that the internal equilibrium of the solution is probably, if not certainly, different from that in the solid, as otherwise it is not easy to account for some of these phenomena by means of this theory. What happens then if the solution is removed and the metal extracted from it? The solution of metal in, say, hydrochloric acid comes to the same thing. Chlorides corresponding to the molecules M_1 and M_2 are produced in the proportion of the ionic solution equilibrium. If these are reduced at the lowest possible temperature so as to minimise disturbance of the equilibrium, a metal is obtained which is different from that with which we started, since it now contains molecules M_1 and M_2 in a non-equilibrium condition for the solid. Such differences have frequently been observed. One might cite pyrophoric iron and lead, and platinum and palladium black. In these cases the chemical activity has been greatly increased, but on heating, which tends to restore the equilibrium, the special characters either grow less pronounced, or disappear. There are, of course, other explanations, such as increased surface action, of why finely divided metals are more reactive, but the above case is mentioned to show how far-reaching is this theory of dynamic allotropy.

A few words may be said as to the nature of allotropes themselves. If they are to exhibit such distinctive features as changed chemical and physical behaviour there must be either some definite change in the structure of the molecules or in their arrangement, that is to say a reorganisation of the atoms composing them, or a change in their number, or different molecular groupings.

When an allotropic change takes place one must assume that every changing molecule suffers the same rearrangement, and if this reconstruction necessitates a corresponding change in the forces with which they react on each other, the space lattice, which represents the grouping of the centres of gravity of the molecules relatively to each other, may also become altered, and so result in a new crystalline form. It is not very easy to see how this could come about if one is to regard solid metal as an equilibrium of two components of a pseudo system. Researches like those carried out

by Bragg on the reflexion of X-rays from the internal planes of crystals, would scarcely be possible, for the molecules in these planes would not be all alike, and no simple space lattice could be deduced. If one is to believe in dynamic allotropy it is easier to imagine the allotropes as differing in the internal structure of the molecules than in their arrangement in the space lattice. This would be quite in accordance with the view that different sorts of ions exist in solution, for it is not very obvious why different space lattices should give different ions.

An attempt has indeed been made to form some conception of what is the difference in the internal molecular structure of allotropes. On the electron theory of valency the valency bonds are considered as having definite direction. The relative direction of these bonds in the molecule may be influenced by the conditions under which such a molecule is formed. Variation in direction would give rise to molecular structures differing in the distribution of the electric charges among the constituent atoms. These would be allotropes, and that configuration in which the charges were most symmetrically arranged or neutralised would be the stable form under those conditions.

In conclusion I must point out that other explanations, not based on allotropy, have been given for many of the phenomena which have been so rapidly touched on in this communication. I would express no opinion as to the merits of one view over another, but I hope the little I have had time to say may show that allotropy may prove to be a very important consideration when one is dealing with the chemistry or metallurgy of metals.

DISCUSSION.

Professor BALY said that Smits' theory of molecular species was a special case of his own molecular force field theory. Certain points arose in his mind which seemed to require some explanation. For example if one allotropic modification of an element were raised to a temperature just above the transition temperature and if the change then set in to a second allotrope, surely it was to be expected that the change would continue until the conversion was complete. Yet Dr. Holt assumed that in certain cases the change was only partial and was arrested after it had proceeded to a definite small extent. If such condition really did obtain it might be possible to explain it by introducing a new conception, namely, that the velocity of the transition depended upon the concentration of the phases. If that were so it seemed at once possible to account for Ostwald's discovery of the periodicity in the evolution of hydrogen by metallic chromium, when treated with acids. Smits' theory of the passivity of metals alone did not seem capable of explaining this interesting phenomenon.

Dr. HOLT, in reply to Prof. Baly's questions, said that cases where the conversion from one allotrope to another appeared to be only partial and to take place over a temperature range instead of at a particular temperature, had been described by Benedicks for silver iodide and some other substances, and the view of limited solubility of one constituent in the other had been postulated to account for the observed phenomena. If it was correct he would agree with Prof. Baly that the velocity of change depended on the concentration of the phases. A somewhat similar case to the periodicity of the evolution of hydrogen by metallic chromium was the change in anodic potential observed in some cases during the electrolysis of acids with iron electrodes. To account for this it must be assumed that the velocity of restoration to the stable state must depend on the concentration of the phases.

London Section.

Meeting held at Burlington House, on Monday, June 7th, 1915.

PROF. W. R. HODGKINSON IN THE CHAIR.

THE DEMULSIFICATION VALUES OF MINERAL LUBRICATING OILS FOR USE IN STEAM TURBINES.

BY ARNOLD PHILIP, B.Sc., A.M.I.E.E.

From time to time since the introduction of the use of the steam turbine combined with a forced lubrication system, much trouble has been experienced, both by the users and the sellers of lubricating oils, due to the formation of emulsions of the oils with water. The leakage of water into the oil system and the churning up of the oil with the water by rapidly moving surfaces are the prime causes of the formation of such emulsions, but a further necessary cause is that the oil must itself possess special properties which permit it to emulsify. In fact, it is found that under the same conditions of use, some oils become emulsified whilst some do not.

The chief troubles caused by the formation of emulsions in a lubricating system are three in number. Firstly, an emulsion of oil and water in many respects may behave more like a semi-solid than a liquid, and such a mixture therefore refuses to flow satisfactorily in the lubricating system under the available pump pressure. Secondly, the water present in such emulsions frequently contains more or less salt in solution, and, in so far as this electrolyte can be forced through the bearings, it is liable to be the cause of electrolytic corrosion of the journals of steel shafts, etc., due to the contact e.m.f. set up by the steel of the journal and the white metal or brasses of the bearings in the presence of the salt water. Even in the presence of only traces of salt in the water, condensed steam may contain sufficient dissolved carbonic acid or may extract sufficient organic acid from the lubricating oil itself, whether this is a pure mineral oil or whether it consists of a mixture of a mineral oil with a larger or smaller proportion of a fatty oil, to cause it to act as an electrolyte. Undoubtedly, however, this particular trouble is most marked when the water mixed with the oil contains larger proportions of salt, derived either from sea water or from ordinary shore water.

The passage of sea water or shore water into the oil is, in general, due to the fact that the oil from the forced lubrication system is cooled down after its passage through the engines by pumping it through an oil cooler. An oil cooler consists of a series of tubes through which the oil is pumped, and the outer surfaces of these tubes are in contact with a current of either sea or shore water, which is pumped through the cooler in order to remove the heat from the oil. Leaks not infrequently occur in the tubes of the oil cooler due to corrosion on their water side, thus permitting the access of the cooling water to the oil.

The third objection to the formation of emulsions in lubricating systems from the consumer's point of view is that it is the cause of a serious loss of lubricant. When an emulsion has once been formed it becomes practically impossible to separate the oil from the water by gravitational settling, even when this is assisted by heating, whilst it is evident that in all cases the necessity of such special treatment of a lubricant is undesirable, even in shore installations, whilst at sea it is practically impossible to carry it out.

The difficulties experienced from the emulsification of lubricating oils caused the author to study this subject some years ago, and he arrived at the conclusion that it was very easy to obtain two samples of lubricating oils the difference between which could not be ascertained by any chemical or physical test that it was possible to apply to them, and yet one of these oils would be found to be satisfactory as a lubricant on a turbine forced lubricating system, whilst the other was practically useless.

As a result of this conclusion it appeared evident that the only test to apply to a lubricating oil in order to ascertain whether it was or was not capable of resisting emulsification, must be of a practical character and must directly measure the power of the oil to resist emulsification. With this view the author designed a special form of tester, a general view of which is shown in Fig. 1. This apparatus actually consists of a high speed stirrer driven by an electro motor at a definite speed for a definite time. This stirrer is employed to make an intimate mixture of 500 c.c. of the oil under test with 500 c.c. of distilled water at 100° C. At the end of the period of agitation of the oil and water, the mixture is run out of the vessel in which the stirring has taken place into a graduated glass measure. Here, after a sufficiently lengthy period, it separates generally into three layers, viz., a top layer of oil, an intermediate layer of emulsion, and a bottom layer of water. At the end of a fixed period of time (24 hours), the volume of oil which has separated is read off and the percentage of this, calculated on the volume of oil originally placed in the tester, is recorded as a measure of the power which the oil possesses for resisting emulsification.

This percentage the author proposes to call the "demulsification value" of the oil.

As the result of numerous tests carried out with this apparatus throughout the past four or five

years, it has become evident that mineral lubricating oils which possess a demulsification value of 90% and over can be readily obtained commercially in as large a quantity as is desired, and also that, out of between 700 or 800 samples of such oils which have been tested and passed as satisfactory as possessing demulsification values of 90% or over, not a single one has given any trouble whatever due to the formation of emulsions under the practical conditions of use on a forced lubricating system on steam turbines. On the other hand, previous to the use of this system of testing lubricating oils for steam turbines, much trouble and annoyance frequently occurred, due to the fact that it was found impossible by any chemical test to ascertain beforehand whether any given lubricant would or would not give rise to difficulties under practical working conditions due to the formation of emulsions.

Quite small amounts of the class of colloids known as reversible colloids or emulsoids are capable of producing very marked emulsive effects. In the case of mineral lubricating oils the nature of the emulsoids which are present in the faulty lubricant may not be known in all cases, but one active emulsoid is considered to be most probably the bituminous matter which is present to a greater or smaller degree in almost all natural mineral oils which have not been purified by distillation. Evidence that this is so is given by the following results. Samples of high class special mineral lubricating oils were selected which were found to possess demulsification values of 91% and upwards, and to each of these 1% by weight of some oil fuel was added, the bitumen content of which was determined and the resulting mixture of 99% satisfactory lubricating oil and 1% fuel oil then tested for its demulsification value. The results of these tests are shown on Tables I and II.

The bituminous matter present in fuel oils from different sources may very well possess

TABLE I.

1		2			3
High class special mineral lubricating oils for turbines.		Fuel oil of which 1% was mixed with oils in Column 1.			Demulsif. value of 1% mixture.
Laboratory number.	Demulsification value.	Laboratory number	Origin.	Bitumen %. By amyl alcohol method. By ether-alcohol method.	
1139 A/14	96%	732 T/14	Shale oil (cracked)	Nil	94%
1140 A/14	94%	1003 A/14	Borneo	0.38%	94%
657 Y/14	94%	487 A/14	Roumanian	1.8%	94%
636 Y/14	94%	140 V/14	Burmah (distilled)	Nil	92%
1138 A/14	94%	1054 A/14	Texas	1.0%	92%
1093 A/14	94%	1035 A/14	Persian	1.21%	88%
1176 A/14	92%	488 A/13	Trinidad	7.1%	74%
1149 A/14	95%	1145 A/14	Persian	2.15%	34%
492 Y/14	91%	482 A/14	Mexican	17.62%	30%

TABLE II.

Variation of demulsification value caused by adding 1 part of various fuel oils to 99 parts of special mineral turbine lubricating oil (laboratory number 533 A/13) which contained no bitumen and whose demulsification value was 98.0%.

Laboratory number of added oil fuel	491 A/13	486 A/13	492 A/13	484 A/13	487 A/13	488 A/13	489 A/13	480 A/13
Description of added oil fuel	Burmah distilled.	Borneo.	Texas.	Persian.	Roumanian.	Trinidad oil fuel.	Trinidad Lake.	Mexican.
Percentage of bitumen in added oil fuel	nil	0.38	1.00	1.40	1.80	7.10	11.75	26.25
Demulsification value of mixture	93	90	74	73	64	63	57	27
Percentage of bitumen in mixtures as shown by amyl alcohol method ..	nil	0.0038	0.010	0.014	0.018	0.071	0.1175	0.2625

greater or smaller emulsifying properties, but when this is borne in mind, and also the fact that the determination of bitumen in oils does not possess an accuracy of more than about 0.5%, it is considered that a fair conclusion to draw from these figures is that the bitumen in undistilled oils is the cause of the observed decrease in the demulsification value noticed in these tests.

Whether the lowering of the demulsification value of a high class lubricating oil by the addition of 1% of an undistilled fuel oil is or is not caused by the amount of bitumen in the added oil, although of interest, is actually a matter of secondary importance. The main point is the recognition of the fact that such lowering of the demulsification value does take place, whatever may be the real active constituent present in the added oil which causes this lowering. On this account those manufacturing or handling such oils should avoid carefully any contamination of their products with small amounts of other oils.

It is a matter of interest to compare the results of the actual chemical analysis of a high class mineral lubricating oil suitable for use on turbine engines (Column 1, Table III.) with the imaginary results (Column 2, Table III.) of an oil fuel the figures for each of whose results of test have been intentionally selected as representing outside possible values for any fuel oil. If from these two series of results a third series is calculated for what would be the results of test on a mixture of 1% of this imaginary oil fuel with 99% of the high class mineral lubricating oil, on the assumption that the quantities are additive, we get the series of figures given in Column 3, Table III.

TABLE III.

	1 High class special mineral lubricating oil.	2 Imaginary oil fuel, all results being extreme values.	3 Calculated values for mixture 1% of 2 with 99% of 1.
Sp. gr. at 60° F.	0.8770	0.9685	0.8779
Flash point	403° F.	180° F.	400.7° F.
Viscosity at 70° F. (seconds)	675	2586	694.1
Free acidity to water as oleic acid	Nil	0.5%	0.005%
Sulphur	0.109%	3.98%	0.147%
Iodine value	16.2	100.0	17.03
Saponification value .	0.28	6.0	0.33
Bitumen	Nil	38.0	0.38%
Paraffin wax	Nil	27.5	0.275%
Demulsification value	96%	Nil	Nil

When one considers the difficulty that is found in making a reliable test that shall estimate such small quantities of paraffin wax or bitumen as 0.275% or 0.38% calculated as being present in the 1% mixture of fuel oil and 99% lubricating oil, it is clear that the only difference which can lead one to discriminate against the oil represented by the results given in Column 3 as against the oil represented by the results given in Column 1, Table III., is the demulsification value. In fact, as far as the use of a mineral lubricating oil for turbines is concerned, the determination of the demulsification value is of greater use than any other test which can be made.

Cases have arisen in practice in which from the behaviour of an oil it has been suspected that it has been mixed with minute amounts of a fuel oil, owing to the tank wagon in which it was transported not having been thoroughly cleaned out from the remains of some other oil which had previously been carried in it, and here the only difference which could be clearly established between the oil as accepted and the oil as delivered was in the important respect of its demulsification value.

In what has been said above, attention has been chiefly directed to the bad effects of mixing small quantities of fuel oils with special mineral lubricating oils, but experience has shown that the admixture of fatty oils may also, under certain circumstances, produce trouble as indicated by the lowering of the demulsification value of the mixture. The reason that small admixtures of fatty oils sometimes do and sometimes do not alter the demulsification values of lubricating oils, is no doubt due to the different conditions under which the fatty oils have been refined. Information as to the nature of the refining process to which an oil has been submitted is generally not available, whilst for practical purposes it is not of much importance on account of the fact that the physical and chemical peculiarities of an oil, due to the special method by which it has been refined, are so slight that they cannot be readily detected by ordinary methods of analysis, and the stated nature of the refinery process cannot be verified. Hence it is in general not possible to state from the alleged method of refining used or the results of chemical tests, whether the admixture of a given oil would be liable to cause the mixture to emulsify. By far the simplest method of investigating the point is to prepare a sample mixture and test its demulsification value.

The addition of paraffin wax to mineral lubricating oils has not in general been found to decrease their demulsification value, and as a matter of fact in some cases has been found to increase the demulsification value of a faulty oil.

No doubt there are other substances which tend to improve the demulsifying properties of lubricants, and the tester now described forms a convenient method of searching for such substances and also a means by which the oil blender can examine on the small scale various blends of oil before undertaking the costly venture of recommending them for use on the large scale. It is desirable that both the blender and the user should purchase all lubricating oils for turbine work on the basis of a demulsification test.

The recognition of the fact that the addition of quite small proportions of some types of oil fuels, or even of some fatty oils, may cause a very serious modification of the emulsifying properties of a mineral lubricating oil, renders it necessary to employ special delivery pipes from tanks used for storing special non-emulsifying mineral lubricating oils suitable for turbine lubrication. In some oil refineries it has been observed that the same delivery pipe is capable of supplying oil from storage tanks of different grades of oil, and this practice has been defended on the ground that the amount of oil of one grade which it is possible can be mixed with another due to drainage in the pipes is so small as to be negligible. This is, no doubt, generally true in so far as the results of any chemical tests can decide, but when the question as to freedom from emulsifying properties is of so much importance as in the case of lubricating oils for turbines, it is wiser to avoid all risks of mixtures, even when of quite small amounts.

The Demulsification Tester now described (Figs. 1 and 2) consists of a jacketed cylindrical vessel, A, supported on a tripod stand, B, and fitted with a removable lid or cover, C, carrying a mechanical stirring device, D. The jacket of the cylindrical vessel contains distilled water which can be boiled by the flame from the ring burner, E. The jacket is fitted with a water gauge, F, visible on the right hand side, and on the left hand side at the top is a short metal tube, G, for the escape of steam. The upper end of G is connected to a suitable vertical reflux condenser, which is not shown in the figure. When thus connected the loss of water in the jacket takes place very slowly, but a refilling opening, H, is provided and is seen in the centre

of the figure at the top of the jacket, and is closed with a screw cap.

To carry out a test on a sample of oil, 500 c.c. of distilled water is placed in a suitable metal vessel and on the surface of this water 500 c.c. of the oil under test is poured, the oil and water are placed over a ring burner and heated until the

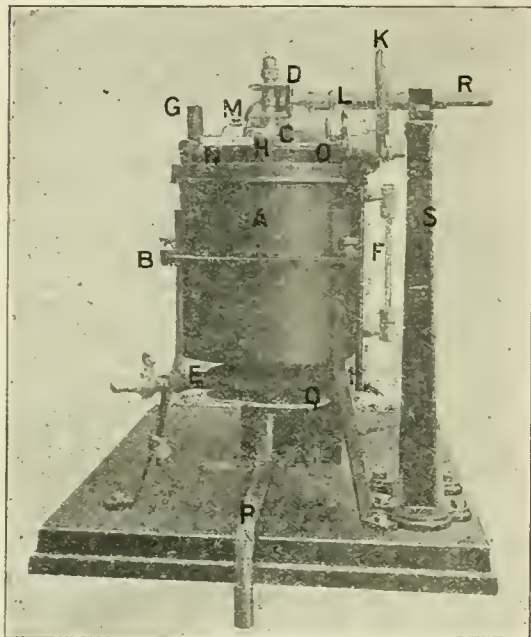


FIG. 1.

water boils well. The stirrer, D, in the top of the tester is disconnected from the shaft of the driving pulley, K, which is independently supported on the standard bearing, S, by rotating and slipping back a sleeve, L. The lid or cover of the tester can now be removed, together with the stirrer, if the pin at the back at M, which is attached to the tester by a chain, is pulled out and the cover is rotated clockwise for about half an inch in order to free the three lugs at its edge from the clips, two of which, N and O, can be seen at the right and left at the top. After lifting off the cover the hot oil and water is poured into the interior cylindrical receptacle, which has already been heated by boiling the water in the water jacket. The lid and stirrer are then put back into position and secured by rotating the lid slightly counter-clockwise until its three lugs re-engage in their clips. The pin at M is next replaced and the lid and stirrer are thus firmly secured in position, the stirrer is then connected with the pulley by the sliding sleeve on the stirrer, which slips over the pulley shaft and is driven by it by two pins on the shaft engaging with two slots cut in the sleeve.

Everything being now ready for carrying out the agitation of the oil and water, the electric motor, which is visible in Fig. 2 only, is started by means of a starting switch and speed regulator, which is on the base of the support carrying the motor (*vide* Fig. 2).

The speed at which the stirrer runs can be modified by means of the speed regulator handle. The speed of the pulley should be kept at about 350 to 400 revolutions per minute. After stirring the mixture of oil and water at this speed for five minutes the mixture is run off from the tester into a previously warmed 1000 c.c. graduated glass jar

through the pipe, P. This is done by pushing up the loose metal disc, shown at Q, the underside of which is coated with asbestos sheet in order that it may be handled comfortably when hot. By raising this disc a valve in the centre of the bottom of the container is opened and the oil and water run out through the pipe, P. After allowing the oil and water a period of about a minute to drain out, the glass cylinder containing oil, water, and emulsion is set aside to stand for 24 hours. At the end of this period the volume of oil is read off in cubic centimetres and this divided by five gives the percentage of oil separated as calculated on the amount taken.

The apparatus is made for any desired supply voltage and can be used either on direct or alternating current systems.

In the event of a breakdown of the electric supply or of the motor the shaft of the pulley, K, which extends to the right of the bearings at R, is provided with a key way and a hand wheel by means of which the stirrer may be driven by hand, but this is a somewhat tiring operation and becomes practically impossible if any number of tests have to be made.

The determination of the demulsification value of an oil is necessarily an arbitrary process. The nature and duration of the stirring, the relative volumes of oil and water taken, the temperature at which the test is carried out, the drainage losses of oil which occur during the test on the three occasions upon which the oil and water are transferred from one vessel to another, are all arbitrary conditions of test. These arbitrary conditions are unavoidable but they can be readily reproduced and concordant results are obtained. One of the results of the drainage losses in transference is that even an ideal oil cannot give a demulsification value greater than about 98%. The variation of speed of rotation of the stirrer may be from 350 to 400 r.p.m., and this variation does not cause

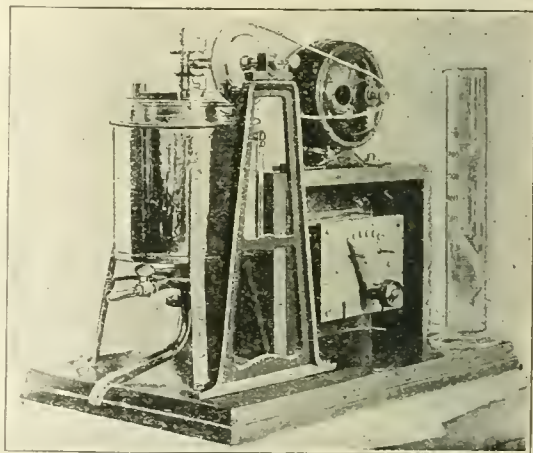


FIG. 2.

variations in the results obtained, but if too low or too high a speed is employed the apparatus does not yield satisfactory results.

DISCUSSION.

The CHAIRMAN thought that the presence of some basic nitrogenous compound might assist in the emulsification process. What was called bitumen was not a definite chemical compound, and nearly always contained some nitrogen. He understood that fatty oils emulsified rather more

readily if they were mixed with other oils: this might possibly be due to hydrolysis.

Mr. D. A. SUTHERLAND thought Mr. Philip had not quite hit upon the cause of the emulsification in assuming it to be "bitumen," and that it was more likely the sulphur compounds in the oils used. Emulsification could be readily caused by over-treatment with sulphuric acid, of Scottish shale oils which contained olefine bodies and other unsaturated hydrocarbons, so that sometimes the soda solutions used in the subsequent treatment formed a "glut" with the oil most difficult to separate. In testing oils he had been in the habit of simply putting so much oil and water into a bottle on the waterbath, shaking the mixture vigorously, and seeing if separation took place. He thought the stirring method he had employed, namely by air blowing, would give much the same results as the apparatus described. On smelling Mr. Philip's samples he noticed, as he expected, that the Mexican and Texas samples had a strong smell of sulphur compounds. The Mexican oil had the characteristic odour of acid tars from treated oils, and he felt certain the sulphur compounds were the actual cause of the emulsifying. He would not be surprised if the separated water was in some cases milky or opaque. He asked if Mr. Philip had tried to determine the influence of the compounds of sulphur that were present in the Mexican oil. He suggested in order to settle this question that a comparative experiment should be made with heavy California oil such as that from the Kern River district, which contained a high percentage of "bitumen," in the sense in which Mr. Philip used the word, and could be obtained practically free from sulphur. The Texas sample also contained sulphur compounds, and they would notice, in Mr. Philip's test, evidence of its influence to a lesser degree on account of the lesser quantity of sulphur compounds. The Persian oil had still less sulphur but also had a marked effect. The samples of Borneo, Burmah, and Russian oils shown, judged by the absence of smell, were comparatively free from sulphur compounds and did not emulsify. Crude petroleum could not be classified as to sulphur contents by countries, as in each oil country oil might be found practically free from sulphur or might contain a large percentage. In the latter case sometimes the natural oil from the wells was so emulsified with water that it could only be separated with great difficulty. It was evident to him from a cursory examination that there were sulphur compounds present in the oils which Mr. Philip had found to emulsify, and in quantity proportional to the extent of emulsification, the highest result being from the Mexican sample. He drew attention to the characteristic odour similar to that of sulphonic compounds, possessed by this oil.

The CHAIRMAN said that sulphonic acids generally were very frothing agents.

Mr. G. NEVILL HUNTLY said that bitumen and sulphur were not the only factors producing emulsification; fatty oils also had a marked effect, and the accidental addition of less than 0.2% of saponifiable oil to a satisfactory mineral oil, completely changed its properties in the crank chamber of a high speed vertical engine, emulsification being produced. Emulsification depended on the water as well as on the nature of the oil, as it took place more readily with distilled water or very soft natural waters than if electrolytes were present in solution, and that fact had been utilised in practice.

Mr. D. A. SUTHERLAND said he had been addressing his attention particularly to the difficulty raised by Mr. Philip's experiments as to pure samples of oils and not to difficulties due to

extraneous causes of contamination to which the last speaker had referred. Less than 1% of resin soap or other reagent would emulsify oils or even render them solid, but he did not think Mr. Philip's tests were directed to this, and he had presumed the absence of such impurities in the samples used.

Mr. PHILIP agreed with the Chairman that probably the presence of nitrogenous bodies in fatty oils was a cause of emulsification. Undoubtedly nitrogenous albuminoid bodies were present in natural fatty oils, and such bodies were reversible colloids or emulsoids and thus so far resembled bitumen. The cause of the emulsification of oils was, however, a side issue; it was the detection of the existence of this peculiarity with which he was chiefly concerned.

Mexican oil contained 3½% of sulphur, which was as high as, or probably higher than, the amount present in any other natural petroleum oil fuel in the market. He did not, however, quite see how a Mexican or any other natural petroleum fuel oil could contain sulphuric acid; such oils, so far as he was aware, were never treated with sulphuric acid. This treatment was only used to refine oils, and natural petroleum fuel oils were not refined oils; they were usually merely crude oils dehydrated and topped as far as necessary for the required flash-point; hence such oils contained no sulphonic acids or sulphonates. If, however, any oil did contain a sulphonate or sulphonic acid, these bodies might assist in causing such oils to form emulsions, but he had made no experiments to demonstrate as to whether this hypothesis was correct or not. In regard to the possibility of sulphur itself, as existing in a natural or distilled oil and not in the form of a sulphonic acid, being the cause of emulsion, he had found that if a distilled fuel oil which contained practically no bitumen but more than 4% of sulphur, such as some of the Devonshire shale oils, were mixed in small amounts, up to say 2%, with a good class, non-emulsifying lubricating oil, this addition did not cause the lubricating oil to lose its non-emulsifying properties and it therefore seemed fairly clear that sulphur did not of itself cause the lubricating oil to emulsify, whilst in so far as he could see the addition of either bitumen or albuminoids, and particularly the former, did have this effect.

The case Mr. Huntly had mentioned was an example of exactly what he had tried to demonstrate, namely that the chemical differences between satisfactory and unsatisfactory lubricating oils for use in turbines or other engines where emulsification was possible were very small. It required extremely careful work to demonstrate these differences by ordinary chemical or physical tests, and it would be very difficult to convince the contractor that the proposal to reject a delivery of oil on the strength of a difference of 0.1 in its saponification value was a right or a reasonable proceeding. The differences in the demulsification values were readily apparent and he had found were readily accepted as deciding the quality of lubricating oils for turbines, etc.

Mr. PHILIP wrote subsequently that, owing to an oversight, he had omitted at the meeting to reply to the suggestions that the experimental emulsification of oils and water might be conveniently carried out by an air blast, and that hand shaking of a mixture of oil and water in a corked bottle was a simple method of obtaining the same results. He had, as a matter of fact, endeavoured to use both these methods, among many others, but had been unable to obtain satisfactory results and had, on the other hand, obtained extraordinarily concordant results with the form of demulsification tester he had finally adopted and described.

Journal and Patent Literature.

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I.—GENERAL PLANT; MACHINERY.

PATENTS.

Furnaces and the like; Gas-heated ——. J. King, Warrington, J. B. Burnett, Stockton Heath, The Richmond Gas Stove and Meter Co., Ltd., Warrington, and A. Mead, Sheffield. Eng. Pat. 8638, April 6, 1914.

IN muffle, crucible, tank or like gas-heated furnaces of the kind described in Eng. Pat. 27,686 of 1912 (this J., 1913, 1055), the primary air is supplied under pressure through pipes passing below the floor of the heating chamber. The gas is supplied through separate passages opening into the air passages near their delivery end. The products of combustion pass to the chimney through passages below the floor of the chamber.—W. F. F.

Furnace-hearth. J. H. Klepinger, Great Falls, Mont., and F. R. Corwin, Douglas, Ariz. U.S. Pat. 1,140,042, May 18, 1915. Date of appl., Dec. 17, 1914.

AN arched reinforced concrete hearth is provided with openings for the discharge of the material treated, and with a central opening for a rabble shaft. The rabble shaft is of smaller diameter than the opening, and the annular space thus formed is closed by removable sector blocks.—W. F. F.

Kiln; Down-draught continuous ——. F. D. Shaw, Chicago, Ill. U.S. Pat. 1,140,719, May 25, 1915. Date of appl., May 1, 1912.

THE articles to be burned are carried through a masonry tunnel on cars, the sides of which are made of an irregular shape conforming with a similar irregular shape given to the sides of the tunnel, in order to obstruct the passage of gases. The cars carry flaps of resilient material for sealing the bottom portion of the kiln.—F. Sp.

China or other clay, fullers' earth, pigments, whiting, and the like; Apparatus for drying ——. W. J. Gee, London. Eng. Pat. 8892, April 8, 1914.

THE material is fed by an oscillating blade from a hopper in which it is preheated, on to a band of parallel wires moving longitudinally over a table of aluminium supported by channel irons, and heated from below by electric heating coils to about 300°—400° C. (for China clay). The thin film of material sags between the wires on to the table, thus forming channels for the escape of steam. Air is drawn through a flat chamber placed above the material, and heated by radiation, and is returned over the material. The hot air and steam are used for preheating the material in the hopper.—W. F. F.

Grinding or crushing machinery. A. H. Moss, Gainsborough, Notts. Eng. Pat. 17,629, May 21, 1914. Addition to Eng. Pat. 3258, Feb. 7, 1914 (this J., 1915, 478).

IN grinding machinery of the type comprising a horizontal ring with a concave upper grinding face, supported on rollers of which one is driven, and grinding-rollers rotating on swivelling shafts, the driving-roller shaft is extended beyond the centre of the machine and a grinding-roller is driven from it. The grinding-roller shafts are pulled towards the ring by wire ropes inclined in a direction opposite to that of the rotation of the ring. Air

may be blown against the grinding surfaces through pipes attached to the hollow central pedestal.—W. F. F.

Crushing mill. J. D. Millar, Milwaukee, Wis., Assignor to E. F. McCool, Victor, Colo. U.S. Pat. 1,139,790, May 18, 1915. Date of appl., Sept. 26, 1908.

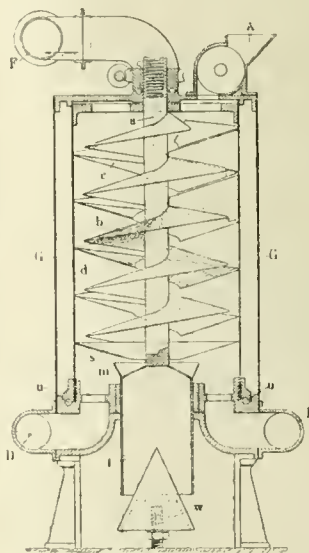
TWO grinding or crushing discs having flat surfaces slightly hollowed at the centres are supported horizontally face to face. The upper disc is carried by a hollow shaft through which the material is fed into the space formed by the hollowed out centres. The lower disc is carried on a shaft which is mounted eccentrically within a sleeve, the axes of both being parallel. The shaft and sleeve are rotated at different speeds.—W. H. C.

Agitating devices especially applicable for promoting solution of solids in liquids or for causing them to remain suspended therein. F. Shewring, Droitwich. Eng. Pat. 11,777, May 13, 1914.

THE agitator consists of a cross or star of metal strips, which is suspended and rotated in a suitable tank, resilient devices such as metal spiral springs being attached to the lower side of the strips.—W. H. C.

Drying, kiln-drying, humidification and like treatment of any materials or products in a state of division; Apparatus for the ——. G. Desaulles, Paris. Eng. Pat. 12,299, May 19, 1914. Under Int. Conv., May 20, 1913.

THE material is fed into the apparatus through the hopper, A, and passes down between the two helices, b, c, which are enclosed in a cooling jacket, G, and are rotated one about the shaft, a, and the other by the cylinder, d, upon the ball bearings, u. The treating agent enters through the pipe, D, and after passing through the material is discharged through the pipe, F, which may be connected to a vacuum pump. The treated material falls into the funnel, s, and thence through m, into the cylinder, l, which has a discharge opening at its lower end, controlled by the adjustable cone, w.—W. H. C.



Dryer. C. E. Geiger, Assignor to W. E. Koop and G. W. Fiske, Louisville, Ky. U.S. Pat. 1,139,663, May 18, 1915. Date of appl., April 10, 1911.

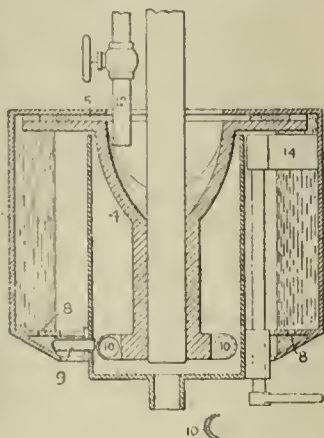
STEAM pipes arranged within a horizontal rotary

drying cylinder, parallel to its axis, are connected to a manifold for the supply of steam and the extraction of condensed water. The manifold is rotated with the cylinder and enclosed in a fixed casing.—W. H. C.

Centrifugal clarifier. E. D. Mackintosh, New York. Eng. Pat. 20,084, Sept. 23, 1914.

TURBID liquid is delivered by the pipe, 12, into the rotating bowl, 4, from which it flows by centrifugal force through passages, 5, to the drum, 1, carried by the bowl, 4. Heavy and light particles move to the outer and inner surfaces respectively of the liquid annulus, and the liquid passes through holes, 8, to an annular passage, whence it is guided by the scoop, 9, into buckets, 10, to assist in their rotation. Solid matter deposited on the inner wall of the drum, 1, may be removed by the scraper, 14.

—W. F. F.

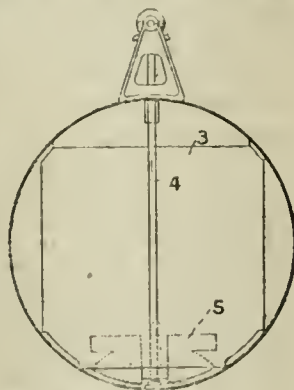


Separating solids from liquids: Apparatus for continuously —. J. Van N. Dorr, Denver, Colo. U.S. Pat. 1,140,131, May 18, 1915. Date of appl., May 8, 1914.

A HYDROMETER suspended in a settling tank is connected to a recorder and to an electric circuit in such a way that upon a given change in density, the discharge pipe for the settled material is regulated, and an alarm sounded.—W. F. F.

Mixing apparatus. R. B. Grey, London. Eng. Pat. 1891, Feb. 5, 1915.

A HORIZONTAL tank, shown in cross-section in the figure, is divided into communicating compartments by vertical partitions, 3, and a propeller, 5, driven by a shaft, 4, is provided in each compartment. Each compartment is also provided with diverters, above the partitions, to disturb the surface tension of the liquid in the vortices created by the propellers. The propellers have flanged lower edges and are all driven from a common horizontal shaft above the tank.—W. H. C.



Filter-press. J. Johnson, Brooklyn, N.Y. U.S. Pat. 1,139,767, May 18, 1915. Date of appl., Feb. 9, 1912.

THE peripheral joint between adjacent filter-plates is made by a collapsible packing ring, carried by a shoulder on one plate and pressed against a projecting piece on the face of the opposite plate

by a cam ring. A toolled spacing ring is used to adjust the distance between the plates.—W. H. C.

Filter-mass washer. J. Kraus, Anaconda, Mont. U.S. Pat. 1,139,776, May 18, 1915. Date of appl., June 5, 1913.

THE filter mass is treated in a casing with water and steam supplied through a hollow central shaft and branches. An external pipe is also provided, through which the filter mass is withdrawn from the lower part of the casing and delivered into the upper part.—W. H. C.

Liquids and solids [e.g., pulp]; Treating [filtering] mixtures of —. A. E. Vandercook, Alameda, Cal., Assignor to California Macvan Co., San Francisco, Cal. U.S. Pat. 1,139,825, May 18, 1915. Date of appl., April 14, 1914.

To prevent the formation of a cake of pulp on the filtering medium, part of the pulp to be filtered is directed on to the medium in the form of jets.

—W. F. F.

Filter-presses; Apparatus for collecting the liquid draining from —. A. Eberhard. Ger. Pat. 282,372, June 25, 1914.

BELOW the filter-press, and held tightly against it, in an inclined position, by means of weights or springs, is a band of flexible impermeable material, e.g., a thin metal plate, which can be wound on and unwound from either of a pair of rolls. In one position the plate covers the receptacle for the press-cakes but allows liquid draining from the press to flow into a receiver, whilst in another position the receiver for the liquid is closed and the receptacle for the press-cakes left open.—A. S.

Boilers; Removing scale from —. G. Jayne, Pittsburgh, Pa. U.S. Pat. 1,139,873, May 18, 1915. Date of appl., July 21, 1914.

A MIXTURE of crude oil and kerosene is introduced into the lower end of the boiler, then water is introduced, and the liquid agitated by a current of steam.—W. F. F.

Scale in boilers and water pipes; Prevention of —. E. J. Mico. Fr. Pat. 473,613, Oct. 1, 1913.

A MIXTURE of graphite with any other substance, animal, vegetable, or mineral, is added to the water, and prevents the precipitate formed from depositing and forming scale.—J. H. J.

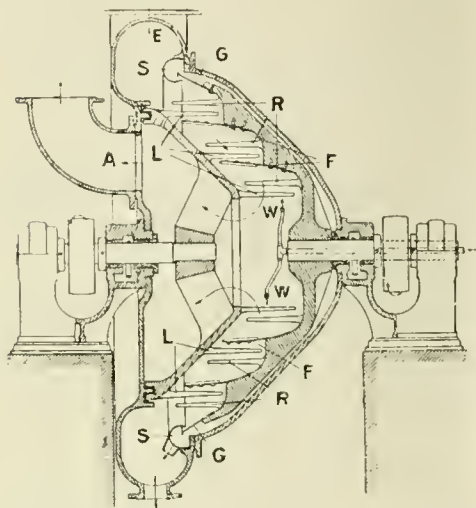
Suspended particles; Separation of — from electrically insulating fluids, especially gases. E. Möller. Ger. Pat. 282,737, July 23, 1913. Addition to Ger. Pat. 277,091 (see Fr. Pat. 449,337 of 1912; this J., 1913, 495).

THE discharge electrodes are charged negatively, and the potential difference between them and the collecting surface is regulated so that it is higher than the maximum potential which would be attainable if the discharge electrodes were charged positively. The potential difference is regulated preferably with the aid of an auxiliary spark gap, which is so adjusted that sparks just cease to pass when the desired potential difference between the discharge electrodes and the collecting surface is attained.—A. S.

Gases and vapours; Process and apparatus for purifying —. H. Zschocke. Ger. Pat. 282,088, Dec. 7, 1913.

THE water used for washing is supplied through the nozzles, W, and is thrown against the first set of disintegrator-bars, L, whence it passes to the adjacent set of bars, R, rotating in the opposite direction to the first set. From the bars, R, the water is projected on to the collecting surface, F; this is divided by cuts into a series of strips, the

edges of which are turned over and perforated. The water flows through the perforations and is delivered in the form of separate streams on



to the next set of disintegrator-bars, L, after which the operations described are repeated in sequence. From the last collecting surface, G, the water flows into the annular trough, S, and thence to a settling vessel. The gas to be purified enters at E, passes through the apparatus in the opposite direction to the water, and leaves through the pipe, A.—A. S.

Liquids or solids: Apparatus for treating —. R. Timm. Ger. Pat. 282,656, June 20, 1911. Addition to Ger. Pat. 276,119.

IN using the apparatus described in the chief patent (this J., 1915, 130) for the treatment of mobile liquids or for expelling gases from liquids, greater efficiency is secured by placing in the compartments fixed packing pieces made of expanded metal or wire gauze in the form of rolls or in other forms composed of a number of layers.—A. S.

Acid-proof transport vessels: Process for coating —with pitch, asphalt-cement, or the like, applied hot. R. Jordan. Ger. Pat. 280,863, July 1, 1913.

THE coating consists of an innermost bituminous layer containing fibrous material, such as jute or hair, a middle elastic layer of wool, peat, etc., and an outer bituminous layer strengthened with sand or gravel. The successive layers interpenetrate by fusion to form an acid-proof coating which also protects vessels, for instance of glass, against shock.—F. SODN.

Distillation: Process and apparatus for continuous —. F. Raschig, Ludwigshafen, Germany. U.S. Pat. 1,141,265, June 1, 1915. Date of appl., Jan. 8, 1913.

SEE Ger. Pat. 260,060 of 1912; this J., 1913, 692.

Absorption and reaction tower for acids, etc. F. Raschig, Ludwigshafen, Germany. U.S. Pat. 1,141,266, June 1, 1915. Date of appl., May 26, 1914.

SEE Eng. Pat. 6288 of 1914; this J., 1914, 907.

IIa.—FUEL; GAS; MINERAL OILS AND WAXES.

Coal ash; Fusibility of —in various atmospheres. A. C. Fieldner and A. E. Hall. J. Ind. Eng. Chem., 1915, 7, 399—406, 474—481.

SAMPLES of ash of widely varying composition from anthracite, bituminous, semi- and sub-bituminous coals, lignite, and peat, were mixed with 10% dextrin solution, moulded into triangular pyramids, dried slowly, and the dextrin burnt out by igniting in a muffle. The softening points of the pyramids were determined in various kinds of furnaces, and other conditions also were varied. The results were affected by the size and shape of the pyramid, the fineness of the ash, the inclination at which the pyramids were mounted, and the rate of heating, but to a much greater extent by the character of the atmosphere surrounding the pyramids, the maximum variation from this cause ranging from 143° to 495° C. for different samples of ash. The highest softening temperatures were obtained either in an atmosphere of air or in a strongly reducing atmosphere of carbon monoxide, which reduced the iron oxide to metallic iron before softening of the ash began. The lowest softening temperatures were obtained in atmospheres of mixed gases in which ferric oxide was reduced to ferrous oxide, which is the most active compound of iron in regard to slag formation at relatively low temperatures; these conditions approximate to those under which clinker formation takes place in practice, and a method of determining softening temperatures under such conditions will be described in a subsequent paper.—A. S.

Calorific value; Simple and accurate method of determining —with Junkers' calorimeter. H. Strache and E. Glaser. Z. Gas u. Wasser, 1915, 55, 1—9, 17—23. Z. angew. Chem., 1915, 28, Ref., 208—209.

THE gas of which the calorific value is to be determined is supplied to the calorimeter from a large measuring bottle, from which it is displaced by the cooling water flowing from the calorimeter. The cooling water flows first into a Woulfe's bottle in which any air carried mechanically by it can escape. If t_D represent the difference of temperature of the water entering and leaving the calorimeter, γ the correction factor for temperature and pressure, and H the reading of the hygrometer, the gross calorific value is given by the formula: $\frac{t_D}{\gamma} \cdot 1.01 + 64 - H$; whilst the net calorific value is given by the formula:

$$\frac{1.01}{\gamma} \left(t_D - \frac{597d}{V_D} \right) - 10,$$

where d represents the quantity of condensed water obtained from the combustion of V_D litres of gas. These formulæ are applicable only in the case of coal gas or mixed coal gas and water gas having a calorific value of 4500—5500 Calories and when the room temperature is 3°—4° higher than that of the water supplied to the calorimeter, when 1.6—2.1 litres of gas is burnt per minute, and when the quantity of carbon dioxide yielded by 1 cb. m. of the gas amounts to 0.48 cb. m.—A. S.

Blast-furnace gas; Premature ignition of —in gas-engines. C. Waldeck. Stahl u. Eisen, 1915, 35, 65—71. Z. angew. Chem., 1915, 28, Ref., 216.

ANALYSES of blast-furnace gas which ignited prematurely in the combustion chamber of a gas-engine, showed that it contained relatively more hydrogen and less oxygen than normal gas. This abnormal composition is probably due to the

interaction between very finely-divided particles of incandescent carbon and excess moisture introduced with the charge, such action taking place in the middle and upper parts of the furnace, particularly when the material caves in and reversed draught occurs. Blast-furnace gas is less likely to contain an appreciable amount of this deleterious mixture if it be tapped from different points on the main-pipe; premature ignition may be further guarded against by thorough cooling of the gas, and absolute cleanliness of the combustion chamber.—E. H. T.

Oil gas; Time factor in making——. M. C. Whitaker and C. M. Alexander. J. Ind. Eng. Chem., 1915, 7, 481–491.

EQUILIBRIUM is not attained, in practice, in the thermal decomposition of petroleum hydrocarbons to produce oil gas, and the authors studied the influence of the time factor in an experimental apparatus. This consisted of a carbon tube electric resistance furnace in which the rate of oil feed could be varied whilst the pressure (atmospheric) and temperature (800° – 1600° C.) were maintained constant. Water-white kerosene of b. pt. 150° – 290° C. was used and in all cases was vaporised in an electrically heated preheater before entering the furnace. At 1600° C., with the oil supplied at about 30 c.c. per minute, the gas contained 96% of hydrogen, whilst with about 10 c.c. of oil per minute, the hydrocarbons were decomposed practically completely into carbon and hydrogen. At 800° C., with a rate of oil feed about 61 c.c. per min., it was possible to obtain gas containing 52% of illuminants, but a large amount of tar was also produced.—A. S.

Gas oils and derived tars; Physical constants of——. W. F. Rittman and G. Egloff. J. Ind. Eng. Chem., 1915, 7, 481–484.

SAMPLES of gas oils and of the tars derived from them were obtained from four different plants producing carburetted water-gas. The tars yielded a larger percentage of constituents boiling below 300° C. than the oils from which they were derived; and the sp. gr., surface tension, and refractive index of the distillation fractions from the tars were higher than those of the corresponding fractions from the oils, indicating that the tars contained aromatic hydrocarbons. The values for the specific gravity, surface tension, and refractive index of a number of aliphatic and aromatic hydrocarbons are tabulated.—A. S.

Mineral oil industry of the Caucasus. Board of Trade J., June 17, 1915.

UNREST amongst the working classes and labour strikes, followed by the war, did much to interfere with normal conditions on the Baku oilfields in 1914; nevertheless there was considerable activity in mineral oil spheres. In some districts, especially those of Grozni, Schemaha, Djevat, Tiflis, and Lenkoran, much exploration work was done and new alleged oil-bearing lands were added to the existing petroleum fields of the locality. The discovery of fresh petroliferous territory near Grozni augurs well for the supply of motor spirit. In view of the immense stocks of benzine that have accumulated and are accumulating in the Northern Caucasus, very large quantities of the liquid will be available to meet the ever-increasing demand so soon as shipments of petrol from the country are possible.

When compared with the figures of 1913, the year 1914 shows a decrease in production on all the old fields (Balachani, Sabounchi, and Bibic-Eybat). On the other hand, a marked increase in production has taken place on the new Surachina fields, the yield of oil being 53,500,000 pounds in 1914, as against 42,000,000 pounds in 1913. Of this

quantity 22,000,000 pounds was procured from spouting wells, as compared with 13,000,000 pounds in 1913. Benagadi has now become an oilfield of some importance, the wells of this field having produced 22,000,000 pounds during 1914. The production on Holy Island has also increased. The Island of Cheleken, however, shows a decrease, the production in 1914 being 5,000,000 pounds. The total production dealt with by the Baku producers and refiners was 436,500,000 pounds, a decrease of about 32,000,000 pounds on the 1913 production. At least from 35,000,000 to 40,000,000 pounds was lost to Baku in consequence of strikes. All the Russian oilfields outside Baku, except those of Maikop, increased their production in 1914, the Grozni fields, where new lands were opened up, taking the first place. The Emba Ural fields also show a substantial increase. The total production of all the Russian oilfields is estimated at about 560,000,000 pounds, a decrease of about 11,000,000 pounds as compared with the production of 1913.

The latter half of 1914 showed a marked decrease in drilling activity, especially on the old fields. This is, to a certain extent, attributable to the uncertainty of the situation, but was due in a greater measure to a shortage of materials, and to the high prices ruling on materials that were obtainable.

The production of ozokerite on the Island of Cheleken continued during the year; the output of the mines varied from 50,000 pounds to 125,000 pounds a month. The raw material has hitherto been sent abroad to be refined, but, owing to the difficulties experienced in finding railway trucks, stocks have accumulated.

Except in the case of lubricating oils, the returns of exports to Europe for the first six months of the year were satisfactory. On the closing of the Dardanelles, however, the exports of mineral products ceased and the Baku-Batoum pipe line has remained idle.

The cessation of exports affected the manufacture of certain oils. Refiners are now endeavouring to produce as much residuum for liquid fuel as possible, and to curtail their output of lubricating oils. Residuum is forwarded to the interior, whereas lubricants are mostly exported. The difference in the output of kerosene during the year was small, but the benzine production was very considerably less than in 1913. The total output of all mineral oil products in 1914 was 270,000,000 pounds, as compared with 320,000,000 pounds in 1913.

"Natalite," a new alcohol fuel. Chem. Trade J., June 19, 1915.

A CERTIFICATE has been published as a result of a test by the Royal Automobile Club of a new motor fuel known as "Natalite." The fuel is reported to consist of alcohol and ether, about 40% of ether being present. The fuel consumption in an official trial was at the rate of 16.4 miles per gallon, or 26.2 ton-miles per gallon. The engine started easily on all occasions either from cold or when warm. The valve caps and heads were found to be very clean after the trial. "Natalite" is wholly produced in an alcohol distillery from alcohol crops or their by-products.

The official trial does not give any comparative data, but an opportunity has been afforded "The Engineer" of testing this fuel against petrol, as a result of which they are led to the conclusion that the fuel consumption in the two instances is almost, if not quite, identical. The only alteration necessary to get the best results with "Natalite" is a slight reduction in the supply of air to the carburetter. It is impossible to detect any difference in the running of an ordinary petrol engine when "Natalite" is used, and the exhaust is clear. The fuel appears to have the capacity of

actually cleaning an engine in which deposit has formed, and has no tendency towards corrosion of the metal of the cylinders or other parts. It is intended in the first instance to manufacture the fuel in quantity in South Africa from molasses. In addition to alcohol and ether, the fuel contains at least a trace of ammonia for the purpose of neutralising any tendency towards acidity which might develop.

PATENTS.

Fuel-brick. W. Rakowski, Logan, W. Va. U.S. Pat. 1,140,395, May 25, 1915. Date of appl., May 20, 1913.

AN unstrained decoction of bran is used as binding material in the production of briquettes from coal dust or a mixture of coal dust and sawdust.
—E. R. A.

Lignite filler sludge; Process for the utilisation of —. Maschinenbau-Anstalt Humboldt. Ger. Pat. 281,472, Oct. 9, 1913.

THE sludge is mixed with powdered clay and pressed into pieces suitable for furnace fuel.
—F. SODN.

Fuel, and method of making the same. T. M. Hickman, Wolverhampton. Eng. Pat. 4214, Feb. 18, 1914.

COKED fuel, of any desired hardness, is obtained from carbonaceous materials possessing little or no coking properties by incorporating with the latter, previous to or during distillation, substances such as are found naturally in coking carbonaceous materials, the quantities being regulated so as to obtain great permeability, comparatively low fusibility, and effective binding of the coke particles formed. Suitable substances are compounds of aluminium with silica, alkalis, alkaline earths, magnesium, iron, etc.—E. R. A.

Coke; Process and apparatus for quenching, screening, and transporting —. E. Bremer. Ger. Pat. 281,559, May 10, 1914.

THE hot coke is introduced into running water, so that the larger pieces, which float for a longer time than the small material, are carried away by the current. The small coke is sorted by a screen arranged below the floating material.—F. SODN.

Coal; Utilisation of fine — by coking and gas production. H. Voss. Ger. Pat. 283,062, July 7, 1914.

THE fine coal is first mixed with, say, 10–15% of lignite in pieces 5–15 mm. in size and containing its natural amount of moisture.—J. H. L.

Coal; Treatment of [fine] — for coking. H. Koppers. Ger. Pat. 283,132, Nov. 27, 1913.

FINE coal is moistened with a fat solvent, e.g., it is allowed to fall through a spray of soap solution. The soap facilitates wetting of the fine coal, and also increases the yield of ammonia during coking.
—J. H. L.

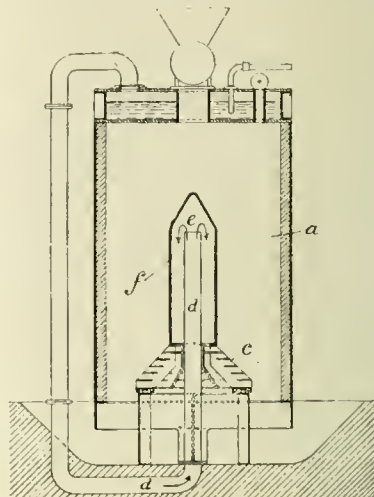
Gas generating apparatus; Coal —. H. A. Carpenter, Sewickley, Pa., Assignor to Ritter-Conley Manufacturing Co., Pittsburgh, Pa. U.S. Pats. (A) 1,140,797 and (B) 1,140,798, May 25, 1915. Dates of appl., Sept. 14, 1914, and Jan. 2, 1915.

(A) A stand pipe placed at one side of and extending above and below a series of horizontal retorts, arranged one above the other, communicates by means of ports with the mouth-pieces of the retorts; the mouth-pieces are provided with flanged portions which overlap and are secured to the stand pipe. (B) The mouth-piece of the retort has an opening closed by a door, and

adjacent to this is a valved conduit inclined downwards and connected with a stand pipe; the valve is spaced apart from the stand pipe, and a cooling medium is discharged into the conduit between the valve and the stand pipe.—E. R. A.

Gas-producer. T. R. Wollaston, Manchester. Eng. Pat. 12,400, May 20, 1914.

THE producer has a conical stepped grate, *c*, which may be fixed or oscillating or rotating concentrically with the producer body, *a*. The blast is



introduced by means of the pipe, *d*, to the upper portion, *e*, of the dome, *f*, whence it travels downwards, becoming superheated by the surrounding fuel, and passes through the bars of the grate, *c*, to the fuel bed. The grate may have the form of an oblique cone, with the dome attached eccentrically to the axis of rotation, and the dome may be of any regular or irregular cross-section, so that crushing and distributing effects may be obtained.
—E. R. A.

Gas-generator. W. Mitchell, Malden, Mass., Assignor to Willis Mitchell Co., Inc., New York. U.S. Pat. 1,141,072, May 25, 1915. Date of appl., June 16, 1913.

THE space between a tapering core and an external cylinder forms an elongated retort chamber of thin annular tapering shape; liquid fuel is introduced into the retort chamber at the larger end and fixed gas discharged at the other. A branch from the fuel inlet pipe, placed above the level of the retort chamber, out of the line of flow of the fuel, communicates with a regulating tank, forming an "air cushion to aid the operation of the retort chamber."—E. R. A.

Gas; Apparatus for purifying —. W. Climie, jun., Glasgow. Eng. Pats. 11,136, May 6, and 23,460, Dec. 3, 1914.

GAS is admitted into the lower end of a vertical cylindrical casing fitted at both ends with cover plates, and placed concentrically within an outer cylinder closed at its upper end with a cover plate. The space between the casings is fitted with perforated plates, preferably V-shaped, and the cylindrical surface of the inner casing is perforated in zig-zag formation, above the gas inlet. A central vertical shaft, passing through the casings, carries a turbine in the upper part of the space between the casings, and also a series of blades within the inner casing. Water is led into the turbine and discharged on to the V-shaped plates; the gas is drawn in from the inlet pipe by the

rotation of the shaft, and forced through the perforations of the inner casing on to the V-plates, where it meets the descending streams of water and is freed from tar, etc. The purified gas leaves at the top, and the tarry water is discharged at the bottom of the outer casing.—E. R. A.

Oil; Cracking of—O. H. Valpy and O. D. Lucas, London. Eng. Pats. 12,653, May 22, and 18,923, Aug. 21, 1914.

OIL vapour is removed from a still by means of steam or an inert gas under pressure, and the mixture is brought into contact with a heated catalyst, such as nickel or one of its alloys, or nickel oxide or suboxide, and the pressure of the mixture after leaving the catalysing chamber is reduced suddenly. The light oils produced are condensed.—E. R. A.

Protective materials for mineral oil containers. Mittelrheinische Teerprodukten- und Dachpappenfabrik A. W. Andernach. Ger. Pat. 282,712, June 30, 1914.

Wood tar pitch is used alone or mixed with suitable amounts of wood tar. Mineral matter, colouring matters, fibrous substances, or drying agents, for example quartz sand, asbestos fibre, or kieselguhr, may be incorporated with the mass, which may be dissolved or mixed with solvents in order that it may be used cold if necessary. Petroleum and other mineral oils do not attack or dissolve wood tar pitch to any appreciable extent. The most suitable tar and pitch are obtained from beech wood.—F. W. A.

Coal; Process for converting fine—into a marketable fuel. J. Evans, Melbourne, Australia. U.S. Pat. 1,140,735, May 25, 1915. Date of appl., Aug. 14, 1913.

SEE Fr. Pat. 461,400 of 1913; this J., 1914, 213.

Coke oven; Regenerative—C. Still. Fr. Pat. 473,855, June 22, 1914. Under Int. Conv., June 23, 1913.

SEE Ger. Pat. 271,515 of 1913; this J., 1914, 471.

Producer-gas plants; Method of working ammonia-recovery—T. Rigby, Dumfries, Scotland, Assignor to Wetcarbonizing, Ltd., London. U.S. Pat. 1,141,829, June 1, 1915. Date of appl., May 13, 1911.

SEE Eng. Pat. 12,013 of 1910; this J., 1911, 1105.

[Mineral] oils; Process of treating—A. Philip. Fr. Pat. 473,529, June 16, 1914. Under Int. Conv., June 26, 1913.

SEE Eng. Pat. 14,778 of 1913; this J., 1914, 824.

Process for destroying the malodorous gases and vapours produced in the distillation of ammoniacal liquor. Ger. Pat. 282,373. See VII.

IIB.—DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Dry distillation of wood; Theory of the—I. P. Klason. J. prakt. Chem., 1914, 90, 413—447. Z. angew. Chem., 1915, 28, Ref., 131.

Two stages are to be distinguished in the dry distillation of wood; the primary reactions proceed best in a high vacuum, with the formation of much tar and small amounts of charcoal; the secondary reactions proceed most favourably with very slow distillation at atmospheric pressure, with the production of more charcoal, water, carbon dioxide, and tar oils, but only small amounts of tar. The amount of formic acid produced is

considerable in a high vacuum but small in distillations carried out at atmospheric pressure, as it is not stable at the temperature attained (250°—100° C.). The amounts of methyl alcohol and of acetic acid are independent of the rate of carbonisation, both being stable at the usual temperature required for the dry distillation of wood. The yield of acetone is practically nil from the vacuum distillation, and acetone must be regarded as a secondary product from acetic acid. Pyroigneous acid from birch-wood contains formaldehyde corresponding to 1% of the dry weight of the wood. The ratio of the acetic acid and formic acid contents is characteristic for the conditions of carbonisation employed; a low content of formic acid indicates that the products have been overheated.—F. W. A.

PATENTS.

[Heating] furnace. R. S. Moore, El Paso, Tex. U.S. Pat. 1,139,558, May 18, 1915. Date of appl., Nov. 18, 1914.

A MOVABLE hearth at the end of a stationary hearth is carried by the piston of an inclined hydraulic ram which lifts the hearth at an angle to the vertical. The mechanism for moving the material along the slideways controls the supply of pressure liquid to the ram.—W. F. F.

Incandescence lamp. Production of compound metal articles. Low-expansion wire. B. E. Eldred, Assignor to The Commercial Research Co., New York. U.S. Pats. (A) 1,140,131, (B) 1,140,135, and (C) 1,140,136, May 18, 1915. Dates of appl. (A and B) Dec. 30, 1914, (C) Dec. 22, 1913.

(A) A COMPOSITE leading-in wire, sealed into the glass of the lamp, comprises a core of nickel-iron alloy, in which the metals are in such proportion as to give an average coefficient of expansion, from the setting temperature of the glass down to normal temperature, less than that of the glass. The core is enclosed in and welded to a sheath of a metal of high electrical conductivity, such as copper, the average coefficient of expansion of the sheath being greater than that of glass. The resulting average coefficient of expansion of the composite wire is such that a tight joint may be made between the sheath and the glass. (B) Iron and nickel are combined in proportions to give a predetermined coefficient of expansion, and the thickness of the sheath is similarly adjusted to give a definite coefficient, the metal then being worked up to wire of the desired size. (C) The low-expansion wire comprises a core of nickel steel and an external copper sheath welded to it, the composite wire having a coefficient of expansion below that of platinum.—B. N.

Reducing coke to produce battery carbons. Kiln for treatment of carbonaceous materials. U.S. Pats. 1,141,117 and 1,141,118. See XI.

III.—TAR AND TAR PRODUCTS.

Phenol; Bromine method of determining—W. Versfeld. Analyst, 1915, 40, 281—283.

PHENOL is titrated with a hypobromite solution, prepared by saturating 250 c.c. of N/5 sodium hydroxide solution with bromine, boiling to expel the excess of bromine, cooling, and diluting to 1 litre; 100 c.c. of this solution is used for each 1 c.c. of 5% phenol solution or its equivalent. The phenol solution (containing approximately 0.05 gm. of phenol) is placed in a stoppered flask of 500 to 1000 c.c. capacity, 50 c.c. of water is added, followed by 5 c.c. of concentrated hydrochloric acid and 100 c.c. of the hypobromite solution.

After 15 mins., 20 c.c. of 10% potassium iodide solution is added, the mixture allowed to stand for 5 mins., then diluted with water to 400 c.c., and the iodine titrated with *N*/10 thiosulphate solution. A control is run at the same time, using the same quantities of reagents. The difference in c.c. of *N*/10 thiosulphate solution used for the control and the test multiplied by 0.156746 gives the percentage of phenol in the solution, if 1 c.c. of the latter was taken for the determination.—W. P. S.

Nitrotolylglycines. W. Pollak. J. prakt. Chem., 1915, 91, 285—306.

ALTHOUGH no action occurred with chloroacetic acid, the mononitrotoluidines when warmed with bromoacetic acid, either with or without water, yielded the corresponding nitrotolylglycines. The reaction failed in the case of the only *o*-nitrotoluidine examined ($\text{CH}_3:\text{NH}_2:\text{NO}_2=1:2:3$), but was given by five isomeric substances in which the last two groups occupied either the *m*- or *p*-positions with regard to one another. The nitroglycines thus obtained are strong monobasic acids, soluble in sodium carbonate solution. The ammonium salts are readily soluble. The methyl and ethyl esters of 1,2,4-nitrotolylglycine were prepared, respectively, by the action of methyl iodide on the silver salt and by passing hydrogen chloride into an ethyl alcoholic solution of the acid. The acid was reduced by tin and hydrochloric acid to 1,2,4-aminotolylglycine. *m*-Nitrotolylglycines yield piperazine derivatives when heated above the m. pt., e.g., the 1,2,4-compound yields 1,2,4-dinitroditolyl- α - γ -diazipiperazine. 1,2,5-Nitrosnitrotolylglycine was produced from 1,2,5-nitrotolylglycine by the action of nitrous acid.—J. R.

Physical constants of gas oils and derived tars. Rittman and Egloff. See IIA.

PATENTS.

o-Chlorotoluene-*p*-sulphonic acid; *Manufacture of* —. Farbw. vorm. Meister, Lucius, und Brüning. Fr. Pat. 473,518, June 15, 1914. Under Int. Conv., June 28, 1913, and Jan. 15, 1914.

AQUEOUS solutions of *p*-toluenesulphonates are treated with chlorine below 70°—80° C. The solution must be concentrated or contain sufficient salt so that the *o*-chlorotoluenesulphonate separates immediately, and is not further chlorinated. When the *p*-toluenesulphonate contains *o*-toluenesulphonate, the latter is converted into a chloro-derivative which remains in solution.—F. W. A.

Acylated arylsulphonamides; Preparation of —. C. Büchel. Ger. Pat. 281,363, Nov. 22, 1913.

ARYLSULPHAMIDES or their alkali compounds are heated with chlorides of higher fatty acids, with or without the addition of indifferent solvents. Quantitative yields of the corresponding acylarylsulphonimides are obtained, which give salts with the alkali, alkaline-earth, and heavy metals. The new compounds may be used for raising the melting-point of certain fatty acids, increasing the amount of water taken up by ointments, in the preparation of detergents and emulsions, for making phenols soluble in water, etc. The reactions of benzenesulphamide-potassium with stearyl chloride and of toluenesulphamide with palmityl chloride are especially mentioned.

—F. W. A.

1-Nitroanthraquinone from crude nitroanthraquinone; *Isolation of* —. F. Ullmann. Ger. Pat. 281,490, Jan. 29, 1914.

CRUDE nitroanthraquinone is fractionally distilled *in vacuo*. At a pressure of 7 mm. and with the heating bath at 280° C., 1-nitro-anthraquinone

distils over undecomposed at 270°—271° C., the dinitro-compounds remaining in the residue.

—F. W. A.

Sulphochlorides of the anthracene series; Preparation of —. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 281,911, Aug. 13, 1913.

CHLORIDES of dichloroanthracenedisulphonic acids are obtained by the action of chlorosulphonic acid on anthraquinone or β -chloroanthraquinone.

—F. W. A.

Extraction of reduction products of aromatic nitro-compounds from aqueous solutions; Process for the —. Chem. Fabr. vorm. Weiler-ter Meer. Ger. Pat. 282,531, April 26, 1914.

ANILINE, azobenzene, toluidine, xylydine, naphthylamine, etc., are extracted almost quantitatively from aqueous solutions by the original nitro-compound used for their production. Nitrobenzene and aniline may be separated quantitatively by subsequent distillation, or the extract may be returned to the reducing apparatus.—F. W. A.

Aromatic amines from nitro-compounds; Preparation of —. Badische Anilin und Soda Fabrik. Ger. Pat. 282,568, Nov. 7, 1913.

NITRO-COMPOUNDS are reduced by hydrogen or gases containing hydrogen, in presence of copper and of activators. The copper is prepared by ignition of a salt or reduction with hydrogen or carbon monoxide at a temperature below red heat; suitable salts are those which give indifferent gases on heating, such as copper carbonate, formate, oxalate, or nitrate, or mixtures of copper salts with ammonium carbonate and similar salts. If copper formate is used, the reduction temperature may be below 300° C. The copper may be used as such or on pumice, asbestos, or kieselguhr, with addition of activators, such as alkali compounds, metallic oxides, such as magnesia or aluminium oxide. The reduction may be carried out at 200° C. or a lower temperature; at a higher temperature impure products are obtained, and the activity of the catalyst may decrease.—F. W. A.

1,3-Dimethyl-5-hydroxybenzene-4-sulphonic acid; *Preparation of* —. F. Raschig. Ger. Pat. 283,306, Feb. 4, 1914.

1,3-DIMETHYL-5-HYDROXYBENZENE is treated with concentrated sulphuric acid or other sulphonating agent. The *ortho*-sulphonic acid obtained exhibits great reactivity on account of the *para*-position to the hydroxyl group being unoccupied. It is very readily soluble in water, and is reprecipitated by strong hydrochloric acid from concentrated solutions in colourless needles, m. pt. 102°—103° C.

—F. W. A.

Protective materials for mineral oil containers. Ger. Pat. 282,712. See IIA.

Preparation of a binding material for roads from crude gas-tar, pitch, bitumen, and stones. Ger. Pat. 281,900. See IX.

Process for improving the fungicidal and insecticidal action of nitrogenous bases. Ger. Pats. 279,561 and 279,565. See XIXB.

IV.—COLOURING MATTERS AND DYES.

Hydroxy-derivatives of indigo. P. Friedländer and O. Schenck. Ber., 1914, 47, 3040—3052. Z. angew. Chem., 1915, 28, Ref., 136—137.

MONO- and dichloro-*m*-hydroxybenzaldehydes, obtained by Raschig's method of chlorinating the carbonic ester of mono- and dichloro-*m*-cresol in

the methyl group, readily give *o*-nitro-derivatives on nitration; after isolating the isomers they are converted into di- and tetrachloro-dihydroxy-indigo in the usual manner by the Baeyer-Drewsen reaction. The hydroxyl group influences the stability of the indigo molecule in presence of alkalis. The easily saponified carbonyl, acetyl, and benzoyl esters of hydroxynitrobenzaldehyde are affected by the saponifying action of the alkali in the Baeyer-Drewsen reaction, whereas the *p*-sulphotoluene ester and the diphenylcarbamie acid ester are stable and may be converted into crystalline indigo derivatives. The compounds are stable towards mineral acids, and their leuco-compounds are stable in absence of oxidising agents; sulphotoluene-indigo white may be saponified in an atmosphere of coal-gas, the hydroxy-indigo white precipitated by acidifying, and oxidised to dihydroxy-indigo in presence of acids.—F. W. A.

Triphenylmethane dyes; Temperature coefficients and the effects of acids, bases, and salts in reaction velocities of the —. H. C. Biddle and C. W. Porter. J. Amer. Chem. Soc., 1915, 37, 1571—1589.

THE temperature coefficient for the conversion of a triphenylmethane carbinol into the quinonoid form in the presence of an acid is independent of the concentration of the acid and also of the temperature between 25° and 40° C.; the increase in velocity is 66% per 5° for Crystal Violet. Similarly the temperature coefficient for the fading of a triphenylmethane dye is independent of the concentration of the alkali and independent of the temperature; for Crystal Violet it is 43% per 5°. The velocity of the colour development in Crystal Violet is an inverse function of the concentration of hydrogen ions for concentrations below 0.024-N, and a direct function for higher concentrations. The rate of fading is a direct function of the concentration of hydroxyl-ions. Neutral salts retard the rate of fading and also of development of colour in the basic triphenylmethane dyes; they accelerate the rate of fading of acidic dyes.—G. F. M.

PATENTS.

[Azo] dyestuffs; *Production of new — and their utilisation.* H. Levinstein, J. Baddiley, and Levinstein Ltd., Manchester. Eng. Pat. 8569, April 4, 1914.

SUBSTANTIVE dyestuffs have been prepared of the type: $X.N_2.D.N_2.R$, where D is a diamine, such as *m*-azoxyaniline, *p*-diaminophenylaziminobenzene, *p*-diaminodiphenyl ether, their homologues and simple substitution products, X an acyl derivative of a β -aminonaphtholsulphonic acid, and R resorcinol or a homologue or simple substitution product. The bright orange, scarlet, and red shades obtained become extremely fast to washing on after-treatment on the fabric with formaldehyde. Dyestuffs obtained from non-acylated β -aminonaphthol give brown or technically less valuable shades.—F. W. A.

Dyestuffs from natural flavone or flavonole colouring matters; Manufacture of new —. E. R. Watson and K. B. Sen, Dacca, India. Eng. Pat. 1253, Jan. 26, 1915.

ETHYLATED flavones or flavonols are treated with magnesium ethyl bromide in dry ethereal solution, and the products de-ethylated, either completely by heating with strong hydrochloric acid under pressure, or partially by treating with sulphuric acid. The products produce full shades on metallic mordants on wool.—F. W. A.

Sulphur dyestuff. B. Jaekel, Elberfeld, Assignor to Synthetic Patents Co., New York. U.S. Pat. 1,140,715, May 25, 1915. Date of appl. Sept. 11, 1914.

SULPHUR dyestuffs are obtained by heating aromatic bases with sulphur and benzidine. The dried yellowish powders are insoluble in water, and generally dye unmordanted cotton yellow shades fast to chlorine and to boiling. The dyestuff obtained from ethylaniline and benzidine gives pure greenish-yellow shades on unmordanted cotton.—F. W. A.

2,3-Hydroxynaphthoic acid derivative [and its use in dyeing]. M. Kahn and A. Ossenbeck, Cologne, Germany. Assignors to Synthetic Patents Co., New York. U.S. Pat. 1,140,747, May 25, 1915. Date of appl., Sept. 11, 1914.

THE compounds, $HO.C_{10}H_6.CO.NH.C_{10}H_6.OH$ derived from 2,3-hydroxynaphthoic acid and an aminonaphthol, and are grey powders soluble in hot sodium carbonate solution. On cotton fibre they give fast yellowish-red to brownish-red shades on treatment with diazo-compounds. The compound from 7-amino-2-naphthol dissolves in hot sodium carbonate solution, and unmordanted cotton impregnated with this solution gives fast scarlet shades on treatment with diazotised *p*-nitraniline.—F. W. A.

Triarylmethane dyestuffs; Preparation of —. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 474,260, June 29, 1914. Under Int. Conv., July 9, 1913.

AMINES or their salts are treated with basic or acid *pp*-diaminotriarylmethane dyestuffs containing a halogen or alkoxy-group in the *para*-position to the methane carbon atom, in presence or in absence of condensing agents. The dyestuffs obtained give bluish shades on cotton mordanted with tannin.—F. W. A.

Wool dyestuffs; Production of —. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 282,957, July 15, 1913.

THE diazo-compound of *p*-chloro-*o*-anisidine ($Cl:NH_2:OCH_3=4:2:1$) is combined with an alkylaralkylanilinesulphonic acid. Valuable yellow dyestuffs for wool result which give level shades and are fast to milling.—F. W. A.

Colouring matter for foodstuffs; Preparation of a harmless —. P. D. Jacquemin. First Addition, dated Oct. 4, 1913, to Fr. Pat. 460,411, Oct. 5, 1912 (this J., 1914, 19).

THE purity of the product is increased by washing with ether or benzene. The dry material is treated with an equal weight of pure sulphuric acid at 15°–20° C. until insoluble in water, and the mixture then poured into ice water, and the product washed until neutral.—F. W. A.

Leuco-compounds of vat dyestuffs; Manufacture of —. A. Brochet. Fr. Pat. 473,536, Sept. 29, 1913.

VAT dyestuffs, suspended or dissolved in water, are converted into their leuco compounds by the action of hydrogen in presence of a metallic catalyst. (See also this J., 1915, 416.)—F. W. A.

Arylidoanthraquinones; Preparation of —. Farb. vorm. Meister, Lucius, und Brünig. Fr. Pat. 473,904, June 22, 1914. Under Int. Conv., Aug. 23, 1913.

1-AMINO-2-ALKOXYANTHRAQUINONES containing a negative group in the 4-position are treated with aromatic amines or their sulphonic acids. The arylidoanthraquinonesulphonic acids obtained dye wool very fast and level violet shades from an acid bath.—F. W. A.

Condensation products of the anthraquinone series or their sulphonic acids; Preparation of—. Farb. vorm. Meister, Lucius, und Brüning. Ger. Pat. 282,672, March 14, 1913.

ACID substitution products obtained by the action of ethylenedihalogenides on Alizarin (Ger. Pat. 280,975; this J., 1915, 543) are treated with ammonia, amines, or aminosulphonic acids in presence or absence of contact substances, and the dye bases obtained are sulphonated.—F. W. A.

Polychloroanthracenes; Preparation of—. Farb. vorm. Meister, Lucius, und Brüning. Ger. Pat. 282,818, Dec. 24, 1913.

THE chlorine addition products of 9.10-dichloroanthracene are treated with aqueous alkali in presence of alkali salts of benzylsulphanilic acid, without addition of alcohol. The reaction commences at the ordinary temperature and is completed rapidly on warming, giving, for example, an almost theoretical yield of 1.3.9.10-tetrachloroanthracene from dichloroanthracene tetrachloride. Similarly dichloroanthracene hexachloride gives a pentachloroanthracene, and the octachloride a hexachloroanthracene. The yellow polychloroanthracenes may be used as pigment colours and as intermediate products in the preparation of chlorinated anthraquinones and dyestuffs.

—F. W. A.

Disazo-dyestuffs; Production of—. Farb. vorm. Meister, Lucius, und Brüning. Ger. Pat. 281,449, May 14, 1913.

THE tetrazo-compound of the urea from *p*-aminophenylurea-*p*-aminophenyldisulphonic acid is combined with two mols. of the same or a different azo-component. Greenish-yellow to bluish-red dyestuffs are obtained, which are notable for their purity of shade and fastness to washing and to light. The urea required is obtained by the action of nitrophenylurea chloride on *p*-phenylenediaminedisulphonic acid, reduction of the nitro-compound, and treatment of an aqueous solution of the alkali salt of the resulting *p*-aminophenylurea-*p*-aminophenyldisulphonic acid with phosgene in presence of a substance which will combine with the acid produced, e.g., chalk, sodium carbonate, or sodium acetate. On acidifying, the acid sodium salt is precipitated; it is slightly soluble in hot water, insoluble in organic solvents, and yields an intense yellowish-brown tetrazo-compound, soluble with difficulty in water.—F. W. A.

Ethyl esters of Indirubin-oxime; Preparation of—. Farb. vorm. Meister, Lucius, und Brüning. Ger. Pat. 282,278, Oct. 24, 1913.

SALTS of indirubin-oxime are treated with alkylating agents. The products may be converted into valuable dyestuffs in several ways; for example, red dyestuffs for wool are obtained by the action of concentrated sulphuric acid.—F. W. A.

Yellow to brown dyestuffs for wool; Production of—. Farb. vorm. Meister, Lucius, und Brüning. Ger. Pat. 282,317, Nov. 15, 1913. Addition to Ger. Pat. 263,655 (see Fr. Pat. 447,592; this J., 1913, 226).

INSTEAD of aminodiphenylaminesulphonic acids, *p*-aminocarbazolemonosulphonic acid or its carbazole-*N*-alkylated or arylated derivatives are combined with dinitrochlorobenzene. Yellow dyestuffs for wool are obtained which give pure shades fast to washing.—F. W. A.

Polyazo-dyestuffs from diaminocarbazole; Preparation of black—. L. Cassella und Co. Fr. Pat. 474,234, Nov. 11, 1913.

TRISAZO- and tetrakisazo-dyestuffs have been prepared from tetrazocarbazole. They are black dye-

stuffs of high tinctorial power, possessing an excellent fastness to washing; after-treatment on the fibre with formaldehyde gives brownish- or bluish-black shades, which are very fast to washing.—F. W. A.

Vat dyestuffs; Preparation of—. Badische Anilin und Soda Fabrik. Ger. Pat. 280,880, Oct. 21, 1913.

THE dyestuffs prepared according to Ger. Pat. 276,956 (this J., 1914, 1084) are treated with halogens or halogenating substances to give new dyestuffs of remarkably pure shades.—F. W. A.

Ketonic condensation products; Preparation of—. Badische Anilin und Soda Fabrik. Ger. Pat. 283,066, Oct. 31, 1913.

HYDROXYNAPHTHALENES are treated with glycerin or a similar substance, such as triacetin, epichlorhydrin, acrolein, glyceraldehyde, etc., in presence of acid condensing agents. The products are ketonic in character, whereas *α*- or *β*-naphthol heated with glycerin and sodium acetate give ethers. The product, C₁₃H₈O, obtained from *α*- or *β*-naphthol with glycerin and sulphuric acid, gives a violet vat dyestuff on fusion with aqueous or alcoholic caustic potash.—F. W. A.

Indigo; Preparation of condensation products from—. T. Posner. Ger. Pat. 281,998, Aug. 30, 1913.

INDIGO and its derivatives when heated with reactive methylene compounds, e.g., malonic ester or phenylacetic ester, in presence or absence of solvents or condensing agents (e.g. copper powder), yield coloured compounds which may be used as dyestuffs or as intermediate products.—F. W. A.

Sulphur dyestuffs; Production of—. Akt.-Ges. f. Anilinfabr. Ger. Pat. 282,163, Oct. 24, 1913. Addition to Ger. Pat. 267,089 (see Fr. Pat. 454,782; this J., 1913, 863).

RING-SUBSTITUTED alkyl derivatives of 4-hydroxydiphenylamine are heated with sulphur or polysulphides in presence of compounds which yield aromatic amines on reduction.—F. W. A.

Safranine dyestuffs; Preparation of basic—. L. Durand, Huguenin und Co. Ger. Pat. 282,346, Mar. 12, 1914.

NITROSOMETHYL- or nitrosoethyl-*o*-toluidine is condensed with *m*-aminomethyl- or *m*-aminoethyl-*p*-toluidine respectively to form basic Safranine dyestuffs which give yellowish red prints on cotton. The alkyl radical in the azine group gives the dyestuff a yellower shade; aromatic radicals give bluish red shades.—F. W. A.

Anthracene derivatives; Production of—. M. Kardos. Ger. Pat. 282,711, Jan. 30, 1913.

ACEANTHRENEQUINONE-OXIME or a halogen substitution product is treated with acid, especially concentrated sulphuric acid. Similar products are obtained by acidifying an alkaline solution of anthracene-1.9-dicarboxylic acid amide, and by the action of ammonia on anthracene-1.9-dicarboxylic acids or their anhydrides. The compounds obtained are anthracene-1.9-dicarboxylic acid imides or their decomposition products, the monoamides of the anthracene-1.9-dicarboxylic acids, the acids themselves or their anhydrides; the amounts obtained vary with the conditions of the reaction. These substances form valuable intermediate products for the production of dyestuffs. As distinguished from phthalimide and naphthalene-1.8-dicarboxylic acid imide, the imides are of a yellow colour, and possess the properties of vat dyestuffs, giving yellow solutions in alkaline reducing agents which dye cotton clear yellow shades.—F. W. A.

Red dyestuffs for wool from aminoaryl-p-sulphaminic acids; Preparation of—. H. Weil. Ger. Pat. 282,958, July 20, 1913.

OXIDATION of aminoarylsulphaminic acids together with N-alkylated *m*-aminophenols gives blue solutions, whereas brilliant red solutions are obtained with N-arylated *m*-aminophenols, from which solutions bronze coloured crystals are obtained on concentrating and on addition of salt. The yield of the new oxidation products approximates to the theoretical, and the substances may be dyed on wool from a slightly acid bath, but are mainly of importance as intermediate products for the preparation of sulphur dyestuffs.—F. W. A.

Sulphonic acids of aromatic aminothiazoles; Preparation of— for the production of azo dyestuffs. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 473,766, June 19, 1914. Under Int. Conv., June 23, 1913, and Jan. 21, 1914.

SEE Ger. Pat. 281,048 of 1913; this J., 1915, 545. The diazo compounds derived from the aminothiazolodisulphonic acids when combined with acetylacetylides give dyestuffs which dye cotton shades very fast to light.

Arylaminoanthraquinone dyestuffs. G. Kränzlein, Assignor to Farb. vorm. Meister, Lucius, u. Brüning, Höchst, Germany. U.S. Pat. 1,139,540, May 18, 1915. Date of appl., July 1, 1914.

SEE Fr. Pat. 473,904 of 1914; preceding.

Leuco compounds and process of making same. A. Schmidt and A. Steindorff, Assignors to Farb. vorm. Meister, Lucius, und Brüning, Höchst, Germany. U.S. Pat. 1,141,148, June 1, 1915. Date of appl., Dec. 6, 1911.

SEE Fr. Pat. 437,809 of 1911; this J., 1912, 529.

Dyestuffs of the triphenylmethane series; Production of—. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 473,568, June 16, 1914. Under Int. Conv., June 23, 1913.

SEE Ger. Pat. 278,423 of 1913; this J., 1915, 273.

Val dyestuffs; New—, and process for preparing them. R. Wedekind und Co. Fr. Pat. 473,744, Oct. 10, 1913.

SEE Eng. Pat. 19,435 of 1913; this J., 1914, 415.

Diazo salts; Preparation of solid—. L. Cassella und Co. Fr. Pat. 473,864, Oct. 16, 1913.

SEE Eng. Pat. 23,945 of 1913; this J., 1914, 743.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Separation of wax from straw. Heuser. See XII.

PATENTS.

Fibres from flax and other plants; Obtaining—. W. Greaves, Wimbledon. Eng. Pat. 12,162, May 16, 1914.

FLAX, ramie, and other fibrous plants are scoured in an alkaline solution containing a spirit soap, at a temperature below boiling point; after washing, the fibres are treated with a solution of curd or glycerin soap and again washed.—F. Sp.

Textile fibres; Chemical treatment of alfa (esparto grass) and other plants for obtaining strong—. F. E. M. Dubrot. Fr. Pat. 473,828, Oct. 7, 1913.

THE material is submitted to the action of a solution of sodium or potassium hydroxide of 2°–4° B. (sp. gr. 1.014–1.029), then combed, dried, immersed for 5–15 mins. in an alkali lye

of 15°–20° B. (sp. gr. 1.116–1.162), washed and immersed for 2–5 mins. in an acid solution, such as sulphuric acid of 15°–33° B. (sp. gr. 1.116–1.297).—B. N.

Cellulose or lignocellulose; Hydrated—. J. A. De Cew, Montreal, Canada. U.S. Pat. 1,140,799, May 25, 1915. Date of appl., May 11, 1912. Renewed April 27, 1915.

CELLULOSE or lignocellulose is treated with an alkali and carbon bisulphide, the proportions being such that the material absorbs approximately 2% by weight of alkali.—F. Sp.

Cellulose solutions; Machine for spinning— in vacuo, and for recovering the solvents. M. Denis. Fr. Pat. 473,481, May 12, 1914. Under Int. Conv., May 23, 1913.

A VERTICAL spindle carrying a split bobbin is rotated and also made to move vertically, so that the cellulose (or nitrocellulose) thread is wound regularly on the bobbin. When the bobbin is full, the spindle is automatically lowered so that the full bobbin is transferred to the upper part of the spindle, and the latter picks up a fresh split bobbin previously placed on a circular platform surrounding the spindle lower down. The full bobbin continues to rotate on the upper part of the spindle until it is removed. The whole is covered with a bell, preferably of glass, in which a vacuum is maintained, and the solvents are recovered. The process saves labour and solvent, and gives a more uniform product.—F. Sp.

Artificial silk; Method of making—. K. Kishi. Fr. Pat. 473,986, June 23, 1914. Under Int. Conv., July 2, 1913.

CELLULOSE from mulberry-tree bark is nitrated and dissolved in an equal weight of ether-alcohol (1:1), and to the solution is added 3% or 4% of oil or "essence" of chrysalis from which volatile compounds have been removed by heating until the volume has been reduced by a quarter. The solution is spun, and the silk washed with water, alcohol, hydrochloric acid, and saturated potassium sulphate solution. The oil of chrysalis is said to give increased lustre, tenacity, and resistance to water.—F. Sp.

Artificial silk; Manufacture of— from solutions of cellulose acetate. W. Vieweg. Fr. Pat. 474,163, June 26, 1914. Under Int. Conv., June 28 and July 5, 1913.

CELLULOSE acetate threads may be rapidly coagulated by using as the precipitating bath concentrated aqueous solutions of alkalis such as 25% ammonia or 20% soda lye. The cellulose acetate is not destroyed, and quicker spinning is possible. The threads may be made more brilliant and transparent by adding to the coagulating bath dextrose, ethyl alcohol, glycerin, aldehydes, or especially 10% of cane sugar.—F. Sp.

Lustrous threads; Preparation of— from non-purified viscose by means of mineral acid. Vereinigte Glanzstoff-Fabriken A.-G. Ger. Pat. 282,789, Nov. 27, 1913.

THE acid used must be comparatively weak, 10% or under, and the time of passing through the bath as short as possible, the process being carried out at the ordinary temperature. The quality of the threads corresponds to that of the material prepared by the acid-salt process.—F. W. A.

Paper making; Boilers or digesters for treating material used for—. S. Milne, Edinburgh. Eng. Pat. 12,881, May 26, 1914.

A HORIZONTAL rotary digester, mounted on

trunnions and furnished inside with gratings, one near each trunnion, is provided with a pipe extending axially from one grating to the other. A steam pipe passes through one trunnion into the central pipe, in such a way that the injector action of the steam causes the liquor in the digester to circulate through the pipe, thence through the grating at one end, returning through the pulp in the digester and through the second grating into the central pipe again. The pulp is meanwhile agitated by the revolution of the digester, so that thorough treatment is obtained with a minimum quantity of liquor. In an alternative arrangement a steam pipe passes through each trunnion and there is an opening in the middle of the central pipe, so that the liquor is circulated from the centre of the digester to either end, returning through the central pipe. Beneath the digester is a tank, provided with agitating gear and a circulating pump, into which the contents of the digester may be discharged. The liquor may then be drawn off from the pulp through a perforated plate and outlet cock, or the material may be diluted with waste liquor and pumped off.—F. Sp.

Writing-paper; Treating —. E. H. Clifton, Assignor to J. M. Hester, Boston, Mass. U.S. Pat. 1,140,253, May 18, 1915. Date of appl., Aug. 26, 1913.

CALENDERED writing papers, to be used for cheques, drafts, and the like, are immersed in a bath of 6 parts of sulphuric acid, 24 parts of hydrochloric acid, and 700 parts of water, until permeated with the liquid, then removed, and dried.—B. N.

Paper; Method and machine for making —. C. E. Pope, Holyoke, Mass. U.S. Pat. 1,140,711, May 25, 1915. Date of appl., Feb. 19, 1914.

A FOURDRINIER paper-making machine is provided with a rotary press roll and felt, or with two press rolls having a felt between them. The web is transferred from the upper press roll to the felt by means of a thin blast of air delivered tangentially to the cylindrical surface of the roll.—F. Sp.

Cellulose; Process of preparing solutions of —. R. Willstätter, Berlin-Dahlem, Germany. U.S. Pat. 1,141,510, June 1, 1915. Date of appl., May 14, 1914.

SEE Eng. Pat. 10,605 of 1914; this J., 1914, 859.

Paper, cardboard, and the like; Apparatus for treating articles of — with waterproofing material. A. Stephen, London. U.S. Pat. 1,140,626, May 25, 1915. Date of appl., Jan. 9, 1913.

SEE Eng. Pat. 14,246 of 1912; this J., 1913, 748.

Producing grey to black shades on paper, textile goods, etc. Ger. Pat. 282,592. See VI.

Apparatus for fermenting sulphite liquor. U.S. Pat. 1,139,507. See XVIII.

Production of glucose and ethyl alcohol [from sawdust, etc.]. Fr. Pat. 473,925. See XVIII.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Tendering of cloth during singeing; Note on the influence of magnesium and zinc chlorides on the —. W. Thomson. J. Soc. Dyers and Col., 1915, 31, 133—134.

WHEREAS 5% solutions of magnesium and zinc chlorides both caused charring of cloth on ironing, the latter at a lower temperature, a mixture of the

two solutions only caused at the most a slight discoloration. It is considered that these results explain the behaviour of certain samples of cloth during the singeing process noted by the author; samples which contained either magnesium chloride or zinc chloride tendered on singeing, whereas those containing both salts were undamaged. The behaviour of the mixture may be due to the formation of a double chloride of magnesium and zinc, more stable towards heat than the separate chlorides, but attempts to isolate a definite crystalline double chloride have failed. In the discussion, it was mentioned that the mixed chlorides are usually employed in practice, the zinc chloride being added to act as an antiseptic.—F. W. A.

Chemistry of Turkey-red oils. Tschilikin. See XII.

PATENTS.

Scouring yarns or threads of fibrous substances. G. Bailey, Bradford. Eng. Pat. 16,629, July 13, 1914.

HANKS of yarn are carried, on and between a series of tapes, through the liquid and between guiding and pressing rollers, being finally delivered from the vat beyond its edge by suitable guiding rollers. The tension of the tapes is maintained by adjustable guiding rollers, and the tapes are kept in their positions by guiding fingers or by cross tapes.—B. N.

Cleaning and disinfecting; Process of —. G. Wetzels et Cie. Fr. Pat. 473,970. Oct. 24, 1913.

DEGREASING and cleaning are combined with efficient disinfecting by immersing the material in a bath of benzene and emulsifying agents, and rinsing in benzene to which has been added an alcoholic solution of trioxymethylene or other disinfecting agent soluble in benzene. The solution of trioxymethylene is obtained by adding 50 grms. to a litre of alcohol and introducing a small amount of sodium; the solution obtained is mixed with 25 litres of benzene. The impregnated material is steamed, when the formaldehyde liberated thoroughly disinfects the material.—F. W. A.

Cleaning process. Karplus und Herzberger. Ger. Pat. 281,303. Aug. 27, 1913. Addition to Ger. Pat. 267,659 (this J., 1914, 365).

DYED goods are cleaned according to the process described in the main patent in presence of substances which fix dyestuffs, e.g., tannin, or which have colouring properties (e.g., suitable inorganic pigments).—F. W. A.

Oxygen bleaching agents; Process for regulating the evolution of oxygen from — at high temperatures. V. Wintsch. Fr. Pat. 473,581, May 18, 1914.

BORON compounds, e.g., sodium metaborate, as well as pyrophosphates are added to peroxide bleaching solutions. (See also this J., 1915, 349.)—F. W. A.

Earthenware rollers for bleaching and dyeing machines and method of securing metal ends and shafts thereto. S. H. Walker, F. Hewitt, and S. Walker and Sons, Ltd., Manchester. Eng. Pat. 12,899, May 26, 1914.

METAL gudgeons or spindles, screw cut at the ends and fitted with renewable metal caps, are secured in the earthenware by lead, cement, etc. The gudgeons project inside the cemented part and are connected to a metal shaft, pipe, or tube fitting loosely between the two gudgeons to allow for expansion and contraction.—F. W. A.

Dyeing machine. S. Barker, Providence, R.I. U.S. Pat. 1,141,301, June 1, 1915. Date of appl., Nov. 10, 1914.

A DYE-TANK open at the top is provided with means for holding yarn beams near the bottom and near the top: dye-liquor is forced through the lower beam by means of a rotary pump, and the upper beam is connected to a source for supplying dry air under pressure to extract the excess liquor from the yarn and dry it whilst still in the tank.—F. W. A.

Aniline Black on cotton: Process for obtaining —. Blanchisserie et Teinturerie de Thaon. Fr. Pat. 474,276, Nov. 14, 1913.

AN ungreenable Aniline Black is obtained by impregnating cotton with a mixture containing one or more salts of aniline, a small amount of one or several salts of amines, diamines, or aminophenols, an oxygen carrier (copper or vanadium salt, etc.), a salt having an acid reaction (magnesium or aluminium chlorides, etc.), and a large proportion of an oxidising agent. The impregnated fabric is dried in a warm moist atmosphere, and then well washed.—F. W. A.

Grey to black shades on paper, textile goods, etc.; Process for producing —. Adenzer Graphit- und Talksteingewerkschaft. Ger. Pat. 282,592, Oct. 19, 1913.

GRAPHITE powder is used as filling material, giving level grey to black shades fast to light.—F. W. A.

Dyeing of alizarin and similar dyestuffs; Process for the —. L. Schreiner. Ger. Pat. 282,947, May 15, 1913.

ALIZARIN and similar dyestuffs are dyed from a vat in presence of salts of aluminium, iron, chromium, etc., which act as mordants. In this manner alizarin may be dyed on unprepared cotton, the fast lake being developed by warming, steaming, or drying and steaming.—F. W. A.

Designs on woven goods by carbonising; Production of —. H. Giesler. Ger. Pat. 282,351, Jan. 3, 1914. Under Int. Conv., Nov. 17, 1913.

THE threads to be woven as warp or weft, or both, are treated with an acid or salt solution which decomposes vegetable fibres at higher temperatures, the woven material suitably treated in certain places to render the acid or salt inactive, and the material then heated to the temperature of carbonisation. The threads of wool, cotton, mercerised cotton, artificial silk, flax, jute, etc., unbleached, bleached, or dyed, are impregnated with sulphuric or hydrochloric acid (sp. gr. 1.02–1.05), or aluminium or magnesium chloride, and dried at a low temperature. The prepared woven material is printed with a solution of sodium carbonate, ammonia, caustic soda, etc., carbonised, and the carbonised threads removed by suitable apparatus.—F. W. A.

Tissues; Treatment of — to render them impermeable. Comp. Franç. d'Injection pour la Conservation des Bois et Tissus. Fr. Pat. 474,145, Nov. 5, 1913.

AFTER a preliminary heating, the material is impregnated by injection according to the process of Boucherie (this J., 1911, 535), and finally completely dried, the solvents being recovered. The treated fibres are impermeable, imputrescible, and supple, and the "handle" is improved.—B. N.

Woven cloth; Treatment of — with bisulphites to increase its elasticity. E. C. Lehmann. Ger. Pat. 280,366, Nov. 7, 1913.

THE cloth is exposed to the action of hot solutions

of bisulphites, washed in cold water, and then dried without stretching.—F. W. A.

Wool-like effects on cotton fabrics: Process for producing —. G. Heberlein, Wattwil, Switzerland. U.S. Pat. 1,141,872, June 1, 1915. Date of appl., May 28, 1914.

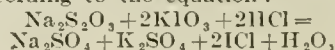
SEE Fr. Pat. 468,821 of 1914; this J., 1914, 959.

2,3-Hydroxynaphthoic acid derivative [and its use in dyeing.] U.S. Pat. 1,140,747. See IV.

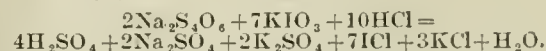
VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Polythionic acids; Volumetric determination of — by potassium iodate. G. S. Jamieson. Amer. J. Sci., 1915, 39, 639–642.

A PROCESS described previously by the author (this J., 1914, 917) yields accurate results when applied to the titration of thiosulphates and tetrathionates. With thiosulphates the reaction proceeds according to the equation:—



and in the case of tetrathionates:

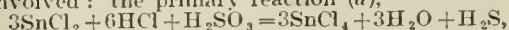


Owing to their stability, dithionates cannot be determined by this method, and their presence does not interfere with the titration of thiosulphates.

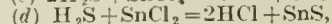
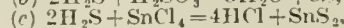
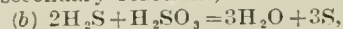
—W. P. S.

Stannous chloride; Action of — on sulphuric acid and on sulphurous acid. R. G. Durrant. Chem. Soc. Trans., 1915, 107, 622–638.

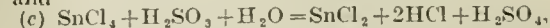
BY the action of concentrated sulphuric acid, in excess, on stannous chloride between 20° and 90° C., stannous sulphate was formed and hydrogen chloride liberated; between 130° and 200° C., oxidation took place: $\text{SnSO}_4 + 2\text{H}_2\text{SO}_4 = \text{Sn}(\text{SO}_4)_2 + 2\text{H}_2\text{O} + \text{SO}_2$ (compare Sandonini and Aureggi, this J., 1912, 384). When heated alone to between 360° C. and a dull red heat, stannous sulphate was decomposed into stannic oxide and sulphur dioxide. Various reactions were observed between dilute sulphuric acid and stannous chloride, but these were due to the secondary influence of dissolved sulphur dioxide and hydrogen chloride. Sulphurous acid attacked solutions of stannous chloride at the ordinary temperature, partial or complete oxidation occurring according to the proportions of stannous chloride, sulphurous acid, hydrochloric acid, and water. Oxidation was slow and incomplete unless an excess of hydrochloric acid was present, complete oxidation occurring when the molecular ratios, $\text{SnCl}_2 : \text{H}_2\text{SO}_3 : \text{HCl}$, were in the proportion 3:1.55:6. Five reactions are believed to be involved: the primary reaction (a),



and the secondary reactions,



and



the last retarding oxidation. The principal secondary reaction was (b); (c) was only manifest with high concentration of hydrochloric acid, and (d) only during the earlier stages. Stannous sulphide only appeared when there was a deficiency of sulphurous acid, but there was evidence of the production of a colloidal form. With an excess of hydrochloric acid the action was bimolecular.

—F. SODN.

Sodium hypochlorite; Preparation of—M. Ricci. *Annali Chim. Appl.*, 1915, 3, 282—284.

THE statements of Cattania and Ranucci (this J., 1915, 489) in regard to the effect of sodium chloride on the stability of sodium hypochlorite solutions are contradicted. A hypochlorite solution containing 15% of available chlorine can be prepared from a 24% solution of commercial caustic soda containing 5—6% NaCl, without any separation of solid sodium chloride, and even if sodium chloride is added to the solution until some remains undissolved, the stability of the hypochlorite is not diminished appreciably.—A. S.

Potassium permanganate: Velocity of reduction of—by oxalic acid. A. Boutaric. *Comptes rend.*, 1915, 160, 711—713.

MEASUREMENTS of the rate of change of colour (absorption of rays of wave-length 558 μ) in solutions containing 0.005 gm. of potassium permanganate, 1.25 gm. of oxalic acid, and 0.125 c.c. of sulphuric acid per 100 c.c., indicated that the speed of reaction increases slowly to a maximum and then decreases more rapidly than the concentration of permanganate; the reaction therefore does not appear to be unimolecular.—J. H. L.

Iodide; Permanganate and iodometric determination of—in presence of chloride and bromide. O. L. Barnebey. *J. Amer. Chem. Soc.*, 1915, 37, 1496—1507.

THE determination of iodide in presence of bromide and chloride by oxidation to iodate with permanganate in neutral or alkaline solution, and subsequent determination of the permanganate used, by means of ferrous iron, gives erroneous results owing to the formation of free bromine, chlorine, or hypochlorous acid. By the addition of manganous sulphate and phosphoric acid to the ferrous iron solution, however, the excess of permanganate and manganese dioxide is removed without these undesirable side reactions, and the excess of ferrous iron can then be correctly titrated with permanganate. A check determination can be made on the iodate which has been found in the residual solution from the above titration, by adding potassium iodide and titrating the liberated iodine with thiosulphate, and where very small amounts of iodine are in question, this iodometric determination gives better results than the previous permanganate titration.—G. F. M.

Iodine from Russia. *J. Pharm. Chim.*, 1915, 11, 313—314.

A VARIETY of *Fillafora* growing abundantly in the Black Sea has been found to yield 11% of ash containing about 3.8% of iodine. It is proposed to manufacture iodine on a commercial scale by extracting the ash with alcohol.—T. C.

Chromates; Sensitive reaction of—P. N. van Eck. *Chem. Weekblad*, 1915, 12, 6—S. Analyst, 1915, 40, 292.

SOLUTIONS of chromates give an intense blue coloration with α -naphthylamine in presence of tartaric, citric, or oxalic acid. A reagent prepared by grinding 0.5 gm. of α -naphthylamine with 50 grms. of tartaric acid and dissolving the mixture in 100 c.c. of water, will detect 0.001 mgrm. Cr in the form of chromate. A solution of potassium chromate is used as standard when the reaction is applied to the colorimetric determination of chromium. Chromic oxide may be fused with sodium carbonate and potassium chlorate, and the coloration obtained in the test matched with that given by a solution of chromate prepared in the same way from pure chromic oxide.

Litharge; Analysis of—P. Beck. *Z. anal. Chem.*, 1915, 54, 137—147.

To determine copper, 100 grms. of the sample is dissolved in nitric acid, the lead is precipitated as sulphate and separated, and the solution then diluted to 1 litre. According to the amount of copper present, a quantity of the solution, varying from 10 to 100 c.c., is treated with an excess of ammonia, aluminium and ferric hydroxides are filtered off, the filtrate acidified with sulphuric acid, and the copper deposited electrolytically. If the colour of the deposited copper indicates the presence of other metals, the metal is dissolved in nitric acid, the solution treated with ammonia and ammonium carbonate, any precipitate (bismuth hydroxide) is separated, and the copper again deposited electrolytically. Litharge for use in pottery and glass manufacture should not contain more than 0.004% Cu or more than 0.006% Fe. To determine these two impurities in one portion of the sample, 100 grms. is dissolved in nitric acid, the lead precipitated as sulphate, washed with dilute nitric acid, and the filtrate and washings are evaporated and heated until fumes of sulphuric acid appear; after dilution, the solution is filtered to remove any lead sulphate, and the copper is precipitated as sulphide in the filtrate. The copper sulphide is collected, dissolved in nitric acid, evaporated with sulphuric acid, any traces of lead sulphate are separated, bismuth is removed by treatment with ammonia and ammonium carbonate, and the copper again precipitated as sulphide, ignited, and weighed as oxide. The iron, contained in the filtrate from the first copper sulphide precipitate, is determined gravimetrically in the usual way. Litharge intended for use in the manufacture of accumulators, should be free from nitrites and nitrates and should not contain more than traces of iron, copper, or other metals precipitated by hydrogen sulphide; the chlorine content should not exceed 0.05%. The quantity of metallic lead in litharge may be determined by mixing 100 grms. of the sample with 700 c.c. of water, adding 70 c.c. of nitric acid (sp. gr. 1.4) in small quantities at a time, so that the solution does not become heated, collecting the insoluble metallic lead on a filter, then dissolving it in hot dilute nitric acid, and determining its quantity either electrolytically or gravimetrically. Insoluble substances, e.g., lead sulphate, silica, etc., are best determined by heating 100 grms. of the sample with 750 c.c. of water and 80 c.c. of nitric acid (sp. gr. 1.4) until lead oxide, metallic lead, etc., have dissolved, and then collecting the insoluble portion on a filter; the filter and its contents are washed six times with hot water, dried, ignited in a porcelain crucible, and the residue weighed.—W. P. S.

Permanganate determination of iron in presence of fluorides. Analysis of silicates and carbonates for their ferrous iron content. Barnebey. See XXIII.

Valuation of commercial lead arsenate. Robinson and Tartar. See XIXB.

PATENTS.

[Nitric acid] retorts; Process for heating—F. T. Beers, Barksdale, Wis., Assignor to E. I. du Pont de Nemours Powder Co., Wilmington, Del. U.S. Pat. 1,140,351, May 25, 1915. Date of appl., Nov. 15, 1913.

THE retort is heated by means of an oil jacket forming part of a circulatory system containing a heater. The temperature of the retort may be regulated by varying either the quantity or the temperature of the oil supplied to the jacket.

—F. Sp.

Leaden sulphuric acid chambers: Means for fixing walls of—M. Seeck. Fr. Pat. 474,302, June 30, 1914.

LEAD sheets are rolled round flat pieces of iron, tubes, etc., which rest freely in hooks suspended from brackets. The hooks can be adjusted to any height, and the brackets are placed at right angles to the sheets and only touch them at one point.—E. H. T.

Ammonia: Process of oxidising—Soc. Générale des Nitrures. Fr. Pat. 473,618, Oct. 1, 1913.

IN the oxidation of ammonia by passing it with air over heated catalysts, a better yield is obtained by bringing a current of gas, e.g., air, oxygen, nitrogen, in contact with the oxidation products immediately after they have left the catalyst.—E. H. T.

Ammonia: Manufacture of—[by synthesis]. G. Calvert, London. Eng. Pat. 10,612, April 29, 1914.

NITROGEN and hydrogen are caused to unite under pressure in the presence of a heated catalyst, action being promoted by moving the catalyst or heater, or both, relatively to the gases. For example, the catalyst may be carried by a rotating arm fitted with a heating coil, which is driven by an electric motor contained in a chamber communicating with the reaction chamber, as described in Eng. Pat. 18,350 of 1913 (see Fr. Pat. 468,426 of 1914; this J., 1914, 973).—F. SODN.

Ammoniacal liquor: Process for destroying the malodorous gases and vapours produced in the distillation of—J. Becker. Ger. Pat. 282,373, Dec. 7, 1913. Addition to Ger. Pat. 278,776 (this J., 1915, 354).

IN one portion of the gases the hydrogen sulphide is burnt to yield sulphur dioxide, and the resulting gases are then mixed with the other portion of the original gases, containing hydrogen sulphide, and the mixture, at a high temperature, is caused to interact in a reaction tower, the sulphur which is formed being subsequently separated in a washer. The condensed liquor from the ammonia still is returned to the still.—A. S.

Sodium chloride: Separation of—from liquors containing it and nitrate of soda in solution. Gibbs and Co., Valparaiso, Kestner Evaporator and Engineering Co., Ltd., and I. B. Hobshawm, London, and J. L. Grigioni, Richmond. Eng. Pat. 12,474, May 20, 1914.

AN aqueous solution of mixed sodium chloride and nitrate, such as is obtained in the Chili-salt-petre industry, is concentrated until it attains a temperature of about 123° C., under normal pressure, whereupon chloride containing very little nitrate separates out. The process is rendered continuous by using a steam-heated evaporator and a separator, through which the liquor is circulated continuously. At intervals a portion of the liquor, together with the separated chloride, is drawn off through a valve at the bottom of the separator into a steam-jacketed filter-box, whence the nitrate liquor flows into crystallisation tanks; the residual salt is washed with hot water or steam and then removed.—E. H. T.

Salt: Process of damp-proofing—J. D. Miller, Assignor to L. Feuerstein, sen., Norfolk, Va. U.S. Pat. 1,140,995, May 25, 1915. Date of appl., Dec. 27, 1913.

THE heated salt is intimately mixed with stearic acid and magnesia.—F. SODN.

Salt: Process for preventing the formation of, or destroying, the skin which forms on the surface of solutions of common—on boiling. M. Leistico. Ger. Pat. 282,489, March 20, 1913.

A QUANTITY of magnesium chloride corresponding to the organic matter present is added to the brine before or during the boiling process. It may be added in the solid form, or a solution, such as the waste liquor from the manufacture of potassium chloride or sulphate, may be used.—A. S.

Sodium silicate composition. J. G. Vail, Chester, and J. D. Carter, Lansdowne, Pa. U.S. Pat. 1,139,741, May 18, 1915. Date of appl., Sept. 3, 1914.

A SODIUM silicate composition, soluble in cold water, is prepared by adding sodium sulphate to a solution of sodium silicate and removing sufficient water from the solution to yield an apparently dry powder.—W. C. H.

Soda-ash process. J. H. Hirt, El Paso, Texas. U.S. Pat. 1,141,639, June 1, 1915. Date of appl., Feb. 11, 1913.

SODIUM sulphide in a hot, fluid state is granulated in wet sawdust, then mixed with excess of crude limestone, and heated to redness.—E. H. T.

Kelp: Process for extracting potash and other substances from—S. R. Oppenheim, Long Beach, Cal. U.S. Pat. 1,141,482, June 1, 1915. Date of appl., Oct. 12, 1914.

DRIED kelp is placed on the horizontal bed of a furnace maintained at below 350° C., and a direct flame is applied periodically to it until the whole mass is charred.—E. H. T.

Potash salts; Apparatus for dissolving—Gebr. Burghard. Ger. Pat. 282,750, Feb. 26, 1914. Addition to Ger. Pat. 238,255. (See also Ger. Pat. 256,196; this J., 1913, 426.)

A HORIZONTAL shaft extending through the long dissolving chamber carries a number of agitators arranged in the spaces between vertical partitions projecting downwards from the cover of the chamber; these partitions serve also as heating devices. Discs, fixed to the shaft, divide the chamber into several compartments, each containing a number of the heating devices and agitators; the scoops carried by some of the agitators are turned in a different direction to those carried by others in the same compartment, so that whilst the solid material is moved forward gradually, it is also mixed thoroughly with the liquid, which flows through the apparatus in the opposite direction.—A. S.

Calcium hypochlorite; Manufacture of solid, high-grade—Chem. Fabr. Griesheim-Elektron. Ger. Pat. 282,746, Nov. 12, 1913.

SOLID calcium hypochlorite is prepared by chlorinating a concentrated lime paste containing just sufficient water to retain in solution the calcium chloride which is formed. The lime paste is kept in motion by agitators or the like and is treated with chlorine under pressure at a temperature high enough to prevent the separation of the basic intermediate product (see Fr. Pat. 376,846 of 1907; this J., 1907, 1047).—A. S.

Zinc sulphate; Production of—R. B. Llopert, Cordoba, Argentina. U.S. Pat. 1,140,354, May 25, 1915. Date of appl., March 16, 1915.

AN aqueous solution of zinc sulphate, which may be heated by injecting steam, is treated with an oxidising agent, e.g., a dioxide, and air. A white stable product is obtained.—F. SODN.

Zinc sulphide; Preparation of—A. Helbrouner and E. Vallée. Fr. Pat. 473,575, Sept. 30, 1913.

BASIC or neutral salts of zinc are mixed with sulphur and a hydrocarbon such as naphthalene, and heated in a crucible to about 200° C. The operation may be carried out under pressure. The nascent hydrogen sulphide thus formed converts the zinc salt into sulphide. The solid product is finally heated to 700°–800° C. in an inert atmosphere.—T. ST.

Zinc sulphide; Manufacture of—P. Pipercaut. Fr. Pat. 474,057, Oct. 30, 1913.

ZINC compounds such as the sulphate or carbonate are heated in a retort in a current of sulphur dioxide and a reducing gas such as carbon monoxide. Nascent sulphur is formed which converts the zinc salt into sulphide. The product is washed with dilute alkali solution to remove the small amount of oxide formed.—T. ST.

Zeolites; Manufacture of—Water Softeners (France), Ltd. Fr. Pat. 474,283, June 29, 1914. Under Int. Conv., June 30 and July 5, 1913.

THE zeolite is prepared in the wet way by the use of very dilute solutions of sodium aluminate and sodium silicate, in such proportions as to produce a gelatinous precipitate, which is washed, pressed into a cake, and dried in air. After drying, the cake is broken up and washed with hot water. It is then suitable for use in the softening of water.—J. H. J.

Separating salts from solutions by means of an air-current; Process for—C. Breithaupt and W. Ziervogel. Ger. Pat. 281,831, June 1, 1913.

THE hot salt solution is passed through a rotating drum traversed by an air-current. The drum is rotated in a trough containing cold solution which serves as cooling agent, and is fitted with a conveyor to remove the crystals which separate.—F. W. A.

Nitrogen; Fixation of—as cyanamides or cyanides, with or without subsequent treatment for obtaining ammonia and alkalis. E. A. Ashcroft, London. Eng. Pat. 10,420, April 27, 1914.

SODIUM, nitrogen, and carbon unite directly to form disodium cyanide, Na_2CN , when the metal is heated with a slight excess of finely powdered charcoal in nitrogen, or nitrogen and coal-gas, under pressure. The synthesis is effected in a polished iron crucible contained in a steel autoclave, the intervening space being filled with gas. The action begins at 350° C. under 200 atm. and then proceeds spontaneously, and more nitrogen must be supplied as the action continues. The pressure required varies inversely as the temperature, the minimum pressure being 50 atm. and the maximum temperature 700° C. In presence of finely divided iron as catalyst, the elements unite to give a quantitative yield of disodium cyanamide, Na_2CN_2 , which is also formed by heating disodium cyanide in ammonia at about 500° C. The cyanamide may be used directly as a fertiliser, or it may be decomposed into ammonia and sodium carbonate by heating at or below 200° C. under pressure. Sodium cyanide is obtained from the cyanamide by fusing it with potassium ferrocyanide at 500°–600° C., or by melting it with charcoal at 750° C.—E. H. T.

Cyanides; Process for producing—Nitrogen Products Co. Fr. Pat. 474,023, May 29, 1914. Under Int. Conv., Nov. 7, 1913. (See also Fr. Pat. 455,799 of 1912; this J., 1913, 943.)

IN the fixation of atmospheric nitrogen by passing it over a heated mixture of alkali carbonate,

carbon, and iron, better results are obtained if the mixture is used in the form of small briquettes, which are preheated by the hot waste gases. The charge descends gradually through a narrow vertical furnace where it meets the nitrogen, which has been preheated by using it to cool the final product. The carbon-content of the charge is increased by causing the carbon monoxide, formed in the main reaction and introduced with the nitrogen, to decompose into carbon dioxide and free carbon in presence of the briquettes. The latter must be cooled to a temperature at which they are no longer plastic before they are removed at the finish.—E. H. T.

Boron nitride; Manufacture of pure or nearly pure—Ehlich and Graetz, and E. Podszus. Ger. Pat. 282,701, Dec. 7, 1913.

A MIXTURE of boron trioxide or the like with an inert material or a substance which can be easily removed by means of ammonia, e.g., boron nitride or carbon, is heated to a high temperature and subjected to the action of ammonia; the mixture is preferably finely ground, for example in a ball-mill. Residual traces of boric oxide or carbon are removed by heating the product to a very high temperature in a current of ammonia, preferably in a tube of boron nitride. The method may be applied to the purification of boron nitride obtained by reduction of boron trioxide with carbon and treatment with nitrogen.—A. S.

Sulphur from sulphur-gases; Process for recovering elemental—W. F. Lamoreaux and C. W. Renwick, Isabella, Tenn. U.S. Pat. 1,140,310, May 18, 1915. Date of appl., June 21, 1913.

SULPHUR dioxide, mixed with atmospheric oxygen, is reduced to elemental sulphur by maintaining it in contact with a bed of incandescent carbon for a predetermined period, and supplying electrically to the carbon the heat necessary to secure practically complete reduction of the sulphur dioxide.—W. C. H.

Oxygen generator. T. Griswold, jun., and E. O. Barstow, Midland, Mich., Assignors to The Cleveland Trust Co., Cleveland, Ohio. U.S. Pat. 1,140,373, May 25, 1915. Date of appl., Aug. 18, 1910.

A GENERATING chamber, which may be heated by steam, is connected with a mixing chamber fitted with a mixing device, and both chambers are connected with a washing chamber. A stand-pipe in the washing chamber, sealed against the escape of gas, opens into the mixing chamber, and another pipe from the generating chamber opens into the washing chamber, near the bottom.—F. SODN.

Oxygen; Apparatus for obtaining high-percentage—by rectification of liquid air. H. Barschall. Ger. Pat. 282,665, Aug. 31, 1911.

THE apparatus comprises a series of coils of tubes of short pitch and with only narrow spaces between adjacent portions. Liquid air flows through the interior of the tubes, and the vapour from liquid air or liquid oxygen passes upwards and through the narrow spaces around the tubes. Oxygen of 99.5% purity and nitrogen containing about 7% of oxygen are obtained.—A. S.

Hydrogen; Manufacture of—Badische Anilin- und Soda Fabrik. Ger. Pat. 282,849, Dec. 4, 1913.

IN the manufacture of hydrogen by the interaction of steam with carbon monoxide or gases containing it, contact masses containing, in addition to nickel or its oxides, a preponderating quantity of iron or its oxides, are used. It is possible thus to secure satisfactory activity of the nickel without causing the formation of methane.—A. S.

Hydrogen: Production of—from water-gas or other gases containing carbon monoxide. Badische Anilin und Soda Fabrik. First Addition, dated June 15, 1914, to Fr. Pat. 459,918, July 2, 1913. Under Int. Conv., June 23 and Dec. 3, 1913, and April 7 and May 13, 1914.

SEE Ger. Pats. 279,582 and 282,849; this J., 1915, 355, and preceding. Contact masses composed of metals or oxides of metals other than iron, nickel, and cobalt may be used, together with activating substances consisting of compounds of metals differing greatly in chemical properties, such as basicity, reducibility, etc., from the metal used as catalyst.

Argon or mixtures of argon and nitrogen: Preparation of—Chem. Fabr. Griesheim-Elektron. Fr. Pat. 473,985, June 5, 1914. Under Int. Conv., June 6, 1913.

OXYGEN rich in argon, such as is obtained by rectifying liquid air, is passed together with hydrogen over heated copper, the water formed being removed by condensation. The process is continuous, as the copper oxide is reduced by the hydrogen at once, and the only heat required is that necessary to start the action. The method is simplified by burning the oxygen and hydrogen, mixed in the theoretical proportion, in a single flame, in a closed cylinder, the walls of which are kept cool; the condensed water removes any nitrogen oxides which are produced from the nitrogen present in the oxygen. The gas which emerges is passed through a small tube containing copper; if the latter becomes oxidised more hydrogen is passed into the flame.—E. H. T.

Sulphate furnace: Mechanical—Chem. Fabr. Rhenania, K. Thelen, and F. Wolf. Fr. Pat. 473,607, May 28, 1914. Under Int. Conv., June 3, 1913.

SEE Ger. Pat. 279,997 of 1913; this J., 1915, 355.

Apparatus, vessels, etc., or linings, resistant to ozone. Chem. Fabr. Griesheim-Elektron. Fr. Pat. 473,508, June 15, 1914. Under Int. Conv., June 16, 1913.

SEE Ger. Pat. 274,872 of 1913; this J., 1914, 790.

Nitrogen and oxygen, and nitrogen and hydrogen: Process for obtaining compounds of—O. Bender. Fr. Pat. 474,107, June 25, 1914. Under Int. Conv., Oct. 20, 1913.

SEE Ger. Pat. 279,007 of 1913; this J., 1915, 228.

Titanium and oxygen: Process of obtaining compounds of—from titanite, titaniferous iron ores, or other substances. P. Farup. Fr. Pat. 474,309, June 30, 1914. Under Int. Conv., July 1, 1913.

SEE Ger. Pat. 276,025 of 1913; this J., 1914, 920.

Coating acid-proof transport vessels with pitch, asphalt-cement, etc. Ger. Pat. 280,863. See I.

Converting the precipitate resulting from the electrolysis of magnesium chloride solutions, such as waste liquors of potash factories, into oxychloride cement. Ger. Pat. 280,906. See IX.

Hydrofluoric acid containers. Ger. Pat. 282,128. See XIV.

Process for obtaining glutamic acid and alkali chlorides from molasses, etc. Melasse-Schlempe Ges. Ger. Pat. 280,824. See XVII.

VIII.—GLASS; CERAMICS.

Analysis of litharge. Beck. See VII.

PATENTS.

Glass: Manufacture of—T. J. I. Craig and P. Spence and Sons, Ltd., Manchester. Eng. Pat. 21,231, Oct. 20, 1914.

THE residue obtained from treating bauxite, china clay, or coal measure shales with sulphuric acid is mixed with burnt lime and other known ingredients employed for making various kinds of glass.—W. C. H.

Enamel-ware: Continuous burning furnace for burning—C. Bickmeier and D. A. Läston, Bellaire, Ohio. U.S. Pat. 1,140,105, May 18, 1915. Date of appl., Oct. 29, 1913.

THE furnace bottom consists of two blocks, spaced apart, and having their upper surfaces curved downwards and backwards from the middle line of the furnace. The cover of the furnace has on its underside a depending tongue in the middle and curved portions on each side of the tongue. Below the furnace is a buggy from which a standard projects upwards through the furnace bottom; at the top the standard carries a three-armed frame, from which rise fingers with finely pointed tops for supporting the ware within the furnace.—W. C. H.

[Carborundum] abrasive wheels and the like: Process of forming and binding material for use in—J. G. Vail, Chester, and J. D. Carter, Lansdowne, Pa. U.S. Pat. 1,139,739, May 18, 1915. Date of appl., Nov. 4, 1913.

CARBORUNDUM is mixed with a binding material, composed of an alkaline solution of a silicate in which an oxidising agent, such as potassium permanganate, is dissolved, and the mass is then baked in moulds at a relatively low temperature.—W. C. H.

[Boron and titanium] nitrides: Manufacture of coherent objects from—E. Podszus. Ger. Pat. 282,748, Oct. 23, 1913.

COMPOUNDS of boron or titanium capable of being sintered, e.g., boric oxide or titanium dioxide, are formed into the desired shape, then sintered by heating, and afterwards heated to a high temperature in an atmosphere of ammonia or the like, to produce boron or titanium nitride. A mixture of nitride and oxide may be used instead of the oxide alone, and such mixtures may be produced by partial oxidation of the nitride. For instance, objects may be formed from a mixture of boron or titanium nitride and an organic binding agent, and the latter destroyed by burning in the air, whereby the nitride is partially converted into oxide. Titanium dioxide is preferably calcined or fused before use. Objects formed from boron nitride may be impregnated with fused boric oxide or a solution of boric acid, and then heated in a current of ammonia, the operations being repeated if necessary. The products are suitable for use in the construction of furnaces, being capable of withstanding very high temperatures and also changes of temperature, and retaining their electrical insulating capacity even at the highest temperatures. They are also suitable for crucibles for melting metals, as they are not attacked even by boiling alkali metals.—A. S.

Apparatus for drying china or other clay, fullers' earth, pigments, whitening, etc. Eng. Pat. 28892. See I.

IX.—BUILDING MATERIALS.

Plaster of Paris; Presence of sodium and magnesium sulphates in—E. Canals. J. Pharm. Chim., 1915, 11, 286—290.

SODIUM and magnesium sulphates are nearly

always present in traces in plaster of Paris, generally in about equal proportions. They behave as activating agents in materially reducing the time required for the plaster to set, sodium sulphate having a greater effect than magnesium sulphate in this respect.—T. C.

PATENTS.

Moulded articles [of kieselguhr]; Process of making —. T. M. Caven, Chicago, Ill., Assignor to Kieselguhr Co. of America, Los Angeles, Cal. U.S. Pat. 1,139,637, May 18, 1915. Date of appl., April 1, 1914.

KIESELGUHR and subdivided vegetable fibrous material are mixed with water to form a plastic mass, which is subjected to mechanical agitation until the mixture becomes more fluid, when a further quantity of subdivided vegetable fibrous material is added and the mass again agitated, these operations being repeated until the required proportion of vegetable fibrous material has been added. The moulded articles are dried and subjected to sufficient heat to decompose the vegetable fibrous material.—W. C. H.

Magnesium chloride solutions, such as waste liquors of potash factories; Process for converting the precipitate resulting from the electrolysis, with or without diaphragm, of — into oxychloride cement. E. Dietz. Ger. Pat. 280,906, Dec. 17, 1913.

THE precipitate is partly freed from adhering liquor, and heated to remove sufficient water of crystallisation so as to obtain a mixture of magnesium oxide and chloride which forms a homogeneous mass of oxychloride when treated with water.—F. SODN.

Plaster slabs for moulds; Preservation of —. O. Haase. Ger. Pat. 281,169, July 23, 1913.

PLASTER slabs are treated with a mixture of hydrofluosilicic acid and zinc silicofluoride, which prevents the formation of a saline efflorescence, or destroys such efflorescence if it has already formed, and also prevents the development of moulds on the surface of the slabs.—A. S.

Binding material for roads; Preparation of a — from crude gas-tar, pitch, bitumen, and stones. E. Buchmann. Ger. Pat. 281,900, March 9, 1913.

CRUDE gas-tar is partially dehydrated by heating and mixed with a boiling mixture of pitch and bitumen, so that foaming occurs and water is completely expelled from the tar.—F. SODN.

Impregnation of green wood; Process for the —. Rütgerswerke A.-G. Ger. Pat. 282,777, March 13, 1912.

FRESHLY cut or insufficiently dried wood is heated in the impregnating liquid under a small constant vacuum, and the vacuum is maintained when the heating liquid is drawn off, giving a suitable impregnation with limited amounts of tar oil. —F. W. A.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Metals and alloys as cast; The Brinell ball test on —. A. Portevin. Rev. Mét., 1915, 12, 95—100.

THE character of the impressions formed by the Brinell ball test was studied in cases where the action could be confined to a single grain, and in cases where several grains similarly oriented were concerned, the surface of the metal being in all cases polished and suitably etched. Single grains large enough for test were obtained with the alloys

Cu 95.5, V 0.5%; Cu 99.25, Al 0.75%; Cu 97.84, Al 2.16%, and Cu 84, Sn 16%. The impression in nearly all cases was a square with rounded corners. The small diameters were in the directions of the dendritic axes, and the long diameters along lines bisecting the dendritic directions. The difference between the two diameters was a maximum when the dendritic directions were rectangular. In the alloy Cu 97.84, Al 2.16%, a difference of 1.01 mm. on a mean value of 3.45 mm. was obtained. Tests made on the cleavage planes of an ingot of commercial antimony gave oval impressions with torn edges, the diameters being roughly 2.57 mm. and 3.47 mm. with a 10 mm. ball under a pressure of 250 kilos. In the second group, cylindrical brass ingots containing Cu 70, Zn 30%, and Cu 57, Zn 43%, with long radial grains, were formed by quick cooling and tested on transverse sections. The ball impressions were squares with rounded corners. The short diameters were normal and parallel to the ingot surface, and the long diameters were at 45° to these directions. A zinc ingot of the same nature gave oval impressions, the short diameters being in the direction of the length of the grains (radial) and the long diameters at right angles to this direction. An impression made at the centre of the section was almost circular.—T. ST.

[Steel;] *Autogenous process of cutting* [—]. R. Pleninger. Z. kompr. n. fl. Gase, 1914, 16, 6—11, 21—25, 45—50, 72—76, 87—97, 131—139. Z. angew. Chem., 1915, 28, Ref., 7—8.

WITH a constant working pressure, the amount of oxygen required, and hence also the time, increase with decrease in the concentration of the oxygen. For example, in the case of steel plate 40 mm. thick, each decrease of 2% in the oxygen concentration involved an increased consumption of about 30% of gas. The use of higher pressure reduces considerably this increased consumption of gas when oxygen of low-percentage is used. The proportion of iron in the slag decreases with decrease in oxygen concentration. The actual consumption of oxygen is considerably greater than the theoretical. With 40 mm. plate and 99% oxygen the excess consumption was 250%. With low percentage oxygen the excess is still greater (e.g., 560% with 81% oxygen). Considerable economy can be effected, especially with low-percentage oxygen, by preheating the oxygen or the metal and proper regulation of the pressure. With high % oxygen alteration of the material is only perceptible to a depth of about 0.8 mm., whilst it is considerably deeper with poorer oxygen. In cutting nickel steel plate, the proportion of nickel is considerably lower in the burnt material in comparison with the original metal. The nickel remains for the most part attached to the cut surface.—C. A. M.

Metals; Some observations on the annealing of —. G. Méker. Rev. Mét., 1915, 12, 101—103.

BLEMISHES formed on the surfaces of rolled steel and brass during annealing were traced to the presence of mineral matter arising from soaps, and the like, in the lubricating greases used in rolling, etc.; entirely combustible oils and fats had no effect.—T. ST.

World's copper production. Chem. Trade J., June 12, 1915.

THE total production of copper in 1914 was about 10% less than that of 1913, according to statistics just compiled by Messrs. H. R. Merton and Co. Germany's output increased during 1914 by 20%, and Austria's by 6%. Since the beginning of 1915 there has been a general and steady increase of production owing to the heavy demands by

belligerent countries. The average price of standard copper in 1913, based on the figures of the first of each month, was £68 5s. 9d.; in 1914, £59 8s. 11d.; while the price on April 15th, 1915, was £74 10s. per ton.

The total production of the world in 1914 was 893,085 tons, against 981,860 tons in 1913, a decrease of 91,775 tons. The estimated production of Germany in 1914 was 30,000 tons, as compared with 24,910 tons in 1913. The Austrian total in 1914 was 4,000 tons, an increase of 235 tons over 1913. The production in Cuba rose by about 50%, and there was a larger output from Africa owing to the extension of mining at Katanga. The production in the United States declined from 547,205 tons to 507,025 tons; in Spain and Portugal from 53,835 tons to 36,515 tons; in Mexico from 40,500 tons to 23,580 tons; and in Australasia from 46,550 tons to 37,000 tons.

Sodium cyanide and zinc for use in the Siberian and Ural gold mines; Proposed duty-free admission of —. Board of Trade J., June 17, 1915.

ACCORDING to the "Official Messenger" of Petrograd of the 30th April/13th May, the Council of Ministers has approved the proposals of the Minister of Commerce for the admission into Russia, free of Customs duty (and under regulations to be drawn up by the Minister of Finance in concurrence with the Minister of Commerce), of cyanide of sodium, sheets of zinc, and zinc dust, for the needs of the Siberian and Ural gold-mining industries. It is further proposed that this exemption from duty shall take effect as from the 1st/14th January, 1915, and that Customs duties paid after that date on such materials imported for the purposes mentioned, shall be refunded.

Gold; Relative efficiency of various amalgams in the recovery of —. F. A. Thomson and R. Koffer. Met. and Chem. Eng., 1915, 13, 367—370.

WITH an ore composed mainly of quartz and containing 2.49 oz. Au per ton, extractions of 76.9, 70.2, 68.7, 63.9, 56.3, 55.4, 43.0, and 32.4% were obtained by plate-amalgamation with pure mercury and amalgams of sodium, lead, silver, tin, zinc, cadmium, and gold, respectively. When the ore was mixed with 5% of ferrous, manganese, and zinc sulphate, the extractions with pure mercury were 43.4, 43.0, and 55.2% respectively; the highest results were 65.9% with lead amalgam in presence of ferrous sulphate, and 61.9 and 62.9% with tin amalgam in presence of manganese and zinc sulphate respectively. The superiority of amalgams over pure mercury, in the presence of the sulphates mentioned, is regarded as due to their greater resistance to "coating," cadmium amalgam being the most resistant and the remainder following in the order named: lead, tin, gold, silver, sodium, and zinc.—W. E. F. P.

Bearing metals and alloys of high copper-content; Rapid analysis of —. C. G. Lutts. Met. and Chem. Eng., 1915, 13, 346—347.

THE original method of Demorest (solution in strong sulphuric acid and titration of antimony and tin in succession with permanganate and iodine solutions, respectively) is regarded as unsatisfactory for alloys containing 5% or more copper. In such cases the alloy should be treated with nitric acid of sp. gr. 1.20, the antimonious and metastannic acids filtered off and re-dissolved, with the paper, in sulphuric acid, and the carbonaceous matter oxidised by additions of potassium chlorate to the hot, diluted solution. The latter is then boiled for 30 mins. with sulphur ($\frac{1}{2}$ gm. for 1 gm. of alloy) to reduce the antimonious salt, the ball of

sulphur is removed, and any lead sulphate filtered off and reserved for addition to the main quantity. The filtrate is heated to 60° C., excess of standard permanganate added, the excess titrated with standard ferrous sulphate, and the percentage of antimony calculated. One-third of its volume of hydrochloric acid and, if necessary, sufficient antimony sulphate solution to bring the antimony content of the alloy up to 15% or more, are then added to the titrated liquid in which tin is subsequently determined by reduction with metallic iron and titration with N/10 iodine, standardised against pure tin dissolved in sulphuric acid and reduced as described. The original nitric acid solution of the alloy is evaporated with sulphuric acid, the lead sulphate filtered off and weighed, and copper, iron, and zinc determined in the filtrate by usual methods. With alloys of low copper content (about 10%), a separate determination of copper is necessary, owing to the occlusion of this constituent in the antimony-tin precipitate: 1 gm. of the alloy is dissolved in 10 c.c. of sulphuric acid, the solution diluted with twice its volume of water, the lead sulphate filtered off, 3 grms. of tartaric acid added, the solution made slightly alkaline with ammonia, then acidified with 3 c.c. of sulphuric acid and heated to boiling; 2 grms. of sodium thiosulphate and 1 gm. of potassium thiocyanate are added in succession and the precipitated copper thiocyanate is filtered off and weighed.—W. E. F. P.

Alloys; Electrolytic separation of — and their metallographic and mechanical investigation. VI. Pyrophoric cathodic deposits from baths containing iron sulphate, magnesium chloride, and glycerin. R. Kremann and J. Lorber. Monatsh. Chem., 1914, 35, 1387—1422. Z. angew. Chem., 1915, 28, Ref., 217.

THE cathodic deposits separated from a solution of iron sulphate and magnesium chloride in 75% glycerin contained carbon compounds in addition to the metals and their oxides, and yielded sparks when scratched with metals. The intensity of this phenomenon depends upon the composition of the bath. In 75% glycerin with a current of 0.26 amp. the intensity increases with the ratio $\text{FeSO}_4 \cdot 7\text{H}_2\text{O} : \text{MgCl}_2 \text{ aq.}$, beginning when this ratio is about 0.7, reaching the maximum at about 1.25, and disappearing at about 1.8. With 80, 50, and 20% glycerin the deposits were not pyrophoric. Only by the use of stronger currents with 50% glycerin were sparking deposits obtained. The intensity of the phenomenon increases with the temperature, reaching its maximum at 200° to 300° C. Above that it diminishes and finally disappears. (See also this J., 1914, 792.)—C. A. M.

Iron in basic slag; Determination of —. L. Blum. Mittheilung aus der Chemikerkommission des Vereins deutscher Eisenhüttenleute. Stahl u. Eisen, 1915, 35, 14—18. Z. angew. Chem., 1915, 28, Ref., 198.

THE author has shown previously (this J., 1900, 692) that the presence of vanadium in puddling furnace slags interferes with the determination of iron by the permanganate and stannous chloride processes, and the same applies to basic slags, which almost invariably contain vanadium. The iron and vanadium may be determined together by Reinhardt's method, then the vanadium determined separately, and the iron-content ascertained by difference; or the iron may be determined direct by the following method:—The solution prepared from 1 gm. of the sample as for the determination of total phosphoric acid by the official (German) method, after filtering from silica and calcium sulphate, is treated with ammonium chloride, neutralised with ammonium carbonate, diluted, and treated hot with ammonium

acetate. The precipitate is separated, washed with hot water, dissolved in hydrochloric acid, the solution treated with sufficient tartaric acid to prevent the formation of a precipitate on addition of ammonia, then diluted with water, and treated with excess of ammonium sulphide. The ferrous sulphide precipitate is separated, washed with water containing ammonium sulphide, dissolved in dilute hydrochloric acid, the solution boiled to expel hydrogen sulphide, then oxidised with nitric acid, filtered, and the iron precipitated with ammonia.—A. S.

Premature ignition of blast-furnace gas in gas engines. Waldeck. See IIA.

Action of certain colloids on ions during electrolysis. Mutscheller. See XI.

PATENTS.

Iron ores or residues; Treatment of finely divided — preparatory to smelting. J. A. Heskett, Waihi, New Zealand. Eng. Pat. 4639, Feb. 23, 1914.

THE ore is mixed with one-sixth of its weight of coking coal and a suitable flux, all in a finely divided state, and the mixture coked in a coking oven prior to smelting.—W. R. S.

Iron surfaces; Method of coating.—A. Samuel, Lyons, France. Eng. Pat. 12,045, May 15, 1914.

THE surface is painted with a mixture of red lead, or other lead oxide, and aluminium powder in linseed oil, and heated by means of a blowpipe to produce a coating of metallic lead.—W. R. S.

Steel: Process for making.—G. E. Weissenburger, Berlin. Assignor to Otis Elevator Co., New York. U.S. Pat. 1,140,550, May 25, 1915. Date of appl., Feb. 29, 1912.

A CHARGE of iron low in oxidisable constituents is heated in a Bessemer converter until oxidation of the carbon begins, when heating is discontinued and air blown over the charge until the impurities have been eliminated by oxidation.—W. R. S.

Iron: Process of hardening.—S. L. Brown, New York. U.S. Pat. 1,140,568, May 25, 1915. Date of appl., April 16, 1915.

IRON is heated to a white heat and then immersed in a bath of boiling sodium chloride for a short time.—W. R. S.

Steel or iron sheets; Method of oxidising.—A. J. Maskrey, Assignor to J. E. Carnahan, Canton, Ohio. U.S. Pat. 1,141,719, June 1, 1915. Date of appl., Oct. 14, 1913.

THE sheets are annealed in a pack in a retort impervious to the combustion gases, and are then separately exposed to an oxidising agent while still heated.—T. St.

Steel or iron sheets; Method of oxidising.—J. E. Carnahan and A. J. Maskrey, Canton, Ohio. U.S. Pat. 1,141,769, June 1, 1915. Date of appl., Aug. 16, 1912.

SEPARATE sheets are heated indirectly, in the presence of an oxidising agent, in a substantially closed chamber, just to the temperature required to produce the desired colour, and are then withdrawn from the action of the heat.—T. St.

Steel or iron sheets; Method of bluing.—J. E. Carnahan, Canton, Ohio. U.S. Pat. 1,141,770, June 1, 1915. Date of appl., Jan. 2, 1914.

THE sheets are oxidised by steam or other oxidising agent and at the same time are subjected to the action of sulphur fumes at above 700° F. (370° C.). —T. St.

Furnaces; Electric smelting.—*Smelting of ores and apparatus therefor.* F. W. Highfield, Caversham, Oxford. Eng. Pats. (A) 2728 of 1915; date of appl., Feb. 25, 1914, and (B) 4937, Feb. 25, 1914.

(A) THE iron hearth of the furnace is provided first with a refractory lining of firebricks, then with a second-class conducting support of magnesite, chromite, or dolomite, and finally with an internal lining of a mixture of coarse calcined magnesite, fireclay, and fine caustic magnesite, the support and lining having approximately the same coefficient of expansion. A resistance element formed of 3 parts of finely pulverised carbon (coke), 4 of carborundum, and 3 of fused magnesia, is enclosed between the lining and support, and a coating of 3 parts of carborundum and 1 of water glass or glue may be interposed between the lining and support or between the resistance element and the lining. The exposed surface of the lining may be coated with a mixture of siloxicon and water-glass. The resistance element, with approximately the same coefficient of expansion as the support and lining, acts as a conductor when cold. The furnace may act as a roasting or car furnace, an electrolytic bath, or combination of these. (B) The material is roasted to remove sulphur, then mixed with a reducing agent and heated in an electrical resistance furnace in a reducing atmosphere to about 950° C. The zinc is volatilised, whilst the lead is separated as a fluid and run off. The remaining matte is heated electrically to about 1300° C. to form silicious slags, and decomposition of the fluid copper and iron sulphides may be promoted by the action of a direct current. All the actions, or the whole with the exception of the last decomposition, may be effected in the same hearth.—B. N.

Furnaces; Electric — for melting iron and steel. C. Brackelsberg. Fr. Pat. 473,959, June 23, 1914. Under Int. Conv., May 13, 1914.

THE electrodes are removed whilst the furnace is at rest, and the chamber is heated during this time by oil or similar material, so as to maintain the furnace at a temperature at which the lining remains intact.—B. N.

Crushing ores; Mills or apparatus for.—G. A. Robertson, Germiston, and D. Robertson, Johannesburg, Transvaal. Eng. Pat. 12,351, May 19, 1914.

THE mill comprises a rotary casing with grooved or curved crushing surfaces in combination with a loose weighted roller entirely enclosed by, and running in the grooves of, the casing. The latter may have two separate crushing surfaces at each end, the loose crusher consisting of two rollers supporting between them a heavy weighting body. The ore is delivered into the mill by launders leading through the perforated open ends; the crushed ore passes through the perforations, while the coarse falls again into the launders and is returned to the mill.—W. R. S.

Gold ore, tailings, etc.; Treatment of.—W. R. Feldtmann, London. Eng. Pat. 12,654, May 22, 1914. (See also this J., 1915, 495.)

CARBONACEOUS or graphitic auriferous material is treated with sodium sulphide or hydrosulphide solution (0.3%) and the gold precipitated by means of metallic copper or copper sulphide; the residual liquor may be used again as a solvent. —W. R. S.

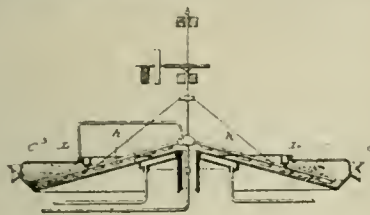
Ores; Apparatus for sintering.—A. F. Plock, Assignor to Pittsburgh Metallurgical Co., Pittsburgh, Pa. U.S. Pat. 1,140,710, May 25, 1915. Date of appl., July 14, 1914.

IN an apparatus for sintering ores by ignition

downwards, the ore is contained in a series of shallow, movable cars each having a perforated bottom and an airtight connection at the upper part with an ignition furnace. The cars are passed below the furnace in succession, and the waste gases withdrawn from below the track along which they are moved.—W. E. F. P.

Classifier and declassifier. W. J. Boudwin, Salt Lake City, Utah. U.S. Pat. 1,140,793, May 25, 1915. Date of appl., Nov. 23, 1914.

The ore pulp is fed continuously through an annular trough, L, into a circular pan having a conical bottom the apex of which is higher than



the rim of the vessel. By means of arms, *h*, attached to the trough, L, and rotating over the conical surface the solids are moved progressively upwards to the unsubmerged portion of the cone and discharged at the apex; the overflow of the watery residue is governed by a vertical flange, C, attached to the sides of the pan.—W. E. F. P.

Minerals; Flotation of —. R. F. Bacon, Pittsburgh, Pa., Assignor to Metals Research Co., New York. U.S. Pats. (A) 1,140,865 and (B) 1,140,866, May 25, 1915. Date of appl., Aug. 14, 1914.

(A) SULPHIDE minerals, and (B) the metallic sulphides produced by treating oxidised ores with a soluble sulphide, are separated from associated gangue by subjecting the finely divided ore to the "flotation action of colloidal sulphur," the flotation liquid being produced by reaction between a soluble sulphide and sufficient sulphur dioxide to render the solution slightly acid.—W. E. F. P.

Galvanising; Method of —. W. Gibson, sen., Vandergrift, and R. Skemp, Scottdale, Assignors to American Sheet and Tin Plate Co., Pittsburgh, Pa. U.S. Pat. 1,140,898, May 25, 1915. Date of appl., Mar. 9, 1912.

METAL sheets, etc., are passed through a bath of the molten coating metal, and sprayed with a finely divided fluxing agent while emerging into a non-oxidising atmosphere through feed-out rolls.—W. E. F. P.

Zinc and similar metals; Process for the manufacture of —. H. Specketer, Ger. Pat. 282,795, Feb. 6, 1914. Addition to Ger. Pat. 254,029 (see Eng. Pat. 10,349 of 1912; this J., 1912, 1082).

THE charge is kept in one furnace until about 70% of the zinc has been distilled and is then transferred to a smaller furnace in which the distillation is completed; or two or more charges from which about 70% of the zinc has been separated are united and treated further in a large furnace.

—A. S.

Metals; Apparatus for filtering molten — through materials of different permeability. Gebr. Seyboth, Ger. Pat. 282,894, Oct. 18, 1913.

SUPERPOSED layers of different degrees of permeability are placed on the bottom of the melting chamber, one or more of the layers being composed of a mixture of substances of which only one

is decomposed by heat. In passing through the layers the metal is deoxidised and freed from suspended impurities. The bottom layer consists of finely divided clay or felspar, the intermediate layer of coarser magnesite or of felspar mixed with limestone and carbon, and the top layer of coarse sand.—A. S.

Iron; Treatment of —. A. V. Dismore, Buckingham. U.S. Pat. 1,141,530, June 1, 1915. Date of appl., Jan. 31, 1914.

SEE Eng. Pat. 4292 of 1913; this J., 1914, 697.

Cast irons; Pure — obtained by synthesis, and process and electric furnace for making them. C. A. Keller. First Addition, dated Sept. 11, 1913, to Fr. Pat. 405,277, Nov. 10, 1908.

SEE Eng. Pat. 22,692 of 1913; this J., 1914, 868.

Iron ores; Process for smelting —. F. J. Machalske. Fr. Pat. 474,132, June 26, 1914. Under Int. Conv., June 27, 1913.

SEE Eng. Pat. 15,457 of 1914; this J., 1915, 233.

Copper; Process of extracting — from a sulphate solution. N. V. Ilybinette, Christiansand, Norway. U.S. Pat. 1,140,682, May 25, 1915. Date of appl., March 6, 1912.

SEE Fr. Pat. 440,712 of 1912; this J., 1912, 822.

Solid bodies from [metal] powder; Process for the manufacture of —. H. Leiser, Berlin. U.S. Pat. 1,141,469, June 1, 1915. Date of appl., Sept. 27, 1912.

SEE Eng. Pat. 22,011 of 1912; this J., 1913, 1017.

Alkali metals; Electrolytic manufacture of —. E. A. Ashcroft. Fr. Pat. 473,580, May 15, 1914.

SEE Eng. Pat. 10,980 of 1914; this J., 1914, 794.

Metals from ores; Extraction of — by electrolysis. H. A. Wagner. Fr. Pat. 473,957, June 23, 1914.

SEE U.S. Pat. 1,115,351 and Eng. Pat. 14,374 of 1914; this J., 1914, 1161; 1915, 287.

Metal articles; Production of composite —. Low-expansion wire. U.S. Pats. 1,140,135 and 1,140,136. See IIB.

XI.—ELECTRO-CHEMISTRY.

Electrolysis; Action of certain colloids on ions during —. A. Mutscheller. Met. and Chem. Eng., 1915, 13, 353–357.

FROM experiments made with solutions of silver nitrate and copper sulphate, it is concluded that, in an acid electrolyte, gelatin forms an absorption compound with the anions, the initial charge and migration velocity of which are thereby partly or totally neutralised or reversed, according to the amount of gelatin present. The velocity of the cations is proportionally increased by the decrease in velocity of the anions, so that at the point where the latter is zero the cations carry the full quantity of electricity across the electrolyte and migrate to the cathode as fast as they deposit, with the result that the metallic deposit on the cathode is smoothest and purest at that point.—W. E. F. P.

Analysis of litharge. Beck. See VII.

PATENTS.

Batteries; Electric —. G. G. J. A., and L. Fuller, London. Eng. Pat. 18,713, Aug. 15, 1914.

A DRY battery comprises an inner carbon and outer zinc electrodes, and a separator of porous material, such as cotton wool, mixed with the active material,

Such as ammonium chloride. A piece of absorbent material, previously saturated with zinc chloride and dried, is arranged between the separator and the inner electrode.—B. N.

Electrical battery. W. Hoppie, Assignor to Hoppie Electrical Appliance Co., Salt Lake City, Utah. U.S. Pat. 1,140,826, May 25, 1915. Date of appl., June 24, 1914.

A CONTAINER made of pulp, reinforced by an embedded metallic winding, encloses a zinc plate, a layer of absorbent material in contact with the inner face of the zinc layer, saturated with a mixture including aluminium chloride, and a "filler" including mercurial salts. The electrolyte is preferably composed of glycerin 1 part, gelatin 8, sal ammoniac 8, aluminium chloride 2, and zinc chloride 8.—F. SODN.

Battery carbons; Reducing coke to produce —. *Kiln for treatment of carbonaceous material.* H. T. Johnson. New York. U.S. Pats. (A) 1,141,117 and (B) 1,141,118, June 1, 1915. Date of appl., Feb. 3, 1913.

(A) PETROLEUM coke is reduced to carbon of high electrical conductivity by burning the mass to bring it to a high temperature, introducing a forced draught of air, whilst thoroughly agitating the mass by mechanical means, and continuing the operation until the mass is calcined and all impurities are removed. (B) The "fire-pot" of the furnace is provided with a flat imperforate floor free from obstructions, and with inclined or hopper sides, extending from front to rear of the furnace and down to the floor. Two horizontal series of ports, consisting of chambers formed in the side walls of the fire-pot, have outlets flush with the inner surface of the walls, one series being arranged above the other, and means are provided for supplying through pipes terminating in the ports, either gas or air or a mixture of these. The fire-pot is also provided with a vertical, rear opening enlarged at the top, and a front opening, through which the reduced contents collected on the floor of the furnace may be pushed out by a tool inserted through the rear opening.—B. N.

Plate for secondary batteries. J. O. Luthy, San Antonio, Tex. U.S. Pat. 1,141,251, June 1, 1915. Date of appl., July 7, 1914.

THE electrode comprises a supporting grid filled with active material, and a perforated conducting screen covering the face of the electrode; a porous enamel-like coating, consisting of pulverised pumice stone and sodium silicate, is applied to the screen.—B. N.

Electrolytic apparatus employing filmed electrodes. R. D. Mershon, New York. U.S. Pat. 1,141,402, June 1, 1915. Date of appl., June 19, 1913 (see also U.S. Pat. 1,065,704; this J., 1913, 796).

AN electrolytic condenser comprises a vessel containing aluminium electrodes, which are coated with heat-resistant electrolytic films, and an electrolyte, containing borax and a free acid, capable of producing the films.—B. N.

Furnaces; Electric —. Norsk Hydro-Elektrisk Kvaelfstofaktieselskab. Fr. Pat. 474,104, June 25, 1914.

SEE U.S. Pat. 1,122,555 of 1914; this J., 1915, 432.

Separation of suspended particles from electrically insulating fluids, especially gases. Ger. Pat. 282,737. See I.

Converting the precipitate resulting from the electrolysis of magnesium chloride solutions, such as waste liquors of potash factories, into oxychloride cement. Ger. Pat. 280,906. See IX.

XII.—FATS; OILS; WAXES.

Oils; Solubility of — in alcohol. J. Davidsohn and W. Wrage. Chem. Rev. Fett-Ind., 1915, 22, 11—14. Z. angew. Chem., 1915, 28, Ref., 219.

NEUTRAL rapeseed and olive oils are much less soluble in alcohol than neutral cottonseed and linseed oils. The effect of free fatty acids upon the solubility of oils is commonly over-estimated; a considerable addition is required to increase materially the solubility of neutral oils.—C. A. M.

Canarium polyphyllum. *Investigations of fat-bearing fruits and seeds from German colonies.* IV. H. Wagner and J. B. Lampart. Z. Unters. Nahr. Genussm., 1915, 29, 105—111. Z. angew. Chem., 1915, 28, Ref., 229.

THE seed-kernels of *Canarium polyphyllum* yielded 69.58% of a fat of the consistence of butter and with a nut-like odour and flavour. It had the following characters:—Sp. gr. 0.9042 at 30° C., refractometer reading 47.4 at 40° C., m. pt. 22° C., solidif. point 10°—9° C., acid value 1.49, saponification value 189.7, iodine value 52.95, Reichert-Meissl value 0.33, Polenske value 0.4, phytosterol 0.1492%. The residue left after extraction of the fat contained a high proportion of proteins.

—J. H. L.

Nickel borate as catalyst for the hydrogenation of unsaturated fats. E. Erdmann and E. Rack. Seifensiederzeit., 1915, 42, 3—5. Z. angew. Chem., 1915, 28, Ref., 220.

CONTRARY to the claims of Schönfeld (Z. angew. Chem., 1914, 27, 601), nickel borate, whether hydrated or anhydrous, does not convey hydrogen to unsaturated fats at 175° C. At 260° C. hydrated nickel borate is decomposed with the formation of nickel oxides, which then act catalytically. On heating nickel borate in hydrogen to 300° to 340° C. partial reduction of the nickel oxide, invariably present, to suboxide occurs, and the latter acts as catalyst, though less actively than pure nickel suboxide. Nickel borate offers no advantages over nickel oxide, for the lower temperature required is due to the previous formation of the suboxide. Boric acid is an injurious ingredient.—C. A. M.

Nickel borate as catalyst in the hardening of fats. W. Normann. Seifensiederzeit., 1915, 42, 46—47. Z. angew. Chem., 1915, 28, Ref., 220.

THE catalytic action of nickel borate is attributable to nickel liberated by the hydrogen. As soon as hydrogenation begins free nickel can be detected in the catalyst. There is no positive evidence of the presence of nickel suboxide. Defective electrical conductivity is no proof of the absence of metallic nickel. (See also this J., 1915, 237.)

—C. A. M.

Viscosity and fluidity of the aliphatic acids. Relation between viscosity and chemical constitution. IX. A. E. Dunstan. Chem. Soc. Trans., 1915, 107, 667—672.

DETERMINATIONS of viscosity at various temperatures gave a series of values for each acid which lie on a smooth curve. The viscosity rapidly decreases as the temperature rises. For a given temperature, logs. of viscosities plotted against molecular weights gave a nearly straight line between the limits C₃ and C₉. Abnormally high values were obtained below this limit, and above it a steady diminution in the increase of viscosity for each additional CH₂ group was observed. At 70° C., 80°, and 90° C. respectively, the viscosities ($\eta \times 10^5$) of the higher fatty acids were: lauric acid, 4430, 3620, 2990; myristic acid, 5835,

4645, 3810; palmitic acid, 7835, 6130, 5000; stearic acid, 9870, 7720, 6098.—F. SODN.

Melipona and humble-bees' waxes. H. Fischer. Z. öffentl. Chem., 1914, 20, 315—318. Z. angew. Chem., 1915, 28, Ref., 8.

MELIPONA or trigona wax is much softer than ordinary beeswax and has a penetrating aromatic odour. The abnormal constants are attributable to the liquid gum and exudations of *Carcinia*, which is collected by the insects. Humble-bees' wax has a sweet acid odour and is very sticky at low temperatures. It cannot be bleached and is therefore of little technical value. It has a normal Hübl value. When ignited it behaves like tallow. It has been detected in beeswax from S. America, East Africa, and India.—C. A. M.

Wax from straw: Separation of——. E. Heuser. Papier-Zeit., 1914, 36, 2699—2701. Z. angew. Chem., 1915, 28, Ref., 220.

CHOPPED straw extracted with petroleum spirit yielded 1.18% of soft dark green wax, which when purified with charcoal gave 85.2% of light yellow wax. Cellulose prepared from the residual straw was more readily bleached than that obtained from the untreated straw.—C. A. M.

Turkey-red oils; Chemistry of——. M. Tschilikin. Färber-Zeit., 1914, 25, 419—421. Z. angew. Chem., 1915, 28, Ref., 139.

IN sulphonating castor oil or ricinoleic acid, instead of cooling to below 35° C. as usual, it has been found possible to heat on a water-bath after allowing the product to stand for twelve hours. The action of 1 mol. of sulphuric acid on 3 mols. of ricinoleic acid gives an ester which forms salts with alkalis; on warming with dilute hydrochloric acid it is decomposed into ricinoleic acid or a product containing 2 or more mols. of ricinoleic acid, as shown by the saponification value; the iodine value shows that the double bond is not attacked. The latest researches confirm the view that polyricinoleic acids are mainly formed. By the action of more than 1 mol. of sulphuric acid the double bond is attacked; on washing with water a hydroxyl group is introduced and a saturated acid is formed. The reaction with formaldehyde depends on the hydroxyl group of ricinoleic acid; methylene derivatives, similar to glycol esters, are produced, and at the same time the acid produced or already present combines at the double linking. Monopole soap contains saponifiable complex esters, glycerides, and similar esters. All the sulphuric acid and one-quarter to one-half of the ricinoleic acid are neutralised. On warming the sulphonated product to 100° C. for 4 hours and neutralising, a new product of still greater emulsifying power is obtained; it does not, however, give transparent solutions, but dense white emulsions. If brought into solution by the original Monopole soap, no precipitate is obtained with hard water.—F. W. A.

Soap; Lathering power of——. M. Steffan. Seifensiederzeit., 1915, 42, 1—3, 23—25, 68—70, 115—116. Z. angew. Chem., 1915, 28, Ref., 220—221.

THE lathering power of saponin solutions increases with the concentration. An addition of soap increases the lathering power of saponin solutions, but an addition of saponin lowers that of soap solutions; the addition of saponin to soaps for use in cold soft water is therefore disadvantageous, but the addition is useful in the case of detergents poor in soap and intended for use with hard water. Ricinoleic acid and acid Turkey-red oil added to soaps of poor lathering capacity increase their

lathering powers. Toilet curd soaps not containing coconut oil are materially improved in lathering power by addition of ricinoleic acid or acid Turkey-red oil.—C. A. M.

Rubber substitutes from oxidised oils. Chardet. See XIV.

PATENTS.

Copra and other materials in bulk; Apparatus for drying, mixing, and otherwise treating——. R. H. Annison, London. Eng. Pat. 12,670, May 22, 1914.

THE material is fed on to the uppermost of superposed tables, enclosed in a casing, and is constantly stirred and moved forwards by travelling blades or the like, which are preferably carried in an endless chain passing above the tables. It falls through openings at the alternate ends of each table on to the next one below, and is sprayed or heated in its downward passage. The tables may be perforated, and air and moisture may be withdrawn from the casing by means of an exhaust fan or the like.—C. A. M.

Copra; Apparatus for drying——. C. Pombo and T. del Casal, Manila. U.S. Pat. 1,141,003, May 25, 1915. Date of appl., Mar. 28, 1914.

THE copra is placed on a series of superposed shelves in a carriage which can be moved into a closed casing, so that each shelf passes between superposed banks of steam pipes and rests by means of projecting portions on ledges within the casing. The alternate ends of the shelves are extended so as to leave a zig-zag passage between shelves and casing.—C. A. M.

Fats and oils and the products derived from the same; Process of aromatising——. N. Sulzberger, New York. U.S. Pat. 1,140,629, May 25, 1915. Date of appl., Aug. 9, 1911.

COTTONSEED oil or other oils, etc., intended for butter substitutes, are flavoured with the aromatic principles of leguminous or graminaceous feeding stuffs such as hay or clover. For example, the vegetable material may be extracted with the oil.—C. A. M.

Hydrogenation and dehydrogenation; Process of——. Badische Anilin und Soda Fabrik. Ger. Pat. 282,782, Dec. 12, 1913.

CONTACT masses are used which contain fluorine, tellurium, antimony, or their compounds in addition to the catalytic metal. For example, nickel carbonate may be treated with a solution of a silicofluoride of sodium, calcium, etc., or of potassium titanofluoride, and the mixture dried and reduced. Nickel wire gauze, etc., may be prepared by moistening it with dilute nitric acid and then with ammonium silicofluoride, adding a little aluminium nitrate, and drying and reducing it.—C. A. M.

Preparation of acylated arylsulphonamides. Ger. Pat. 281,363. See III.

Hydrogenation and dehydrogenation of carbon compounds. Fr. Pat. 473,697. See XX.

Preparation of chlorides of higher fatty acids. Ger. Pat. 281,364. See XX.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Paint films; Vapours from drying——. H. H. King. J. Ind. Eng. Chem., 1915, 7, 502—504. (See also this J., 1913, 320; 1914, 266, 363, 973.)

GLASS plates coated with paint or with linseed oil

were suspended within an air-tight box, and air, dried and freed from carbon dioxide by passing it over calcium chloride and potassium hydroxide, was drawn through the box, then through barium hydroxide solution to remove carbon dioxide, and afterwards through a U-tube containing iodine pentoxide, heated to 150° C., to detect carbon monoxide. Control experiments were also made. The vapours given off by the paint films (linseed oil with white lead, zinc oxide, white lead plus zinc oxide, or sublimed white lead respectively) and by linseed oil films always contained small quantities of carbon monoxide. In experiments extending over periods of from 15 to 30 days, amounts of carbon monoxide ranging from 0.098 to 0.13% of the weight of linseed oil used, were found.—A. S.

PATENTS.

Lampblack from bituminous coals of all kinds; Preparation of—D. P. Schröder. Ger. Pat. 282,891, Feb. 14, 1914.

VERY finely ground coal is extracted with hot water, washed, pressed, and ground up first with dilute and then with 10 to 30% caustic soda or potash solution. It is then freed from excess of alkali, e.g., by treatment with sulphuric acid, hydrofluoric acid, or the like, washed, and dried, with or without treatment with alcohol. Or the material may be ground up with solutions of salts, such as sodium chloride or sulphate, and the mixture electrolysed. By the treatment described bituminous constituents are removed, and the residual coal yields lampblack of extreme fineness and superior quality.—C. A. M.

Metal polishing compositions. H. Levin, London. Eng. Pat. 3367, Feb. 9, 1914.

THE fine precipitate obtained in removing iron from metallic salts (see Eng. Pat. 17,672 of 1912; this J., 1913, 790) is mixed in the proportion of, say, 20 parts, with a suitable medium, such as petrol (32 parts), fat (7 parts), and oleine (1 part). The mixture produces on metals a lasting polish free from scratches. A polishing earth, such as aluminium silicate, calcined magnesite, powdered pumice stone, etc., may also be added.—C. A. M.

Finish remover. C. Ellis, Larchmont, N.Y., Assignor to Chadeloid Chemical Co., New York. U.S. Pat. 1,140,449, May 25, 1915. Date of appl., May 22, 1907.

A MIXTURE of a solvent (e.g., 15 galls. of benzol, 10 galls. of acetone, and $\frac{1}{2}$ lb. of oleic acid), with a waxy stiffening substance (e.g., 4 lb. of paraffin wax), and ammonia solution (2 quarts of "26° strength").—C. A. M.

Formaldehyde-resins soluble in oil: Production of—Chem. Fabr. K. Albert and L. Berend. Ger. Pat. 281,939, June 27, 1913.

SUBSTANCES soluble in both oil and resin are added to the condensation products of phenols and formaldehyde. Resin acids or esters, resinates, etc., may be used. The products are soluble in turpentine, benzol, benzine, etc., and are converted into odourless esters by longer heating with resin acids.—F. W. A.

Oil varnishes; Process for preparing—from copal resin and fatty oils. Reichhold, Flügger, und Boecking. Ger. Pat., 282,959, July 8, 1913.

SULPHUR, selenium, or a compound of either, is added to a mixture of the resin and oil at a low temperature, and the mixture heated until a varnish is obtained.—C. A. M.

Resin size from unsaponifiable rubber resins and colophony or other saponifiable resins; Preparation of—E. Häuser and G. Boedeker. Ger. Pat. 283,111, Dec. 9, 1913.

A MIXTURE of unsaponifiable rubber resin and dry powdered colophony is heated with an aqueous solution of a caustic alkali or an alkali carbonate. The saponifying agent may be mixed dry with the resin mixture and the whole boiled with water.—F. W. A.

Vinyl esters; Polymerisation of—to obtain products of industrial value. Chem. Fabr. Griesheim-Elektron. Fr. Pat. 474,086, June 25, 1914. Under Int. Conv., July 3 and Nov. 12, 1913, and April 1, 1914.

SEE Ger. Pats. 281,687, 281,688, and 281,877; this J., 1915, 623. The vinyl esters or halides may be only partially polymerised before use, and polymerisation completed subsequently.

Apparatus for drying china or other clay, fullers' earth, pigments, whiting, etc. Eng. Pat. 8892. See I.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Rubber; Determination of sulphide and sulphate sulphur, and the action of solvents on vulcanised—H. P. Stevens. Analyst, 1915, 40, 275—281.

To determine sulphide sulphur, 20 c.c. of concentrated hydrochloric acid and 30 c.c. of ether are placed in a Voigt's flask (a flask having a ground-in stopper which carries an outlet tube; an inlet tube passes through the side of the flask and reaches nearly to the bottom) and air is expelled from the flask by a current of carbon dioxide. The flask is now connected with an absorption apparatus containing lead acetate solution and a weighed quantity of the rubber is introduced; the rubber swells gradually and, after the lapse of about 15 mins., the ether together with the evolved hydrogen sulphide is driven over into the absorption apparatus by gently heating the flask, the decomposition being completed by boiling the mixture for a few minutes. Any remaining traces of hydrogen sulphide are expelled by a current of carbon dioxide, and the lead sulphide is collected, washed, and titrated iodometrically. The residue in the Voigt flask, containing the sulphates, is extracted repeatedly with hydrochloric acid, and the sulphate in the extracts determined as barium sulphate. Ether in the presence of hydrochloric acid gradually dissolves vulcanised rubber at the ordinary temperature, and the dissolved rubber contains about 1.5% S; a mixture of benzene and hydrochloric acid also dissolves vulcanised rubber; the first extract in this case contains less sulphur than the later ones, but the solvent action, after the first extraction, is not selective and may be taken as an indication that vulcanised rubber is practically homogeneous. Chlorohydrocarbons act similarly to a mixture of solvent and hydrochloric acid.—W. P. S.

Rubber compounds; Influence of temperature on the tensile properties of—P. L. Wormeley. Rubber Industry, London, 1914, 246—256.

EXPERIMENTS made in the U.S. Bureau of Standards led to the following results:—In measuring the thickness of thin rubber sheet by a spring micrometer, the expansion due to increased temperature is practically counterbalanced by a softening of the rubber, and its consequent greater yielding to the weight of the micrometer foot. Tensile strength, elasticity, and ultimate elongation

are all appreciably affected by change of temperature, elasticity to a greater and ultimate elongation to a less extent than tensile strength. Tensile strength decreases, ultimate elongation and, in general, elasticity increase, with rise of temperature. No fixed relation is apparent between the chemical composition of the rubber and its tensile properties. The tests were carried out at temperatures ranging from 48° to 95° F. (9° to 35° C.).

—E. W. L.

Synthetic rubber. Researches on the commercial preparation of isoprene. G. Chardet. Rubber Industry, London, 1914, 276—278.

By steam-distilling rosin oil and passing the vapour mixed with hydrogen through a porcelain tube containing a roll of iron wire gauze heated to dull redness, a product was obtained which, after dehydration with calcium chloride, and fractional distillation, yielded 8 to 12% of isoprene, together with a dipentene distilling at about 170° C., and some cymene and phenanthrene.—E. W. L.

Rubber; Effect of acids and alkalis on —, more especially in relation to reclaimed rubber. W. G. Martin. Rubber Industry, London, 1914, 205—210.

THE vulcanisation of hard line Para rubber, in a mixing consisting of rubber, 38½; zinc oxide (or barytes), 60; and sulphur, 1½%, was accelerated by the addition of caustic soda in quantities up to 0.5%, but retarded by addition of further quantities up to 5%. Vulcanisation was retarded by the addition of from ½ to 5% of sulphuric acid; in this case only the mixing containing barium sulphate was employed. Retardation was also caused by acetic acid, though not to the same extent. The degree of vulcanisation was judged by noting the load required to stretch a test piece to three times its original length, and by determining breaking strain and elongation at break.—E. W. L.

Oxidised oils; Rubber substitutes derived from —. G. Chardet. Rubber Industry, London, 1914, 280—282.

WHEN linseed oil, together with 1% of manganese resinate, was heated for 2½ hours in a current of ozone, a large amount of gas and irritant vapour, probably acrolein, was evolved, and the product on cooling formed a brown elastic mass. Hempseed and poppyseed oils gave more fluid masses than linseed oil, and fish oil yielded a tenacious elastic mass.—E. W. L.

PATENTS.

Hydrofluoric acid containers. H. Traun und Söhne vorm. Harburger Gummi-Kamm Co. Ger. Pat. 282,128, July 12, 1913.

CONTAINERS for hydrofluoric acid are prepared from a mixture which can be vulcanised consisting of rubber and a substance which is not attacked or penetrated by hydrofluoric acid gas, such as paraffin wax.—F. W. A.

Rubber; Process for accelerating the vulcanisation of natural or artificial —. Farbenfabr. vorm. F. Bayer und Co. Second Addition, dated June 4, 1914 (under Int. Conv., Dec. 31, 1913), to Fr. Pat. 464,533, Nov. 7, 1913.

SEE Ger. Pat. 280,198 of 1914; this J., 1915, 436.

Preparation of resin size from unsaponifiable rubber resins and colophony or other saponifiable resins. Ger. Pat. 283,111. See XIII

XV.—LEATHER; BONE; HORN; GLUE.

Chestnut and oakwood extracts; Distinction between —. J. Jedlicka. Gerber, 1915, 85—86. J. Amer. Leather Chem. Assoc., 1915, 10, 330. (Compare Stiasny and Wilkinson, this J., 1911, 1172.)

TEN c.c. of 10% acetic acid and 5 c.c. of 10% lead acetate solution are added to 5 c.c. of tannin solution (analytical strength), the precipitate is filtered off, and 0.5 c.c. of 1% iron alum solution and 0.5 gm. of sodium acetate are added to the filtrate. Chestnut extract gives a strong blue-violet colour, and oakwood a yellowish colour. The ash of oakwood extract is usually from 1.2% to 1.8%, that of chestnut only 0.4% or 0.5%.

—F. C. T.

Tannin extracts; [Determination of] sulphurous acid in sulphid —. C. Schiffkorn. Collegium, 1915, 14, 101—108, 146—154. J. Amer. Leather Chem. Assoc., 1915, 10, 333—335.

THE qualitative tests are as follows:—100 c.c. of solution of analytical strength is detannised, warmed with 3 grms. of magnesium oxide, and filtered. Granulated zinc and then hydrochloric acid are added, and the mixture allowed to stand in a beaker covered with a lead acetate paper. A brown coloration shows the presence of sulphurous acid in the original extract. An alternative test is to expel sulphur dioxide from the extract by phosphoric acid, and test with starch-iodate paper. For quantitative purposes the sulphur dioxide is liberated by phosphoric acid, and removed by a current of carbon dioxide. In the gravimetric method it is collected in iodine solution, which is subsequently acidified with hydrochloric acid, boiled till the yellow colour disappears, and the sulphur estimated as barium sulphate. In the volumetric method the sulphur dioxide is collected in standard potassium iodate solution, the liberated iodine expelled, and the excess of iodate titrated with thiosulphate after adding excess of potassium iodide and acidifying. Free sulphurous acid is estimated by distilling the extract with methyl alcohol. The sulphur dioxide is collected in hydrogen peroxide, excess of which is afterwards distilled off. The sulphuric acid formed may then be titrated or estimated as barium sulphate.

—F. C. T.

Tanning; A quick method of —. H. R. Procter. Leather Trades Review. J. Amer. Leather Chem. Assoc., 1915, 10, 292—293.

BUTTS from the handlers were coated on the flesh with a ½ inch layer of paste made from strong hemlock extract liquor and divi-divi powder. The goods were then placed flesh to flesh and made into piles of 20 butts, a layer of divi-divi chaff, which contains very little tannin, being placed between each pair to separate the grains and absorb the exhausted liquor. After a day or two the goods were washed free of paste and finished in the usual manner.—F. C. T.

Lactic acid in leather and in tan liquors; Detection of —. R. Lauffmann. Ledertech. Rundsch., 1915, 7, 105—110. J. Amer. Leather Chem. Assoc., 1915, 10, 329—330.

THE test depends on the production of acetaldehyde on boiling lactic acid with lead peroxide or hydrogen peroxide; 25 c.c. of the solution is boiled with lead peroxide, and 5 c.c. of distillate collected in a test-tube containing a mixture of 1 drop of diethylamine and 5 drops of dilute sodium nitroprusside solution in 12 drops of water, which develops a blue colour in 1 or 2 mins.; the colour disappears unless the distillate contains acetaldehyde, in which case it persists or changes to violet. An alternative test

is to mix 5 c.c. of distillate with 8 or 10 drops of 10% potassium iodide solution, and almost discharge the colour with strong sodium hydroxide solution; the smell of iodoform indicates acetaldehyde. The method is applicable to 10% solutions of tanning extracts and to the liquors obtained by dialysing leather as in Paessler's method for the determination of free acid (see this J., 1914, 365). If the solution remains acid after boiling, mineral acid or non-volatile organic acids are present. Oxalic acid may be detected by calcium chloride, after acidifying with acetic acid. Before testing for lactic acid, sufficient sodium carbonate must be added to neutralise any mineral acid present.
—F. C. T.

Wattle bark in Natal. Board of Trade J., June 10, 1915.

A WATTLE bark extract factory is to be erected at Merebank, Natal, in which the green bark will be subjected to a series of mechanical pressings by means of heavy bronze rollers, hot water and tan liquor washes being applied to the pressed bark between each set of rollers. The extraction is effected within two minutes, and no darkening in colour is possible as occurs in the process of leaching in pits.

The amount of the bark exported from Natal in 1914 was 58,132 tons, valued at £286,399, as compared with 65,012 tons, valued at £309,268, in 1913.

PATENTS.

Fat from glue solution; Apparatus for the continuous separation of mixed liquids, especially —. H. Meyer. Ger. Pat. 282,705, July 19, 1913.

A RECEPTACLE, open at the top, is arranged in the upper part of the vessel in which the glue solution is evaporated; a hood or bell within the receptacle serves as the fat-separating chamber. The glue solution is introduced into the lower part of the receptacle, below the hood; the fat rises and is led off through a pipe connected with the upper part of the hood, whilst the glue solution flows under the lower edge of the hood into the receptacle and overflows from this into the evaporating vessel.
—A. S.

Leather substitute and method of making it. R. O. Herzog, Prague, Austria-Hungary, and A. Meier, Berlin. U.S. Pat. 1,141,545, June 1, 1915. Date of appl., Oct. 10, 1912.

SEE Ger. Pat. 256,407 and 256,408 and Fr. Pat. 449,213; this J., 1913, 438, 545.

XVI.—SOILS; FERTILISERS.

Nitric nitrogen in soils; Determination of —. E. R. Allen. J. Ind. Eng. Chem., 1915, 7, 521—529.

As a result of careful examination of various reduction methods, it is concluded that for the determination of nitric nitrogen in presence of much organic matter, especially in soil extracts, the most satisfactory process is a combination of the Mitscherlich and Valmari modifications of Devarda's method. 250 c.c. of the aqueous soil extract is treated with 2 c.c. of a 50% solution of sodium hydroxide in a 500 c.c. Kjeldahl flask, the latter is closed with a funnel, and the contents are boiled for 30 mins. and then diluted to the original volume. After cooling, 1 gm. of Devarda's alloy (Cu 50, Al 45, Zn 5%), ground to 60-mesh, and a small piece of paraffin wax are added, and the mixture is distilled for 40 mins. The steam and ammonia vapour pass first into a 200 c.c. round-bottom Jena flask containing 40 c.c. of water

in which a small quantity of magnesia and of magnesium sulphate has been dissolved, and then through a quartz connecting tube into a 300 c.c. Erlenmeyer flask of Jena glass containing 25 c.c. of standard acid and 60 c.c. of neutral redistilled water. The excess of acid is titrated with standard alkali, using methyl-red as indicator, the solution being boiled just before the end of the titration to expel carbon dioxide. Control determinations showed that the probable error of the method is ± 0.009 mgrm. in the case of 5 mgrms. and ± 0.028 mgrm. in that of 25 mgrms. of nitric nitrogen.
—A. S.

Carbon dioxide as fertiliser; New experiments with —. H. Fischer. Ern. Pflanz., 1915, 11, 11—12. Z. angew. Chem., 1915, 28, Ref., 215.

PREVIOUS experiments by the author on the effect of growing plants under glass in an atmosphere containing increasing quantities of carbon dioxide, showed a doubled or trebled increase in green weight, accelerated growth and development, an earlier flowering period, and increase in yield of fruit. Löbner confirmed these results but recorded a detrimental after-effect. Fischer's latest experiments with tomatoes show greatly increased yields—plants manured with carbon dioxide giving 4.4 kilos. of fruit as against 2.4 kilos. in the case of unmanured.—E. H. T.

Calcium cyanamide and its application. B. Schulze. Deutsche Landw. Presse, 1914, 41, 761. Z. angew. Chem., 1915, 28, Ref., 110.

THE fertilising effect of calcium cyanamide in granular form was only about two-thirds that of the finely ground product; the activity was not appreciably affected by the addition of tar-oil.
—F. SODN.

Determination of iron in basic slag. Blum. See X.

Fertiliser value of filter-press cake. Cross. See XVII.

Valuation of commercial lead arsenate. Robinson and Tartar. See XIXB.

PATENTS.

Fertiliser, and process of producing same. C. A. Black and W. H. Teare, Cleveland, Assignors to J. R. Cowell, Toledo, Ohio. U.S. Pat. 1,140,437, May 25, 1915. Date of appl., July 24, 1914. (See this J., 1915, 566.)

LOGGERHEAD sponge is dried, granulated, and treated with sulphuric acid or other acid which will disintegrate cellulose.—E. H. T.

Bone meal; Process for rendering — free from dust. C. Böhrsch. Ger. Pat. 281,766, Dec. 10, 1913. Under Inter. Conv., Oct. 18, 1913.

BONE meal or a mixture of bone meal with other finely ground phosphate is intimately mixed with water and a little acid or acid salt, and the excess of water is evaporated by heating until a granulated, easily distributed product is obtained. Suitable proportions are 100 kilos. of degelatinised bone meal, 40 of water, and 10 of waste sulphuric acid. The acid acts as a preservative and also produces soluble phosphate which forms a binding agent with any residual gelatin.—F. SODN.

Carnallitic waste salts ["Abraumssalze"]; Process for treating — to obtain products for fertilisers. E. Seidl. Ger. Pat. 281,913, Sept. 5, 1912.

THE material is heated and subjected to a very high pressure, to promote fusion of the magnesium chloride hexahydrate and facilitate separation of the molten product from the "Hartsalz"-like residue. The latter may be used as a fertiliser.
—F. SODN.

Fertilisers containing ammonia and phosphoric acid; Process for making—M. Gerlach. Ger. Pat. 282,915, Jan. 20, 1914.

CALCIUM phosphates is treated first with sulphuric acid and then with gaseous ammonia.—E. H. T.

Production of a copper lime mixture [insecticide]. Fr. Pat. 473,710. See XIXB.

XVII.—SUGARS; STARCHES; GUMS.

Cane juices; Influence of temperature upon the viscous fermentation of—W. L. Owen. Intern. Sugar J., 1915, 17, 275—280.

SAMPLES of fresh cane juice contained in flasks plugged with cotton-wool were maintained at temperatures averaging 9.5°, 12°, and 34° C., and allowed to ferment spontaneously during a week, at the end of which time the viscosity and the relative numbers of "viscous bacteria" and of yeasts per c.c. were ascertained. The most favourable temperature for bacteria causing the so-called "viscous fermentation" was found to be between 10° and 16° C., while that for yeasts and bacteria not producing gummy substances was higher. These results corroborate observations regarding the appearance of viscous fermentation in the sugar factories of Louisiana.—J. P. O.

"Frothy fermentation" of the after-products of the cane sugar industry; Cause of the—H. C. Prinsen Geerligs. Louisiana Planter, 1915, 54, 205—206.

ACCORDING to Lafar (Österr.-Ungar. Zeits. Zuckerind., 1914, 42, 737), and to Herzfeld and Kraisy (Deut. Zuckerind., 1914, 39, 197), the sudden and considerable evolution of gas known as "frothy fermentation," which occurs in after-products and molasses, is caused by the interaction between the reducing sugars and amino-acids, the former being produced either by heating or by certain thermophilic yeasts, and the latter being already present. While admitting that so far as the beet sugar industry is concerned this explanation may satisfactorily cover all known facts, the author considers it inapplicable to the cane sugar factory for the following reasons: the amino-acid content of cane products is small; the odour produced by "frothy fermentation" is disagreeable, whereas that resulting from the reaction indicated is pleasant; and the evolution of gas should commence during clarification and elimination, yet it is always retarded until the last stages. "Frothy fermentation" of cane products is considered to be due to the spontaneous decomposition of products resulting from heating reducing sugars with alkalis, and of products formed by superheating, formic, acetic, and humic acids and carbon dioxide and other gases being thus formed. In a Java cane factory operating the carbonatation process, an excess of lime had inadvertently been added, and previous to the stage at which the molasses was boiled to yield a second sugar nothing abnormal had been noticed; but at that point a particularly violent "frothy fermentation" occurred, after the termination of which the contents of the crystallisers was transformed into a black charred mass evolving acrid odours.—J. P. O.

Filter-press cake; Fertiliser value of—By-products of the cane sugar industry. W. E. Cross. Intern. Sugar J., 1915, 17, 267—271.

ANALYSES made of filter-press cakes from cane sugar factories in Tucumán showed them to vary in composition according to the process of clarification followed, the limiting values (as percentages on the dry substance) of the principal constituents being: lime, 2.95—11.20; phosphoric acid, 3.04—

7.81; nitrogen (as ammonia), 2.27—3.33; and organic matter, 50—70. Taking the price of phosphoric acid (citrate-soluble) and nitrogen (as ammonia) to be \$0.21 and \$2.70 per ton per unit, the average value of this by-product would range between \$10 and \$12 per ton, without taking into consideration the value of the lime and organic matter. It is urged that the cake should never be sold by the planter, but that after drying, it should be returned to the land on which the cane was grown.—J. P. O.

Working-up of sugar beets in the distillery. Windisch. See XVIII.

PATENTS.

Glucose from starch; Production of—H. Wulkan, Budapest, Assignor to Dextrin Automat, G. m. b. H., Vienna. U.S. Pat. 1,139,620, May 18, 1915. Date of appl., Nov. 7, 1912.

STARCH is treated with dilute acid to produce a dilute solution of glucose, which is then made to act upon successive fresh quantities of starch, in presence of small quantities of acid, so that finally a concentrated solution of glucose is obtained without evaporation. The concentrated solution is neutralised with borax.—J. H. L.

Levulose; Manufacture of—H. L. Cartier. St. René. Fr. Pat. 474,015, Oct. 28, 1913.

JUICES from plants containing inulin, levulin, or levulose are saccharified and treated with lime to precipitate the levulose. The washed precipitate is decomposed, preferably by sulphurous, sulphuric, or carbonic acid, and the solution of levulose filtered from calcium salt and evaporated.—J. H. L.

Caramel; Production of—J. Lehmann. Ger. Pat. 282,823, March 4, 1914.

CARBOHYDRATES are heated with acetic acid, with or without addition of acetic anhydride, mineral acids, sodium acetate, carbonate, or hydroxide, or with sodium acetate alone, in an open vessel, under a reflux condenser, or under pressure.—J. H. L.

Glutamic acid and alkali chlorides from molasses, etc.; Process for obtaining—Melasse-Schlempe Ges. Ger. Pat. 280,824, Dec. 18, 1912.

THE mixture of alkali chlorides and glutamic acid hydrochloride, obtained by the treatment of residues from the beet sugar industry with concentrated or gaseous hydrochloric acid, is treated with alcohol and gaseous hydrochloric acid. The readily soluble ester hydrochloride is obtained and may be separated from the insoluble alkali chlorides, the filtrate containing glutamic acid being evaporated to a syrup and saponified by boiling with water. Glutamic acid and its hydrochloride may be added to baking powders and are useful also as therapeutic substances.—F. W. A.

Potato-starch; Production of—by bacterial fermentation in absence of air. M. S. Hansen. Ger. Pat. 281,830, Oct. 19, 1912.

POTATOES are cut into small pieces and kept under water in a closed vessel at 25°—40° C. for several days. The yield of starch obtained is greater than in the ordinary process.—F. W. A.

Dextrin; Process for moistening and cooling—H. Wulkan, Budapest, Assignor to Dextrin Automat, G. m. b. H., Vienna. U.S. Pat. 1,139,621, May 18, 1915. Date of appl., Aug. 13, 1913.

A HOT mixture of air and steam is brought into contact with dextrin whilst the latter is agitated and maintained at 40°—50° C. The vessel containing the dextrin may be kept at the desired temperature by passing cold air through a jacket,

and the same air may afterwards be mixed with steam and introduced into the vessel.—J. H. L.

Locust beans; Process for obtaining gum from — in the form of a pure and dry powder. A. Pinel. First Addition, dated Oct. 15, 1913, to Fr. Pat. 470,899, June 26, 1913 (see Eng. Pat. 13,508 of 1914; this J., 1915, 43).

The grinding of the dried material is facilitated by carrying out the preliminary moist grinding in presence of the minimum amount of moisture necessary. The beans need not first be decorticated, and the process may be applied to beans of the bastard locust tree.—J. H. L.

Sugar-cane and similar saccharine material; Extraction of juice from —. O. Mengelbier, Berlin. U.S. Pat. 1,141,572, June 1, 1915. Date of appl. Sept. 6, 1913.

SEE Ger. Pat. 261,999 of 1912; this J., 1913, 920.

Production of glucose and ethyl alcohol [from sawdust, &c.]. Fr. Pat. 473,925. See XVIII.

XVIII.—FERMENTATION INDUSTRIES.

α -Glucosidase; Influence of acetic acid on the synthetic and hydrolytic activities of —. E. Bourquelot and A. Aubry. Comptes rend., 1915, 160, 742—745. (See this J., 1915, 159.)

The hydrolytic and synthetic actions of α -glucosidase (from air-dried bottom-fermentation yeast) with respect to α -methylglucoside, were studied in presence of various amounts of added acetic acid. The normal equilibrium was attained both in hydrolytic and synthetic reactions in presence of concentrations of acid up to 0.01%; between 0.01% and 0.06% this equilibrium was not reached in either reaction, and in presence of 0.06% of acid no hydrolysis or synthesis occurred. When the normal equilibrium was not attained the enzyme was found to have been destroyed, for no further action took place after the solutions had been neutralised. α -Glucosidase is therefore very sensitive towards acids, and the fact that the hydrolytic and synthetic functions are affected to the same extent confirms the view that they are the work of a single enzyme.—J. H. L.

Distillery; Working-up of sugar-beets in the —. K. Windisch. Z. Spiritusind., 1914, 37, 580—581. Z. angew. Chem., 1915, 28, Ref., 234.

The difficulties associated with the working-up of sugar-beets in distilleries, such as the formation of excessive "head" during fermentation and the "fobbing" of the mash during distillation, may be avoided by the addition of green malt after the charge has been blown out into the cooling vat. Presumably the malt enzymes dissolve the hemicelluloses of the cell walls of the beets and so produce a thinner mash. Fermentation may be effected by "lactic acid- or sulphuric acid-yeast," pitched at 20°—22° C.; it occupies about 3 days, and the "head" can be kept within limits by stirring the mash. The charge per 1000 litres capacity of the vats is 600—700 kilos. of beets. The mash usually attenuates to 1.2°—1.3° Balling. The yield of alcohol per 100 kilos. of roots containing 16% of sugar is 9.5—10 litres. The vinasse from beets is greater in amount but of rather lower nutrient value than that from potatoes. When beets are worked as well as potatoes or maize, they should be steamed and saccharified separately. (See also Antal, this J., 1911, 825.)

—J. H. L.

PATENTS.

[*Hop*] oasts, drying kilns and the like. W. L. White and A. W. Evans, Birmingham. Eng. Pat. 20,893, Sept. 16, 1913.

THE construction specified in Eng. Pat. 21,039 of 1912 (this J., 1913, 955) is modified as regards the means for raising and folding back the segments of the movable floor; both movements are effected by the same cables, and means are provided for shaking the segments.—J. H. L.

Beer; Production of —. Nathan Institut A.-G., Zurich, Switzerland. Eng. Pat. 564, Jan. 8, 1914. Under Int. Conv., Jan. 8, 1913. (See also Eng. Pats. 16,355 of 1898, 8526 of 1901, 20,534 of 1904, 519, 5619 and 28,261 of 1906; this J., 1899, 700; 1902, 491; 1905, 100; 1906, 603, 1229; 1907, 427.)

CARBON dioxide free from air is passed through worts, before or during fermentation, to remove dissolved air; before being used again the gas is completely freed from oxygen by passing it over heated copper scraps, or together with hydrogen over platinum black or palladium asbestos, or by means of ferrous sulphate or yeast which is in need of air. The early stages of fermentation may be so conducted, e.g., at a low temperature, that the yeast remains near the bottom of the wort, and after the rising gas has swept out the dissolved air the yeast is roused, preferably by means of the fermentation gas from which the oxygen has been removed. To eliminate the last traces of oxygen from beer in the maturing cask, the beer is bunged down under high pressure until the yeast has subsided, and then the pressure is reduced so that the yeast rises and absorbs all the dissolved oxygen. Apparatus is also claimed which, when connected with a pipe conveying carbon dioxide, automatically indicates the presence of air in the gas; a by-pass from the pipe leads a small proportion of the gas through a solution of potassium hydroxide, and any air accumulates unabsorbed until by its pressure it actuates an electric device which allows it to escape and rings a bell.—J. H. L.

Fermentation; Method of —. A. Lebbe. Fr. Pat. 473,849, June 22, 1914. Under Int. Conv., June 24, 1913.

To avoid the necessity for artificial cooling, fermentation is conducted in shallow vats of large area; the depth of the wort depends on its density and on the surrounding temperature.—J. H. L.

Wort; Method of extracting — from mashes. J. Schaefer, Frankfort, Germany. U.S. Pat. 1,141,491, June 1, 1915. Date of appl. Mar. 19, 1912.

IN a mash filter the grain cakes are trapezoidal in shape and increase in thickness towards the bottom, and their faces are ribbed uniformly from top to bottom. They are treated, through the ribbed portions, with water introduced into alternate spaces between the cakes, without alteration of the pressure on the cakes at any part of their surfaces due to the head of the water. Each cake is thus sparged uniformly throughout.

—J. H. L.

Wines; Manufacture of sparkling — and all gaseous or fermented beverages, and their sterilisation by oxygen under pressure. A. Chaussepied. First Addition, dated June 9, 1914, to Fr. Pat. 470,539, June 17, 1913 (this J., 1915, 194).

IN the manufacture of sparkling wines by the process described in the main patent, the albumin may be precipitated by addition of tannin solution after fermentation is complete, so that injury to

the yeast by an excess of tannin is of no consequence. If priming is necessary it is also added at this stage, and clarification is completed by strong chilling. Injection of oxygen is then unnecessary for sterilising the wine, though it is sometimes desirable on other grounds. Various modifications of the apparatus previously claimed, are described. In some, provision is made outside the closed vessel, for the refrigeration and storage of the fermentation gases under pressure until they are returned to the vessel to rouse or chill the wine. When the wine is racked from the closed vessel it passes through a regulating apparatus in which suspended matters are removed, and which automatically regulates the outflow of the wine so as to maintain a constant pressure and avoid fobbing.—J. H. L.

Fermenting sulphite [cellulose] liquor; Apparatus for—. P. G. Ekström, Harnäs, Sweden. U.S. Pat. 1,139,507, May 18, 1915. Date of appl., Mar. 2, 1912.

SULPHITE liquor is supplied centrally to a fermentation vat by a pipe, which is provided at its end with an extension having horizontal discharging arms of different lengths which rotate close to the bottom of the vat, the ends being bent so as to discharge the liquor tangentially. The liquor is drawn off from the vat below the level of the spent yeast, by means of a horizontal pipe provided with a valve to close its inner end, and with a vertical pipe extending upwards above the level of the healthy yeast, and open at its upper end, so that, by means of two valved discharge pipes, either fermented liquor or spent yeast may be drawn off.—B. N.

Glucose and ethyl alcohol [from sawdust, etc.]; Production of—. A. de Posnansky. Fr. Pat. 473,925, Oct. 22, 1913. (See also Fr. Pats. 464,502 and 468,188; this J., 1914, 497, 978.)

To ensure more uniform heating and avoid local formation of empyreumatic products injurious to yeast, the sawdust is heated with a much larger proportion of liquid than hitherto, *e.g.*, with 5—6 times its weight. Instead of one prolonged heating with strongly acid liquid, the material is heated several times with fresh quantities of acid of concentration not exceeding 2%.—J. H. L.

Diatase preparations; Production of—. I. Pollak. Fr. Pat. 473,476, May 5, 1914. Under Int. Conv., May 23, 1913.

MALT is extracted repeatedly with water in presence of calcium carbonate or analogous substance, the residue is saccharified at 65°—66° C., and the resulting solution, after being clarified and cooled, is mixed with the extracts obtained previously. The mixture is treated with a small quantity of a strong reducing agent, such as a thiosulphate or sulphyxylate, and concentrated *in vacuo* to a syrup.—A. S.

Diatase preparations; Production of—. I. Pollak. Ger. Pat. 283,061, May 30, 1913. Under Int. Conv., May 23, 1913.

DIATASE extracts are prepared and concentrated in presence of a reducing agent, or small quantities of a reducing agent are added to diatase preparations, after concentration, preferably at about 40° C. Stable solutions of diatase are obtained, for example, by treating extracts, which have not been concentrated, with hydrosulphurous or sulphylic acid or their salts or derivatives, or with compounds of sulphurous acid with formaldehyde. Addition of strong reducing agents prevents almost entirely the loss of activity which otherwise occurs when solutions of diatase are concentrated *in vacuo*, partially restores the activity of preparations which have been impaired by heat, and

helps to conserve the activity of dilute solutions of diatase.—J. H. L.

Fermentation of sugar and saccharine materials [by Bacillus macerans]; Production of acetone and alcohol by—. Farlenfabr. vorm. F. Bayer und Co. Ger. Pat. 283,107, July 19, 1913.

INDIFFERENT materials, such as asbestos, filter paper, or brewers' grains, are added to the fermenting mass; fermentation is thus accelerated and the yield of alcohol and acetone greatly increased.—J. H. L.

Alcoholic fermentation; Process of—. R. de Fazi. Rome. U.S. Pat. 1,140,882, May 25, 1915. Date of appl., Jan. 26, 1914.

SEE Eng. Pat. 1335 of 1914; this J., 1914, 936.

Diatase preparations; Production of—. I. Pollak. Fr. Pat. 473,475, May 5, 1914. Under Int. Conv., May 23, 1913.

SEE Ger. Pat. 283,061; preceding.

Production of caramel. Ger. Pat. 282,823. See XVII.

Production of dried yeast for nutrient purposes. Ger. Pat. 283,177. See XIXA.

XIXA.—FOODS.

Milk; The alcohol test in relation to—. S. H. Ayers and W. T. Johnson. U.S. Dept. Agric., Bull. No. 202, May 12, 1915. 35 pages.

MILK which is not fresh coagulates when mixed with its own volume of 68% alcohol (see Fendler and Borkel, this J., 1911, 643). When applied to mixed market milk, the test may be positive as a result of changes produced by bacterial action. There does not appear to be any definite relation between the alcohol test and the number of bacteria in the milk, but, in general, when bacterial growth has advanced to a point where chemical changes are produced in the milk, the test will be positive as a result of lactic- or rennet-fermentation, or a mixture of both. The addition of alizarin to the alcohol used in the test serves as an indicator of the acidity of the milk and gives some additional information as to the kind of fermentation which has taken place. It is possible, to a certain extent, to differentiate between acid- and rennet-fermentation by neutralising the milk before the alcohol test is applied; if the coagulation is due solely to acidity the test will be negative, otherwise it will be positive. The alcohol test is of value only as affording evidence that the milk is abnormal and should be examined by other tests. Titration of the milk with alcohol does not seem to offer any advantages over the usual way of applying the test.—W. P. S.

Flours and baking powders; Determination of carbon dioxide in self-raising—. T. Macara. Analyst, 1915, 40, 272—275.

THE author suggests that, for the valuation of baking powders and similar preparations, the "apparent" available carbon dioxide should be determined, *i.e.*, the amount of carbon dioxide evolved on boiling with water for 30 mins.; this includes the carbon dioxide liberated by the action of the acid ingredient, and 25% of the carbon dioxide present in the excess of bicarbonate (when boiled for 30 mins. with water, sodium bicarbonate yields 25.58% of the total carbon dioxide). Five grms. of the baking powder is treated in a flask with 100 c.c. of alcohol and 100 c.c. of water, 100 c.c. of liquid paraffin and a few pieces of pumice-stone are added, and the mixture is boiled for 15 minutes, the evolved carbon dioxide being

absorbed in excess of barium hydroxide solution; 500 c.c. of boiling water is then added to the flask and the boiling continued for a further 15 minutes. The excess of barium hydroxide is then neutralised and the barium carbonate titrated.—W. P. S.

Canned foods; Effect of the mineral content of water on —. H. L. Huenink and E. Bartow. J. Ind. Eng. Chem., 1915, 7, 495—496.

BEANS were soaked for about 12 hours in water, then rinsed several times, covered with a preserving syrup, and sterilised by heating for 65 mins. at 14 lb. steam pressure. When water containing dissolved calcium or magnesium salts was used, the beans after treatment were considerably harder than when distilled water was used, and with water containing more than 300 parts CaCl_2 per million, or an equivalent quantity of another calcium or magnesium salt, they were so hard as to be practically worthless commercially. Sodium carbonate and bicarbonate, on the other hand, had a softening effect and caused a darkening of colour of the beans.—A. S.

Protein; Combination of — with halogen acids. J. H. Long and M. Hull. J. Amer. Chem. Soc., 1915, 37, 1593—1606.

THE amounts of halogen acids which combine with casein, fibrin, and egg albumin as measured by the usual indicator titration, are low and not proportional to the molecular weights of the acids. This is probably due to the more or less complete dissociation of the protein-acid compounds in aqueous solution; in fact a large part of the acid may be washed away from the protein. Definite compounds can be obtained from mixtures of protein with excess of halogen acids by evaporating over sulphuric acid at low temperatures, then over solid alkali, and finally drying at 75°C . These compounds contain much more acid than is suggested by the titration, and the dry salts are extensively dissociated when mixed with water. The combining proportion is relatively greater for hydriodic than for hydrobromic acid, and greater for hydrobromic than for hydrochloric acid. If the evaporation of the acid-protein mixture is carried out on a water-bath the behaviour of hydrochloric and hydrobromic acids is essentially the same, but much larger quantities of hydriodic acid are taken up, and it seems probable that substitution by the iodine in the protein nucleus occurs with consequent loss of protein reactions.—G. F. M.

Determination of trypsin in gastric contents. Spencer. See XXIII.

PATENTS.

Stock food and method of preparing the same. T. B. Walker, Austin, Tex. U.S. Pat. 1,140,638, May 25, 1915. Date of appl., May 29, 1913.

CELLULOSE waste material is heated under pressure with hydrochloric acid; to convert the cellulose partially into saccharine substances; the mixture is freed from resinous substances, neutralised, and the liquid portion is separated, evaporated, and again mixed with the solid portion.—W. P. S.

Food from bean vines; Manufacture of —. D. Y. Strauss, Artesia, Cal., Assignor to California Retarder and Fibre Co., Los Angeles, Cal. U.S. Pat. 1,141,079, May 25, 1915. Date of appl., March 24, 1914.

BEAN vines are boiled with water and the aqueous extract is separated; the vines are next crushed between rollers, whereby a further quantity of extract is expressed, and then rinsed with water. The rinsing water is mixed with the extracts, the liquid is concentrated, and an absorbent edible material is added.—W. P. S.

Lactic acid bacteria; Manufacture of durable ferment preparations, especially of —. M. Groll. Ger. Pat. 282,296, Sept. 19, 1913. Under Int. Conv., Sept. 21, 1912.

BACTERIA cultures, alone or together with other substances, such as phosphates, organic acids, etc., are mixed with confectionery sugar, i.e., sugar which has been so treated that it shows no tendency to crystallise, and remains moist (22—24% H_2O) even when kept for a long time. A preparation of *Bacillus bulgaricus*, for example, is obtained by inoculating whole milk with a pure culture of the bacillus, incubating for 2 hours at 40°C ., removing the whey, and mixing the residual soft curd with an equal quantity of confectionery sugar. The product may be coated with crystal sugar, chocolate, paraffin wax, etc., to prevent it from drying.—A. S.

Yeast; Production of dried — for nutrient purposes. Versuchs- und Lehranstalt für Brauerei. Ger. Pat. 283,177, Oct. 31, 1913.

TOP-FERMENTATION yeast, e.g., Weissbier or pressed grain yeast, is neutralised with alkali and dried.—J. H. L.

Milk, cream, beverages, and other alimentary substances; Process of sterilising —. A. Rutter, Mentone, Australia. U.S. Pat. 1,140,717, May 25, 1915. Date of appl., Dec. 19, 1913.

SEE Eng. Pat. 216 of 1914; this J., 1915, 507.

Kola preparation; Process for making a —. G. C. Zimmermann, Stuttgart, Germany. U.S. Pat. 1,180,934, May 25, 1915. Date of appl., June 27, 1914.

SEE Eng. Pat. 15,725 of 1914; this J., 1915, 374.

Production of a harmless colouring matter for food-stuffs. Addition to Fr. Pat. 460,441. See IV.

Process of aromatising fats and oils. U.S. Pat. 1,140,629. See XII.

XIXB.—WATER PURIFICATION; SANITATION.

Bacteriological examination of water; Studies on the culture media employed for the —. I. The Schardinger-Dunham medium for testing for the presence of hydrogen sulphide-forming bacteria. E. M. Chamot and H. W. Redfield. J. Amer. Chem. Soc., 1915, 37, 1606—1630.

A CONCENTRATION of 3—4% of peptone in the final inoculated and incubated medium is best for the most rapid and energetic production of hydrogen sulphide. In 3% peptone media the presence of 0.5—1% of potassium chloride led to quicker and more uniform results than with any other inorganic salt tried, and positive indications of hydrogen sulphide formation were obtained in 18 hours, whilst with a "clean" natural water no hydrogen sulphide was obtainable in 72 hours. The large amounts rapidly produced by organisms of sewage appear not to be due primarily to members of the *B. coli* group. The organisms which produce hydrogen sulphide do not actively ferment carbohydrates; testing for their presence is of special value in polluted waters in which *B. coli* is absent.—G. F. M.

Waters; Determination of dissolved oxygen in polluted —. L. W. Winkler. Z. Unters. Nahr. Genussm., 1915, 29, 121—128. Z. angew. Chem., 1915, 28, Ref., 230.

By addition of calcium hypochlorite solution and sulphuric acid to waters containing nitrites, the nitrous acid is rapidly oxidised to nitric acid and the organic matter is more slowly converted into

compounds which no longer absorb the dissolved oxygen. After excess of chlorine has been eliminated by potassium thiocyanate the oxygen can be determined in the usual manner (by Winkler's method), except that manganous sulphate should be used instead of the chloride, and sulphuric acid instead of hydrochloric acid for acidifying. In the case of natural or waste waters heavily charged with organic matter, the dissolved oxygen must be determined gasometrically.—J. H. L.

Oxygen demand; Determination of the biochemical — by the saltpetre method in stockyards, tannery and corn (maize) products wastes. A. Lederer. *J. Ind. Eng. Chem.*, 1915, 7, 514—516.

In the author's method (*Amer. J. Publ. Health*, April and May, 1915), samples of sewage or the like are incubated for 10 or 20 days at 20° C. with known quantities of sodium nitrate solution, and the residual nitrite and nitrate are determined, the former by the sulphanilic acid-naphthylamine method and the latter by reduction with aluminium and estimation of the ammonia with Nessler's reagent. Assuming that 2 mols. NaNO_3 contain five atoms of available oxygen, the results agree satisfactorily with those obtained by diluting the sewage with fresh water and incubating (see this J., 1914, 1168). The presence of an appreciable quantity of nitrite after incubation is the safest indication that sufficient sodium nitrate has been used. In the case of trade wastes it may be necessary to modify the method in accordance with the character of the waste in question. In some cases it is advisable to inoculate the sample with a small quantity of domestic sewage or polluted river water to insure effective denitrification of the sodium nitrate. If free acid be present it should be neutralised with sodium bicarbonate. Addition of sodium bicarbonate is necessary also in the case of corn (maize) products waste, otherwise denitrification is inhibited by the organic acids produced by fermentation of carbohydrates during incubation. If the waste, e.g., tannery waste, contain caustic alkali, this must be neutralised by hydrochloric acid.—A. S.

Lead arsenate; Valuation of commercial —. R. H. Robinson and H. V. Tartar. *J. Ind. Eng. Chem.*, 1915, 7, 499—502. (See also this J., 1914, 1008.)

The practical value of lead arsenates as insecticides depends upon their arsenic content, and on their insolubility, which prevents them from injuring foliage. In examining commercial products it is of importance to determine water-soluble impurities, as these may have an injurious action on foliage and may also interact with lead arsenate to produce soluble arsenic compounds. The U.S. Federal Insecticide Law specifies that lead arsenate must not contain more than 50% H_2O , less than 12.5% As_2O_3 , and more than 0.75% water-soluble As_2O_3 . On a 50% water basis pure basic arsenate of lead contains only 11.71% As_2O_3 ; it is therefore suggested that separate specifications should be framed for lead hydrogen arsenate and basic lead arsenate. Commercial preparations were found to vary considerably in composition; some contained large proportions of lead carbonate and soluble impurities. The content of lead carbonate was calculated from the amount of carbon dioxide yielded by the sample on treatment with hydrochloric acid.—A. S.

PATENTS.

Feed water supplied to steam generators; Apparatus for purifying —. H. Hocking, Liverpool. *Eng. Pat.* 11,799, May 13, 1914.

IMPURE water containing oil or grease is passed upwards through a perforated floor to the upper

part of a chamber, and flows over a submerged weir in the centre of the chamber to the bottom of the adjacent chamber containing an annular filter, the water passing from the outside to the central core. The water outlet of the filter chamber maintains the level of the water in the first chamber above the mouth of the weir; much of the oil is separated in this layer of water above the weir. When the filter gets clogged, the water level rises and the water overflows into a small box outside the upper portion of the first chamber, in which is a floating indicator.—J. H. J.

Sterilisation of water; Ozoniser for the —. Comp. Industrielle d'Ozone Naturel (Ion) et des Rayons Ultra-Violetes par les Proc. Piestrak. *Fr. Pat.* 473,453, Sept. 22, 1913.

THE water to be sterilised is passed through an exhaust pump and draws in the ozonised air. The mixture of water and air leaving the pump falls on to the arms of a turbine enclosed in a circular box, in which the water is completely sterilised before passing out. The electric current interrupter is worked on the same shaft as the turbine and regulates the action of the induction coil. The turbine may be used alone to mix the water and ozone necessary for sterilisation.—J. H. J.

Water charged with carbonic acid; Preparation of —. L. Sarason. *Fr. Pat.* 473,625, June 17, 1914.

THE water is charged with carbon dioxide by addition of a carbonate and an acid, and chlorophyll, hæmoglobin, or their derivatives, are added to retard evolution of the gas.—J. H. J.

Water, especially polluted water and sewage; Apparatus for the clarification and purification of —. M. C. Brajon and P. R. Giraud. *Fr. Pat.* 474,060, June 12, 1914.

CLARIFICATION is effected by means of any suitable filter material laid on an endless travelling bed on to which the sewage is fed slowly. The rate at which the travelling bed advances is adjusted so that filtration is complete when the bed reaches the end of its run. The effluent is carried to a stream or a bacteria bed. The clogged filtering material falls off the travelling bed at the end of the run and is carried by an elevator to the upper part of a dryer where it passes over a sifting cylinder and is broken up and dried, the dirt passing through the perforations into a hopper and over an auxiliary drying cylinder. The filtering material after passing over the sifting cylinder is ready to be used again.—J. H. J.

Sterilising water; Process for —. Sucofilter- und Wasserreinigung-Ges. *Ger. Pat.* 281,810, June 7, 1913.

THE water is treated with potassium permanganate and copper sulphate, the latter acting as catalyst in the oxidation process which completely destroys the bacteria. The necessary amount of hydrogen peroxide is added to precipitate the excess of the reagents.—F. W. A.

Water; Regeneration of manganiferous filtering materials used for removing manganese from —. J. Tillmans and O. Heublein. *Ger. Pat.* 283,154, Nov. 6, 1913.

THE material, e.g., pyrolusite, manganese-permutite, etc., is made alkaline and exposed to a current of air; after being washed until neutral it is again ready for use.—J. H. L.

Filter beds; Cleansing of —. W. Boby, London. *Eng. Pat.* 15,370, June 26, 1914.

A SPECIAL small pipe is placed inside the effluent collecting pipe in mechanical filters, and is perforated with holes along its under side. Air

admitted for cleansing first fills the small pipe, passes out through the perforations into the collecting pipe, and from the latter by nozzles into the filter bed. In lieu of the inner pipe, the collecting pipes may be moulded with interior flanges along the roof on each side of the nozzles, so as to provide a continuous air channel between the flanges and the walls of the pipe.—J. H. J.

Sewage disinfection. L. C. Frank. Washington, D.C. U.S. Pat. 1,141,050, May 25, 1915. Date of appl., April 24, 1915. (Dedicated to the public.)

SEWAGE is admitted to a closed tank by a pipe reaching nearly to the bottom, and passes out by another pipe opening near the bottom and bent over the top of the tank. Steam is brought into contact with the sewage by a pipe which passes through the side of the tank near the bottom, and is provided with a valve having a lost-motion connection with a floating arm.—J. H. J.

Refuse organic matter: Apparatus for the production of valuable products from—. T. Craney, Bay City, Mich. U.S. Pat. 1,140,502, May 25, 1915. Date of appl., June 28, 1913.

THE material is fed into an upright retort closed at the top and surrounded by a vapour chamber and condenser. A tube passes from the vapour chamber to carry off the gases and condensable products. The retort has an active combustion zone in its lower portion and a destructive distillation zone above. The latter is surrounded by the condenser, and the former by a chamber which collects the condensed products from above and also is provided with a vapour-discharge pipe.—J. H. J.

Copper-lime mixture [insecticide]: Production of a—. M. Maguet. Fr. Pat. 473,710, Oct. 9, 1913.

BY treating quicklime with copper sulphate solution of known strength, a mixture of cupric hydroxide and calcium sulphate is obtained as a homogeneous, dry, impalpable and extremely light powder, suitable for dressing vines. The process may be varied by adding water to a mixture of quicklime and dehydrated copper salt.—E. H. T.

Nitrogenous bases: Process for increasing the fungicidal and insecticidal action of—. Chem. Fabr. Flörsheim Dr. H. Noerdlinger. Ger. Pats. (A) 279,564 and (B) 279,565, Dec. 16, 1913. Additions to Ger. Pat. 257,848 (this J., 1913, 479; see also Ger. Pat. 276,685; this J., 1914, 1025).

BASES from tar or tar-oils, or those obtained by the dry distillation of other nitrogenous substances, such as animal oil and molasses, are treated in acid solution, (A) with such metals as iron, zinc, tin, magnesium, or aluminium, (B) by the passage of an electric current.—F. SODN.

Liquids: Apparatus for treating— with ultra-violet rays. V. Henri, Paris, and A. Helbronner and M. von Recklinghausen, Suresnes, France. Assignors to The R. U. V. Co., Inc. U.S. Pat. 1,140,818, May 25, 1915. Date of appl., March 12, 1913.

SEE Eng. Pats. 12,948 and 18,458 of 1910; this J., 1911, 828.

Water and other liquids: Apparatus for the treatment of— by ultra-violet rays. V. Henri, Paris, and A. Helbronner and M. von Recklinghausen, Suresnes, France, Assignors to The R. U. V. Co., Inc. U.S. Pat. 1,140,819, May 25, 1915. Date of appl., Nov. 10, 1913.

SEE Eng. Pat. 30,397 of 1909; this J., 1911, 151.

Sterilisation of liquids. A. Helbronner and M. von Recklinghausen, Paris, Assignors to The R. U. V. Co., Inc. U.S. Pat. 1,141,056, May 25, 1915. Date of appl., June 21, 1912.

SEE Fr. Pat. 442,807 of 1911, and Addition thereto; this J., 1912, 1004; 1913, 620.

Process of disinfecting and cleaning. Fr. Pat. 473,970. See VI.

Manufacture of zeolites. Fr. Pat. 474,283. See VII.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Heroin: Rapid determination of small quantities of—. R. Miller. Amer. J. Pharm., 1915, 87, 248—250.

HEROIN in the absence of morphine and other interfering substances may be estimated colorimetrically by the following method: A weighed quantity containing from 1/50—1/20 grain of heroin is treated in a Nessler tube with 1 c.c. of 1% sulphuric acid and 3 c.c. of a solution consisting of 600 c.c. of commercial sulphuric acid, 300 c.c. of water, and 25 c.c. of 40% formaldehyde solution. A coloration varying from straw yellow to deep red is produced, which at the end of 10 mins. is compared with standard tints; 1/100 grain of heroin produces a very perceptible change in colour when 1/20 grain of the sample is used. The presence of cocaine does not interfere with the test.—G. F. M.

Calamus oil: Separation of a sesquiterpene from Japanese—. Y. Asahina and E. Imai. J. Pharm. Chim., 1915, 11, 299—301.

TREATMENT of the lowest boiling fraction of Japanese calamus oil, b. pt. 120°—140° C., with ethyl magnesium bromide, at 170°—180° C., with subsequent treatment with water, converts the methyl ether which it contains into the corresponding phenol; this can then be removed by alkali, leaving a tricyclic sesquiterpene, C₁₅H₂₄, which, after distillation *in vacuo* over sodium, forms a colourless oil with a smell resembling that of cedar oil, b. pt. 138°—140° C. at 31 mm., sp. gr. 0.9379 at 20° C., n_D^{20} = 1.51009, n_D^{25} = 2.06°. Oxidation of the highest boiling fraction, b. pt. 160°—170° C., with potassium permanganate yields asarylaldehyde, confirming the presence of asarone already recorded.—T. C.

Azulene, a blue hydrocarbon. II. A. E. Sherndal. J. Amer. Chem. Soc., 1915, 37, 1537—1544. (See this J., 1915, 150.)

AZULENE forms a picrate which crystallises from alcohol in jet black, shiny needles, m. pt. 120° C. (with decomp.). The hydrocarbon was isolated as picrate from cubebs oil, camphor oil, and the artificial blue gurjun oil obtained by the oxidation of gurjunene with sulphuric acid in acetic anhydride. Azulene was reduced quantitatively with palladium-hydrogen to a tricyclic dihydro-sesquiterpene, C₁₅H₂₆, an oil with a faint green tinge, which gave an intense blue colour with acetic anhydride and sulphuric acid or with bromine and acetic acid, resembling in this respect and in physical constants dihydro- α -gurjunene. Azulene probably contains an aromatic nucleus, indicated by the ready formation of the picrate; it is tricyclic, and contains four ethylenic linkings.—G. F. M.

Vanilla extract: Acidity and ash of—. A. L. Winton, A. R. Albright, and E. H. Berry. J. Ind. Eng. Chem., 1915, 7, 516—519.

IN 77 samples of extract prepared in the laboratory, by the U.S.P. method, from vanilla beans of

different varieties, grades, and lengths, the total acidity ranged from 30 to 52 c.c. of *N* 10 alkali per 100 c.c.; acidity other than that due to vanillin (by diff.), 14–42 c.c. *N* 10 alkali; total ash, 0.22–0.43 gm., per 100 c.c.; soluble ash, 0.18–0.36 gm.; alkalinity of total ash, 30–54 c.c. *N* 10 acid; alkalinity of soluble ash, 22–40 c.c. *N* 10 acid. The vanillin content of imitation vanilla extracts may be determined approximately by titrating with *N* 10 alkali the ether solution of vanillin and coumarin obtained in the Hess and Prescott method (this J., 1899, 397, 525).—A. S.

Coumarin, particularly in facitious vanilla extracts: Modification of Wichmann's method for the detection of small amounts of—. J. R. Dean. J. Ind. Eng. Chem., 1915, 7, 519.

THE following modification of Wichmann's method (this J., 1912, 839) is applicable in the presence of salicylic acid and saccharin. The residue left from the determination of alcohol is treated with 5 c.c. of ammonia and extracted with 15 c.c. of ether; coumarin is dissolved by the ether, but vanillin, salicylic acid, and saccharin remain in the aqueous layer. The ether extract is evaporated, the residue treated with five drops of 50% potassium hydroxide solution, dried, fused, dissolved in a few c.c. of water acidulated with sulphuric acid, and extracted with chloroform. The chloroform solution is tested for salicylic acid, formed from the coumarin, by means of ferric chloride.—A. S.

Epinephrine [adrenaline] content of suprarenal glands: Variation in the—. A. Seidell and F. Fenger. Hyg. Lab., U.S. Publ. Health Service, Bull. 100, Nov., 1914, 57–66.

ANALYSES of a very large number of samples collected at frequent and regular intervals in the Union Stock Yards, Chicago, showed that the epinephrine content of suprarenal glands from sheep, hogs, and cattle, varies irregularly during the year. Glands from cattle are much larger than those from sheep and hogs and contain about twice as much epinephrine. A standard of 0.25% epinephrine in the dried powder could be easily maintained in the case of glands from sheep or hogs and one of 0.6% for glands from cattle; a limit of 0.4–0.5% is suggested for commercial desiccated glands.—A. S.

Caffeine and antipyrine in admixture: Determination of—. W. O. Emery and S. Palkin. J. Ind. Eng. Chem., 1915, 7, 519–521.

THE antipyrine is converted into moniodoantipyrine and this is extracted from the reaction mixture, together with the unchanged caffeine, by means of chloroform (see this J., 1914, 983). The residue left on evaporation of the chloroform solution is dried for $\frac{1}{2}$ hour at 105° C. and weighed. It is then dissolved in 5 c.c. of glacial acetic acid, the solution treated with 10 c.c. of a saturated aqueous solution of sulphur dioxide, diluted to about 200 c.c., and the iodine precipitated as silver iodide in presence of nitric acid; the weight of silver iodide multiplied by 0.8012 gives the quantity of antipyrine, and by 1.3371 the quantity of iodoantipyrine; by subtracting the latter from the weight of the original residue the quantity of caffeine is obtained.—A. S.

Hexamethylenetetramine: Quaternary salts of—. III. Monohalogenoacylated aromatic amines and their hexamethylenetetraminium salts. IV. Monohalogenoacylated simple amines, ureas, and urethanes, and the hexamethylenetetraminium salts derived therefrom. W. A. Jacobs and M. Heidelberg. J. Biol. Chem., 1915, 21, 103–152. (See this J., 1915, 634.)

III. THE paper deals with compounds obtained from the halogenoacetyl derivatives of aromatic

amines in which the amino-group is connected directly with the nucleus. The method most frequently used for the chloroacetylation consisted in dissolving 1 mol. of the base in toluene or benzene, adding an excess of 2*N* sodium hydroxide solution, and then introducing, drop by drop, with cooling and constant agitation, a solution of 1.25 mol. of chloroacetyl chloride in 2 vols. of dry benzene; the chloroacetyl derivative usually crystallised out on standing. The addition of the halogen compound to hexamethylenetetramine was accomplished as described previously (*loc. cit.*). A description is given of the preparation and properties of over 100 different compounds.

IV. The hexamethylenetetramine salts described in this paper were, with one exception, of purely aliphatic origin. They were all readily soluble in water; on standing, or more rapidly when heated, the solutions decomposed with the liberation of formaldehyde and other products, which, contrary to the behaviour observed with the aromatic compounds, remained in solution. A description is also given of the preparation and properties of a number of chloroacetyl compounds of several of the simpler amines. In all, twenty-one compounds and salts are described.—W. P. S.

Acetylsalicylic acid: Formation of—. D. E. Tsakalotos and S. Horsch. Bull. Soc. Chim., 1915, 17, 186–190. (See also this J., 1915, 101.)

THE speed of formation of acetylsalicylic acid from salicylic acid and acetic anhydride in benzene solution, was measured by determining from time to time, at constant temperature, the decrease in acidity of the reaction mixture after hydrolysis with water. The reaction was found to be of the second order. At about 90° C. acetylsalicylic acid in benzene solution decomposes with appreciable rapidity into acetic anhydride and salicylsalicylic acid.—T. C.

Mercury compounds of hydroxybenzoic acids. H. Lajoux. J. Pharm. Chim., 1915, 11, 279–285.

THE basic mercury compound, obtained by the interaction of sodium salicylate and a mercury salt, or from salicylic acid and yellow mercuric oxide or mercuric acetate at 100° C., gives none of the ordinary mercury reactions, and Buroni (Gaz. Chim. Ital., 1902, 32) suggested for it the formula, $\text{HO} \cdot \text{C}_6\text{H}_3 \cdot \begin{smallmatrix} \text{CO} \\ \diagup \\ \text{Hg} \end{smallmatrix} \diagdown \text{O}$. This has been confirmed by preparing a similar salt from methylsalicylic acid as well as from *m*-hydroxybenzoic acid. The mercury atom probably occupies the *para*-position to the carboxy-group, for anisic acid gives the normal mercury salt, whilst *p*-hydroxybenzoic acid behaves anomalously, giving a number of basic salts.—T. C.

Formaldehyde: Salts of—. H. Franzen and L. Hauck. J. prakt. Chem., 1915, 91, 261–281. (See also this J., 1915, 249.)

By shaking finely divided lead hydroxide with dilute formaldehyde solution for 24 hours a white crystalline deposit of a lead salt was produced, to which the following structure is assigned: $\text{CH}_2(\text{OPbOCH}_2\text{OPbOCH}_2\text{OPbOH})_2 + 2\text{H}_2\text{O}$. A similar calcium derivative, $\text{Ca}(\text{O} \cdot \text{CH}_2\text{OH})_2$, was obtained by shaking milk of lime for a short time with formalin; the substance was gradually decomposed by alcohol or water. A strontium salt, $\text{CH}_2(\text{OSrOCH}_2\text{OH})_2 + 7\text{H}_2\text{O}$, was also isolated; the barium salt was unstable. Magnesia gave an indefinite compound. A zinc salt, $\text{CH}_2(\text{OZnOH})_2 + 2\text{H}_2\text{O}$, was obtained by adding zinc sulphate solution to an equimolecular mixture of formaldehyde and sodium hydroxide solution.

The constitution of the cadmium salt is similar to that of the lead salt except that the formula includes 9 mols. H_2O . The copper salt is represented as $Cu(OCH_2OCuOCH_2OH)_2 + 2H_2O$. Nickel, iron, and aluminium failed to yield derivatives. The substances were dried *in vacuo* over sulphuric acid and potassium hydroxide; they had a strong smell of formaldehyde, and dissolved to clear solutions in dilute nitric or acetic acids. Such salts are regarded as intermediate products in the conversion of formaldehyde to sugars in presence of the hydroxides of lead, calcium, etc.—J. R.

Determination of creatinine and creatine. Occurrence of creatine [in urine]. Morris. See XXIII.

PATENTS.

Diacylpyrocatechin-ortho-carboxylic acid compound. E. Rietz, Eberfeld, Germany. Assignor to Synthetic Patents Co., New York. U.S. Pat. 1,140,716, May 25, 1915. Date of appl., Oct. 6, 1914.

ACYLATED catechol-*o*-carboxylic acid derivatives are claimed as antipyretics, particularly diacyl-catechol-*o*-carboxylic acid, of the probable formula $C_6H_3(O.CO.CH_3)_2COOH(1.2.3.)$, which is a whitish powder, of m. pt. $148^\circ-150^\circ C.$, soluble in the usual organic solvents and insoluble in water.—F. Sp.

Hydrogenation and dehydrogenation of carbon compounds; Process for —. Badische Anilin und Soda Fabrik. Fr. Pat. 473,697, May 30, 1914. Under Int. Conv., June 21, July 25 and 26, Aug. 29, Nov. 15 and 20, Dec. 11 and 12, 1913.

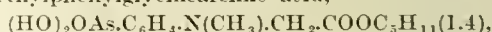
HYDROGENATION and dehydrogenation of carbon compounds by means of catalysts which do not belong to the platinum-palladium group, may be carried out more rapidly and at lower temperatures by mixing with the catalyst (a) oxy-compounds or oxy-salts of the earth metals (including rare metals, beryllium, and magnesium); (b) other oxy-compounds fusible and reducible with difficulty, particularly those of titanium, uranium, manganese, vanadium, niobium, tantalum, chromium, boron; (c) silica; (d) difficultly soluble salts formed by the alkaline earth metals or lithium with the oxy-acids of phosphorus, molybdenum, tungsten, selenium, or with fluorine, tellurium, antimony, or with complex compounds of these metalloids. The mixtures may be prepared by moistening the compound from which the catalyst is to be prepared with a solution of a compound of the activating substance and drying; by precipitating together the hydroxides, oxides, carbonates, etc., of the catalyst and activating substance; or by melting or grinding their salts together. In each case, the product is reduced with hydrogen or with a mixture of hydrogen and carbon monoxide. It is advantageous for the activating substance to contain a trace of alkali, e.g., caustic soda, and for the metallic catalyst to be reduced from a compound containing carbon. Binding media or substances producing porosity may be added, provided that risk of poisoning the catalyst by chlorine, sulphur, phosphorus, or arsenic is avoided. The new masses are, however, less susceptible to poisoning than pure metals. The reactions may be carried out under pressure. *Example.*—15 parts of nickel nitrate and one part of beryllium nitrate are dissolved in water, precipitated together by sodium carbonate, filtered, washed, and dried. The mass is treated at 250° to $300^\circ C.$ with a mixture of 1 vol. of carbon monoxide and 3 vols. of hydrogen until the nickel oxide is reduced and the carbon monoxide completely converted into methane. The catalyst may then be cooled to $150^\circ C.$ without losing its activity.—F. Sp.

Mono- and di-para-monoalkylaminophenylarsinic acids; Process for obtaining —. Poulenc Frères, and K. Oechslin. Fr. Pat. 473,704, Oct. 9, 1913.

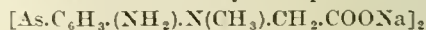
MONO- and di-*p*-monoalkylaminophenylarsinic acids, having the formulæ $OAs(OH)_2(C_6H_4.NHR)$ and $OAs(OH)(C_6H_4.NHR)_2$, where R may be CH_3 , C_2H_5 , C_3H_7 , etc., or CH_2COOR , are prepared by oxidation of the product of the reaction between arsenic trichloride and the corresponding substituted amine in presence of pyridine. *Example.*—163 grms. of amylaniline, 180 grms. of arsenic trichloride, and at least 79 grms. of dry pyridine are heated for 1 to 2 hours at $106^\circ-108^\circ C.$ to produce amylanilinophenylarsinic acid, or at $115^\circ-120^\circ C.$ to produce diamylanilinophenylarsinic acid. The product is poured into 400 c.c. of water and oxidised in acid or alkaline solution by a slight excess of hydrogen peroxide. After removal of the unchanged base the mixed acids are precipitated by making the solution feebly acid to Congo red. The mixture is dissolved in absolute alcohol, and the primary acid precipitated by addition of ether. It crystallises from hot water in white flakes, decomposing without melting at $172^\circ C.$, and is soluble in alcohol, acids, and alkalis, but only slightly soluble in water. The secondary acid, which is insoluble in water, soluble in acids and alkalis, and very soluble in alcohol, remains in the mother liquor. Methyl- and ethylanilinophenylarsinic acids, phenylglycine-arsinic acid (by starting from phenylglycine ester and saponifying the product), and the corresponding diphenylated acids have been isolated.—F. Sp.

Nitroalkylphenylglycinearsinic acids and their reduction products; Method of obtaining ortho- and meta- —. Poulenc Frères, and K. Oechslin. Fr. Pat. 473,705, Oct. 9, 1913.

ORTHO- and meta-nitro derivatives are produced by the nitration of alkylphenylglycinearsinic acids by a mixture of sulphuric acid and the theoretical quantity of nitric acid, the position of the NO_2 group depending on the concentration of the sulphuric acid. Their products of reduction with sodium hydrosulphite are also claimed. *Example.*—To 50 grms. of the amyl ester of methylphenylglycinearsinic acid,



dissolved in 228 grms of sulphuric acid and 152 grms. of water, is added one mol. of nitric acid in 30 grms. of sulphuric acid (3:2). The mixture is slowly warmed, kept at $42^\circ C.$ for half an hour, and then poured into water. The purified precipitate (2-nitro-derivative) is deep yellow, scarcely soluble in hot water, easily soluble in alcohol, and melts at about $130^\circ C.$ The amyl group is removed by saponification with excess of sodium carbonate at $50^\circ C.$, the free acid being formed, which crystallises slowly from water, and on reduction with sodium hydrosulphite forms



—F. Sp.

o-Hydroxyarylarinic acids; Preparation of —. R. Meyer and K. Oechslin. Fr. Pat. 474,056, Oct. 30, 1913.

THE nitro group in *o*-nitroarylarinic acids may be replaced by hydroxyl by treatment with acids or alkalis, with or without organic solvents. The replacement is assisted by reducing and oxidising agents, and by substances which destroy nitrous acid, such as amines. *Example.*—1 part of *p*-dimethylamino-*o*-nitrophenylarsinic acid is added to 0.5 part of urea in 10 pts. of 60% sulphuric acid. Carbon dioxide and nitrogen are evolved, and *p*-dimethylamino-*o*-hydroxyphenylarsinic acid

is precipitated on dilution and partial neutralisation. It is soluble with difficulty in water, soluble in hot dilute acetic or sulphuric acid, and in dilute alkalis.—F. Sp.

Acetaldehyde: Preparation of— from acetylene. Chem. Fabr. Griesheim-Elektron. Fr. Pat. 474,246, June 29, 1914. Under Int. Conv., June 30, 1913.

ACETALDEHYDE is produced by passing excess of acetylene through hot, moderately concentrated acids containing mercury salts, the temperature of the acid being below boiling point but high enough for the aldehyde to be continuously carried over by the excess of acetylene. The aldehyde is removed in absorption vessels containing a solvent of acetaldehyde, e.g., water, from which it is recovered by distillation, and the remaining acetylene may be passed into a second reaction vessel. The acid may be sulphuric (20–25%), phosphoric (30–35%), or organic sulphonic acids. The use of concentrated acids diminishes the rate of the reduction of the mercury salts to metallic mercury.—F. Sp.

Chlorides of higher fatty acids: Preparation of—. C. Büchel. Ger. Pat. 281,364, Nov. 22, 1913.

COMMERCIAL fatty acids are converted into chlorides in presence of indifferent solvents, e.g., stearic acid with phosphorus pentachloride in presence of carbon tetrachloride, and palmitic acid with thionyl chloride in presence of carbon tetrachloride.—F. W. A.

Tasteless powders from quinine salts, etc.: Preparation of—. T. Sartorius. Ger. Pat. 281,390, Sept. 24, 1912.

QUININE salts, etc., are heated with substances such as gelatin to obtain products with a less pronounced taste, which are compatible with resin and balsam solution. On powdering, treating with resin or balsam solution, and drying, these intermediate products give absolutely tasteless powders.—F. W. A.

Acetone: Process for purifying—. K. J. Freudenberg. Ger. Pat. 281,473, Sept. 21, 1913.

ALCOHOLS, e.g., methyl alcohol, present in the crude acetone, are combined with acid chlorides of which the esters are non-volatile or only slightly volatile, and the mixture is dried with a basic dehydrating agent and distilled. Organic acid chlorides of benzenesulphonic acid, nitrobenzoic acids, naphthoic acid, etc., are suitable; benzoyl chloride may be used in cases in which the traces of methyl benzoate which distil over are of no consequence; of inorganic acid chlorides, phosphorus oxychloride must not be used on account of its condensing action. The crude mixture of the nitrobenzoyl chlorides may be used.—F. W. A.

Lipoid phosphorus compounds of derivatives of higher fatty acids. F. Hoffmann-La Roche und Co. Ger. Pat. 281,801, Dec. 5, 1913.

KETO-FATTY acids of high molecular weight or their derivatives are treated with phosphorous acid as such or in solution, or the oxyphosphinous acids obtained from such acids according to Ger. Pat. 280,411 (this J., 1915, 452) are treated with weak oxidising agents and the free acids converted into salts as usual. The oxyphosphinic acids obtained are somewhat more soluble in water than the corresponding oxyphosphinous acids, are very soluble in ether, alcohol, and glacial acetic acid, but insoluble in light petroleum. On heating alone the acids decompose only at a high temperature. They are stable to weak oxidising agents, but are oxidised by permanganate to ketonic and phosphoric acids. The oxyphosphinic acids are of therapeutic value.—F. W. A.

Hydrocarbons and ketones: Preparation of aromatic or aliphatic aromatic—. H. Lecker. Ger. Pat. 281,802, Aug. 3, 1913.

A HALOGEN-HYDROCARBON or acid chloride is heated at 150°–200° C. with a hydrocarbon in presence of phosphorus pentoxide to act as catalyst in the liberation of hydrochloric acid. One gram-mol. of the halogen compound only requires 2–3 grms. of commercial phosphorus pentoxide, whereas 134 grms. of aluminium chloride would be required. The phosphorus pentoxide is recovered by extracting the organic substance with a suitable solvent.—F. W. A.

Hydroxy-compounds: Process for eliminating the elements of water from organic—. J. D. Riedel A.-G. Ger. Pat. 281,902, Sept. 18, 1913.

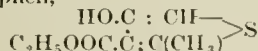
SUBSTANCES containing a hydroxyl group are heated with glycollic acid or glycollicide; secondary reactions only occur to a very slight extent, and no excessive frothing occurs during the reaction, which may be carried out at a diminished pressure. Examples are the production of acrolein from glycerol and glycollic acid, pyruvic acid from tartaric acid and glycollic acid, and dipente from terpineol and glycollicide.—F. W. A.

Acyl compounds of p-hydroxyphenylethylamine and β-iminazolyethylamine. F. Hoffmann-La Roche und Co. Ger. Pat. 281,912, April 3, 1913.

THE amines are combined with halogenacyl chlorides and the halogenacylamines obtained are treated with ammonia. The resulting aminoacylamines are much less poisonous than the amines themselves. *p*-Hydroxyphenylethylamine gives the fairly strongly basic glycyl-*p*-hydroxyphenylethylamine, and *β*-iminazolyethylamine gives glycyl-*β*-iminazolyethylamine.—F. W. A.

Thiophen derivatives: Preparation of—. E. Benary. Ger. Pat. 282,914, June 20, 1913.

HALOGEN acylamino- or acylalkylamino-crotonic acid esters are treated with alkali hydrosulphides. On treatment with potassium hydrosulphide in alcoholic solution, the ethyl ester of chloroacetylaminocrotonic acid gives ammonia and a derivative of hydroxythiophen,



The products are disinfectants, and are suitable for the treatment of skin diseases.—F. W. A.

Hydroxy derivatives of aliphatic aromatic ethers: Preparation of—. Farbenfabr. vorm. F. Bayer u. Co. Ger. Pat. 282,991, July 13, 1913.

HOMOLOGUES of ethyleneglycol or their derivatives are treated with phenols, their homologues or substitution products. The products obtained, of the general formula: $\text{HO.CH(R}_1\text{).CH(R}_2\text{).OR}$, where R is an aryl radical, and of R₁ and R₂ one is an alkyl and the other hydrogen, are more powerful analgesics than the ethyleneglycol aryl ethers. Propyleneglycol-(1)-phenyl ether (2), $\text{HO.CH}_2\text{.CH(CH}_3\text{).O.C}_6\text{H}_5$ is described.—F. W. A.

Urcides of brominated monobasic fatty acids: Preparation of—. Farbenfabr. vorm. F. Bayer u. Co. and Knoll und Co. Ger. Pat. 283,105, Aug. 8, 1912.

SYMMETRICAL diacylated ureas of the formula, RCO.NH.CO.NH.CO.R , where RCO is a fatty acid residue containing bromine, are converted into monoacylated ureas of the formula, RCO.NH.CONH_2 , by weak saponifying agents. For example, *bis*-bromodiethylacetylurea in methyl alcohol gives bromodiethylacetylurea with aqueous ammonia solution; *bis*-*a*-bromoisovalerylurea suspended in water gives *a*-bromoisovalerylurea with N/1 caustic soda.—F. W. A.

Process of hydrogenation and dehydrogenation. Ger. Pat. 282,782. See XII.

Process for obtaining glutamic acid and alkali chlorides from molasses, etc. Melasse-Schlempe Ges. Ger. Pat. 280,824. See XVII.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Photographic action of α , β , and γ rays. R. R. Sahni. Phil. Mag., 1915, 29, 836—841.

A BRAND of plate was selected which gave a film quite free from silver grains when developed without exposure, and special precautions were taken to avoid fogging by the dark-room light and to avoid dust particles in the washing water, etc. The radio-active sources employed were polonium, thorium active deposit, and radium C, carried either on the points of fine needles or on metal plates. Where a needle point was used as active source the α rays gave radiographs showing a central nucleus and straight tracks radiating from the nucleus. Measurements of these tracks are given. By screening off the α rays the effect of the β rays was obtained; no regularity of distribution of the silver grains could be traced. The radiographs obtained from γ rays were similar to those from β rays, the effect of the γ rays being due to the secondary β rays which they excite.—B. V. S.

XXII.—EXPLOSIVES; MATCHES.

Explosion; Report on the circumstances attending an— which occurred on May 10, 1915, in a nitro-glycerin final washing house at the factory of the New Explosives Co., Ltd., Stormarket, Suffolk. A. Cooper-Key. No. CCXV.

FOUR men were killed by the explosion of about 800 lb. of "cordite paste" and unmixed guncotton in a nitroglycerin final washing house. In this building, the nitroglycerin was washed, filtered through flannel and salt, and poured on to the weighed quantity of guncotton or collodion cotton. At the time of the explosion there were only 7 bags in the building, each containing 51 lb. of guncotton and 21 lb. of nitroglycerin, and about 300 lb. of unmixed guncotton, also in bags. The building was wrecked, but none of the neighbouring workshops, 50 to 75 yards away, was seriously damaged. The explosion is attributed to an electric spark, which, it is suggested, might have been produced under the following conditions:—It was a fine, dry, cold morning, the cordite paste was contained in bags of canvas impregnated with rubber, and the two nitroglycerin workers were wearing rubber overshoes, which would insulate them from contact with "earth." It is probable that the men in the building were preparing the bags for removal by wiping them down with their hands to remove guncotton dust, and if one of the men had a naturally dry skin, sufficient electricity would be generated in his person to cause a spark to pass on touching an uninsulated object. In support of this explanation the following authenticated instances are cited:—Duff Grant of the New Explosives Co. stated that in a dry cold atmosphere in Canada, he had repeatedly lit the gas by a spark from his finger after rubbing the feet on a thick pile carpet. Again, at Ardeer, a workman in rubber shoes fired acetone vapour by a spark from his finger, after allowing thin strands of rifle cordite to pass over his hand. As a remedy it is recommended that every worker in

a danger building should be put in contact with "earth," by the insertion of a copper or lead stud in the heel of the rubber overshoe. There are advantages in carrying out all the process from nitration to filtration in a single building. Fewer workmen are required, and the objection to the presence of acids in the same building as the finished product has not been borne out in practice. —C. A. M.

PATENTS.

Explosive. C. Schanandoah, Brooklyn, N.Y. U.S. Pat. 1,141,009, May 25, 1915. Date of appl. April 18, 1914.

A MIXTURE of one part of sugar and one-sixteenth part of alum is moistened with "liquid coffee," a quantity of wood alcohol is added, the mass is boiled to dryness, and the residue mixed with potassium chlorate.—F. Sp.

Hexanitroethane; Preparation of—. Central-stelle f. wiss.-techn. Untersuchungen. Ger. Pat. 281,906, Oct. 21, 1913.

SALTS of tetranitroethane are dissolved in concentrated acids and the solutions are treated with nitrating agents.—F. W. A.

XXIII.—ANALYTICAL PROCESSES.

Magnesium from lithium; Separation of— by means of ammonium carbonate in alcoholic solution. J. G. Dinwiddie. Amer. J. Sci., 1915, 39, 662—664.

MAGNESIUM is precipitated from a 50% alcoholic solution by the addition of ammonium carbonate. Twenty-five c.c. of an aqueous solution containing magnesium and lithium chlorides is treated with 25 c.c. of 93% alcohol, and 50 c.c. of alcoholic ammonium carbonate solution added (this solution is prepared by mixing 1500 c.c. of saturated aqueous ammonium carbonate solution with 360 c.c. of concentrated ammonia and 1900 c.c. of 93% alcohol, and filtering off the precipitated ammonium carbonate). The precipitate is collected on a filter, re-dissolved in the minimum quantity of hydrochloric acid, the solution diluted to 10 c.c. and treated with 15 c.c. of alcohol and 50 c.c. of the ammonium carbonate solution. The precipitate now obtained is collected, washed with the ammonium carbonate solution, ignited, and weighed as magnesium oxide.—W. P. S.

Copper; New test for—. W. G. Lyle, L. J. Curtman, and J. T. W. Marshall. J. Amer. Chem. Soc., 1915, 37, 1471—1481.

AN aqueous solution of α -amino- n -caproic acid is an exceedingly sensitive reagent for copper, with which it forms an insoluble greyish blue precipitate. A solution containing 0.67% of the acid is used with an equal volume of 40% sodium acetate solution to eliminate free mineral acid. Under these conditions 0.004 mgrm. Cu may be detected with certainty. The reagent is more specific for copper than any hitherto proposed, and has the advantage over the ferrocyanide test that small quantities of iron do not interfere. Mercury and zinc are the only common metals which yield a precipitate with the reagent, but the addition of sodium chloride prevents precipitation in the first case, and adjustment of the acidity of the solution to a hydrogen-ion concentration of about $10^{-5.2}$ prevents interference in the second case. The adjustment is effected by using p -nitrophenol as indicator and adding the sodium acetate solution to the slightly acid solution under test till a faint yellow colour is produced. The general procedure is to add an excess of ammonia to the solution in hydrochloric acid, filter, evaporate the filtrate to

dryness with potassium hydroxide, dissolve the residue in dilute hydrochloric acid, and adjust the acidity with sodium acetate and *p*-nitrophenol before applying the test.—G. F. M.

Iron: Permanganate determination of — in the presence of fluorides. Analyses of silicates and carbonates for their ferrous iron content. O. L. Barnebey. *J. Amer. Chem. Soc.*, 1915, **37**, 1181—1496.

THE permanganate titration of ferrous iron in presence of hydrofluoric acid gives an unstable end point. The addition of sulphuric acid of *N*/1 to 5*N* concentration or of certain acid sulphates renders, however, a good titration possible in presence of *N*/1 hydrofluoric acid. Boric acid was the most efficient of the reagents studied, and moreover in presence of the fluoboric acid formed, ferrous iron solutions are quite stable in presence of air. A modified procedure for the analysis of silicate and carbonate rocks for the ferrous iron content is based upon the use of boric acid to remove the detrimental influence of the hydrofluoric acid. The rock is dissolved in sulphuric and hydrofluoric acids in an atmosphere of carbon dioxide, an excess of solid boric acid is added to the somewhat diluted solution, and after filtering off organic matter through an asbestos filter, the solution is titrated with permanganate in the usual way.—G. F. M.

Nickel: Volumetric determination of —. G. Zucari. *Annali Chim. Appl.*, 1915, **3**, 277—279.

NICKEL may be determined in a similar manner to copper (this *J.*, 1915, 51) by titration with sodium nitroprusside solution, the end point being ascertained by spot tests with sodium sulphide solution on a hard filter paper. The solution should be acid and contain not less than 1—1.5% Ni; it should be agitated vigorously during the titration.—A. S.

Phosphorus: Precipitation of — as ammonium phosphomolybdate in the presence of sulphuric acid. K. G. Falk and K. Sugiura. *J. Amer. Chem. Soc.*, 1915, **37**, 1507—1515.

THE precipitate of ammonium phosphomolybdate formed in the presence of sulphuric acid, as in Neumann's method for the determination of phosphorus in organic compounds, contains sulphate as an essential part of the molecule, together with an excess of molybdic oxide and no nitric acid. The composition of the precipitate varies with the concentration of the different constituents in the solution, and different factors are consequently found for the titration with alkali. Under a particular set of conditions investigated the precipitate was found to have the composition, $4[(\text{NH}_4)_3\text{PO}_4 \cdot 12\text{MoO}_3] + (\text{NH}_4)_2\text{SO}_4 \cdot 5\text{MoO}_3$.

—G. F. M.

Trypsin in gastric contents: Determination of —. W. H. Spencer. *J. Biol. Chem.*, 1915, **21**, 165—167.

DILUTIONS of the gastric contents are made as follows: Of a series of 5 test-tubes, the first two receive 0.5 c.c. each of the gastric contents and to each of the tubes 2, 3, 4, and 5 is added 0.5 c.c. of water; 0.5 c.c. of the liquid in tube 2 is now transferred to tube 3, then 0.5 c.c. of the contents of this tube is placed in tube 4, and from this 0.5 c.c. to tube 5. One drop of phenolphthalein solution is added to each tube, and 2% sodium bicarbonate is added, drop by drop, until the mixtures show a pink coloration. The first four tubes then each receive 0.5 c.c. of casein solution, whilst the fifth tube receives 1 c.c. The tubes are placed in an incubator at 40° C. for 5 hours, the undigested casein is then precipitated by the addition, drop by drop, of a solution consisting of glacial acetic

acid, 1 c.c., alcohol, 50 c.c., and water, 50 c.c. The contents of the tubes in which digestion has been complete remain clear, whilst the others become turbid. The tryptic values are expressed in terms of dilution. Thus complete digestion in tube 3 (a dilution of one-fourth) shows four times the tryptic value of undiluted gastric juice. The casein solution used is made by dissolving 0.4 gm. of casein in 40 c.c. of *N*/10 sodium hydroxide solution, adding 30 c.c. of water and then 30 c.c. of *N*/10 hydrochloric acid.—W. P. S.

Creatinine and creatine: Determination of —. The occurrence of creatine [in urine]. J. L. Morris. *J. Biol. Chem.*, 1915, **21**, 201—208.

THE presence of acetone compounds and dextrose in certain urines interferes with the determination of creatinine and creatine by Folin's method, and the results obtained for creatinine-creatinine, after the creatine has been hydrolysed, are so affected as to render the actual presence of creatine uncertain. The author recommends, therefore, that the creatinine be precipitated as creatinine potassium picrate by treating 100 c.c. of urine at 60° C. with 1 gm. of picric acid, then cooling the mixture and collecting the precipitate after 4 hours. The precipitate is dissolved in 100 c.c. of *N*/2 hydrochloric acid, the solution diluted with water to 500 c.c., and the creatinine determined colorimetrically. To determine the creatine, the urine is heated under pressure with hydrochloric acid in the usual way, then neutralised with sodium hydroxide, filtered, and the total creatinine in the filtrate precipitated as described.—W. P. S.

Simple and accurate method of determining calorific value with Junkers' calorimeter. Strache and Glaser. See II A.

Bromine method of determining phenol. Versfeld. See III.

Volumetric determination of polythionic acids by potassium iodate. Jamieson. See VII.

Permanganate and iodometric determination of iodide in the presence of chloride and bromide. Barnebey. See VII.

Sensilive reaction of ehromales. Van Eck. See VII.

Analysis of litharge. Beck. See VII.

Determination of iron in basic slag. Blum. See X.

Rapid analysis of bearing metals and alloys of high copper content. Lutts. See X.

Determination of sulphide and sulphate sulphur, and action of solvents on vulcanised rubber. Stevens. See XIV.

Distinction between chestnut and oakwood extracts. Jedlicka. See XV.

Determination of sulphurous acid in sulphited tannin extracts. Schiffkorn. See XV.

Detection of lactic acid in leather and in tan liquors. Lauffmann. See XV.

Determination of nitric nitrogen in soils. Allen. See XVI.

Alcohol test in relation to milk. Ayers and Johnson. See XIX A.

Determination of carbon dioxide in self-raising flours and baking powders. Macara. See XIX A.

Determination of dissolved oxygen in polluted waters. Winkler. See XIX B.

Determination of the biochemical oxygen demand by the saltpetre method in stockyards, tannery and corn (maize) products wastes. Lederer. See XIXb.

Rapid determination of small quantities of heroin Miller. See XX.

Determination of caffeine and antipyrine in admixture. Emery and Palkin. See XX.

Modification of Wickmann's method for the detection of small amounts of coumarin, particularly in facitious vanilla extracts. Dean. See XX.

PATENT.

Thermocouples; Protecting hood for—A. F. Mitchell, Homestead, Pa. U.S. Pat. 1,140,701, May 25, 1915. Date of appl., June 23, 1914.

THE hot end of the thermocouple is contained in a hood packed with insulating material and provided with a hollow handle through which the leads extend. The base of the hood is open, and the thermocouple so arranged as to be in contact with the object upon which the hood is placed.—W. E. F. P.

XXIV.—MISCELLANEOUS ABSTRACTS.

Electrons and heat. O. W. Richardson. Royal Inst., May 7, 1915 Engineering, 1915, 99, 631—632.

THE lecturer showed by experiments that positive ions only are emitted from metals at a dull red heat, and both positive ions and negative electrons at a white heat. The emission of both electrons and ions gave currents, named thermionic currents, which affected a galvanometer; only the electrons were deflected by a magnet, and the thermionic current was not disturbed. The analogy between ordinary evaporation and "electric evaporation" was traced by a variety of experiments, in which it was shown that the thermionic current varied from 0.000000235 micro-amp. per sq. cm. at 1050° abs to 674,000 micro-amp. at 2300° abs. Between certain ranges of temperature a thermionic current curve agreed so exactly with a vapour pressure curve that the two could be superposed. The latent heat of evaporation, i.e., the number of calories absorbed for each mol. of electrons emitted, was also determined experimentally, one mol. of electrons being the mass occupying the same volume as 2 grms. of hydrogen at the same temperature and pressure. Dealing with the velocities at which particles were emitted, an analysis of the numbers at different velocities was made experimentally, and Maxwell's rule, concerning the average energy distribution and the free path of the molecules in a gas, was found to hold also for the distribution of energy among the electrons emitted from a hot body. In the case of tungsten, the electrical effects were out of all proportion to the chemical. Vertical tungsten filaments were surrounded by copper cylinders inside specially prepared bulbs, with the highest vacuum inside and outside the bulb, and whilst the latter was maintained at 560° C. and the filament at 2200° C. for many hours, the following observations were made at pressures of 10⁻⁶ mm. and less: (1) 260,000,000 electrons were emitted by the filament for every gas molecule emitted. (2) 15,000 electrons were emitted for every gas molecule impinging on the filament. (3) 984,000 electrons were emitted for every atom of tungsten lost from the filament by evaporation, spitting, chemical action, or other effect. The mass of the electrons was three times the mass of the tungsten lost. (4) The current was reduced or remained unaltered when gas was admitted, but was never increased.—B. N.

Thermionic currents from tungsten; Negative—K. K. Smith. Phil. Mag. 1915, 29, 802—822.

A DETAILED quantitative investigation has been made of the negative thermionic emission from tungsten over a large temperature range. The variations in the emission appear to be the results of progressive changes in the surface conditions. When the filament is first heated, its surface is probably slightly oxidised and otherwise contaminated by impurities, but if the filament is heated for a sufficient time above 2700° C., as measured on an optical pyrometer of the Holborn-Kurlbaum type, the impurities are removed, and a permanent thermionic emission characteristic of the pure metal is obtained. If the vacuum is maintained, this condition is permanent, but it changes if gas is liberated inside the lamp by excessive heating and bombardment of the anode, or if the filament is oxidised by allowing small quantities of water vapour to enter.—B. N.

Chromogens of plants; Phenomena of oxidation and reduction due to the—J. Wolff and N. Rouchelmann. Comptes rend., 1915, 160, 716—718.

THE reaction of plant juices with starch-iodide paper, which Chodat and Bach attributed to the presence of peroxides (see this J., 1902, 1561) is, according to the authors, due to pigments produced from chromogens by the oxidising action of laccase. Wherever the presence of laccase in a plant was demonstrated, substances oxidisable by this enzyme were found. To prevent oxidation by the laccase during extraction of plant tissues the latter were ground with an equal weight of N/2 sulphuric acid. The clear filtered extract, which was usually nearly colourless, was neutralised by disodium phosphate or calcium carbonate, and two portions of 2 c.c. each were taken. One of them was treated with a few drops of a glycerinated maceration extract of *Russula delica* containing laccase, and then to both was added 0.25 c.c. of a 3% solution of potassium iodide and starch, followed by 0.15 c.c. of N/1 acetic acid. According to the quantity of chromogen present the portion treated with laccase gave a blue coloration immediately or after some time, whereas no colour was produced in the other portion. This test was applied to young leaves of various plants and a positive result obtained in most cases.—J. H. L.

Trade Report.

Prohibited Exports. Order in Council. June 24, 1915.

THE following articles are added to the list of goods the exportation of which is prohibited to all destinations:—Capsicum and oleo-resin of capsicum; caffeine and its salts; paraldehyde; theobromine-sodium salicylate. The following are added to the list of goods the exportation of which is prohibited to all destinations abroad other than British Possessions and Protectorates:—Bone ash; guanos; phosphates of metals, manufactured; phosphate rock, viz., apatites, phosphates of lime and alumina; phosphides; phosphoric acids and oxides; steel containing tungsten or molybdenum or both, and any tools or other articles made from such steel. The heading "Rubber (including raw, waste, and reclaimed rubber, solutions containing rubber, jellies containing rubber, or any other preparations containing rubber)" and goods made wholly of rubber" in the list of goods the exportation of which is prohibited to all destinations abroad other than British Possessions and Protectorates, is deemed

to include balata and gutta-percha and the following varieties of rubber, viz.:—"Borneo, Guayule, Jelutong, Palembang, Pontianac, and all other substances containing caoutchouc"; and the words "goods made wholly or partly of rubber" are substituted for the words "goods made wholly of rubber." The heading "rosin" in the list of goods the exportation of which is prohibited to all foreign ports in Europe and on the Mediterranean and Black Seas, other than those of France, Russia (except Baltic ports), Belgium, Spain, and Portugal, is deleted, and the exportation of the following is prohibited to all foreign ports in Europe and on the Mediterranean and Black Seas, other than those of France, Russia (except Baltic ports), Spain, and Portugal:—Gums, resins, balsams, and resinous substances of all kinds, except such as contain caoutchouc (the export of substances containing caoutchouc being prohibited to all destinations abroad other than British Possessions and Protectorates).

Exports to the Netherlands.

A ROYAL Proclamation, dated June 25th, prohibits the exportation of all articles to the Netherlands, unless consigned to the Netherlands Oversea Trust.

Trade products of the British Empire.

A SPECIAL Supplement has been issued with the July issue of the Chamber of Commerce Journal (price 1s.), containing a statistical account of the resources of the British Empire as a supplier of foodstuffs and of raw materials for British industries, including vegetable oils and oilseeds, rubber and guttapercha, textile fibres, paper-making materials, gums, varnish-resins, lac, turpentine, essential oils, drugs, tanning materials, natural dyestuffs, minerals and metals (including petroleum, saltpetre, etc.), tallow, manures, etc. Statistics and notes as to foreign sources of supply complete an interesting and useful summary.

French Patents.

THE French "Journal Officiel" for May 29th contains the text of a law establishing temporary rules for the exploitation of patents held by enemy subjects. French, Allied, or neutral subjects exploiting patents which were taken out by enemy subjects may continue to do so provided they can prove that such agreement was made previous to the outbreak of hostilities. Enemy patents recognised as useful for national defence or public interest may be exploited, either partly or wholly, for a determined period by the State, or by French, Allied, or neutral subjects who can justify their ability to do so to the Minister of Commerce. The decree of August 14th, 1914, allowing patentees and applicants to leave over all payments until after the war, only applies to French citizens and to Allied and neutral subjects if their country concedes these same advantages to French citizens. The delays of priority are suspended from August 1st, 1914, until the cessation of hostilities, and the benefits of this suspension may only be claimed by subjects of countries which grant these same advantages. German and Austro-Hungarian subjects under certain very exceptional circumstances may be excepted from the application of the above law.

German chemical companies' dividends. Chem. Trade J., June 19, 1915.

THE Th. Goldschmidt A.G., Chemische Fabrik, of Essen, which has a paid-up share capital of £592,500, reports net profits of £66,000, in 1914, as against £107,000 in 1913, and a dividend of 8% as compared with 12% is declared. The Chemische

Werke (vorm. H. und E. Albert), of Amoneburg-Biebrich, records net profits of £196,000 on a capital of £500,000, as contrasted with £251,000 in 1913, the dividend being 15% as compared with 30% in the previous year. The net profits of the Chem. Fabrik von Heyden, of Radebeul-Dresden, were £52,000, as against £65,000, and the dividend is 12% as contrasted with 14% on capital of £350,000. In addition, the rate of distribution of the A.G. Georg Egestorffs Salzwerke und Chemische Fabrik has declined from 11% in 1913 to 8% last year; that of the Chem. Werke Schuster und Wikeling has fallen from 7% to 5%; the Chem. Fabrik Buckau, from 8% to 6%; Gehe und Co., from 16% to 12%; and the Chem. Fabrik Rhenania, from 22% to 14%. On the other hand, the dividend of the Chem. Fabrik Griesheim-Elektron has been maintained at 14% for 1914 as in the previous year, and that of the Chem. Fabrik Wesseling at 12% as in 1913, whilst the Chem. Fabrik (late P. Romer and Co.) records an increase from 4½% in 1913 to 10% last year. The Farbwerk Mühlheim (vorm. A. Leonhardt und Co.), the Germania A.G., and the Verein Chemischer Fabriken have been unable to make any distribution for the past year.

Books Received.

SURFACE TENSION AND SURFACE ENERGY. By R. S. WILLOWS and E. HAUSCHKE. J. and A. Churchill, 7, Great Marlborough Street, London. 76 pages. 7½ × 5 in. Price 2s. 6d.

THE object of this little book is to give the student of chemistry an adequate idea of the fundamental laws of surface tension and surface energy. It is based on a course of lectures delivered by one of the authors at the Sir John Cass Technical Institute. The authors discuss the temperature coefficient of surface tension and its relation to coefficient of expansion; Laplace's theory of molecular attraction in liquids; intrinsic pressure and its connection with latent heat of vaporisation; relations between surface tension and compressibility, vapour pressure, solubility and osmotic pressure, molecular weight, and other properties; factors influencing distribution of a solute in a solvent; adsorption and adsorption equilibrium; effect of electric charge on surface tension; condensation of vapours; the capillary electrometer; the double layer (Helmholtz) Nernst's solution pressure theory; the electric charge on the surface air-liquid. The work of Eötvös, Ramsay, Shields, Walden, Jäger, Traube, Czapke, Gibson, Van der Waals, Thomson, Gibbs, Lewis, Donnan, Barker, Smith, Quincke, Lenard, and McTaggart is described and criticised, details being given of more recent experiments. The treatment of the subject is such that it can be readily followed by those not possessing a very intimate knowledge of mathematics, and the book can be recommended with confidence to those who desire to make a closer acquaintance with these interesting and important subjects.

THE BY-PRODUCTS OF COAL-GAS MANUFACTURE. By K. R. LANGE, Ph.D. Translated from the German by CHARLES SALTER. Scott, Greenwood and Son, 8, Broadway, Ludgate, London. E.C. 155 pages. 7½ × 5 in. Price 5s.

THIS small volume gives a brief account of the various by-products obtained in the manufacture of coal gas. It is divided into the following chapters:—I. Purification of coal gas. II. Coke. III. Retort graphite. IV. Gas tar. V. Gas liquor.

VI. Treatment of the gas-purifying agents. VII. Treating the cyanogen sludge. VIII. Treating the crude liquors. IX. Treatment of crude ammonium thiocyanate and cuprous thiocyanate. X. Potassium ferrieyanide. XI. The cyanogen pigments. XII. Sulphur and sulphuric acid. Whilst the book serves as an introduction to this highly important industry, it might well have been somewhat amplified without unduly increasing its bulk, and fuller illustration would have been an advantage. For example, no illustration of a tar still is given.

INTERNATIONAL CATALOGUE OF SCIENTIFIC LITERATURE. D. CHEMISTRY. Harrison and Sons, St. Martin's Lane, London, W.C. Price 37s. 6d.

THE chemical literature indexed in this volume is mainly that of 1912, but contains some entries relating to earlier years and also some dated 1913. Author and subject catalogues are included, the latter being subdivided into a number of classes. The volume occupies 910 pages, $8\frac{1}{2} \times 5\frac{1}{2}$ in.

PERFUMERY AND ESSENTIAL OIL RECORD. SPECIAL NUMBER. June 11, 1915. 8, Searle St., London, W.C. Price 1s. 6d.

THIS extra number of the Perfumery and Essential Oil Record is devoted to an epitome of the present state of our knowledge of essential oils, drawn up by the Editor (Mr. J. C. Umney), in collaboration with Mr. C. T. Bennett. It presents an excellent survey of the sources, constituents, preparation, properties, analysis, and sophistication of the aromatic distillates, in the space of 56 pages.

SALINES IN THE OWENS, SEARLES, AND PANAMINT BASINS, SOUTH EASTERN CALIFORNIA. BY H. S. GALE. U.S. Geological Survey, Bulletin 580-L. Government Printing Office, Washington.

CONTAINS 72 pages, $9\frac{1}{4} \times 6$ in., fully illustrated by diagrams and maps.

* New Books.

[The Roman numerals in thick type refer to the similar classification of abstracts under "Journal and Patent Literature" and in the "List of Patent Applications."]

I. Döchting, W.: Entstaubungs- u. Entnebelungs-Anlagen. (6 S. m. 11 Fig.) 31, 5 + 23, 5 cm. Berlin, Polytechn. Buchh. A. Seydel. 1915. 40 Pf.

Gucst, J. J.: Grinding machinery. Svo. pp. 456. E. Arnold. 1915. Net 15s.

IIA. Hofer, Dr. H. v.: Die Nomenklatur in der Erdölwissenschaft. (1 S.) Lex 8°. Berlin. Verlag f. Fachliteratur. 1915. 50 Pf.

Redwood, Sir B. Bt., and A. W. Eastlake: Petroleum technologist's pocket book. 1915. 16mo. C. Griffin. Net 8s. 6d.

Hübers, J.: Ueber Verwertung der Lignitkohle. (6 S.) Lex 8°. Wien. 1915. Berlin. Verlag f. Fachliteratur. M 1.20.

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Hedvall, J. A.: Ueber die Reaktion zwischen Zinndioxyd u. Kobaltoxydul bei höheren Temperaturen. (7 S.) 8°. Uppsala. 1914. Berlin. R. Friedlander & Sohn. 60 Pf.

VIII. Selch, Prof. E.: Der Einfluss der basischen Flussmittel auf die Haarrissigkeit u. den Schmelzpunkt v. borsäurefreien Bleiglasuren. 2. Aufl. (12 S.) gr. 8°. Berlin. Keram. Rundschau. 1915. M 1.

X. Dittler, Dr. E.: Mineralsynthetisches Praktikum. Eine Prakt. Anleitung f. das Laboratorium. Mit e. Beitrag: "Optische Untersuchungsmethoden" v. Dr. H. Michel. (VIII, 150 S. m. 56 Fig.) gr. 8°. Dresden. Th. Steinkopff. 1915. Cloth, M. 6.

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Smith, S. W. J., and J. Guild: Thermomagnetic study of the eutectoid transition point of carbon steels. 4to. swd. pp. 28. Dulau. London. 1915. Net 2s.

XI. Arrhenius, Prof. S.: Lehrbuch der Elektrochemie. Vom Verf. durchgesehen u. verm. deutsche Ausg., aus dem Schwed. übers. v. Doz. H. Euler. 3. unveränd. Abdr. (VI, 305 S. m. 57 Abbildgn.) gr. 8°. Leipzig. J. A. Barth. (1901.) 1915. Cloth. M. 9.

Foerster, Prof. F.: Elektrochemie wässriger Lösungen. 2., verm. u. verb. Aufl. (XVIII, 804 S. m. 186 Abbildgn.) Lex 8°. Leipzig. J. A. Barth. 1915. Cloth M. 31.50.

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Hedvall, J. A.: Ueber "Kobaltmagnesium-Rot." (6 S. m. 2 (1 farb.) Taf.) 8°. Uppsala. 1914. Berlin. R. Friedlander & Sohn. M. 1.20.

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* Dissertations.

[Prices vary, ranging from three to four shillings.]

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Wm. H. Nichols, M.S., LL.D., D.Sc.	1904—1905.
† Edward Divers, M.D., D.Sc., F.R.S.	1905—1906.
† Enstace Carey	1906—1907.
Sir Boverton Redwood, Bart., D.Sc.	1907—1908.
Raphael Meldola, F.R.S.	1908—1909.
Prof. Ira Remsen	1909—1910.
Walter F. Reid	1910—1911.
Rudolph Messel, Ph.D., F.R.S.	1911—1912.
Prof. Marston T. Bogert, LL.D.	1912—1913.
Sir William Crookes, O.M., Pres. R.S.	1913.
Rudolph Messel, Ph.D., F.R.S.	1914.
Prof. G. G. Henderson, LL.D., D.Sc.	1914—1915.

† Deceased.

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THE JOURNAL.

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Official Notice.

NEW CLASSIFICATION OF THE MEMBERS OF THE SOCIETY.

When a Deputation from the Council waited recently on the Minister of Munitions and offered the services of the Society to the Government in the present national crisis, the Minister asked whether a classified list of Members of the Society was in existence, as it might afford some idea of the possible chemical resources of the Empire.

In reply, the Deputation admitted that the present classification of the Society was not precise enough for the purposes of H.M. Government, and promised to supply a more perfect one.

The Council accordingly asks all members to fill in the enclosed postcard and return it to this office within fourteen days. An envelope may be used.

Members are requested to base their new classification upon that of the Journal (see below), and enter on the card provided for the purpose one or more of its class numerals, together with one or more of the following eight letters:—

- A. means Agent or Merchant.
- C. „ Consultant or Analyst.
- E. „ Chemical or Metallurgical Engineer.
- M. „ Manufacturer.
- O. „ Official (Government, etc.).
- P. „ Professor or Teacher.
- W. „ Works Chemist or Manager.
- X. „ Any other profession or occupation.

The following is the classification used in the Journal:—

- I.—GENERAL PLANT; MACHINERY.
- IIA.—FUEL; GAS; MINERAL OILS AND WAXES.
- R.—DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.
- III.—TAR AND TAR PRODUCTS.
- IV.—COLOURING MATTERS AND DYES.
- V.—FIBRES; TEXTILES; CELLULOSE; PAPER.
- VI.—BLEACHING; DYEING; PRINTING; FINISHING.
- VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.
- VIII.—GLASS; CERAMICS.
- IX.—BUILDING MATERIALS.
- X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.
- XI.—ELECTRO-CHEMISTRY.
- XII.—FATS; OILS; WAXES.
- XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.
- XIV.—INDIA-RUBBER; GUTTA-PERCHA.
- XV.—LEATHER; BONE; HORN; GLUE.
- XVI.—SOILS; FERTILISERS.
- XVII.—SUGARS; STARCHES; GUMS.
- XVIII.—FERMENTATION INDUSTRIES.
- XIXA.—FOODS.
- B.—WATER PURIFICATION; SANITATION.
- XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.
- XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.
- XXII.—EXPLOSIVES; MATCHES.
- XXIII.—ANALYTICAL PROCESSES.
- XXIV.—MISCELLANEOUS ABSTRACTS.

Example:

- III. M. indicates a Manufacturer of Tar Products;
- XIV. W. a Chemist or Manager in a Rubber Factory.
- XV. P. a Professor or Teacher in Leather Industry.

NOTE.—This Classification has no connection with the National Register.

CHARLES CARPENTER.

President.

CHARLES G. CRESSWELL,
Secretary.

The following is a copy of the Minister's reply:—

Ministry of Munitions for War,
6, Whitehall Gardens, S.W.

23rd July, 1915.

Dear Sir,

I am desired by Dr. Addison to request you to convey to the Society of Chemical Industry his

thanks for the offer made by the Deputation which attended at this Office on the 5th instant to place at the disposal of the Government the organisation of the Society for any purpose for which that organisation might be usefully employed in promoting the development of the chemical industry of the country during the War.

Dr. Addison will not fail to bear in mind the Society's offer of help and will gladly avail himself of it as the occasion arises. In the meantime it would be of assistance to him to know whether the present organisation of the Society is such as would enable it:—

(a) to furnish at short notice, at request, a reliable and complete statement as to the possible sources of supply of particular chemical products;

(b) to keep the Government informed from the manufacturers' point of view of difficulties arising from time to time as respects labour, materials, transport and so forth which may be interfering seriously with the output of essential chemical products.

Yours faithfully,

(Signed) J. A. BARLOW.

The General Secretary.

Society of Chemical Industry,
Broadway Chambers, Westminster.

PROCEEDINGS

OF THE

THIRTY-FOURTH ANNUAL MEETING.

MANCHESTER.

WEDNESDAY, JULY 14TH, 1915.

The Thirty-fourth Annual General Meeting of the Society was held in the Assembly Hall of the Municipal School of Technology, Manchester, on July 14th, 1915, the President, Professor G. G. Henderson, in the chair.

The Lord Mayor of Manchester (Alderman D. McCABE), in welcoming the Society to the City, mentioned how much Sir Thomas Shann, Chairman of the Education Committee, regretted his inability to be present. He believed that the importance of chemical science to industry was beginning to be realised now more than ever before, and the future would see a greater demand for those skilled in chemical science and a closer co-operation between industry and science.

The PRESIDENT cordially thanked the Lord Mayor, on behalf of the Society, for the hearty welcome they had received. He mentioned that Lancashire was the birthplace of the Society, and that the members always looked forward to the meetings in Manchester with the keenest anticipations, knowing that these anticipations would be fully realised. They hoped that the meetings of this Society would impress on the people at large that the prosperity of this country must depend, in a very high degree, on our chemical industry. He was beginning to feel, in view of recent events, that the chemist was at last coming into his own. Such a meeting as the present one, in such a city as Manchester, was likely to bring about that result.

The Minutes of the Thirty-third Annual Meeting, at Nottingham on July 15th, 1914, were read and confirmed, and signed by the President.

NEW COUNCIL.

The PRESIDENT announced that the number of nominations to the Council was exactly what was

necessary to fill the vacancies, so that no election was required. The list of Council for 1915—1916 was then approved by the meeting (see page 743).

REPORT OF COUNCIL

The GENERAL SECRETARY read the Report of Council as follows:—

During the year the Council has held 11 meetings, Accounts Committee 10, Publication Committee 24, Information Bureau 3, General Purposes 1, Publication of Patent Cases 1, Weekly Journal 1, Chemical Products 1, Library 2, Labour in Chemical Works 2, Printing Agreement 1, and Annual General Meeting 3.

The number of Members now on the Register is 4017, as compared with 4142 last year. Since the last Annual Meeting 201 new Members have been elected, and the losses have been 326.

The losses by death amount to 58, viz.:—H. A. Appleton, Theodore Armstrong, J. S. Arnott, T. R. Bayliss, Alex. A. Beadle, J. J. Beringer, Col. R. K. Birley, C.B., Col. Jeffrey H. Burland, Dr. R. J. Caldwell, Eustace Carey, R. Forbes Carpenter, Sir Arthur Church, K.C.V.O., F.R.S., Dr. W. D. Crumbe, L. V. Dalton, Philibert Delahaye, Prof. W. L. Dudley, Dr. Chas. J. Eames, Harry M. Freear, Robt. M. Gloag, Anthony Gref, Henry Hall, Jas. Hargreaves, W. Ross Harvey, T. H. Harvey, Archie Neill Holden, Henry Williams Jones, A. J. Keeble, Henry Knight, Jos. Lee, Capt. Maurice B. Lloyd, D. A. Louis, John Lyle, S. Freemont MacDonald, R. F. Macfarlane, D. M. McKechnie, John M. McMurtrie, Dr. Hugo Müller, John Northing, Prof. Chiri Otsuki, J. M. C. Paton, Lieut. Geoffrey V. Pearce, Albert Plaut, Edward Riley, A. J. Robertson, Prof. W. J. Clunies Ross, Lieut. R. A. Seymour-Jones, Dr. J. Takayama, Oswald N. Tebbutt, Lieut. C. A. R. Tennant, Benjamin F. Thomas, Thomas Thorp, G. Vogeler, Chas. W. Waite, W. J. Webber, Wm. Weston, Chas. Wilkins, Robert Williamson, Dr. Otto N. Witt.

Col. Jeffrey H. Burland died on service, and Messrs. Geoffrey Pearce, R. A. Seymour-Jones, Oswald N. Tebbutt, and C. A. R. Tennant were killed in action.

Four Ordinary Members retire from the Council. Dr. E. F. Armstrong, Prof. H. E. Armstrong, F.R.S., Prof. W. R. Hodgkinson, and Mr. Walter F. Reid have been nominated to fill the vacancies. No ballot will be required.

The following Chairmen of Local Sections retire:—Mr. H. T. Pinnock (Birmingham), Prof. E. C. Baly, F.R.S. (Liverpool), Prof. W. R. Hodgkinson (London), Mr. J. Hübner (Manchester), and Mr. G. W. Thompson (New York). The following succeed them:—Mr. W. J. Rees, Mr. John Gray, Mr. A. R. Ling, Mr. J. H. Hoseason, and Dr. W. M. Grosvenor. The Council desires to express its thanks to the retiring Chairmen for their services to the Society.

Mr. N. H. Martin has been elected to the General Board of the National Physical Laboratory in place of Mr. Reid, whose period of office had expired. Mr. Tyrer has been placed on the Executive Committee, and has taken an active part in its proceedings. Dr. Messel continues to act as the Society's representative on the Council of the Imperial College of Science and Technology.

A new Section for Edinburgh and the East of Scotland has been formed with Prof. Jas. Walker, F.R.S., as Chairman, and Dr. J. P. Longstaff as Hon. Local Secretary.

The Balance Sheet and Annual Statement of Accounts, which have already appeared in the June 30th number of the Journal, will be laid before the Meeting.

Acting under the powers conferred by By-law 9, the Council will entertain applications to Membership, without payment of Entrance Fee, from

candidates on whose behalf a recommendation from a Member is presented stating that the candidate's position requires this special consideration and that his income is not more than £150 per annum.

It has been decided, under By-law 12, to allow those members who are engaged on Active Naval or Military Service to postpone payment of their subscriptions without loss of rights of membership.

The Journal in 1914 contained 1230 pages of text as compared with 1172 pages in 1913.

On the retirement of Mr. Watson Smith, who has been awarded a superannuation allowance of £315 a year, the Council entrusted to the General Purposes Committee the task of finding a successor. It was decided that the new Editor should devote his whole time to the duties of his office, and, subject to the Publication Committee, be held responsible for the whole contents of the Journal, the necessary assistance being provided by the Society. In response to an advertisement inserted in the leading Journals, applications were received from 62 candidates, and after consideration of these the Committee unanimously recommended the appointment of Mr. Tom F. Burton at a salary of £550 per annum, with the provision that his duties should include the preparation of the Annual Indexes and supervision of the next Decennial Index. The Council adopted the recommendation and Mr. Burton took up his new duties on January 1st. This made it necessary to appoint a new assistant for the office, and a little later Mr. L. E. E. Johnson was selected for this post.

A resolution in favour of a weekly Journal, passed by the Council, was considered by the Publication Committee, which pointed out certain difficulties likely to arise. A joint Committee of the two bodies met to consider how to give effect to the Council's resolution, and reported that under present circumstances it would be better to postpone the issue of a weekly Journal in view of the cost and changes it would entail. Certain new features were suggested: such as insertion of correspondence, reports on the position and progress of various branches of Chemical Industry, reports of meetings of other Societies, short reviews of technical books indicating their scope and character, and general news of interest to members. The adoption of other suggestions which, likewise, have been approved by the Council, such as taking the advertisements into the Society's own hands, and raising the subscription price of the Journal to non-members, involves a new agreement with the publishers. Negotiations for a new contract have been begun, but are suspended until the close of the war.

At the beginning of the year a new Brevier type was adopted for the Journal. It is clearer than the old, but will somewhat increase the bulk of the Journal and enhance its cost by some £150 a year.

Dr. F. B. Power has retired from the Publication Committee on going abroad and Mr. Watson Smith has been elected in his place. Dr. J. T. Dunn has been elected to fill the vacancy created by the death of Mr. D. A. Louis.

The Council has satisfaction in reporting that the Society has been able to render assistance on many occasions to the Admiralty, the War Office, and the Board of Trade, and also to Dominion Governments. The services of the Society have likewise been placed at the disposal of the Minister for Munitions.

In November the Council appointed a Committee to consider the foundation of a Permanent Bureau to assist and advise in the consolidation of Chemical Industry in the Empire. That Committee reported, *inter alia*, in favour of the compilation of a register of manufacturers of chemicals, chemical

plant and apparatus, and of the importers and refiners of natural products. The Council asked the Committee to ascertain whether the Board of Trade would give any assistance in preparing such a register. In reply to inquiries made by the Committee, the Board pointed out that, owing to unwillingness of manufacturers to divulge to the public any details of their production, the Board could not be a party to the production of such a register. A means whereby the Society could co-operate in obtaining the desired information was then suggested. Members of the Society might be asked to inform the Board of Trade in strict confidence what products and how much of them they made and could make, and to renew or confirm this information from time to time. The Board proposes to enter this information in its confidential registers and let it be known that *bond fide* applicants, who are prepared to give to the Board full particulars of their requirements in confidence, will be given the names of those manufacturers who can supply their needs.

A joint Deputation from the Royal and Chemical Societies was received by the President of the Board of Trade and the President of the Board of Education on May 6th. With the Deputation, which was introduced by Sir William Crookes, were representatives of the Institute of Chemistry, the Society of Public Analysts, and of this Society in the person of its President. The Deputation advocated Government assistance for scientific research for industrial purposes, the establishment of closer relations between manufacturers and scientific workers and teachers, and the establishment of a National Chemical Advisory Committee for these purposes. The Minister, in reply, pointed out that the Board of Trade fully appreciated the extent to which national industrial progress is dependent on the utilisation of the services of men of science, and the importance of provision for the thorough training of a very much larger number of industrial chemists than are at present available. The war had shown the weakness of our position in certain important respects, and he was in full sympathy with the general views expressed by the Deputation. (See this Journal, 1915, pp. 459—460.)

At the last Annual Meeting it was resolved to hold this Annual Meeting somewhat later in the year and in connection with that of the British Association; it had been decided also that the Meeting should be reorganised on somewhat more scientific lines. After the war broke out the fixture for September of the British Association became uncertain, and consequently this Council, at the instance of the Manchester Section, reconsidered the position and decided to revert to a Meeting of this Society by itself in the month of July as usual. It was also felt that the time would be inopportune for anything in the nature of festivity and that no better occasion could be found for inaugurating the contemplated change in the character of the Meeting. The results of these deliberations are to be found in the programme of papers which are to be read and discussed on this occasion.

An invitation to hold the next Annual General Meeting in Edinburgh will be laid before the Meeting.

The International Congresses of Mining and Metallurgy (London) and Applied Chemistry (Petrograd) have been postponed.

Mr. WALTER F. REID, in moving the adoption of the report, said that it contained a record of a large amount of important work for which they were very much indebted to their Council. The report showed that the Society had been active in many directions. They could congratulate themselves on the formation of a new Section in Edinburgh, and wish it every success. As regards

the Journal, there had been a slight diminution in the quantity of matter available, but that was unavoidable in present circumstances, and there was cause for congratulation that the quality of the Journal had not suffered. They were now in a position to obtain all the technical publications necessary to provide information for the members. He fully indorsed the remarks of the Council as to Mr. Watson Smith, and hoped they would have the benefit of his services on the Publication Committee for many years to come. Regarding the proposal for a weekly issue of the Journal, he mentioned that, though the proposal appealed to him personally, yet it would be difficult to carry out, because it would involve weekly attendance at the Publication Committee.

Dr. C. DREXFUS seconded the motion, and the report was unanimously adopted.

REPORT OF HON. TREASURER.

Mr. THOMAS TYLER, in submitting his annual report, mentioned that the excess of income over expenditure in 1914 was £894 15s. 2d., a larger sum than in either of the four previous years. But it must be remembered that a large proportion of that amount was ear-marked. The entrance fees and life composition fees had been invested, as usual, and now a further sum was required for superannuation. A short time ago they had had the sum of £2400 on deposit at the bank, and a large proportion of that had been invested in the 4½% War Loan, with a view to converting the Society's holdings of Consols. Their securities, taken as a whole, had shown a comparatively low rate of depreciation during recent years, and he believed that in that respect they were in an exceedingly favourable position.

Dr. M. O. FORSTER moved the adoption of the report, and said he thought that it would be found most encouraging and that the Society was in a very fortunate position at such a time as the present. He pointed out, however, that the excess of income over expenditure had been, for many years past, almost exactly balanced by the entrance fees and the interest from their investments, and that therefore it must not be regarded as of the nature of a profit on the year's working. They were very fortunate to have as Treasurer one who took such a deep personal interest in the affairs of the Society, and they offered him their hearty thanks for his services.

Mr. C. RAWSON seconded the motion, which was carried unanimously.

PRESIDENT'S ADDRESS.

The PRESIDENT then read his address, as follows:—

Throughout the period which has elapsed since the date of our last Annual Meeting the Society has had to carry on its work under conditions without parallel in its previous history, and, unhappily, still prevailing. Many of the members are on active service with the forces of the Crown, and some, we note with sorrow, have already fallen in the defence of our country; many others are strenuously engaged in no less important and honourable national service at home; the terrible but inevitable conflict which is being waged between civilisation and Teutonic barbarism so completely absorbs the thoughts and energies of most of us that other matters appear by comparison trivial and of little account. In circumstances such as these it is a reason for congratulation, and a testimony to the inherent strength of the Society, that little or no falling off in its activities can be observed. The local Sections have held their customary meetings and have contributed at least an average number of papers for publication. The Journal has appeared as usual, and although there has been an unavoidable interruption in the supply

of those foreign periodicals from the contents of which a number of the abstracts are prepared, yet the energetic work of the editorial staff and the Publication Committee has to a large extent made good the deficiency; indeed, I think it will be generally agreed that there has been an improvement rather than otherwise in the quality of our publication. Finally, we are now assembled in General Meeting, as in every year since the Society came into existence.

From time to time during the year the sad duty has been imposed upon us of recording the death of one of our members. The customary obituary notices have been published in the Journal in due course, but I feel that it would not be fitting to pass over without further mention the loss of three of the original members of the Society who can ill be spared—Eustace Carey, Russell Forbes Carpenter, and David Alexander Louis. Mr. Louis was for long one of the staff of abstractors and a valued member of the Publication Committee, on which his untiring efforts to maintain the high standard of the Journal were of the greatest benefit. Mr. Forbes Carpenter's services to chemical industry in the capacity of Chief Inspector of Alkali Works can hardly be over-estimated, and his services to the Society were no less valuable. Mr. Carey was one of the small band of enthusiastic and far-seeing men who laid the foundation stone of the Society; he devoted himself to its interests in almost every possible office—as member of the first Publication Committee, as Honorary Northern Secretary, as Chairman of the Liverpool Section, as Member of Council, as Vice-President, and, in 1906-1907, as President. So recently as last year he attended the General Meeting at Nottingham, and he was again a Member of Council at the time of his death. The Society has indeed suffered a heavy loss, but the memory of these upright and lovable men will long remain an incentive to continued progress.

The Society, in common with other scientific societies and institutions, has been eager to render every possible assistance to the Government in carrying the war to the successful issue which we confidently anticipate, and has had the satisfaction of supplying useful information to several Government departments on a number of occasions. I confess to disappointment, however, that fuller opportunities of national service have not been afforded. Many individual members of this Society, and of all the other scientific Societies, have been and are doing splendid work, but it is safe to say that better results would have been achieved by *organised* effort, and it is regrettable on all grounds that the scientific resources of the nation have not been systematically utilised by the Government as they might have been. Organisation has been lacking, with the result that comparatively little advantage has been taken of those resources, and yet it would surely not be a very difficult matter to bring into close co-operation all the Societies representative of the different branches of pure and applied science. It would only be necessary to appoint some central body, which should have the duty on the one hand of keeping in intimate touch with the Admiralty, the War Office, and the Ministry for Munitions, and on the other hand of referring to the Council of each Society the questions with which it is particularly fitted to deal. Whatever method be adopted, it is not by any means too late to set about the organisation of the powers which science can place in the hands of the Government, and the sooner this is done the better for the country. In this connection it is gratifying to note that a Committee, on which the Society is well represented, was appointed last August by the President of the Board of Trade to consider and advise as to the best means of obtaining for the use of

British industry sufficient supplies of chemical products, colours, and dyestuffs of kinds hitherto largely imported from abroad. The problem how best to utilise the opportunities afforded by the war for extending and developing the chemical industries of the country has been discussed at meetings of a number of the local Sections, and much information bearing on the question has been made available through the medium of the Journal. Whether as a result of this or not, even the most pessimistic must admit that British chemical manufacturers have already given evidence of their readiness to extend their operations and to undertake the preparation of many chemicals of different kinds which up till the present time could only be obtained from foreign sources, and that such indispensable materials as filter paper, and glass and porcelain ware for chemical purposes, are now being successfully manufactured in this country.

In the report submitted by the Council to the General Meeting last year it was intimated that a Committee had been appointed to consider the best methods of increasing the usefulness, and incidentally the membership, of the Society. After much careful inquiry, the Committee presented a report which was considered at a special meeting of the Council, and generally approved. The main conclusion arrived at was that, in the first instance, no more important step could be taken than to endeavour to make the Journal as comprehensive, as informative, and last but not least as interesting as possible. An advance towards this end has been made in adopting a clearer and more legible type, in extending the scope of the published matter, and in issuing reviews and not merely notices of new technical books. Further developments will be carried out as circumstances permit, amongst others the publication at suitable intervals of reviews of progress and recent developments in the different branches of chemical industry, and it is hoped that the result will be to render the Journal simply indispensable to every chemist, if indeed that is not already the case.

Among the proposals for widening the sphere of influence of the Society submitted to the Council was one for the establishment, under the auspices of the Society, of an Information Bureau, which should have the duty of collecting, classifying, and distributing information of every kind likely to be of advantage to British chemical manufacturers. Obviously it would be foolhardy to engage in such an enterprise without full inquiry and careful calculation of the cost, and sufficient data are not yet at hand to justify the Council in coming to a decision. However, a committee has been appointed to gather information and to work out details, and although it is too soon to say what the outcome will be, I hope that the difficulties which stand in the way will be overcome and that my successor in the presidential chair will have the satisfaction of witnessing the inauguration of the scheme during his term of office.

Still another weighty matter which has engaged the attention of the Council is the character of the Annual General Meeting. I have for long held the opinion, in common, I believe, with many of the members, that full advantage has not been taken in the past of the opportunities afforded by the gathering together at the Annual Meeting of technologists representing most, if not all, of the branches of chemical industry, and that too much of the time over which the meeting extends has been devoted to purely social functions. Consequently it gave me great satisfaction when the Council came to the decision that at future General Meetings, whilst the social aspect will not be by any means neglected, the greater part of the available time will be set apart for the discussion of subjects of general interest to the members and for visits to works. We hope that the Annual Meetings of the Society will hence-

forth be looked forward to by all the members as congresses of technologists for the consideration of manufacturing problems and for the interchange of information and ideas, and yet none the less as occasions for the renewal of old friendships and the formation of new ones. With the cordial co-operation of the Manchester Section, to whose Chairman the special acknowledgments of the Council are due, the programme of the present meeting has been arranged on these lines, and that programme speaks for itself.

In order to encourage the entrance of the younger members of our profession to the Society, the Council have decided to entertain for a time applications for election without payment of the entrance fee from candidates whose position requires this special consideration. It is hoped that this concession will result in the addition to our ranks of a number of the younger chemists, and that thereby the desire of the Council to enrol every chemist in the Empire on our list of members will be brought nearer realisation.

It must not be forgotten that, in considering the proposals for increasing the activities of the Society which have been laid before them, the Council have had to bear in mind the effect on our financial position which might follow from the adoption of these proposals. The expenditure of a Society such as this tends naturally to grow, and indeed increased outlays are inevitable if the standard of the Journal is to be maintained or if, as some of us hope, it is to be raised to a still higher level. On the other hand, a corresponding increase of income cannot be counted upon, and in fact during the past year we have had to face a not inconsiderable falling off. Consequently whilst we are at one in the conviction that our watchword must be progress, and that we must not hesitate to break out new trails for the reason that the old one has led to creditable success, yet the Council, as trustees for the members, are morally bound to safeguard the resources of the Society and to weigh very carefully the consequences before embarking on any new scheme which involves inroads on the funds.

An encouraging illustration of the Society's vitality is the recent foundation of a new local Section. A strongly supported request from chemists in Edinburgh and the East of Scotland for sanction to carry out this project was willingly agreed to by the Council, and I had the pleasure of presiding at the formal inaugural meeting on April 14th, when Professor James Walker was elected Chairman and a representative committee appointed. The new Section starts under the best auspices and there can be little doubt that its existence will be of benefit both to the industries of the district and to the Society.

Perhaps the most notable events of the year were the resignation of Mr. Watson Smith from the post of Editor of the Society's Journal, which took effect on December 31st, and the appointment of his successor. The General Purposes Committee, to whom was committed the task of considering the numerous applications for the vacant post, were unanimous in recommending that Mr. T. F. Burton should be appointed, and as you are aware this recommendation was adopted by the Council. The new Editor had not to take up duties which were altogether strange, because for a number of years previously he had done excellent work in the capacity of Assistant to the Editor and to the General Secretary, and a glance at the numbers of the Journal which have appeared since the beginning of this year will, I am convinced, lead to the conclusion that he is well qualified for the important position which he now occupies, and that in selecting him the Council chose wisely. I sincerely hope that he will have as long and as highly creditable a period of office

as his esteemed predecessor, of whose services to the Society it is difficult to speak too highly. In his Presidential Address to the first Annual Meeting of the Society, held in July, 1882, Sir Henry Roscoe used the following words:—"The Publication Committee appointed by the Council to carry out and superintend the issue of a Journal was fortunate in securing the services of Mr. Watson Smith, of the Owens College, as Editor." It is only necessary to examine the long series of volumes which appeared under his care in order to realise that the Society was indeed fortunate in the appointment of its first Editor. The Editorship in Mr. Watson Smith's hands, extending as it did over a period of thirty-three years, not only became the work of his life, but was to him in truth a labour of love, and the members cannot permit him to retire without expressing, as I now do on their behalf, their deep appreciation of his long-continued, untiring, and devoted service. It is gratifying to know that the Publication Committee will continue to have the benefit of his wide knowledge and ripe experience.

The resignation of the first Editor naturally carries one's thoughts back to the days when the Journal came into existence under his charge. The early history of the Society has been recorded in most interesting fashion in the addresses of two former Presidents, Sir Edward Thorpe and the late Dr. Divers, which almost completely exhaust the subject. However, through the courtesy of Mr. Watson Smith, I am enabled to add some reminiscences of the movement which led to the foundation of the Society. These are contained in the following letter, written to him in 1895 by the late Mr. George E. Davis, who at the inception of the Society held the post of Honorary General Secretary.

"In 1875 the Faraday Club was formed: in fact it was got together by myself on account of the chemists of Widnes and St. Helens scarcely knowing each other. Some of the chemists, when approached on the subject, would not join, as they said that a similar attempt had been made some five or six years before to form a chemical society in St. Helens, and the masters had prohibited their chemists from attending the meetings. In fact the feeling was so great even at the formation of the club that some few weeks after the first meeting Mr. Gamble came into my laboratory and told me he had heard I was connected with a secret society and desired to know whether this was the case or not. I told him that whether it was called a secret society or not, it was a combination of chemists having no interest but their own profession, and had no adversaries so far as they were concerned, and that he might safely trust me, being the Secretary, to do what was right. He left me quite satisfied, and the Club went on, we holding our meetings every fortnight and alternately in Widnes and St. Helens. By and by the Club became more interesting, and was moved to Liverpool, where we used to meet at an hotel which is now pulled down owing to the station improvements. The Club thus continued until 1879 and has never been dissolved. In 1879 some members who had refused to join us at the start wanted to come in, and as they were not allowed they endeavoured to form a society of their own in Widnes. I believe a meeting was called in the Drill Hall, Widnes, with Mr. J. L. Muspratt in the chair. The meeting appointed a committee to draw up rules, of which I myself, Dr. Hurter, and Douglas Herman were members. These rules were printed, and the committee met several times to discuss them, but they were not to my liking and I was afraid the Faraday Club would suffer by the division. Several meetings were held and at last it was suggested that the society should be called 'The South Lancashire

Chemical Society,' when I pointed out that it would be folly to call the society 'The South Lancashire Chemical Society' when Manchester was included in it and we had not asked Professor Roscoe, the head of the Owens College Laboratories, to take the leading part in it. Meetings were then held in Liverpool and Mr. Mond became interested, he, I believe, taking the chair at one of the meetings there. After seeing Professor Roscoe a meeting was called for Owens College, and about four-and-twenty members representative of the chemical and allied interests sat round the table there. It was proposed to found a society to be called the 'Society of Chemical Engineers.' Up to this time Mr. John Hargreaves had been secretary of the movement, but he became frightened at the immense amount of work the scheme would require and asked me if I would take the Secretaryship if he gave it up, as he said to me, 'They are making the Society a national one, and the next move will be to make it international.' I said, 'And why not? The bigger the scheme is the more honour will be attached to it.' I took the Secretaryship from that point, and the next thing was to call a meeting for London. I am not quite sure where that meeting was held, but I rather think it was in George Street, Westminster, and the idea which ran through the minds of all concerned was the formation of a society to represent chemical engineering. We all went up to that inaugural meeting with the idea of carrying out this scheme, but when the meeting was held one or two of the professorial type foresaw that if it was a Society of Chemical Engineers it was more than probable they would be left out in the cold. The position was rather serious, and as I sat by the side of Professor Roscoe, as Secretary, the thought struck me that if we could give the Society a kind of indefinite title it would stifle all opposition and would go through. I therefore wrote a resolution that the Society should be called 'The Society of Chemical Industry' and gave it to Weldon to propose. Our proposition was carried, and the way was smoothed over by allowing anybody who signed the requisition form before a certain date to become members of the Society without election, and I believe some three or four hundred availed themselves of this.

"Now with regard to the Journal. The idea which ran through my mind was a Journal precisely as we have it now, the size of the 'Athenæum.' I think we had a meeting at the Café Royal to decide whether a Journal should be published or not. I had in my own mind come to the conclusion that without a Journal such a Society as this would be a barren one and would not last long. Most of the members of the committee objected to a Journal being started, and said that we could never find matter enough to fill it, and this they repeated during several meetings. When we held our first General Meeting papers were read at it, and although I suggested the 'Athenæum' form for printing the proceedings I was outvoted, and our first 'Proceedings' were printed to imitate as nearly as possible, but with a blue cover, the Proceedings of the Chemical Society. How far my judgment was correct is proved by the reprinting of that volume of Proceedings into the present Journal size. When I proposed that the Journal should be large enough to take large illustrations I was laughed at, and it was said that children looked over the pictures, but not scientific men. Well, the Journal would never have been started, in my opinion, had it not been for Mr. Mond. He clearly saw the necessity for such a Journal, and a guarantee fund was formed at his suggestion, and he headed the list with a promise of a hundred pounds. It is a matter of history that not one penny piece

of that guarantee fund was ever touched. From this first number I believe you know all the rest, and your labours in connection with that Journal have served to make it the leading Journal of Chemical Industry and the bond which has held together all the Sections of the Society.

"With regard to the Sections I had the utmost difficulty in getting the London Committee to see the necessity for their formation, but I carried my point. I have never regretted the strong measures and the strong arguments which I used in those days."

Mr. Davis' recollection of the incidents associated with the formation of the Society may have been at fault here and there, but, even if this is the case, it appears to me that his racy and intimate narrative is well worth preservation. The rest of the story of the foundation may be told in a few sentences. Following on the preliminary meetings mentioned by Mr. Davis, in October, 1880, a circular letter was issued by Professor Roscoe, who had acted as chairman of the provisional committee appointed to promote the scheme, in which notice was given of the proposal to establish a society to be called "The Institute of Chemical Engineers or the Institute of Chemical Industry," and the support of leading members of the chemical industries solicited. The response to this letter was so encouraging that the Society was formally brought into existence early in 1881, Professor Roscoe being elected President and Mr. George E. Davis Hon. General Secretary. In the Report of the Council presented to the first General Meeting of the Society, which was held in London on June 28th and 29th, 1881, the future policy of the Society was outlined in the statements that "Annual General Meetings will be held in various towns throughout the country," and that the Council had "arranged for the establishment of local sections" and "had under consideration the propriety of publishing a Journal." It is evident that the Council did not long delay in coming to a decision on the last point, for in October of that year Dr. Mond, after consultation with Dr. Angus Smith, proposed to Mr. Watson Smith that he should become Editor of the projected Journal. The first number appeared in January, 1882, and the history of the Society's growth and development is written in the succeeding volumes.

Since the outbreak of the war there has been much discussion concerning the present position and the future prospects of the chemical industries of this country, and I earnestly hope that the serious consideration which has been given to the subject will have at least one result—that we shall refrain from talk and proceed to action. We have been made to realise more clearly than ever before that during the last forty years chemical industry in Germany has made marvellous strides in advance, whilst in this country it has by comparison stood still or even gone back. We have to admit that certain branches of applied chemistry, particularly the manufacture of dyestuffs, of synthetic drugs, and of organic compounds and fine chemicals in general, have passed almost wholly out of our hands, or rather have never been taken up to any notable extent in this country. We cannot deny that the Germans have with energy and success developed on the industrial scale many scientific discoveries, such, for instance, as the various methods for the fixation of atmospheric nitrogen, whilst we have done little or nothing in that direction. Even our former supremacy in the manufacture of heavy chemicals has been seriously attacked. These are the facts, and whilst there may be differences of opinion as to the principal causes of this unfortunate state of affairs, yet I think that no unprejudiced person, who is prepared to study the question dispassion-

ately, can have much doubt in his own mind as to the real reasons for German progress and British backwardness. The position has already been stated so often and in such a clear and comprehensive manner by a number of leading chemists—and in this connection I desire to draw your special attention to the Presidential Addresses delivered recently by Professor Meldola and Professor Perkin to the Institute of Chemistry and the Chemical Society respectively—that I may well be excused from repeating the arguments which, it is to be hoped, are at long last beginning to make some impression. There is, however, one aspect of the question on which I may venture to add a little to what has already been said. It appears to me that the time has come when we may profitably desist from arguing about the causes which have hindered a development of our chemical industries such as has been witnessed in Germany. Let us admit frankly that we have left undone many things which we ought to have done, and having confessed our sins let us unite in striving to secure the future prosperity of our industries. Now, in my judgment, the two main causes of our lack of progress are as follows. Firstly, we have failed to realise that "scientific research work, carried out in the laboratory, is the soul of industrial prosperity"—that modern chemical industry must of necessity be based upon research if it is to meet with success. This axiom may indeed have been tacitly accepted, but, speaking generally, it has not to a sufficient extent been made a guiding principle in our chemical industries. In the second place, there has not been in the past a sufficiently close and intimate interchange of information and opinions between manufacturers and professors of chemistry; in fact, most unfortunately for both manufacturer and teacher, the attitude has rather been one of mutual aloofness and reserve. If this is an accurate statement of the position, as I believe it is, it follows that we ought to seek means of rectifying these errors.

A welcome move in the right direction on the part of the Government was intimated in the House of Commons on May 13th by the President of the Board of Education, who stated that he was including in the estimates a sum of £25,000 to £30,000 for the purpose of instituting an advisory council on industrial research which should represent the various industries of the country and work in co-operation with the Board of Trade to secure closer association of science and industry. This action is bound to be productive of good, if sufficient funds are available, but Government assistance, much as it is required, will not by itself bring about the desired result; all interested in chemistry must also take an active part. Consider for a moment the present state of affairs. It is in many cases difficult if not impossible for chemical manufacturers to carry out the systematic research work without which their business must sooner or later decline, either because they have not the necessary staff of properly trained chemists, or else because their chemists, although qualified to prosecute the experimental investigation of technical problems, are fully occupied in analytical work or in the supervision of manufacturing operations. This difficulty is perhaps most prevalent in those industries which are not usually classed as chemical in spite of the fact that they are based on purely chemical processes. On the other hand, in the Universities and Technical Colleges there is a considerable number of graduates engaged in research, and this number could be greatly increased if more inducements were offered and facilities provided for students who are both able and willing to undertake such work but who for lack of means are compelled to seek a salaried post as soon as they have completed the minimum course of training. Very little of the research work done in

our chemical schools has any *direct* bearing on chemical manufactures, and yet, from the educational point of view, there is no reason why some at least of this army of young research chemists should not be engaged in the attempt to solve problems in applied, instead of in pure, chemistry. Obvious difficulties in carrying out such a suggestion at once present themselves, but many if not most of these could be set aside by the institution of schemes of Industrial Fellowships, more or less on the lines of that successfully inaugurated by the late Professor Kennedy Duncan in connection with the Universities of Kansas and Pittsburgh. The essence of this eminently practical idea is that any manufacturer who desires to have some technical matter investigated applies to the chemistry department of a University or Technical College for the services of a chemist qualified to prosecute research, and undertakes to provide adequate remuneration for a period of one or more years; the work is done in the Chemistry Department under the general superintendence of the Professor, and, if necessary, facilities for large scale experiments are provided by the manufacturers. The details of the scheme are set forth in the following typical agreement, taken from a paper on "Progress in Industrial Fellowships" by Professor Kennedy Duncan.

AGREEMENT FOR INDUSTRIAL FELLOWSHIPS.

For the purpose of promoting the increase of useful knowledge, the University of Kansas accepts from the foundation of an industrial fellowship to be known as Fellowship.

It is mutually understood and agreed that the conditions governing this Fellowship shall be as follows:—

The exclusive purpose of this Fellowship is for the furtherance of which the holder thereof shall give his whole time and attention, with the exception of three hours a week, which he shall give to instructional work in the University.

The Fellow shall be appointed by the Chancellor of the University and the Director of Industrial Research; he shall be provided with a separate laboratory and with all supplies, reagents, etc., which could be reasonably expected to be in possession of a large University, for the cost and payment of which his lectures shall be taken in lieu. The donor, on his part, undertakes to co-operate with the University in this research in providing the Fellow with his sympathy and, on prior consideration, with his factory facilities for large scale experimentation. The Fellow shall work under the advice and direction of the Director of Industrial Research, and he shall forward, periodically, through the Director, reports of the progress of his work to the donor.

For the support of the Fellowship, which shall extend through a period of years, agrees to pay per year, payable annually in advance to the University of Kansas, which sum shall be paid by the University in monthly instalments to the holder of the Fellowship.

Any and all discoveries made by the Fellow during the tenure of his Fellowship shall become the property of subject, however, to the payment by him to the Fellow of an additional consideration. This additional consideration to the Fellow shall depend upon the value of the services rendered, and shall not exceed The character of this additional consideration (whether royalties, stock, or what not), its amount, the time or times of payment shall be determined by the Board of Arbitration provided for herein. At any time during the tenure of this Fellowship the holder may, at the option of the donor, take out patents at the expense of the donor, on condition that at the time of making application therefor

he assigns all his rights to the donor under the conditions of this Agreement.

At or before the expiration of the Fellowship the business services of the Fellow may be secured by the donor, for a period of three years, on condition that the terms of such service are satisfactory to the parties at interest.

In the event of any disagreement between the donor and the holder of this Fellowship it is understood and agreed that such disagreement shall be settled, in so far as the dispute relates to matters of fact, by a Board of Arbitration consisting of a representative of the University, a representative of the donor, and a third person whom these two shall select, that the decisions of this Board shall be binding upon the parties at issue, and that they shall obtain such decision before having recourse to the Courts.

It is also understood and agreed that during the tenure of this Fellowship the holder may publish such results of his investigations as do not in the opinion of the donor injure his interests, and that, on the expiration of the Fellowship, the holder thereof shall have completed a comprehensive monograph on the subject of his research, containing what both he and others have been able to discover. A copy of this monograph shall be forwarded to the donor of the Fellowship, and a copy shall be signed and placed in the archives of the University until the expiration of three years from that date, when the University shall be at liberty to publish it for the use and benefit of the public. In the event that, in the opinion of the donor, publication three years after the termination of the Fellowship would unduly injure his interests, the donor is at liberty to appeal for an extension of time to the Board of Arbitration provided for herein, which, after consideration of this appeal, is at liberty to extend the time of publication to a period which, in its belief, conserves the interests of all concerned.

In a report on the progress of this scheme after it had been in operation for four years, Professor Kennedy Duncan states that eighteen Fellowships had been established in the University of Kansas and twenty were about to be instituted in the University of Pittsburgh, and that the results obtained by each of the Fellows whose term had expired were entirely satisfactory to the donors. In some cases the Fellowship had been extended for a further period, and in addition there had been developed a system of multiple Fellowships requiring for some one problem the intensive work of several men. The amount of the yearly stipend, and the amount of the maximum bonus to be stated in the agreement, were both left wholly to the discretion of the donor, with the understanding that the stipend together with the possible additional consideration determine the quality of the man that can be obtained for the work. Reviewing the results of the scheme as a whole, Professor Duncan expresses the opinion that "from the standpoint of the industrialist this arrangement is an immense privilege, for the facilities and powers which arise from it give him results which, it is safe to say, could not otherwise be obtained, whilst to the young men who hold the fellowships the arrangement gives the double opportunity both of service and of reward." A system of industrial fellowships such as that outlined above, with modifications to suit the circumstances of each case, could be instituted without difficulty in connection with the chemical schools of this country, and there can be no doubt that it would be of benefit to our chemical industries both directly, by the investigation of questions of technical importance, and indirectly, by bringing industrial and professorial chemists into closer contact than formerly. I earnestly commend the suggestion to

the consideration of all interested in chemical industry.

I feel myself precluded from dealing at any length with a subject upon which I may claim to speak with some authority, namely, the education of technical chemists, because that subject has already been discussed in an exhaustive manner by several of my predecessors, and particularly by Professor Meldola, in their Presidential Addresses. There is, however, one point to which I desire to advert very briefly. The opinions of teachers with regard to the training of chemists for technical posts are by no means unanimous, but may be grouped into three categories. Some teachers appear unwilling to admit the possibility of the existence of the chemical engineer, and maintain that the chemical student requires nothing more than a sound scientific training to fit him for an industrial career, and that, if only he is a good chemist, he will be able after he enters a chemical factory to grapple with and overcome the special problems involved in the design and construction of apparatus and plant for chemical operations on any scale. Others, again, hold that in addition to a thorough scientific training the student should receive such a course of instruction in chemical engineering as can be given in any teaching institution properly staffed and equipped for that purpose. Lastly, a few teachers apparently incline to the opinion that the student, after acquiring a comparatively elementary knowledge of general chemistry, should proceed at once to specialise in some branch of chemical technology. This last view I dismiss at once, because I consider it wrong in principle and futile as regards results; any specialisation in technology should be post-graduate work. The other rival methods of training stand upon a different footing, and each can be defended by cogent arguments, but my own experience leads me to advocate the second course. Probably it is true that only a small proportion of our students possess qualities of mind which enable them to become at once skilled chemists and capable engineers, but on the other hand it seems to me equally true that if a student has sufficient intelligence and application to become a good chemist there is no reason why he should not be able to acquire at least such a knowledge of chemical engineering as will make his path smoother when he comes to undertake manufacturing operations. The training of the technologist in pure chemistry, and to a lesser degree in physics and in mathematics, cannot be too high or too thorough—this is universally admitted—but it need not be limited to these subjects. Even at the risk of appearing to secure a gratuitous advertisement, I can best explain my own idea of a suitable course for a student who intends to devote himself to industrial chemistry by outlining the curriculum for the Associateship of the College with which I have the honour to be associated. In addition to full courses of instruction in chemistry, physics, and mathematics, this curriculum includes classes in constructional engineering, in engineering drawing, and in technical chemistry (chemical engineering). The classes in engineering and in drawing are specially arranged for students of chemistry, with the object of preparing them to enter the class in technical chemistry, which includes both lectures and laboratory work. The lectures deal with (1) the materials of construction of chemical plant, particularly with respect to their power of resisting the action of acids, alkalis, and salts under various conditions, (2) fuels—solid, liquid, and gaseous—their production, analysis, and applications, and (3) the various operations of manufacturing chemistry and the forms of plant in general use. In the laboratories, which are equipped with experimental plant and supplied with electric

power, steam, and compressed air, the student receives instruction in the methods of conducting large-scale experiments, which he is required to carry out with sufficiently large quantities of material to give him an insight into industrial methods and to supply information regarding the costs and conditions of economical working on a manufacturing scale. The course also includes gas and fuel analysis, determination of the calorific value of fuels, measurements of high temperatures by means of the various types of pyrometers, experiments in gas production, and the estimation of heat losses in combustion. The full curriculum, outlined above, extends over a period of four years, during each of which the greater part of the time is occupied with work in the chemical laboratories, and on its completion the student is still required to carry out some research work in pure or applied chemistry before admission to the Associateship. Importance is attached to the last condition, because it is considered that the academic part of the training of the chemist is not complete until he has gone a step beyond routine work and has gained some experience in the methods of research. Experience has led me to the conviction that, other things being equal, a young chemist who has added chemical engineering to the other indispensable subjects of his course is a more useful man in a chemical factory than one who has to acquire all his knowledge of the subject after leaving College, and I hope that in future the opportunities afforded for the study of chemical engineering will be greater than they are at present.

Before bringing this rather discursive address to a close I must express to the members my deep appreciation of the signal honour which they conferred in electing me President of this great Society. My year of office will not, I trust, be written down as a barren one by the future historian of the Society, but whether that be the verdict or no, I shall always look back to it with pride and with pleasure. To the officers of the Society—the General Secretary and the Editors, past and present—I am greatly indebted for constant help in circumstances which made their work much heavier than usual, and I tender them my warmest thanks. I am also most grateful to my colleagues on the Council for the kindness and consideration which I have received at their hands. Finally, I desire heartily to congratulate the members of the Society on their choice of a new President. Dr. Carpenter's reputation as scientific man and as man of affairs stands so high as to be above commendation from me, but I lay stress on the fact that he is keenly interested in the welfare of the Society and in close touch with the important matters which have been engaging the attention of the Council. I confidently predict that his period of office will be one of distinction and of enduring benefit to the Society.

Dr. CHARLES CARPENTER, in moving a hearty vote of thanks to the President for his address, said that he had dealt with perhaps the most important work they had to undertake, namely the education of those upon whom the chemical industry of the country would depend in future. As regards the question of early specialisation during the period of training, he reminded them that in the Navy, a man was required to receive first a course of training in the various branches of naval science before he was called upon to decide whether he would follow an executive career or an engineering career. In that way many of the difficulties that had arisen in the past had been overcome. He thought the parallel with naval practice held good in the case of chemical technology. Finally he congratulated the Society on having its affairs under the guidance of such a man as their President, and he asked

them to pass a hearty vote of thanks to him for his admirable address.

Sir WILLIAM RAMSAY, in seconding the motion, congratulated the President on the exceedingly capable manner in which he had filled his office. He warmly supported the President's remarks on the subject of organisation, and mentioned that the French Academy of Sciences had organised itself and formed a number of Committees for different purposes, and these Committees were so far recognised officially that their recommendations went straight to the French Parliament. All the scientific societies should now organise themselves for the good of the country, with the Royal Society as the centre; in that way their efforts would have far more weight than if applied individually. Regarding the President's reference to the scheme of Industrial Fellowships, Sir William said he believed the scheme to be an admirable one, which could be applied in this country with great advantage. One of the difficulties was that the English manufacturer was apt to regard his chemist merely as part of his machinery, and did not allow him to know what was going on in the works. In America they had an excellent system by which a young chemist was allowed to see everything and to learn everything in a works. The English system had done more to hinder progress than anything else. It had been urged that a student should receive instruction in chemical engineering whilst still at college. It might be possible, however, to introduce a scheme whereby the student could spend some part of his four or five years' course in a works, as a kind of apprentice, and in that way he could obtain practical experience.

The motion was then put to the meeting and carried with acclamation.

ELECTION OF AUDITORS.

On the motion of Mr. H. C. CLANAHAN, seconded by Mr. F. TATE, Messrs. Feasey and Co. were re-appointed auditors at a fee of 20 guineas.

NEXT YEAR'S MEETING.

Prof. JAMES WALKER extended a cordial invitation to the Society to hold its meeting in Edinburgh in 1916. Edinburgh was now the headquarters of one of the Sections of the Society, and though the city could not claim to be a centre of chemical industry, yet they had around them such industries as brewing, shale distillation, and the rubber industry.

Mr. B. D. PORRITT seconded the invitation, which was accepted by the meeting.

THANKS TO THE MUNICIPAL SCHOOL OF TECHNOLOGY.

The PRESIDENT moved a very hearty vote of thanks to the authorities of Manchester for putting the building at the disposal of the Society.

Prof. H. E. ARMSTRONG, in seconding, said that the building in which they had met was a very fine example of the foresight of the City of Manchester. All those who were interested in technical education must feel very gratified at meeting in such a place.

Principal MAXWELL GARNETT said it was a matter of great satisfaction to the Governing Body of the Municipal School of Technology, to know that the Society was meeting there, and he would be happy to convey to them the thanks of the Society. The Municipal School had been recognised as of University rank, and was in intimate touch with the industries of the district. The supply of trained men from the school to the industries was not sufficient to meet the demand, and they frequently had difficulty in persuading men to remain at the school for post-graduate research. He believed that the prospects of education in chemical technology were brighter than they had ever been

before, because it was being recognised that faculty training was possible by means of technology as well as through mathematics at Cambridge or "Greats" at Oxford. Further, they were gratified to hear that the Government proposed to increase the grants in aid of technical education and to encourage research.

At the close of the meeting the members were entertained at luncheon by the Manchester Section in the Hall of the Municipal School of Technology. About 180 members and guests were present.

After luncheon the PRESIDENT briefly proposed the toast of the Manchester Section, Mr. HÜBNER responding.

WEDNESDAY AFTERNOON.

At three o'clock the President introduced Mr. W. Hulme Lever, who read the following paper on "Co-Partnership in Chemical Works," on behalf of Sir William Lever, who was unable to be present owing to his having to attend a Government Committee.

CO-PARTNERSHIP IN CHEMICAL INDUSTRIES.

BY SIR WILLIAM H. LEVER, BART.

You have invited me to say a few words on the subject of Co-Partnership in relation to the chemical industry, and I have welcomed the opportunity you thus gave me of doing so, although it has not been a duty easy of fulfilment, owing to the fact that we are living in war times, and that during war a greater demand is made upon the time of each of us than when we are following the routine details of our business under the normal conditions of stable peace.

Lessons of the war.

There is an old saying—"In times of peace prepare for war." I think the opposite of this is more applicable to-day, and is no less true—"In times of war prepare for peace." The industry with which you are all connected, and of which the soap business is a branch, is known as the chemical industry; and we have become accustomed to hear it stated on public platforms and in the public press that we British have allowed the Germans to acquire the lead in the fields of chemical industry. When we examine into these claims we find that it is not because the Germans have originated more inventions, or made more important discoveries, than either we British or our Allies—the French. On the contrary, we find that the initial genius of inspiration has not been of German origin, and that whatever advantages the Germans may have acquired have been accomplished by their better industrial organisation, and the better financial support given by their banking institutions and by their Government. This war has given us our awakening. Our industries will be stimulated to organise efficiently as a direct result of this war; but do not let us fall into the common error, prevalent to-day all over the world, that the only thought we need to give is to the attainment of efficiency in mechanical appliances, in chemical knowledge, and in banking arrangements. These must all receive the fullest consideration, and there would only be one disaster worse than neglect of these essentials, and that would be the neglect of the human element, without proper consideration of which our industries cannot be efficiently carried on.

The man behind the gun.

Every war correspondent tells us that more important than the gun is the man behind the gun; more important than the Dreadnought are the officers and sailors manning the Dreadnought. Neither you nor I need to be told that this is

equally true in industries, and as this country has produced the best man to place behind the gun and bayonet, and the best men to staff the Dreadnought, so, equally, this country possesses the best material for staffing laboratory, works, and offices. The chemical industry is not solely and only a question of science and capital. The managers and workmen are of still greater importance, and it is merely a platitude to say so, and yet there has never been any really organised effort to study the mind and characteristics—delicate and intricate—of the human machine. If you were asked what would be the effect of certain acids or alkalis, or temperatures, or pressures, or vacua, in producing certain results under certain conditions, you would only require to be told the problem, and your pencils would be hurrying over half sheets of note paper, and you could give a definite, exact scientific answer to the problem. But if any of us were asked what would be the effect of certain conditions of employment in industries, I venture to say that we should each of us find it much more difficult to answer such a question from any scientific basis, available at the present moment, of the human element.

Problem of the human machine.

And yet there is no combination of forces or chemicals so delicate and intricate as the mind and body of the human machine, and for this reason—that no two human minds and bodies are alike. You find that "A" is best influenced if handled in one way, "B" if handled in another way, and "C" must be handled entirely differently to either "A" or "B" to get the best results from "C." You will all remember the story of the Englishman, the Irishman, and the Scotsman, and their mental attitude on leaving the train at the terminus, which, if I remember rightly, was somewhat as follows:—The Englishman jumped out and forgot his belongings; the Irishman jumped out with his belongings; and the Scotsman, after picking up his belongings, looked round to see if the others had left anything behind. Now we only know from experience the mental attitudes of our fellow men. We should class Scotsmen as cautious, but we know that all Scotsmen are not cautious. We should class Irishmen as hot-headed, but we all know Irishmen who are as cool and calculating as any Scotsman; and as to Englishmen, we should probably class them as less cautious and thrifty than the Scotsman, but we all know of Englishmen who excel any Scotsman we ever knew in caution and thrift; and as to Jews, all the Jews that ever I have met have belied every characteristic of meanness and love of money the comic papers have ascribed to them. Such is the variable nature of the problem we have to deal with in handling the human machine. Now, if you are dealing with chemicals, you know exactly how they will act and react under given conditions. If we could be equally certain of the effects of various methods of dealing with the human machine, our problem would not be a difficult one.

Different views of profit sharing.

Under these circumstances, it is not surprising that profit sharing in industries has hitherto met with little or no response from employers, and has not proved attractive to employees. The Board of Trade returns show that the average life of profit-sharing schemes in the United Kingdom—and I believe similar results have been shown in the United States, France, and Germany—has been under five years. A profit sharing scheme is started with great enthusiasm, and great results are expected from it by both employers and employees, but not from the same point of view. The employer is bound to view the scheme in

relation to its effect in producing greater efficiency in production, and greater economy of material and care in avoidance of waste. The employee's point of view is that of some immediate increase in prosperity from the point of view of remuneration. Employees have not yet realised that we are all servants of the public, and that the public are the final masters and employers of capital, management, and labour, and that there is no harder taskmaster than the public. Employers know this, and know that a lifelong devotion to the service of the public would not prevent them as, say, chemical manufacturers from being "scrapped," if I may use the term, by the public when a superior process of production of the commodities they manufactured had been discovered and applied by some other chemical manufacturer.

Labour as debenture holder.

Under these circumstances it is no wonder that the time-honoured system of wages and salaries remains master of the industrial field; and, in fact, whatever scheme of profit sharing may be adopted, the payment of interest on capital, and the payment of salary and wages to management and labour, must be recognised as the foundation upon which all profit sharing schemes must rest. But it is the opinion of some of us that the wages system does not go far enough with reference to the human element in business. It places labour and management in the position of debenture holders on the business; in fact, the law has recognised this, and the payment of salary and wages is made by law the first charge on all industries, and must be paid out of capital in priority even to the security held by the debenture holder. Now I ask each of you, if you ever heard of help being given by the debenture holder in the conduct of business? The debenture holder's attitude and frame of mind is to sit tight, receiving a moderate rate of interest and, as far as possible, absolute security; and it is only when the business is *in extremis* that he steps in and seizes the undertaking and shows some signs of spasmodic life in trying, at any rate, to make the business worth as much as will ensure him the safety of his capital. These efforts, like the action of an atrophied limb under temporary galvanic stimulus, all jerks and convulsions, are of very little use. Now, compare this attitude of the debenture holder with the attitude of the ordinary shareholder interested in the profits of the undertaking, especially when the ordinary shareholder sits on the Board of Directors, as is always the case in our best and most successful industries. There you have alertness and that tension of the bow which will ensure a correct aim, and that the arrow will reach its destination somewhere near the bull's-eye. You cannot get the best conditions under any other circumstances than direct personal interest in the results. Commonsense suggests to each of us that if this is the effect on capital when in the position of debenture holder, similar effects must result on labour as debenture holder, and that if the best results are only obtainable when the directors have a direct interest in the profits of the business, it must be equally true that the best results can only be obtained when management and labour are directly interested in the profits.

Inelasticity of present wage system.

In seeking to remedy this condition, we must remember that wages and interest on capital, as a system, have both stood the test of time. They are a convenient and logical system, even if they do not give us finality. At present we know that, whilst there are three distinct methods of payment to capital—namely, a low rate of interest, with all possible security for capital, as debenture

holder; a larger rate of interest, with less security for capital, as preference shareholder; and the remaining profits or losses for capital as ordinary shareholder—there is only one inelastic system for management and labour, namely, salary or wages. The owners of capital have the power of selection of the terms upon which their capital shall be employed, namely, as debentures at a low rate of interest, but with a maximum security; as preference shares, with a higher rate of interest, and some amount of security and some amount of risk; or as ordinary shares, taking the remainder of the profits with all the risks of the business. Just as it is found in practice that the debenture holder, and to almost an equal extent the preference shareholder, take little or no interest in the undertaking in which their capital is invested, so it is found that the sole impulse and inspiration for development, growth, and activity in industries, springs from direct interest in the results as represented by the holding of ordinary shares with possible profits or losses. When the board of directors are simultaneously ordinary shareholders, the greatest amount of efficiency, development, and activity can be attained. The very fact that management and labour are often relegated solely to the position of debenture holder, has reduced the efficiency of management and labour, and their interest in the undertaking in which they are engaged, to the level of that of debenture holder, which, as we all know from experience, is, practically, a minus quantity.

Remedy of co-partnership.

Now, whilst it is not in the power of any debenture holder, or preference shareholder, to do more than to provide his capital and receive a fixed rate of interest or dividend, it is in the power of the management and labour to do much more than to render more or less perfunctory service in exchange for salary or wages. The interest of management and labour can be encouraged, and quickened and stimulated to take the keenest interest in the performance of duty and in the well-being of the undertaking in which they are employed. The only way, logically, in which this can be secured, and the only way in which it can with justice be demanded, is by some system of profit sharing or co-partnership, in other words, to give to management and labour the same interest as that enjoyed by the ordinary shareholder in the success of the undertaking. I am sure we shall all agree in this, but here our first difficulty arises in the uncertainty of the human element. No assurance or guarantee of the rendering of this special interest, efficiency, and alertness can be either asked for or assured from management or labour in exchange for a share of profits or co-partnership certificates.

Founded on natural law.

Whatever firm adopts co-partnership must rely upon the operation of certain laws of human nature, which have been found to be as certain in their effect as, say, the law of gravitation, or the action of certain chemicals under certain conditions, and must allow a wide margin for exceptions to the rule. Now, one of these universal laws is that of enlightened self-interest, and the other is that all human nature possesses an intrinsic and well-ascertained element of goodness, what we often speak of as "decency," and which results in producing a desire to respond to fair, just, and reasonable treatment from the employer. I am certain that whilst there may be exceptions to the possession of this element of fairness and "decency" and desire to respond fully and whole-heartedly on the part of the employee, the principle on the whole mass of employees can be as certainly depended upon as the law of gravitation. And even in the few cases of exception to this law, if

a search be made, we shall find that there has been something interfering with the operation of the law, just as there can be interference with the operation of some well-established law of chemical reaction. Very often it is from an entirely erroneous impression upon the part of the employee, an example of the extraordinary ingenuity of some men in taking invert views of the motives of the employer. The principle of enlightened self-interest requires that we should, everyone of us, seek to achieve the best for ourselves by recognising the rights of others; but mere selfishness sees only a narrow, selfish aim and object in every act. I believe myself, truly, that as civilisation progresses, the highest form of selfishness will be the practice of unselfishness, but we have not arrived at that stage yet; and when disappointing results are experienced from the extension of the benefits of co-partnership you may depend upon it that it is not the principles that I have mentioned as inherent in human nature that have failed us, but that their operation has been interfered with, just as some law of chemistry can be interfered with, and the human machine has been prevented from properly operating by some wrong view which could and ought to be removed.

Employees' interest in avoiding losses.

The employees, as a whole, who have been placed as co-partners in the position of being interested in the profits of the business they are engaged in do respond, with very few exceptions, when co-partnership has been in a spirit of fairness extended to them by the employer, notwithstanding that there may be ignoble exceptions. An increased interest in the business is bound to follow from employees who have received co-partnership certificates, and who are interested in the rate of dividend paid to the ordinary shareholder.

This interest must rest not only on the advantages of profit sharing, but also on the possibility of loss sharing; in fact, the two must be linked together, or no good result can be achieved. Many of the strongest efforts each of us put forward are made to avoid losses; very often we are called upon to work harder to avoid losses than in the actual production of profits; and, under a co-partnership scheme, if a business receives a set-back from losses and the rate of dividend is reduced, the co-partner employee participates with the ordinary shareholder in these losses. And so this element of loss sharing becomes just as essential and necessary to a co-partnership arrangement as the element of profit sharing. The loss sharing must be just as real to the employee holder of co-partnership profit sharing certificates as to the holder of ordinary shares in the business. We each of us know for ourselves that when we are glancing through a stock and share list, we are specially diligent in observing the market quotations of those companies in which we are particularly interested, and that the companies in which we are not shareholders, either presently or prospectively, receive but a very passing notice. This rule must be equally true of the employee. The business in which the employee is engaged for salary or wages only, without any direct interest in the profits, can receive but a very passing interest as to whether the profits are large or small. It is not human nature to have it otherwise. On the other hand the employee who is engaged in a business, either as manager or workman, on salary or wages, and who is also a co-partner or profit sharer, will be one to whom the profits are of vital interest.

How employees can share loss.

In adopting any scheme of co-partnership or profit sharing, we must therefore admit, as a basis, that the employee must receive salary or wages, otherwise he would be unable to live, and

we must also recognise that he cannot take the ordinary risks that capital can take. His skill and labour, in fact, are his capital, but a capital that cannot be stored. It must be used to-day because it has only a value to-day. Cash capital can take risks that management and labour capital cannot take. Therefore the loss sharing that management and labour can take is the loss of profits. We speak of capital as if it were so much money, but we know, each of us, that our capital in any business is represented by certain lithographic scraps of paper called shares or certificates, and that these have been acquired as the result of labour. They represent our labour in past years. If our labour of past years had not acquired what we call these investments, then the benefits to ourselves of that labour would have been lost to us for ever.

System of co-partnership certificates.

Why should we not apply this principle to the employee, and give each year, in addition to salaries or wages, co-partnership certificates entitling him to a share of profits in the business? I see no difference myself between the shares acquired by money, which money was acquired by labour of brain and body, and the certificates, representing no cash capital, but, all the same, acquired by labour of brain and muscle and entitling the holder to a proportion of profits. This system would meet the difficulty of the employee who has not cash capital to place at risk. It converts into certificates the only capital the employee has—namely, his services—and offers the employee opportunities each succeeding year of converting his services, not only into salary or wages for the maintenance of himself, his wife and family, but also into an ever-increasing share in the profits of the business. This system is applicable to all undertakings except a very limited few employing, as a rule, a very small number of men, and where the employee can render no corresponding service in return; but even in these limited few we often find this same principle has been applied. For instance, there is no occupation that is more personal than that of a barrister, and yet we find that the barrister's clerk, by long established custom, receives a percentage on the fees paid to his chief. I very much doubt whether any solicitor or client engaging the services of any barrister, considers for one moment who may or may not be the barrister's clerk; yet I am certain the practice of giving a share of the fees to the barrister's clerk would not have survived if it had not been found that in practice it was profitable for a barrister to continue this system, which has been handed down to us from the wisdom of our forefathers. As far as my knowledge of the history of profit sharing in the past would enable me to form an opinion, I should say that our forefathers did practise profit sharing with their staff to a much greater extent than the same is practised to-day; and yet in those days the personal touch of the master was much closer with his staff, and his personal knowledge and supervision of his staff was also greater than is possible under twentieth century conditions of productive enterprise. My contention would be that because of the fact that the larger the industry and the more complex its organisation, the less it is possible for the board of directors, or the supreme management, to know personally of the individual characteristics of the thousands of employees engaged under their direction, that, therefore, it would become essential that there should be some co-partnership system introduced into our industries.

Applicability of the system to chemical industry.

I know of no industry to which this applies with greater force than to the chemical industry. A

British chemical industry, founded upon the principles of co-partnership, with employees trained and instructed as to what these co-partnership principles meant, and realising the opportunities co-partnership offered them, would surely possess employees superior to those of competitors in Germany, or elsewhere, under mere wage and salary conditions.

It is more difficult in the chemical industry than in any other industry to assess the services of each member of the staff, whether as inventor, developer of the inventions of others, or organiser, or rank and file employee carrying on the routine process of production. We all of us find an increasing difficulty in gauging the results financially of new developments in chemical industries. Some of the greatest disappointments we have each of us had in our businesses have followed upon the greatest prospects of success. It only wants a chemical process to be delayed in the realisation of full success for losses to result instead of profits. Sometimes the smallest and most insignificant means of development have produced the most profitable results, and often the most costly experiments have produced nothing but losses. It must, and can only, be viewed as a whole, and the success of the industry can only be gauged by the success of all its parts. It is an absolute essential to success in the chemical industry that new and costly experiments should be made, and for expensive plant to be installed which may afterwards have to be scrapped. It would not produce that spirit of comradeship and feeling of fairness to discriminate in giving a share of profits between the various members of the staff engaged in various departments of these new experimental developments. It is always possible, by means of salary, to make special recognition to the possessor of special abilities for the solution of difficult problems. Yet the possessor of these superior abilities might fail in the solution of some difficult problem, whilst another, possessing inferior knowledge and inferior ability, might succeed with an entirely different, and what might prove a problem easier to bring to a profit-earning successful conclusion. These adjustments of abilities can best be made in salaries; but the broad success of the undertaking to which the unsuccessful experiment may have equally contributed with the successful experiment, because that ground had to be covered, as men have to cover mountains in search for gold, and cannot discover gold without many borings without results—the broad success of the business can only be recognised, so far as the employees are concerned, on a system of co-partnership; and I cannot help but think that, working on these lines, the whole staff in the chemical industry, as in all other industries, would respond.

Faith in human nature.

I have the utmost faith in human nature, and I believe that human nature can be trusted and depended upon nine hundred and ninety-nine times out of a thousand to respond to fair, just, and proper treatment. The old school-boy love of fairness and justice continues with all of us right through our lives. Often when we are disappointed with effects produced by co-partnership on employees, if we will search a little deeper we shall find that we have overlooked some point or other in our arrangements which has prevented the best results being attained. In other words, to use a chemical parallel, our temperatures may have been wrong, or our catalyst may have been poisoned, and not until we discover the right temperature and prevent the poisoning of our catalyst will our system succeed as it should do. Equally so, as we are in the very infancy of the study of co-partnership and profit sharing with

employees, it may be that we have not yet got all of the details correct, without which the transmutation from a lower value to a higher value cannot be achieved.

Rules for present-day co-partnership schemes.

I would like, in conclusion, to call attention to certain well-defined rules that must be followed in any co-partnership or profit sharing arrangement under present conditions. Some of these rules will always require to be observed; others, I hope, as time progresses, will not be necessary.

1. Profit sharing or co-partnership must not degenerate into charity or philanthropy.

2. Its objects must be the increased success of the undertaking, with increased prosperity for all connected with it.

3. It must not place management in the position of servant to labour through liability to criticism and censure.

4. It must ensure to labour freedom from interference of management in the enjoyment of the benefits derived from profit sharing.

5. It must possess greater stability than a mere system of bonus cash payment.

6. Its benefits must be felt by the wives.

7. It must have a distinctly elevating tendency on management and labour, raising them in the social and intellectual scale, and increasing their power for enjoyment and happiness as well as their power of usefulness.

8. Control must remain with those who find the cash capital.

Basis not philanthropic.

The whole basis of profit sharing or co-partnership cannot be other than enlightened self-interest for both capital and labour. Any other idea would be destructive to the self-respect of the employee, and lead to confusion from the point of view of capital. Philanthropy is own sister to charity, and charity is the mother of pauperism. There is no room for philanthropy in business, there is no room for maudlin sentiment; but there is ample room for a better and improved industrial relationship between capital and labour, one in which labour can become, equally with capital, interested in the results of the undertaking.

Certainty of results.

Wherever this system can be tried, and has been tried, it has always produced the very best results—from the case of the fisherman, either under sailing boat conditions or steam trawler conditions, whereby the value of the catch has a bearing upon the amount of payment received by each member of the crew, from the cabin boy to the captain, and many other examples which might be named. Even in time of war the introduction of prize money, and rewards of honour for exceptional individual service, have always produced their effect; and it has always been recognised that these systems were of value to the nation. A naval or military system under which the whole of the prize money, or the awards or decorations, went entirely to the officers and none to the rank and file, would be viewed by the whole nation as impossible and grossly unjust; but under modern industrialism we are coming very nearly to such a system as that. The excuse in industrialism is that the recognition of special services can be made in increases in salary, or increases in wages; but we are rapidly approaching a phase in industrialism under which, by collective bargaining, thousands and tens of thousands of men receive an absolutely uniform wage for a uniform number of hours, regardless of the fact that the work rendered by the units is not uniform, and never can be uniform.

Gains of co-partnership.

Only by a system of co-partnership, or profit sharing, can payment in addition to salary or wages be given. For not only is it true that wages are paid out of the product of labour, but profits must also come out of the product of labour, whether that labour is the brain and managing power of the directors and managers or the skill and labour of the workmen. The gain to the industries of the country by the adoption of co-partnership or profit sharing would not be confined solely to the stimulating of the direct personal interest of the employees. There would be another gain, which would be the release of the directors and high managers to devote more of their time, freed from minor details, to the consideration of larger problems requiring attention and solution. The present salary and wage system may bind in fetters the employee, but it is only another illustration of the truth of the old Egyptian saying: "The chain that binds the captive holds the captor." By giving a direct personal interest to the employee, less personal supervision by the employer will be required, and the employer will be freed from the fetters that tie him down to close supervision of the employee. Partners are worth more than wage drawers, and when each employee, in proportion to his ability to affect the result, has become interested in the joint product of brain and muscle, we shall then have reached a solid basis for the chemical industry, as for all other industries; and by freeing labour to participate in the products of its own industry, we shall liberate capital and management simultaneously for the enjoyment of a broader, higher, and more useful life.

DISCUSSION.

Sir WILLIAM RAMSAY said that he himself had had the advantages and disadvantages of all the three systems of employment and payment dealt with in the paper. There was no doubt that, however much a man loved his work, material considerations did enter. With the bonus system one was apt to think how much one could get out of the work, whilst with a fixed salary there was a tendency for the work to become perfunctory. The system Sir William Lever had advanced—what he might call the double system—seemed to be the best of all.

Mr. WALTER F. REID expressed his agreement with the principle laid down in the paper. It should be made thoroughly in the interests of the employee to do good work, but under existing conditions it was not possible to introduce such a scheme in every case. In many cases they found the employees themselves were suspicious of such a scheme, and did not appreciate its advantages. Benefit would accrue to the workman as well as to the employer, and the scheme should be introduced wherever it was possible. He was not clear as to the meaning of Rule 4, "It must ensure to labour freedom from interference of management in the enjoyment of the benefits derived from profit-sharing." If it meant that the workman could do what he liked with the money he obtained, he agreed. But it seemed to conflict with Rule 6: "Its benefits must be felt by the wives"; great difficulties were liable to arise when the workmen, feeling themselves partners in the concern, wished to modify the management in a way in which they were not capable. The workman might look on the whole undertaking as a co-operative one and the business and the workmen would inevitably suffer.

Professor H. LOUIS was much in sympathy with the general principle that Sir Wm. Lever advocated. It must be clearly realised that the future of the industries of this country lay in the hands of the

workmen. He was convinced that unless there was a great change in the attitude of their workpeople, the future of industry looked very gloomy. The attitude of too many was the same as that of the men in the South Wales coal mines to-day, namely: "I don't care about my country, all I care about is to get the money I demand." The only solution of the difficulty, probably, was to give the workman a share in the results of his labour. No doubt, much could be done by educating workmen in the principles of economics; but above all the economic heresy of the Trades Unions, that the less work done by the individual, the better for the working community, must be abandoned once for all. Education in economics should be a means of altering that mistake. Co-partnership, where he had seen it tried, had encountered serious difficulties. It was not possible always to ascertain profits over a short period, and yet frequently the workman would demand to receive his share at short intervals, and might be suspicious that he was not receiving his fair share of the profits. He did not care for contingent profits, and often did not want to save many or to increase his income. The workman often wanted higher wages solely in order to get less work and more time to play. In the Tyne-side shipyards it was always noticed that whenever wages were increased men lost time. He was not speaking against the principle of co-partnership, but he had very grave doubts whether it was the best method of interesting men. Personally, he had always favoured the bonus system. Some of the best work done in shaft-sinking and mining had been done in that way. Unless a man put in full time and worked at his job, he would not earn the bonus. He admitted that there were difficulties in applying it, but he thought that some form of bonus system was preferable to the co-partnership system.

Dr. CHARLES CARPENTER said they were face to face with the fact that the average workman to-day was not a contented person, and the average idea of workmen, in a mass, was that they were not receiving the fair share of the profits they were entitled to, and which they had every reason to think they should share. His own company had been working under co-partnership principles for 27 years, and he was very glad to know that Sir Wm. Lever was now one of its strongest supporters. Co-partnership had been tried by many undertakings throughout the kingdom, and in not a single one of the works, large or small, had there been any suggestion of failure. The practice was to make up the companies' accounts half-yearly, but the workman would not get a penny of bonus before July 1st. The result of the system was that they got a body of men who understood something of which the average workman was absolutely ignorant—that was, the principles on which industry in business was built up. Co-partnership stock could be taken out in the joint names of man and wife, and that encouraged wives to have some interest in the undertaking. He had had some experience of the bonus system, but his experience was that it did not encourage saving.

Mr. H. M. RIDGE said that a system of co-partnership had been tried in Germany and had been found to work extremely well. They did not let the men join in a joint-stock purchase, but they set aside a certain percentage of the profits (say 15%), and distributed it among the salaried staff, down to the foremen, according to their salary. This had been found to be a very good way of getting the best out of the men.

The PRESIDENT said he thought the case might be summed up very briefly. The point was that it was necessary to increase the interest of workmen in the work they had to do, and the question was, what was the best way to bring that about,

profit-sharing or bonus? Workmen were just as human as others, and an appeal to the pocket would have an influence on the work produced.

Mr. S. H. DAVIES suggested that a co-interest rather than a co-partnership scheme was under discussion, and asked whether it was customary to hand out the "scrip" with regard to the quantity or quality of the work done. If not, did it apply to all workmen? If stock were simply handed out and collected again when the man left the business, then it was simply a bonus system. Personally, he did not believe any true co-partnership system had yet been evolved.

Professor W. A. BONE was of the opinion that the working of the principle which had been brought before them would not be difficult where the profits were certain and were steady, as, for instance, those of a big gas company, which had a statutory monopoly of supply in a given area, together with limitation of profits on a sliding scale, based upon the price of gas. But it was very difficult to apply the same principle in industries where the profits were uncertain and fluctuated considerably from year to year, as for instance, in the iron and steel industry. One must discriminate. The principle would have to be applied to different branches of industry in different ways.

Mr. J. H. HOSEASON thought that the whole question was not one of masters and men, but of a national asset. There was a great need for recognition of the importance of discipline. The English working-man did not understand the meaning of discipline. Discipline was good both for masters and men. Nothing would ever be settled in labour troubles until trades unions divided their men into separate classes, because, as had been pointed out, men were not alike and equal. No man was exactly equal to another man.

Mr. THOMAS TYRER said that he had been accustomed to apply the principle of rewarding men for new ideas or improvements, however trivial. He thought that was fair treatment, but in the last few years, a different spirit had operated among workmen. If a man did not feel some interest in the results of what he was doing, that man became careless. He (Mr. Tyrer) had not yet seen that that evil had been got rid of, or that the difficulty would be got over by the propositions put before them by Sir William Lever. A uniform wage was a uniform curse, and it was impossible to have equal work all round. In many cases, one man expected the same wages as another, but was not fitted to do the same work. Now they were faced with the difficulty that some men had gone to the front, and others to the docks because they got higher wages. Men who were not fit in the slightest degree, demanded the same amounts, regardless of the tasks. They were untrained and thriftless. Under ordinary circumstances one would not have them. After the war it would be difficult to get the men to work for less than they had been having for some time.

Mr. HULME LEVER said that in the case of Rule 6, when a co-partner died, his co-partnership certificates became exchangeable for preference share certificates which became the property of the widow. Instead of getting a fluctuating co-partnership dividend, as in the husband's life-time, the widow got a fixed dividend of 5%. Thus the wife felt that she became insured against the time when she might become a widow. The difference between the bonus principle and the principle of payment under the co-partnership principle, was, that in the case of the bonus, the man was paid for something he had achieved, but in making him a co-partner, he was put on the same footing as the ordinary shareholder. There was a great difference between co-partnership

and the bonus system, in that the bonus was a consideration paid for something achieved, and it did not in any way put the recipient in a position similar to that of an ordinary shareholder.

ANNUAL DINNER.

The annual dinner took place at the Grand Hotel, Manchester on Wednesday evening, July 14th. The President (Professor Henderson) presided over a large gathering of members and invited guests. In view of the fact that the dinner was an informal one there were no speeches.

THURSDAY, JULY 15TH.

The President took the chair at 10-30 a.m., when the following papers were read and discussed:—

RESEARCH AND CHEMICAL INDUSTRY.

BY DR. M. O. FORSTER, F.R.S.

So much has appeared recently in the press, both general and scientific, regarding the bearings of research upon industry, that in addressing an assembly of chemists it is quite superfluous for me to "reconstruct the crime," namely, that whilst holding the priceless initial advantages of early discoverers and unlimited raw products, this country has relinquished, practically without a struggle, a scientific industry of which the educational value far outweighs even the rich material harvest garnered in consequence by another land.

It is not my intention to review the outward circumstances attending this moral and intellectual humiliation. Those circumstances are known in greater or less detail by all present; they have been ably surveyed by Professor W. H. Perkin in his Presidential Address to the Chemical Society (Transactions, 1915, 107, 557), and crushingly epitomised by Professor Percy Frankland in his address to the Birmingham Section of our own body (Journal of the Society of Chemical Industry, 1915, 35, 307). I have been requested rather to open a discussion on this painful subject in the hope that others may bring forward views or proposals calculated to assist in removing the stain from our national shield. I welcome the occasion because I am convinced that the opportunity to set our scientific house in order will never recur. I go further, and say that if through our own apathy or that of governments and people this opportunity to bring about a revival of scientific thought, and of its application to social and industrial advancement throughout the Empire is not seized, nothing can save us from sinking, more or less rapidly, to a secondary position in the class-list of nations. We know the strength of our opponents; do we know our own weakness? This country, in which public opinion is stronger and more healthy than in any other, and in which public opinion has more influence on the life of the nation than in any other, nevertheless has not any public opinion whatsoever on matters relating to higher education or scientific knowledge. In the minds of the great majority of our people the very word "education," in its public as distinct from its personal application, is associated with pathetic squabbles concerning the circumstances in which the education should be given. If all the energy, thought, and genuine—if often misdirected—enthusiasm which have been devoted to this aspect of the subject had been concentrated on the subject itself, how different would be the situation of our people and our country at the present time. Trifling as is the public interest in the real essentials of elementary education, it is vivid and absorbing compared with their appreciation of scientific education, with the result that the pursuit of chemistry has never been held out as a career in the sense that medicine, law, engineering, and commerce are careers. Consequently, the average substantial British parent, whose boy "goes in for chemistry," suffers

anxiety regarding his future comparable with that incurred by selecting music, painting, or the legitimate stage.

Hence it comes about that the majority of young men who enter upon chemical studies in this country do so as enthusiasts, with a bias towards the academic aspect of the subject, attracted more by theoretical problems than by the application of chemistry to industry. They have the enthusiasms and faults of hero-worshippers, having been nourished and stimulated by the numerous and wonderful researches which have gone to the construction of modern chemistry. Their three years' course is all too short for the assimilation of the principles of their subject, and at its close they are expected by parents and guardians to be fit to earn their living as chemists. More remarkable still, the manufacturer has sometimes thought that the newly-fledged recruit can improve immediately upon his long-established methods, offers him 35s. a week to try, and is hurt and disappointed when he fails. This brings me to the first joint in our chemical harness. Chemistry is not a "career" as understood by the public from whom chemists should be drawn, and until it is recognised as such, the type of mind which would be anxious to apply chemistry to profitable ends, and is capable of so applying it, will join our ranks by accident alone. Such minds are wanted, badly wanted, in order to organise the research minds and to co-ordinate their products. This aloofness of the career-seeker is largely due to the stupid confusion which has been allowed to paralyse the career-seeker's parent in the matter of nomenclature. This country is notoriously a label-worshipper, largely in consequence of our intellectual laziness, for label-worshipping saves trouble. Politics, religion, schools, universities, professions—all are accepted by the label which they bear, and it is easily comprehensible, therefore, that the profession which has no label is ignored by the public. Not being legally entitled to call ourselves "chemists," we are driven to such subterfuges as "professional chemist," "works' chemist," "technological chemist," "consulting chemist," "research chemist," "analytical chemist," or even the worse abomination, "scientific chemist." How is a bewildered public which, from childhood to old-age, has perambulated, walked, hobbled, or driven past the "chemist's shop" (5 per diem for 70 years =) 127,750 times, to dissect out these subtleties? In Austria, France, Germany, Italy, Spain, Switzerland, the United States and other countries, this confusion does not exist, and it is no reflection on pharmacy, a calling which demands careful training and high personal qualities from those who follow it, to say that British chemistry has been grievously handicapped by the perplexity of the public on this particular point. A rose by any other name would unquestionably smell as sweet, always provided that the geraniol, citronellol, and phenylethyl alcohol were present in the right proportion, but chemists would smell much sweeter in the public nostrils if they did not have to open their intercourse with an explanation.

The next point I desire to make is that the initiative in employing chemists must come from the manufacturer; the converse process is impossible, for the newly-trained chemist or the young demonstrator is obviously debarred from touting for problems, and he cannot therefore thrust himself upon the manufacturer. The latter should have at least a rough idea of the kind of work produced at any particular college, and make a selection of the people who might be useful in dealing with his aspect of the subject. If he is not disposed to employ them on his premises, he could at least provide them with raw material or with problems which, if successfully handled and solved,

would not only help him, but would give the instructors in that college the scent for technical inquiries. This would provide the first requirement in a course of genuine technology, a stimulus, and I am convinced that scores of chemists have been lost to industry from the absence of this connecting link. The young demonstrator, anxious and willing to work at anything useful, would be thrilled and exhilarated by a kilo. of waste material from Messrs. X. and Y.'s manufacturing process, and a request to ascertain whether any valuable constituent was being thrown away; his mind would be directed forthwith into that particular field of industry, and whatever he found, even if it amounted to nothing, he would insensibly become potentially more useful to Messrs. X. and Y., so that if these gentlemen ever did summon up courage to employ a chemist, he, or the post-graduate student who had helped him, would be a suitable man to engage. This kind of association between the manufacturer and the college would not take bread from the mouth of the consulting chemist, because Messrs. X. and Y. would probably not have consulted him in any case unless they had been confronted with some unusual dilemma; they certainly would not have thrown away ten good guineas on anything so uninteresting as waste products, because they are only just beginning to realise that the utilisation of such materials will sometimes determine, from the commercial standpoint, the success or failure of a process.

In my belief, this chasm between the college and the factory is responsible for as much mischief as any other circumstance, for, quite apart from the fact that it is bridged in Germany and the United States (for France I cannot speak with first-hand knowledge), the estrangement proceeds in a vicious circle. The factory ignores the college, the demonstrator is not caught young, he therefore grows into an academic professor who, having become deeply interested in theoretical problems and shy of industrial ones, diverts each generation of students more and more away from the factory. The factory responds by despising "pure research," which is a fresh misfortune, because a nibble at research, and the acquisition of those habits of accuracy, responsibility, and inquiry essential to its prosecution, is the minimum qualification with which a diploma-student should be equipped on entering the factory if he may hope to gain a position of maximum utility therein.

Proceeding from this reluctance of the manufacturer to employ chemists excepting when embarrassed by emergencies, there is an enormous loss of potential usefulness in consequence of the following circumstances, which are convincingly demonstrated at Ludwigshafen, Leverkusen, and Hoechst; they apply also to factories employing only fifty chemists, and in lower degree to smaller staffs. Excluding geniuses, the masculine make-up is mentally so ordained that although ample promise may be given at the age of 30, full development is not usually reached before 40, and in many cases even later. If, then, a factory staff of fifty chemists recruited at 22 or thereabouts, be allowed to develop under the influence of factory surroundings and requirements, there will prevail throughout the organisation an interchange of thought and outlook contributing to the highest degree of chemical development along the lines of individual temperament. The legal-minded man will gravitate towards the factory patent-office, the book-worm towards the library. The skilful analyst will become the indispensable and time-saving support of the discoverer, who will ransack raw or waste materials assisted by the man who has found his calling to be preparation. The machine-lover will devise new plant for translating grams into hundredweights, the human person, with less taste for deep study than a desire to knock about,

will become a sufficiently trained and agreeably pushing salesman. The whole point is that at 22, one is only dimly conscious of being either legal-minded, a book-worm, an analyst, a discoverer, a preparator, a mechanic, or a human person, and that, given the necessary chemical rudiments, a plunge into the above-sketched system is the best way for a young chemist to classify himself. Then, imperceptibly but surely, out of the fifty there will emerge a Duisberg or a Bernthsen, capable of running the whole team, observing the psychology of the newcomers, adapting them to the departments for which they become clearly suited, and eliminating those who are not destined for any department at all. In a word, the factory becomes a Technological University.

It may be argued that this is a counsel of perfection and beyond the capacity of this country to adopt. If that is so, this country must be content to relinquish its position in the world. The age of pioneering in the rough-and-ready manner, that kind of pioneering in which the British national genius is easily first, draws rapidly to a close, and on to this character, which will still have great value, there must be grafted a willingness to study patiently, and a capacity for combined effort. In my belief it is foolish, and wickedly foolish, to suggest that the fine chemical industry has been stolen by Germany rather than earned. Foolish because it is not true, and wickedly so, because, by pandering to our national vanity and suspicion of learning, it leaves the real seat of the disease untouched. What has really happened is that Germany has recognised more quickly than we have that clearing the ground is only the first step in building a house, and that if we want to build one also we must employ architects and builders. I am endeavouring to emphasise the factors which, in my belief, are the principal causes of failure in the past, but in doing so, it must not be supposed that I hold ourselves blameless. We chemists also are inculpated, although on different grounds. In the past we have not pulled together as we should have done. Faraday entered the service of science imagining that its pursuers became "amiable and liberal," but his disillusionment remains the disillusionment of many to-day. We are not, I hope and believe, less loyal to one another, less generous-minded, vainer, or more jealous than the general public, but we cannot place ourselves on any lofty pedestal in this respect. Such human failings, and occasional deficiencies in a sense of business responsibility, have sometimes alienated the sympathy and trust of the business world, and confidence must be restored before the new era can dawn. In the process of national stock-taking which the present terrible discipline has instituted, we chemists may learn our lesson too, and realise that co-operation, organisation, and single-minded devotion to the first principle of scientific work, namely, truthful and wise judgment, must henceforth be our only watchwords. In moments of frankness, the citation has fallen lately from the lips of many a business man. I make no pretence of escaping it myself, and my fidelity to chemistry and chemists is undiminished, but some one must say these things, and they must be taken to heart, otherwise the present opportunity will be squandered, as opportunities have been squandered in the past. My only reason for an unvarnished reference to such points is that, like the rest of the nation, British Chemistry is on trial for its life, and it is quite as certain as any other natural process, like the succession of day and night, that unless we review our own weaknesses, and shed them like filthy rags, we shall not stand in shining raiment before the judgment-seat of posterity.

On the academic side, for which alone I am in any sense competent to speak, there is certainly

room for improvement. In the past, we have been victimised by the principle of the hole-and-corner. Appointments to important posts have been sometimes made in the most casual manner, and through the preponderating influence of distinguished and benevolent gentlemen who have either never been in close touch with the persons and principles involved, or have, by passage of years, long ceased to be in touch with them. It is all part of our absurd system of assuming that because a citizen has reached a commanding position in one of the recognised careers, he is therefore competent to exercise a determining voice in the adjustment of everybody's difficulties, and it arises also from the national intellectual laziness, since it appears to save trouble. But life is becoming much too complicated for the universal genius, and like all processes which "save trouble" on inverted premises, it only makes trouble, including England's present difficulties. On this question of appointment to higher posts, for instance, would it not be much more practical if the selection committees, as at present constituted, were limited in their duties to laying down the conditions, weeding out all but six or eight candidates, and having requested the candidates themselves to select the best of their number, reporting this decision to the superior body, which could still exercise the veto if necessary? This device has obvious advantages, prominent among which is the fact that in a small profession like our own, the six surviving candidates for a chair know far more about each other's capabilities and real character than the selection committee are likely to know. Another advantage would be the curtailment of what may be called appointment by clan or school, which sometimes fails to select the best man because he belongs to the less powerful combination, or because he does not belong to any combination at all; it is a lamentable extension of the trust system to patronage, and is based on the totally erroneous hypothesis that any old pupil of the distinguished professor is better than the best of the undistinguished one. But a less obvious, although incalculably more sweeping advantage, would be the cultivation of independence among us from the very outset of our life-work. It is inevitable, and in fact, wholly proper, that the young chemist should receive his early employment by patronage in its undegraded meaning, because the patron is usually the only person who knows anything of his possibilities; but he quickly finds that in prevailing circumstances promotion depends quite as much upon avoidance of offence as upon professional achievement, and this discovery may have the most warping and mischievous effect upon all but the most robust characters. No chemist who has intimate knowledge of the system can deny the existence of this evil, and every academic chemist who has reached middle life could, in a heart-to-heart conversation, give examples of its deplorable results. The same principle applies to selection—or non-selection—for membership of that august body which, as this is an academic discussion, I will entitle The Imperial Association. Every year two harassed and thoroughly conscientious councillors are subjected to all sorts of well-meant influences in favour of the various fifteen or twenty candidates in the subject which they represent. The work of some of these candidates they do not know, or temperamentally cannot fully appreciate, and as decency forbids the public exertion of the well-meant influences, these inevitably operate in holes and corners. Candidates, potential or kinetic, know perfectly well of this, and it is humanly impossible for them to escape entirely the effects of their knowledge. The whole system seems to me utterly wrong, and would it not be better in this case, as in the foregoing one, for the candidates

themselves to select the fortunate couple from their number, or for the whole body of chemical members to relieve the two or three councillors of their burdensome responsibility? I am aware that the proposal is revolutionary, but we think rapidly nowadays, and twelve months ago, he would have seemed crazy indeed who predicted that, within the year, Westminster would be innocent of Party and Hyde Park undecorated by the purple, green, and white.

Far from being discouraged by the outlook, I believe that British Chemistry will gain strength and vitality from its ordeal. There is evidence, on more sides than one, that the body politic and the people of which governments are made, are anxious and willing to render helpful service in the resurrection for which we long, and the final outcome of their repentance is largely in our own hands. Two examples, one commercial, the other political, will suffice to illustrate this evidence. In a pamphlet entitled "The Aniline Dye Question," by Mr. Charles Diamond (a member of the Users Committee), among the concluding passages there occurs the following:—"We have shown that as a people, as nations, and as an Empire, we have not feared to meet the armed might of Germany. But battles won by the sword are hardly more necessary or vital to us than those we must win in the paths of peace. And of our peaceful pursuits, our trade, industry and commerce are not the least important. This national effort, if successful, will make for higher and better scientific education, and will promote and develop other important subsidiary enterprises. It will teach us the power and utility and need of combined effort on a large scale, and will assist to break down the isolation, narrowness, jealousy, and all-for-selfness, which hamper National progress. Here again there is much to be learnt from the Germans. It will also give us much-needed confidence in our ability still to hold our own even in the most difficult circumstances. It will help us to elevate and dignify industry by organising it on a scientific, educational, and intellectual basis. What it would be worth to this country in reputation, as an advertisement, if you like, apart from more tangible and distinctive results, to show the world that the British people have it in them to match their greatest rivals even in their proudest performance?" These are wise and encouraging words. Some months ago, the Royal Society and the Chemical Society presented separate memorials to the Prime Minister, setting forth the urgent necessity of taking State action for the purpose of bringing scientific workers into closer co-operation with the leaders of industrial enterprise, at the same time requesting him to receive a deputation. Mr. Asquith empowered his colleagues of the Boards of Trade and Education to receive these deputations from the two societies, representatives of which accordingly met Mr. Runciman and Mr. Pease, who were supported by the leading permanent officials of the two departments, on May 6th, the proceedings being reported in the daily newspapers of May 8th. On the following Thursday, May 13th in the House of Commons, Mr. Pease announced the intention of the Government to institute forthwith an Advisory Council on Industrial Research, with the object of bringing our universities and technical colleges into closer association with industry, and to bring our industrial leaders into co-operation with skilled workers. The Minister proceeded: "I hope to place on the Estimates for the current year a sum between £25,000 and £30,000, but the demand for money for this purpose will enormously increase as time goes on, and I want to inform the House that whilst we are beginning with this comparatively small sum we think it will develop, and if the scheme is to succeed I believe it must depend upon State help in the years to

come, and State help must steadily progress." The political rearrangement which took place during the Whitsuntide recess is no doubt responsible for some little delay in the elaboration of a Government programme, but we cannot at the moment complain that we have pleaded in vain.*

To summarise the foregoing remarks, I would say that the first necessity for a closer union between research and industry is the development of a healthy public opinion on the subject of acquiring knowledge in general, scientific knowledge in particular, and more important than either because it covers both, national wisdom. In order to do this, speaking bluntly, our Governments must advertise scientific methods of business and education by the employment of such methods in their own operations. This is no more undignified than raising an army by advertisement, and after all, what is advertisement but the act of making known, in a word, education itself? In the establishment of such public opinion an important place should be given to the work which chemists do, the part which chemistry has played in the national economy, and the possibilities offered by a wider application of chemistry to industry, in order to attract to our ranks that type of young man which is able to use a chemical training as a weapon for making chemistry pay. Next, although many enlightened manufacturers already make good use of chemistry, their numbers must be increased, and the newcomers must not be too quickly discouraged by what may seem initially an unprofitable investment; one of the ironies of our present position is that a yearly outlay on chemists and a laboratory, moderate even if regarded as a frill or luxury, would often make relatively small inroads into the profits of a concern, whilst if regarded as an investment would be positively gilt-edged compared with many of the enterprises for which the public are invited, frivolously but successfully, to subscribe millions. To quote Mr. Diamond once more, "Bankrupt Turk and Egyptian, American industrial and other wild-cat schemes, South African or other Colonial or foreign, land, or financial or commercial, mining or timber enterprises or ventures or swindles, have all got their millions or tens of millions from the British public. Promoters have had enormous profits from hundreds of shaky home flotations, and all this with little or no inquiry or investigation or foresight on the part of capitalists, traders, or other investors." On the other hand it has been recently claimed by Mr. W. J. Dibdin, for many years Chief of the Chemical and Gas Department, Metropolitan Board of Works and London County Council, that "the operations of the Chemical Department of the London County Council and the Metropolitan Board of Works effected a saving in one particular item of £10,000,000 capital expenditure to the ratepayers of London," and he added, "the ratepayers of London have acknowledged the work done by its chemical technologists by abolishing the Department." Such misdirection of effort can only lead to disaster. It is not to be expected that when the war is over there will be any mitigation of *Gott strafe British Dyes, Limited*, and any other industry which ventures to raise its head, and the situation must be faced with resolute courage and all the resources of our people, both material and intellectual. In the next place, by some process which I cannot clearly foresee, but which must inevitably depend upon sympathetic pharmaceutical agreement, a means must be found by which the respective activities of chemistry and pharmacy may be differentiated in the public mind, so that existing vague ideas on this matter may be clarified. Concurrently with

* Particulars of the scheme were published on July 28th (see p. 733).

the removal of these notes from the eyes of other people, we must pay attention to the beam or two in our own. If the operation is carried out cheerfully, courageously, and conscientiously, our scientific descendants may have to bless this era as one of chemical regeneration, even if they do curse the ill-wind which wafted it to this country.

In conclusion, I venture to lay before the Society as a basis of discussion, the draft of a scheme for a Chemical Intelligence Department which, in my opinion, should be established by Government as a branch of the Board of Trade. Having placed this in the hands of Mr. Runciman and Mr. Pease on May 6th, I have secured the permission of these gentlemen to use it on the present occasion, making it clear, however, that it represents my own personal views, and not the considered opinion of the deputation as a whole. In doing so, I ought to mention that I had not then read the article by Sir William Ramsay which appeared in *Nature* of May 20th, and which covers a portion of the same ground. Furthermore, it is not contemplated that clauses A (2) and A (3) would conflict with the operations of chemists in consulting practice; on the contrary, under A (5), these clauses should assist in rendering those operations more widely appreciated, recognising, as I gladly do, that the work of such chemists is frequently more entitled to be called "research" than much that is published in the journals of unapplied science.

SUGGESTED SCOPE OF A CHEMICAL INTELLIGENCE DEPARTMENT TO BE INSTITUTED BY H.M. GOVERNMENT AS A BRANCH OF THE BOARD OF TRADE.

A. TECHNICAL.

(1) Classification of chemical discoveries at home and abroad as evidenced by (a) Patent Specifications, (b) Scientific Memoirs.

(2) Distribution of chemical information to scientific inquirers and to manufacturers seeking new developments or desiring to improve existing processes.

(3) Collection of information regarding the most suitable materials for constructing chemical plant and apparatus on a manufacturing scale, and the most convenient sources for supply of such plant and apparatus.

(4) Tabulation of the by-products arising in various chemical industries, and consideration of the most profitable ways of utilising these.

(5) Presentation of problems arising out of (3) and (4) to the numerous research chemists throughout the country, such problems to be offered under proper discretionary safeguards and with appropriate remuneration.

B. TECHNO-COMMERCIAL (by co-operation with the Board of Trade).

(1) Classification of foreign chemical products in respect of their distribution throughout the world, with ruling prices, tariffs, cost of transport, and where possible, cost of production.

(2) Classification of the resources of the Empire and friendly nations in raw materials, for the purpose of finding novel applications of these.

C. TECHNO-EDUCATIONAL (by co-operation with the Board of Education).

(1) Classification of data regarding opportunities for chemical instruction and research in various parts of the Empire, and comparison of these with those offered in foreign countries.

(2) Consideration of possible improvements and extensions in existing Imperial methods suggested by the information thus gained.

(3) Consideration and, where possible, application of methods by which wage-earners of good conduct and adaptability might be trained as technical foremen.

RESEARCH IN TECHNOLOGY.

BY CHARLES CARPENTER.

It is significant that the theme chosen by the Council for discussion to-day was given prominence in the inaugural address delivered by the first President of this Society in the City of Manchester thirty-three years ago. In then pleading the case for research as applied to Chemical Industry, Sir Henry Rosecoe expressed the belief that while the British manufacturer was often late in adapting his methods to the ever-changing circumstances of the time he was not often *too* late. There must be many in this room whose considered opinion a year ago would have been that such hopes had been in the main unrealised, and were even farther than ever from achievement. Disregarding the royal exhortation to "Wake up," the Country continued to surrender the care of its existence to political quacks whose skill lay mainly in mesmerising its reason and blinding its intelligence. A rousing, with terrible force, has come at last, and the Nation turns in its peril from false gods to Science, realising that civilisation unarmed by her is helpless. But it is useless to expect to find in distress an armoury unprovided in times of peace. By diligent, unremitting, and long-continued work alone can such provision be made, and this is no less true of chemical than of all other industries which go to build up the power designated as Applied Science.

Such is research, whether chemical or industrial. Both need undertaking equally, not only to provide present and certain requirements but future and possible ones.

The chemical industry of to-day cannot make progress without research of both kinds, that is why this Meeting is concerning itself not with particular processes or manufactures but with the broad foundations which are an absolute essential to the stability of that industry.

That research must commence with the chemist goes without saying. Circumstances have, however, changed since the inception of the first great chemical processes. The technical demands made by modern manufacturers are much more extensive and exacting, and sole reliance upon the chemist would be fatal to the realisation of success. Sooner or later the aid of the technologist must be called in. His equipment for the task has now to be discussed, and it will easily be seen that this is on a very different footing to that of his confrère, for it must be carried out on the large or working scale. Now surely here is an overwhelming case for localised centralisation if one fact, and one fact only, is borne in mind. It is not from or among themselves that the greatest competition is to be feared, but from producers over the seas already organised. Let, then, every special industry build up its own schools or institutes of technology, not only to provide training for workers, but so fully equipped with resources that problems of all kinds can be submitted to them for research.

It may be said that one manufacturer would be contributing to progress made by another. That may be true; but it would be better for him to put a small tax upon his profits for such a purpose than, by want of united effort, risk losing his trade altogether. It may be argued that the risk would be a great one in reposing so much confidence with the principals of such organisations. But if we distrusted our physicians, we should run the risk of being decimated by disease. Is there one in a thousand who does distrust his adviser in sickness? Why should the physicians of industry be less honourable, or disloyal? Such institutions as suggested would be clearing houses for troubles to which manufacturers would automatically turn whether perfecting an old process or working out a new one.

If as a nation we are to emerge successfully from the industrial battle which is awaiting us, we must pool not only our difficulties but their solution. When it is required to start new processes or adaptations of old ones, it will never do for each manufacturer to proceed as is now the case, viz., to start *de novo* and work out for himself methods of its industrial application which are already known and used in other directions. He would get it from the Institutes. If, as in some cases, the information as to certain methods or plant was confidential, he would be put into communication with the users, and matters might then be left to develop on ordinary business lines.

Put in another way, the proposal is that manufacturers should be able to draw upon sources of technological knowledge just in the same manner as does the chemist from a scientific library; without such aid the foreign competition of the future will never be mastered by them. Such centres of research as advocated already exist. It is not necessary to go outside this City for a splendid example of what can be provided by a far-seeing Council. Whether their provision is supported and its resources drawn upon by manufacturers in the manner suggested cannot be stated. But even when every industry throughout the land has its centre or centres of technological research, the structure upon which the nation's Chemical Industries is to be securely established is still incomplete, the arch is without its keystone, the bonding absent from each component. Their Directors have been likened this afternoon to the physicians of technology. Why should not technology, like medicine and surgery, have its college of control, inspiration and direction? State aided and therefore independent, keeping in touch with all technical progress and requirements through the media of the many associated institutes throughout the land, a Royal College of Technology would raise and promote Chemical Industry to the dignity it deserves as a branch of science, and encourage the utilisation of that knowledge which is fundamental to the maintenance of our position among the Nations of the world.

DISCUSSION.

The PRESIDENT said that during the year the Council of the Society had given very serious consideration to the question of a "chemical intelligence department." The adoption of such a scheme was attended with great difficulties because it could not be carried out without a very large expenditure, and some time would be taken up in working out the details. The Council had, however, elicited at least the sympathy of the Government in this scheme, and he still hoped that a chemical intelligence department of the Board of Trade would be established. Failing that, he hoped our Society might itself undertake it. There could be no two minds as to the value from the scientific and the commercial point of view of such a department.

Mr. H. M. RIDGE said that some years ago a Society had been formed in Germany in the interests of the producers of non-ferrous metals; that Society had sections to deal with special branches of industry, for instance a zinc section consisting of the managers and higher technical officials of the zinc smelting works. They met at the same time as the half-yearly meetings of the Society were held and exchanged experiences, confidentially. No reports of these meetings were published, since they were only for the mutual benefit of the members and for the promotion of German industry, but the system had given excellent results. He suggested that some such course might be followed in regard to parts of the chemical industry in this country.

Mr. F. H. CARR said he thought a chemical intelligence bureau, such as had been suggested, would be destined to failure if it were not well supported financially. Unless the Government were to provide the funds, he did not see how it would be possible to give the information free, which was the essence of value of such a scheme; if the information had to be paid for, then it was foredoomed to failure. Should such a Bureau be established by the Government, it was essential that chemical industry should be fully represented on the Board. Another thing which was very badly needed was a technological library in every great industrial centre.

Mr. R. H. CLAYTON said that they, in Manchester, had long felt the need of such libraries, and had endeavoured to enlist the sympathies of the City Council in the matter. It should be possible to provide and maintain out of the funds of the County, a technological library for each of the great industrial centres—Manchester for the Lancashire district, Leeds for Yorkshire, and so on.

Mr. J. W. HINCHLEY brought forward a suggestion made some time ago, namely, that the laboratories of colleges and universities might be used for making a number of rare or pure products which were required in small quantities only, and which were not produced in this country. That was work which could very well be done by post-graduate students.

Mr. MAXWELL GARNETT, replying to Professor Armstrong, said that the Manchester City Council was fully alive to the necessity for developing technology, and out of the £50,000 given annually for technical education, the School of Technology received £20,000. There was a small amount of unavoidable overlapping between the work of the mechanical and electrical engineering departments, but no other overlapping. The Council was working with the faculties in complete harmony. All the graduates of the School of Technology and of the Science Faculty of the University were at once absorbed in the industries of the district. It was true that a certain amount of elementary work was still done in the School of Technology, but that was due to its constitution: the old Technical Trade Classes were still carried on to a certain extent, but these were gradually being dropped, and more post-graduate work undertaken. As regards research work, he mentioned that the Manchester City Council had recently more than doubled their grants for research scholarships.

The PRESIDENT then put to the meeting the following resolution, submitted by Mr. R. H. CLAYTON:—

"That this meeting is of the opinion that central technological libraries should be established, at the public expense, in all the great centres of industry."

Sir WILLIAM RAMSAY suggested that it would be unnecessary to start another library in Manchester, where they already had a large University Library and City Library.

Prof. LOUIS dissented from the resolution, as he did not see why libraries should be provided for particular industries at the public expense. The manufacturers should provide libraries for themselves.

The PRESIDENT suggested that perhaps Mr. Clayton would withdraw his resolution, since it could carry little weight if it were not unanimous.

Mr. CLAYTON said he rather pressed the matter, because he did not think it was the duty of societies or private bodies to provide libraries. If the Corporation thought fit to provide £20,000 a year to maintain a School of Technology, he thought they were justified in asking for some assistance for an object of the kind proposed in the resolution.

Mr. W. F. REID said that if it were possible to establish technical libraries in different centres, it

would, he thought, help to have the resolution passed. The resolution would move, not only those millionaires of whom Professor Louis spoke, but also others of more modest means. He was sure, if they had the space, with the great generosity of the people, they would have a great many books given to them. Mr. Clayton had put the case very fairly and clearly. There was only one place he knew, where they could get the books and papers they wanted. It seemed unfair that those who contributed to the general rates should have to go so far as to London for their information. They might have something of the kind in the North of England. With regard to Dr. Forster's suggestion, he thought, if that were undertaken by the Government, it would cut the ground from their own Society and from the Journal, and it might interfere with the business of technological chemists and analysts. A large proportion of their members were technical chemists and analysts, and it might reduce the number of their members.

Dr. E. F. ARMSTRONG thought there was a good deal to be said for Mr. Clayton's proposition. A manufacturer could not be expected to spend £1,000 on a library for only one chemist.

Mr. F. H. CARR supported the resolution, and said that if a serious effort were made it would not be difficult to get the necessary funds. The first consideration was to have a library which was as complete as possible.

Mr. REID then submitted an alternative resolution, as follows:—

"That this meeting is of opinion that the establishment of technical libraries throughout the country is of urgent national importance."

Mr. CLAYTON accepted this amended resolution, which was put to the meeting and carried unanimously.

Dr. FORSTER, in reply, said he did not agree with Mr. Reid that the proposed Chemical Intelligence Department would prejudice the interests of professional chemists. On the contrary, he believed that it would result in more business being brought to them. As regards Mr. Hinchley's suggestion, he mentioned that whenever he had seen it tried, the cost of the products made had proved to be absolutely prohibitive.

He sincerely trusted that the recent deputation from the Royal Society to the Boards of Trade and Education would lead to a more intimate association of Government Departments and Scientific Societies in the near future.

THE DEVELOPMENT AND CONTROL OF INDUSTRY BY PUBLIC INFLUENCES.

BY HENRY E. ARMSTRONG.

Of late, our chemical industries have been the subject of benevolent criticism, at all hands; it may be that wisdom will ultimately come of the multitude of counsellors, though present appearances serve rather to justify the adage uncomplimentary to a superabundance of cooks. Everybody wants either to do something or see something done—but as nobody knows exactly what to do, everybody wants somebody else to start the ball rolling; the worst sign of all is the constant request for Government intervention. Nobody seems to realise: that our urgent need is common-sense, the extent to which we lack courage and enterprise, how greatly the spirit of co-operation is wanting in us—in particular, how destitute we are of the German supervice, the cause of our present plight, power of looking ahead and organising forces—that especially we need to take

down the sign "*No expert need apply*" which fills the place of the text-card in too many of our public departments and in the bedrooms of our politicians and administrators, even of the majority of so-called men of business.

Long years ago, Matthew Arnold wrote: "*The want of the Idea of Science, of systematic knowledge, is the capital want of English education and of English life.*" Never was statement so true a picture of our state as this is at the present time. The public is so ignorant of the elements of scientific method that, even now, it can scarcely realise that there is such a thing as science, notwithstanding the existence of aeroplanes and submarines and the many ghastly lessons of the war: the Board of Trade would have none of it recently, when dealing with an essentially scientific problem; the War Office still listens to scientific counsel with wadded ears.

The fault is largely in the body scientific: we do not push our own interests sufficiently; I much fear that the one service that will remain unorganised to the end is our own body—the body scientific. Seemingly, we are too hopelessly individualistic to organise ourselves. The Royal Society, which should be the supreme authority in science, declined the task early in the year and again a few days ago; those who know us not, our masters the politicians, are not likely to seek to bring us together, even for their own ends, as they have no understanding of the use to which we might be put in their service. It is, as Longfellow tells us of "the secret of the sea," only those "that brave its dangers understand its mystery." It is for us therefore to realise that one great lesson of the terrible war we are now waging is the need of bringing home "the idea of science" to the public at large—experts in science they can never be but some respect for it they can acquire: our clear duty is to persist in urging its infinite value and to insist that it be used regularly and systematically in the service of our country.

All this by way of introduction, just to make obvious my one thesis: *that charity begins at home; that this body needs to wake up and intervene actively in the promotion and protection of chemical industry.* Almost supine hitherto, you have allowed others to finker with matters which primarily should be your concern.

The chaos is indescribable. The Royal Society has attempted to do something, as much as a body without leaders can be expected to do perhaps; yet what it has done is as nothing compared with what it might do if the spirit of co-operation were evoked in its Fellows. But lessons may be learnt from its partial activity. It appointed three War Committees towards the end of last year: I cannot speak of the Physicists' Committee; the Chemists' Committee, I know, had not been allowed to do anything effective up to a recent date; but the Engineers' Committee, originally a small one, has been enlarged from time to time and, we are assured, has rendered really important service to the Government. Why the difference? Is it not that engineers, like Brutus, are not only honourable but honoured men, in the sense that they are a professional body, better said perhaps, a body of professionals—accustomed to work together, having learnt that it often pays men to work together? "*Union is strength*" is their motto. Medical men occupy a similar position; lawyers also: both professions are organised on trade-union lines. But those who rate themselves scientific—the academic party as a whole—are an unorganised rabble, so individualistic, self-centred and unsympathetic that what is one man's meat is almost necessarily another man's poison. This is both our strength and our weakness—but we

shall never win through until we can combine strength with weakness. The lesson of the moment, the lesson a life-time has taught me, is that chemists, too, must become professionals; like others, they must sell their services, not give them: we have not yet learnt the lesson of the world, that people only appreciate that which they pay for, that the value of a thing is not appreciated until it has been sold freely. Academic chemists ought not merely to be allowed and encouraged but almost required to work for payment, as consultants, like the engineers. The Professor pure and simple should disappear—his present rating is too clearly indicated by the action of the American who, when in difficulty how to address the celebrated negro, Brooker Washington, feeling that it would not be right merely to dub him *Mister* and unwilling to say *Sir*, as he said, just called him *Professor*!

I am raising a burning question, I know. The academic party, the Professors, are asking to be consulted on industrial problems, to have their work linked with yours; academic schools are coming into existence, colleges of technology and technical schools, which claim to serve the purposes of industry. But do they? The academic mind is not what you want: the academic mind must be fertilised by contact with practice before it can be of service to you and the only way is to fertilise it with fees if you wish it to furnish good fruit. Before long this will be the only way of saving the situation: otherwise there will be few purely academic chemists of worth, chiefly because no proper respect is paid to the calling of teacher, because there is too much restriction of the teacher's liberty of action, too much regulation attempted of his activities by those who have no expert understanding of the office, its cares, duties and responsibilities. No one who has sense and ability will take up a purely academic career, the attraction, the rewards, the opportunities of industry are so much greater; besides which the control of Boards of Governors and Councils will be regarded as insufferable by men of parts.

One main reason why we are so much behind in some of the chemical industries is that the instruction given in our schools has been far too academic in character, in no way in touch with practice. It is all very well for us to speak in their praise in the newspapers but where are our English chemists? Not yet quite to be reckoned with the proverbial snakes in Ireland but dangerously few in number. It cannot be said too definitely, either too loudly or too widely, that chemistry has not attracted gentlemen—men of generous mind, good presence and real ability—in sufficient numbers into its ranks during many years past. We want much of the material that now degenerates into briefless barristers; such material, properly trained, would be of worth and command good pay. Our schools have been overfed with scholarships and scholars have been selected on inadequate tests; too often, indeed almost always, they have been persons of acquisitive power only, destitute of imagination and without breadth of outlook. Examinations like those of the University of London have encouraged the wrong type of man; not a few good men have lost their individuality and failed to develop under the narrowing influence of the course of cramming to which they have been forced to submit. It is to be hoped that the exportation of 1851 scholars abroad will be stopped in future; the depletion of our English schools, in the past, of their best material has been not the least among the causes which have operated against their development and the consequent lack of men of parts. One public influence which this body should seek to gain over is that of the University of Oxford—I verily believe it to be the greatest in the country; to this end, our Society should support the scheme

put forward by Prof. Perkin to make research an integral part of the Honours Degree Course, so that men may grow up with a forward outlook and a consuming desire to consider the inner meaning of things and extend the bounds of knowledge. Our schools generally must be favourably influenced if such a measure be passed.

Since the outbreak of war, action has been taken in various ways to promote the interests which this body has at heart. First in order comes the Board of Trade Committee, appointed August 25, 1914, with the Lord High Chancellor as Chairman, charged to consider the best means of obtaining supplies of chemicals for the use of British industries. This Committee appointed a Sub-Committee of which Lord Moulton was Chairman; apparently the tail soon ran away with the dog. As a result of the report presented by this Sub-Committee, a meeting was held of industrial firms and this was followed by the mysterious appointment of the extraordinary Committees which ultimately negotiated the well-known dye scheme, so universally derided within and without Parliament, which this Society allowed to pass into being without one single word of protest.*

The primary mistake was in appointing lawyers to controlling positions on these Committees—such men, however able and eminent, cannot have any real expert feeling on technical problems outside their own professions and where there is no expert feeling, no proper sense of "technical effect," there can be, to use Faraday's expression, no "proportionate judgment" exercised. Parenthetically remarked, it is strange that the technical members of the Committee did not give effect to their objection to the action taken by the Board of Trade by resigning. When Lord Moulton went to Manchester to advocate the scheme on December 8th last year, he told his audience that our loss of the coal-tar colour industry was for no other reason than that the English dislike study. He could not have given a more complete proof that he lacked "proportionate judgment," a more complete failure to understand the real position were impossible. Since Hofmann left us, almost to the present day, Englishmen, poor devils, have never been allowed, let alone encouraged, to study in any effective manner either at our Public Schools or at the ancient Universities and the opportunities have been few elsewhere. During 40 years past, Oxford has been without a chemical school—how could chemists be trained there? What is far worse, the business community have received no training at our great schools and Universities which has in any way helped them to become acquainted with the idea of science. All the ability of the country that the schoolmasters could lay hands upon has been forced either along classical lines or, in far fewer cases, into mathematics; the school waifs and strays have usually furnished the material for science. Here has been our surpassing blunder. Not a few of us have shown that we can study, that we do not dislike study; but the enforced studies of the majority, under University influences, have been of unreal things without the mental compass and desires of all but very few: of course, dislike of these has often been apparent. We are simply victims of the literary party, of which the lawyer-politician is the supreme development: he grips us everywhere; until we escape from his clutches and are governed by men of practical instincts, who know things and at least hold science in respect, however little they may know of it, we shall make no satisfactory progress.

*The history of the movement is well told in Prof. Perkin's recent Presidential Address to the Chemical Society (Chem. Soc. Trans. 1915, p. 557). See also the "Morning Post" of Jan. 20, 23, 24, Feb. 15, 24, 27, March 1, 12, 13, 15.

The academic party in science are first cousins to the lawyer-politicians—they too must be made human by the touch of practice, if we are to maintain and develop our scientific and industrial position.

The interests of this Society were touched when the question of Government assistance for industrial research was raised in memorials presented by a recent academic deputation, nominally representing the Royal Society and Chemical Society, to the Presidents of the Boards of Trade and Education. (A report appears in the *Journal* of May 15.) Besides further expenditure on Research, the deputation advocated the formation by Government of a standing Committee of chemists to advise manufacturers—but no manufacturer is going either to display his business or bring it under criticism before any Academic Committee, however appointed. Every manufacturer desires to keep and amplify his secrets, not to disclose them; when a manufacturer wants advice, he will seek out that which is of worth to him and pay for it.

We have to bear in mind that the success of German chemical industry is due to two causes: firstly to the fact that their Universities are practical institutions—not collocations of competing colleges—properly supported by the State and in touch with the educated community: the idea of science is abroad in Germany, though "science" is not more taught in the schools than it is here; science, however, is respected and has acquired a money value in public eyes, because it has been made real; the company-promoter has been kept in subordination and it has been shown that trust can be placed in those who undertake scientific ventures. In the first place, we need not only to put ourselves on a high moral plane but to reform our Universities and our University Curricula; but reform must come from within to be of use; the office of Government will be to see that the necessary funds are provided: if it interfere beyond this point, as it is seeking to do, it will only do harm. The second and true cause of German success is that the factories are in the hands of experts; moreover and especially, ample provision is made for carrying out all necessary and desirable research work in well-found laboratories within the factories, this being possible because a supply of properly trained men is to be had from the Universities: such laboratories, not the Universities, are the training grounds of the works chemist. Much is said of the large number of chemists employed in the German works but it must not be forgotten that the majority act merely as foremen, less well paid than our foremen—the Germans having the sense to employ technically trained, expert foremen, whereas we, as a rule, employ uninstructed men who have risen from the ranks, whose ways are too often intensely conservative and obstructive of progress and who can neither take instructions couched in technical terms nor understand the operations they conduct though they are very skilful in their particular work.

When out in Ceylon last winter, in view of the great importance of the rubber industry and of the small amount which is being spent on research work in connexion with it, I made the proposition that Government should levy an "insurance tax" upon all rubber produced in British possessions and require that this be applied to the full scientific study of every particular connected with the industry—the work to be done, however, under the supervision of those concerned in the industry, the task of Government to be merely that of enforcing the application of an adequate sum to scientific inquiry. (The "*Times*" of Ceylon, Nov. 25, 1914.)

Recently, in an introductory address on "The Extension of British Trade," delivered at a Conference held at Cardiff at the instance of the City Education Committee, I made a similar suggestion with regard to the coal and iron industries.*

I would extend this proposal to all industries in which the maintenance of research departments is necessary. One part of the tax should be applied to the upkeep of proper works laboratories, another part to the development of research work in places of higher instruction. In cases in which the industry were alive to its own interests and maintained a proper scientific establishment, due allowance would be made and the contribution exacted would only be that required for public purposes in support of technical education. The necessary interlocking of industry and education would at once follow from such a course of action; Government intervention would be reduced to a minimum; and all sensible manufacturers who desired not to go under would make due provision for the scientific control of their industry.

To continue my argument, not only are the Royal and Chemical Societies seeking to advise you but the voice of the excellent President of the Society of Public Analysts has also been heard. Moreover, an attempt has been made to establish an Institute of Industry and Science which is to do all sorts of wonderful things by way of bringing science and industry into closer co-operation; it is even provided with a research Committee on which figure two chemists, though the rest are mostly persons to whom probably the word research is meaningless. Then there is an Institution of Chemical Technologists which is to put all the different bodies connected with chemistry in their place, to overlord them all; apparently it holds but a poor opinion of this Society and I am informed that members have joined it because they despair of seeing your inertia overcome.

And the Institute of Chemistry must not be forgotten. Though this is a body whose constitutional function is no more nor less than that of issuing a certificate of average competency to embryo chemists, it is seeking to acquire merit by thrusting its tentacles into all sorts of quarters where it has no real place. To give it its due, however, in connexion with the manufacture of glass and the supply of pure chemicals for laboratory use, it has shown more enterprise and real activity than all the other bodies put together. It is also preparing a comprehensive register of chemists.

The Chemical Society also has recently started a register and has constituted its Council as a consultative and advisory body to deal with all propositions that may be brought forward; I am glad to say, however, that it has the intention of consulting all persons to whom it can refer with advantage.

We are at the moment, in fact, threatened with an overwhelming outbreak of Registration fever. Not only the Government but various Societies,

* For the study of many of the problems connected with coal, I think a tax should be imposed upon the industry and that the proceeds should be devoted entirely to research work, under competent control. I should tax the iron industry in a similar way—at least until it had discovered how to make a cheap rustless iron, an absolute need in countries such as Australia, where arduous horses are of vital importance. I made a similar proposition with regard to the Rubber Industry recently when in Ceylon. When "zinc is burnt" in an electric battery, the output of electrical energy is almost theoretical: if we could "burn" coal effectively, so as to convert the energy stored up in it directly into electricity, we should increase its fuel value to a very great extent; our present methods are extraordinarily wasteful. The problem is one of surpassing difficulty but there is no reason to regard it as insoluble: it is one that we should attempt to solve by serious and systematic inquiry, at public cost. Such matters need to be made the subject of exhaustive inquiry by a competent national commission.

from the Royal downwards, are sending out circulars to be filled in: a new form of red-tape-worm disease is upon us—but we want instant action, Germany will not be stayed by any filling in of forms. It is clear, indeed, that, whilst counsellors and counsel abound, there is, unfortunately, no evidence of any co-ordinated effort to lighten the darkness—no proper organisation of effort. The result must be chaos. Yet all such agitation is to the good, especially as evidence of desire and determination to set our ill-furnished, untidy, unregulated house in order.

Per contra, in addition to the benevolent influences, well meant if not tending to the development of industry, to which I have referred, others, insidious in character, threatening industrial liberty and to control it adversely, require attention, as showing the need of organisation for defensive as well as for constructive purposes.

The recent action taken by the Board of Trade in connexion with the manufacture of dyestuffs is of this order and cannot be regarded with equanimity, in view of the impassive front that was imposed by the Board to all suggestions that the scheme must be under scientific control: the complete failure of this department of Government to appreciate the situation, the entire disregard of the gravity of the issues involved, can only be attributed to blank ignorance: yet it was stated openly in the House that the scheme was Lord Moulton's, who is regarded as a scientific authority in Government circles. The action taken is to be deprecated chiefly on the ground that whatever the present worth of the arrangement as a means of increasing our output of dyestuffs, an invaluable opportunity of developing the industry, even during the war, has been sacrificed and its future establishment arrested if not made impossible. We might so well have served our immediate purpose with greater effect and at the same time have worked with an eye to the future had we sought to develop a complete scientific organisation from the outset. Instead, our Government elected to keep up the card, "no expert need apply," all the time; had this body been alive and alert, no such policy could have been allowed to prevail. (The action of the Directors, of which we have just heard, does not meet my criticism: the business being still controlled by men who know nothing of its technical side.)

I may now pass to a case of threatened interference with industry in which effective intervention may yet be possible—that afforded by the Report of the Departmental Committee of the Home Office appointed to investigate the danger attendant on the use of paints containing lead in the painting of buildings. The Committee was appointed in January 1911 and reported in November 1914, though the report was issued only recently. It is impossible to make the case clear without going into it at length; this I hope to do on a subsequent occasion. Suffice it to say, the Committee recommend what amounts practically to the abolition of White Lead—an English manufacture—and the substitution of Zinc White, which has not hitherto been made here and is not easily made. The Committee had not a single scientific man upon it—the only remote approach to one was a medical inspector of factories—and can only be characterised as incompetent either to deal with the issues raised or to appreciate the evidence offered, still less that which should have been required. It is clear that if legislation affecting industries is to be introduced at the instance of Government Departments, the place of science in the attendant inquiries must be asserted and recognised; it is for this body to act in securing such recognition.

The repressive action of the Local Government Board, attempted probably at the instance of a

single official, exercised on several occasions of late in matters requiring the fullest scientific inquiry—in the case of milk and flour, for instance—might also be referred to as further illustration of the need of effective organisation of industrial interests to secure adequate consideration prior to the exercise of control by Government.

I may point out finally that it will be necessary for you, sooner or later and sooner is better than later, to move in the matter of Patent Laws, to consider to what extent, in future, a specification shall be a disclosure and description of the invention for which protection is sought. The oftentimes arbitrary administration of Factory Acts, on purely red-tape lines, will also call for consideration.

In view of the proved inability of our Government Departments to deal with issues which are essentially scientific, to appeal for help, as nominally the Royal and Chemical Societies have done, to those whom we have been forced to describe as flouting science, who hold it in disrespect on account of their entire ignorance of scientific method, is a confession of failure beyond words to describe.

Our plain duty in this Society is to organise ourselves and when we are organised to claim the right to guide Government. But unless the representatives of science subordinate their individualism, sink their differences and form a complete coalition of their forces, no public impression will be made. Much as the public wonder at scientific discoveries—when these are sufficiently sensational and talked about and made obvious—during the last few years, we have done not a little to deprive ourselves of their confidence: company-promoting schemes of the wild-cat order cannot be advanced with impunity—whether guilty or not, we shall all have to do penance on account of not a few of these.

The task before us is indeed colossal. Before the war, Germany had control of the Russian market. It will be long before she will regain this and here will be our opportunity—if our schools take Latin and Greek plays out of their bill and stage Russian instead; and if they add Spanish, we may have some chance in South America also, if meanwhile the Americans do not seal the market against us. The competition we shall have to meet outside Europe, especially in the East, will be greatly intensified, because this will be the chief market open to Germans. I have seen enough recently of German organisation of trade in the East to realise that ours did not compare with it in efficiency.

Unless, however, the desire and impulse come from within, no progress will be made. This country is governed primarily by and from Oxford: if the lessons of the war and public opinion do not cause Oxford to reform, we shall be forced to confess that there is no health left in us and, like the Snark, our industry will "softly and silently vanish away." Some of my friends—men such as Sir Ray Lankester—say the University cannot reform; they say the Royal Society cannot reform; they say both bodies must be reformed. Practical men, I am sure, will agree with me, that this cannot be true—they will hold with me that no progress will be made unless leaders spring up within such bodies to inspire them with courage, men who will lead them to see how great is the service they can render, how essential that service is to the community.

The development of German industrial chemistry has been from within, as I have said, though it has received great assistance from public sources. The academic party in Germany has done its work thoroughly and honestly and under conditions

which have made sound work possible—under conditions of freedom, of *Lehrfreiheit* and *Lernfreiheit*. Such has not been the case here—the Oxford tradition, that it is necessary to be well-read and play games in the afternoon, has dominated the situation; it has not been held that it is necessary to be well practised. The examination fiend has come in to complete our ruin, together with a system of rewards altogether disproportionate, unnecessary and undesirable. German Universities have prospered and have rendered the greatest possible service to industry without the assistance of the Honours degree with its attendant classes, also without Fellowships. The German academic party has received full recognition at the hands of the industrial party, because, on the average, its products have been found to be of worth; here this has not been the case.

Government cannot help us in these matters. The industrial party will consider the academic party and consult it when the latter can do for industry what the German academic party has done for industry. The Oxford degree in Chemistry has been worthless for practical purposes, because men could not get the necessary training, as there was no proper atmosphere in the University; but the tone of the University towards Science must be changed entirely if the school that is being started is to be a success. New laboratories alone will not give what is required.

The conditions at Cambridge have been better but not satisfactory and even now far too much is attempted, the time spent in study being insufficient to give the student a practical, professional outlook. In the schools dominated by the London University, the student has not been placed in a position to learn but has been forced to cram and during so long a period that he has suffered severely from mental atrophy and has been spoilt for practice; in few cases has the attempt been made anywhere in our country to give him that forward outlook and the desire to do something himself which is, to some extent, acquired by every recipient of the Ph.D. degree in Germany.

To progress, we must acquire the desire to do something before we take to learning: knowledge is not power unless it be associated with the desire and power to use it.

It rests with the Royal Society, in my opinion, to give the impulse and start reform, by reforming itself, waking up from its academic slumbers and playing the active part that it is possible for it to play if it only realise what it can do as a live institution. It is our scientific House of Peers; it is not only representative of all branches of experimental and observational science but industrial science has its place in our ranks, although it is to be confessed that we are ultra-academic at present and need a far larger leaven of men accustomed to apply science to practice.

In consequence of the development of the special societies, the Royal Society is no longer of consequence as a scientific society, in the ordinary sense. Unless the forces at its disposal be used effectively, it will cease to be of service and there will be little satisfaction in belonging to it. The Fellows will fail in their duty to the Empire, unless the Society grasp the power which is potential in its hands and claim to be supreme as a deliberative and advisory authority in the interests of science. The voices of scientific workers in our country should be heard as that of one man, through the Royal Society—we should then count for something in the National Councils; it should co-ordinate our scientific forces and link them up with our educational as well as with our industrial system—we should then play our due part in the State and the idea of

science would soon be abroad. But to this end, the Society must be organised as a democracy: at present, it is little short of entirely in the hands of a ring of all but permanent, autocratic officials and the Fellows have but little part in its proceedings, as the Council in no way represents the desires and ideas of the Fellows.

The way before us is clear—we have but to group ourselves in sections mainly according to subjects: for example, all the chemists in one section, the physicists in another, the biologists including medical men in a third; hybrid sections might also be constituted, for example, one to deal with education. The policy of secrecy that prevails in the Society is merely the outcome of an attempt to retain the power in the hands of cliques, in no way worthy of the body or compatible with the proper exercise of its high office.

I claim for this Society a position with regard to Chemical Industry similar to that the Royal Society should have in connexion with abstract science; I consider that your influence should be made operative in the highest quarters both directly and through your proper representation in the Royal Society. You have in no way done your duty to yourselves hitherto or rated your office and opportunities, the calls for your service, sufficiently high.

It rests with the younger men among you now to come forward and make themselves effective as organisers. Organise your forces and use them constructively forthwith you must—the call upon you is imperative; let loose your ideas; many, I know, are afraid to speak: have courage—without it you cannot achieve victory!

CHEMICAL ENGINEERING.

BY G. T. BEILBY, F.R.S.

One of the lessons of the critical times through which we are passing is that as a nation we are lacking in organisation. I fear it must be admitted that even our capacity for organisation is still undeveloped. With our usual frankness in the discussion of our national defects we have sometimes made it appear as if we actually enjoyed this outspoken self depreciation, but there are unfortunately signs that our zeal for discussion may spend itself without leading us any further towards reform. As a Society of Industrial Chemists it is our duty to see to it that this fatal arrest in the pathway of reform shall not occur. The discussion this afternoon is to turn not on any of the wider aspects of the national organisation of industry, but on certain more domestic questions of organisation within the individual works. We may take it, I think, that the President and Council, in preparing the programme of this Annual Meeting, have recognised the deep significance of the present situation. Though I was specifically invited to open a discussion on Chemical Engineering, I shall take the liberty of treating the subject as a central feature in works' organisation rather than as a subject by itself.

Chemical Engineering was first introduced as a subject for discussion by the Society, in an Address to the London Section in 1899, and since then a good deal has been said and written on the subject. It now finds an honoured place in the curricula of several of the leading Colleges, and it is recognised as a degree subject by one or more of our Universities. Chemical Engineering has therefore taken its place as a subject for professional study, and I gladly spare you any reiterated arguments in its favour.

Inasmuch as all works of construction involve questions of engineering, we may take it that even the more crudely equipped chemical works have required for their construction a certain amount of engineering skill. Buildings have had to be

erected, drainage and water supply provided for, and prime movers installed. Provision has had to be made for the evaporation or distillation of liquids under augmented or diminished pressure, for the condensation and fractionation of vapours, and for the cooling, filtration, and crystallisation of solutions. There is not one of these operations which had not been systematically carried out on a large scale long before Chemical Engineering had been accepted as a special branch of professional study and practice. In the development of processes on a large scale improved mechanical appliances have always played an important part, and early in the day engineering firms in chemical manufacturing districts specialised in the manufacture of these appliances. But these firms had not found it necessary to maintain their own chemical laboratories or to employ chemical specialists to aid them in their work. They trusted simply to the knowledge and experience obtained at second hand from the chemical manufacturer and his staff.

From these facts it is evident that engineering has always had a definite place in chemical manufacturing, but if we inquire a little more closely into the degree and kind of engineering skill which found a place in the older chemical works, we shall find that it was frequently not of a very high order.

One of the special features of large scale chemical apparatus is the heavy depreciation to which it is subject and the need, therefore, for continual renewals and repairs. This wear and tear is not simply the result of exposure to atmospheric and other natural agencies, but is due also to the action of the chemical elements and compounds in their most potent forms. The oxidation and burning out of metal and other vessels in high temperature furnaces is a prolific cause of excessive depreciation. The skilled engineer who has been accustomed to the construction of high-class prime movers or mill machinery may be very ill-fitted to design and keep in repair the short-lived apparatus of the chemical works. A more adaptable but rougher type of man is required and these needs have produced a rather special kind of man, the "Chemical Works Engineer," rather than the "Chemical Engineer." If these facts are kept in mind we shall not find it at all surprising that chemical works plant, especially in the older works, often has an improvised appearance which suggests, either that the engineer in charge is actually slovenly, or that he knows so well the temporary character of the work that he does not think it worth while to conform to the ordinary decencies of engineering design and construction! Tumble-down apparatus is only too apt to react on the processes which are carried on in it, and slipshod working is the outcome. The moral effect of rapid destruction of plant is certainly bad; hence the enlightened manufacturer is willing to make many sacrifices to secure more enduring forms of plant.

Apart from the special characters which are due to the necessity for frequent renewal, there is no doubt that the influence of the chemist has had a definite effect on the design of chemical plant. A former colleague of my own, who had himself made splendid contributions to the improvements of the apparatus used in one particular industry, could find no more contemptuous way of expressing his opinion of any piece of apparatus of which he did not approve than to call it a "chemist's job." Of course the chemist did sometimes get back on the engineer if an elaborately designed piece of apparatus failed to give satisfactory results from a process point of view! In this case, unfortunately, any attempt at a *tu quoque* was more than ordinarily ineffective, as an "engineer's job" was just the kind of job the constructor desired to make! It is not easy to define or

characterise these two kinds of job by any simple definition. Chemists' apparatus is more the result of opportunism than of deliberately thought-out design. Contingencies are provided for as they arise, and initial mistakes in design are apt to be met in a partial or temporary way. The origin of the chemists' type of apparatus is found in the chemical laboratory, where it has generally been the aim of the Professor to develop in his students a certain kind of individual resourcefulness. This resourcefulness is an invaluable possession when pioneering work has to be done. The rapid adaptation of means to end which so naturally results from the properties of the chemists' principal raw material of construction, glass, has given its own definite character to the apparatus of the laboratory. Glass, in the hands of a moderately good glass worker, is a marvellously flexible and adaptable material of construction, and with the help of cork and indiarubber there are few types of chemical apparatus which the chemist cannot easily and quickly fit up for himself. When the chemist needs to increase the scale of his apparatus, he naturally follows the type of construction to which he is accustomed and, even when the increased scale gets beyond the resources of the blowpipe table and the cork drawer, his ideas flow along the old laboratory lines. When the increase in scale is so considerable that it becomes necessary to call in the help of the engineer and his craftsmen, the designs proposed by the chemist still show their laboratory origin. The quick adaptability of the plumber's methods attract him rather than the engineer's carefully arranged series of steps from the drawing office through the pattern shop, the moulding shed, and the foundry, to the machine shop. In pioneering work a "chemist's job" is often the most suitable to use, but when the stage of steady manufacturing has been reached, all the resources of the drawing office and workshops should be devoted to the design and construction of suitable apparatus.

Though there are still many very crudely equipped chemical works in this country, there are others of a more fully developed type which are provided with a properly equipped and staffed drawing office, and mechanical workshops furnished with the most modern machine tools. Reference has already been made to the rapid depreciation of chemical apparatus and to the necessity for frequent repairs and renewals, often of a very radical type. A well designed and built steam engine or other machine often outlives its economic usefulness and escapes scrapping because it still looks as good as new. Chemical plant generally scrapes itself, especially if it is allowed to drop out of use even for a short time.

In modern chemical works where sound engineering principles are allowed to have their proper weight, the design of new apparatus is attacked somewhat in the following way. After all process data have been obtained by laboratory methods, the co-operation of the drawing office with the laboratory begins. The nature of each step in the process and the unit output per hour or per day which is to be adopted, the weight and volume of materials to be dealt with in unit time, the conditions of temperature and pressure required at each stage, the method of assembling the various raw materials and their distribution to the apparatus units, the collection and packing of the finished products and, last but not least, the economical and safe disposal of the waste products, solid, liquid, and gaseous, all these must be collected, sifted, co-ordinated, and discussed, not merely in their own light, but also in the light of the most mature experience available among the staff. In addition to the co-operation required to settle the process data, further co-operation is required to find suitable materials for the various parts of the

apparatus. These materials may be required to resist the corrosive action of gases and liquids, or the effects of high temperatures or pressures. Sometimes all these adverse influences combined have to be resisted. The materials found suitable by the chemist have to be studied by the craftsmen in the moulding shop, the foundry, the forge, and the machine shop. When the proper materials of construction have been discovered, and the correct methods of handling them have been evolved, the final completion of the designs in the drawing office is a matter of ordinary engineering construction. The completed apparatus ought not only to look like its work, but to do that work with economy and efficiency.

The stage in the evolution of a new process at which this highly organised method of attack on the design of a suitable apparatus ought to be introduced can only be decided for each new problem as it is dealt with. A premature application of the method often leads to loss of time and money. Those who have had any prolonged experience of industrial processes can no doubt call to mind instances of this. Sometimes the study of an apparently well-thought-out set of plans may give a fictitious air of reality to a scheme which, by right, is only in one of the early pioneering stages. The Company promoter has been known to realise the financial value of this apparent air of completeness and to turn it to his own account! In spite of these dangers, which ought not to be overlooked, the method of organised attack is the true ideal to be striven after. The great strength of German chemical industry rests on the internal organisation of the works quite as much as on mere abstract research. I use the term abstract research to distinguish this type from the more directly practical inquiries which it has been shown above are a necessary part of an organised attack on a manufacturing problem by the laboratory, the drawing office, and the experimental workshop.

In the modern organisation there is room for the research chemist of high and wide attainments, for the scientifically trained engineer, also of wide attainments, and for a type of professionally trained man who is the natural medium of interchange between these two specialists. This intermediary is the Chemical Engineer. He must be a man of special aptitudes inasmuch as *he must have grasped the chemists' point of view as well as the engineers'.* The chemist thinks and works in terms of atoms and molecules and the laws which govern their combination. The engineer thinks of matter in masses which can be moulded to his will by the craftsman, or of mechanical or electrical energy which can be generated, controlled, and measured by machinery. The chemist is the master and director of his own operations which he can, for the most part, carry out with his own hands. The engineer loses his direct hold on his operations whenever his ideas have been fully committed to paper in the drawing office. It is his special function to organise the labours of many workers. A certain number of men are able to enter fully into the spirit which actuates both types of expert, the chemist and the engineer; they can resist the particular exclusiveness of each, while giving to each its due weight. These are the naturally gifted chemical engineers who in one sense are "born not made." In our colleges and universities the best that we can do for men of this gifted type is to give them the best possible opportunities for an all-round development of their powers. For the average men, we ought to provide a properly organised course of training in theoretical and practical chemistry, physics, and mechanics, on professional, not on purely academic lines. Our colleges have thus two distinct functions to perform, and it is best that this should be clearly recognised, first, to allow the future leaders in

applied science to come naturally to the top during their training, and second, to prepare a large number of well trained professional men for the organisation and development of industry. The ideal for these men must be a professional one. The ideal that "every man in the ranks ought to realise that he carries a Marshal's baton in his knapsack" is as false as it is impractical, and it will neither help the drill sergeant to produce useful soldiers, nor the commissioned officer to acquire a sound knowledge of his profession. It is to be feared that the making of practical chemists has suffered severely from a similar fallacy, namely, that all students ought to aim at being pioneers in some branch of their science. Science and industry alike call aloud for *real pioneers*, for without these the highest type of progress cannot be realised. This call, however, cannot be met by the premature stimulation of "originality" in men of very ordinary endowment. The effect of this stimulation is not merely futile, it is positively mischievous, for it raises an ideal which for the ordinary man is quite inappropriate during his preparation for a life of serious practical endeavour. In conclusion I must repeat the statement of my belief that the phenomenal development of chemical industry in Germany has resulted much more from the large command of chemists and engineers of sound professional training and ability than from the possession of an even larger supply of research chemists of mediocre ability.

DISCUSSION.

Sir WILLIAM RAMSAY said that he agreed entirely with the general treatment of the subject by Professor Armstrong, but he did not think it was worth their while to trouble about their mistakes of the past: they should now begin and try to do better, from now on. Professor Armstrong was perfectly right in saying that we wanted some Government department to deal sensibly with scientific progress and operations of all kinds. That ideal might be cherished, but he was afraid that it was impossible to achieve it by political means. But if they could not reach that ideal, what was the next best course? There existed the Royal Society, with Royal patronage, receiving assistance from Government. The Royal Society had constituted its committee of war. The first thing in their minds was to win the war. Of course, industrial considerations were important, but their first consideration was to win that war. The Chemical Society had also constituted itself a war council, and had appointed committees to represent the various branches of chemistry, industrial, pharmaceutical, metallurgical, and so on—each committee being in close touch with the other Societies concerned. If these would form themselves into a channel of communication with the Royal Society it would be well; then they could go to the Royal Society and say:—"Here are we; will you put us in touch with your chemical committee, and then put us in the hands of the Government?" The Royal Society would then say to the Government:—"These are the expert opinions, the 'considered opinions' of the science of the country; you cannot ignore them." That would be all for the good of the country. But they wanted actions more than words. By getting the various branches of chemical industry brought into line it would assist largely in bringing the war to a successful finish.

The PRESIDENT announced that the Council of that Society had, at their meeting on the previous day, decided to appoint six members to act in conjunction with the Council of the Chemical Society, and to appoint their President and Past President to be members of a joint committee which it was proposed to establish.

Prof. HENRY LOUIS said that while he was in thorough agreement with the general tenor of Prof. Armstrong's brilliant exposition, he differed from him in matters of detail. As regards the question how far college professors should act as consultants in industrial problems, he personally held strong views on this point, and had always taken a firm stand with respect to it. A technical professor, who did no consulting work, rapidly got out of touch with the actualities of the industry and would soon look upon it from a purely academical standpoint. Once he was out of touch with workshops, mines, factories, or whatever the actual working place might be, he was reduced to getting his information from text-books, and everyone knew that nothing ever finds its way into a technical text-book until it is on the point of being superseded by something better. Unless a man commanded the respect of those actually engaged in industry sufficiently to obtain a fair share of consulting practice, he was not fit to be a professor in that branch of technology and was not the right man to train students in it. He believed that he was one of the first to advocate strongly the views he was now expressing; he had done so successfully for 20 years, and saw no reason whatever for changing his opinion on this subject.

He noted with interest that Prof. Armstrong, speaking recently at Cardiff, had said: "For the study of many of the problems connected with coal, I think a tax should be imposed upon the industry." Not only did he (Prof. Louis) share his view, but he had actually carried it into effect. He was consulted some four or five years ago by the coal-owners of South Wales for a scheme of mining education, and he suggested that the funds for such a scheme would be readily forthcoming if the great coal producers of South Wales would consent to impose a tax of £d. per ton upon themselves in the interests of technical education, and with some difficulty he managed to get his scheme adopted, and it was now in operation.

He differed widely from Prof. Armstrong on the question of University education; he was speaking, of course, of technical education pure and simple. Prof. Armstrong confined his views to Oxford and Cambridge and entirely ignored the newer Universities, and here he considered that Prof. Armstrong was in error. It was these newer Universities that formed and would continue to form in the future the backbone of technical education throughout the country. He wished to make it clear that he was talking of technology, of applied science; pure science could be taught as well at Oxford or at Cambridge as anywhere else, but not so applied science; in this latter the older academic seats of learning were at a disadvantage compared with places like Manchester, where industrialism was all round the students, where they heard every phase of it discussed hourly, where they sucked it in with the very air they breathed. The technological students turned out from the newer Universities were necessarily superior to the products of the older Universities, and he had no doubt that they would continue to maintain this superiority under the influence of favourable local conditions. It was almost a corollary of what he had just said, that the teaching of technology must conform to local requirements. Whilst each University should be teaching the principles of general technology, it should also specialise in the technology of the local industries. Thus it was proper that Sheffield should specialise in steel-making, Leeds in dyeing, Birmingham in brewing, and so on; it would be a waste of energy for every technological University to attempt to specialise in every branch of technology; each should concentrate its efforts on a limited number of branches, choosing, of course, those particularly

adopted to its environment; by this method, too, the teachers of those subjects could maintain close touch with the industries of the district.

He personally did not hold research in the same profound respect as so many seemed to do; his own view on this subject was very much the same as that expressed by Dr. Forster, who wishes to see the factory becoming a Technological University. In the opinion of the speaker it was a mistake to set college students on to research work; first let them learn what had been and what was being done, before they attempted to break new ground; let them find out for themselves what industrial problems there were awaiting solution before they attempted to begin to solve them. He was in the habit of telling his students that the best post-graduate course they could take would be taken in their shirt-sleeves, by actual work in mill, factory, or mine.

Finally he asked whether it was really true that we, as a nation, are so devoid of capacity for organisation, and whether our individualism is such a source of danger as Prof. Armstrong appears to believe. The way in which a few individuals, often lads fresh from college, controlled vast areas and ruled over vast communities of semi-civilised races, showed that our individualism had its good side; surely our great Colonial Empire and the attitude of these Colonies to the Mother-Country, which recent events had shown up in so bright a light, surely these were evidence that Britain did possess powers of organisation in a very marked degree. At the same time, he was quite in accord with Prof. Armstrong's view that it was a matter for grave regret that these powers had not been brought to bear upon the consideration of our chemical industries.

Dr. GILBERT J. FOWLER said that it seemed to him that we were in danger of yielding to a fallacy, viz., that because we could do one thing well, we must do other things badly. The last speaker had shown that at present we could do some things well, but just now we seemed to be obsessed with organisation. We did not want to find ourselves eventually left with the ethical and political ineptitude of the greatest organising nation the world has seen. It had been his privilege to work alongside some young Englishmen in India; one of these—with whom he had afterwards had the pleasure of working as a colleague—was responsible for the health and well-being of 70,000,000 people. He thought that, as a nation, we were not altogether incapable when we could turn out men who would cheerfully undertake jobs of that sort.

He thought that manufacturers and business men had the feeling that experts were going to rule them all. He believed that this distrust of the expert was because the business man had not taken sufficient interest in the scientific point of view, in what might be called the "romance" of science. There was no reason why there should not be as much poetry in a Diesel engine as in any effort of literature. It all depended on the point of view. The German nation devoted its mind and soul to what was, after all, a rather sordid ideal. In America idealism was wedded to industry. It was to this end, he felt, that we must work in order to get the driving power we desired.

He did not agree with the idea of resolving everyone into a series of Committees. He could say, from personal experience, that it was possible, by holding oneself in readiness, to find means of being useful as occasion arose, without necessarily joining a Committee.

Professor Armstrong had referred to the workmen, but we must again be careful here, or we should make mistakes. At the Annual Meeting of the Sewage Works Managers Association, held recently at Leeds, the President, Dr. Maclean

Wilson, had contrasted the sewage works in Germany with those here. In Germany they were very neat and trim and those in charge obeyed instructions with precision, but had little or no originality. In this country, the Sewage Works Managers had built up their own Association and there were growing up a number of highly intelligent men who were able to grip more and more the higher problems of the situation as they were brought to them by the engineer and chemist. That showed what was being done and what could also be done in other directions.

Professor Armstrong had spoken rather disparagingly, he (Dr. Fowler) thought, of the Institute of Chemistry, although he had admitted the good work being done on glass research. As a member of the Council of the Institute, the speaker felt that he could not let the reference pass, as the Institute was doing its utmost to raise the status of the profession throughout the country.

Finally, he would emphasise his point that in using the word "organise," they must remember that organisation, even if developed to its final point, would not carry them far without the one thing needful, which was intelligence.

Prof. WILLIAM A. BONE said he thought that the British people were apt to take an unduly pessimistic view of their performances and prospects as an industrial nation, and to depreciate themselves quite unnecessarily in the eyes of the world at large. But what were the actual facts? He would venture to assert that any competent review of our economic position up to the outbreak of the war would reveal that we had been, and still were, the greatest and most successful industrial and mercantile nation in the world, measured by outputs or trading per head of population. As a matter of fact we bought more, sold more, and made more per head of population than any other industrial nation, and in the matter of mercantile marine and ocean carrying trade we were not only first, but beat all the rest put together. And, leaving out of account the possible effects of the war, which no one could foretell, he saw no reason for anything but confidence in our economic position as a whole.

The aniline dye industry was being constantly trotted out by our pessimists and croakers as an example of our failure to retain and develop a scientific industry founded upon the discoveries of British chemists, and undoubtedly, if the manufacture of dyes were the only branch of chemical industry worth considering, a strong indictment against the nation might be sustained. But, relatively speaking, the aniline dye industry was of quite minor importance, and those who argued otherwise showed no true sense of proportion. There had been economic, as well as educational reasons for Germany's supremacy in the aniline dye industry which were often overlooked by our scientific leaders. He believed that if the whole output of "chemicals" were taken into consideration, it would be found that we turned out nearly, if not quite, as much per head of population as even Germany, where chemical industries were constantly being held up to our admiration as being so marvellously efficient, as they undoubtedly are. Finally, the financial basis of our industrial system was undoubtedly far sounder than that of Germany, and if Germany did not win this war outright in a way that would enable her to impose her own terms on us (which seemed impossible), her whole financial system would be irretrievably ruined.

He thought that Mr. Beilby had hit the nail on the head in expressing the opinion "That the phenomenal development of chemical industry in Germany has resulted much more from the large command of chemists and engineers of sound pro-

fessional training and ability than from the possession also of an even larger supply of research chemists of mediocre ability." He did not wish, for a moment, to underrate the importance of scientific research, either for its own sake, or on account of its value as a mental discipline, or of its direct material benefits. But in their zeal for research, our academic institutions had rather overlooked the importance of imparting a sound professional training to the average student who wished to enter the ranks of industry. Chemical technology, as a subject of "post-graduate" professional training, had been, and still was, strangely neglected in this country by our higher academic institutions; it was, so as to speak, the Cinderella of our academics, neglected and often scorned by her elder sisters, the pure sciences.

He had, during recent years, in the course of professional work, seen a good deal of the organisation of the fuel and iron and steel industries of Westphalia, and if there was one thing about it which had impressed him more than another it was not so much the predominance of the scientific investigator as the number and ubiquity of the highly trained metallurgical chemists and engineers professionally engaged in directing the smelting and refining processes and the operations of the rolling mills and forges. And, what was still more important, the chemist and engineer had been so trained as to be able to understand clearly each other's ideas and point of view. In the case of one of the largest and most efficient steel works in Germany, which he had visited some time ago, it was the custom for the young men who were recruited as engineers from the Technical High School to be subjected to a probationary course in the works chemical department under the direction of the chief chemist, in order that when they were subsequently given responsible posts as engineers in charge on the plant, they would be able to understand thoroughly the meaning and bearing of reports and recommendations from the chemical department, and work in sympathy with those responsible for the chemical direction of the various processes involved. A better correlation of the work of the chemist and engineer was greatly needed in British industrial establishments, and such could only arise from a sounder professional training of our would-be technical chemists in academic institutions. And if the average academic mind were more familiar with economic and industrial conditions, far more attention would be paid to such professional training and far fewer mediocre persons, with little else than a so-called "research" training to fall back upon, would be turned out.

With regard to Professors of Applied Chemistry being called in as consultants by manufacturers, he thought that such a custom had already been established; indeed, he had sometimes heard complaints on the part of short-sighted academic people that their colleagues in our Faculties of Technology spend too much of their time in consulting work. Of course a professor's prime duty was towards his students, but it was not only consistent with that duty, but also a great stimulus in its performance that he should be constantly in touch, through consultative work, with all the latest industrial developments, and the connections so formed were invaluable. Indeed, he was emboldened to say that a Professor of Chemical Technology whose advisory services were not sought after by manufacturers was incompetent to discharge the prime duties of his chair.

Prof. ARMSTRONG, in reply to Prof. Louis, said that with regard to the importance of chemists acting as consultants, to give an illustration, the one piece of training in scientific method which had been of greatest service to him, in the course of his career, he believed, was that which he had, at an

early stage, when he took part, for the first time, in an important patent case in the Law Courts. The manner in which every witness was cross-examined as well as examined, every statement made thoroughly tested, went far beyond the practice of the lecture room and of the laboratory in completeness, and was of great value as an exemplification of the proper method of arriving at truth.

As to the stress he had laid on the superior value of Oxford and Cambridge, the question was a social one. These two schools would long continue to attract the best material of the country, nearly all of it, in fact, on account of the social advantages they offer and the prestige they rightly enjoy for this reason. It was therefore of the utmost importance that the training they gave should be on right lines.

He agreed entirely with Dr. Fowler in his estimate of the greatness of the work done in India—it was altogether marvellous what a few men had accomplished. But hitherto the work had been mainly administrative. A broader type of intelligence was now required, however—men who could follow up the work of the political administrator and of the engineer and apply science to affairs, especially to agriculture and industries.

He could not agree with Prof. Bone. When in the East recently, he had been greatly struck by the evidence everywhere of the efficient commercial organisation of the Germans. If, instead of making war upon us, they had quietly persevered, we should have been wiped out by them commercially, at no distant date, unless we had mended our ways entirely and followed their example. Only recently we had been told that before the war the forging of large shafting for ships was very largely in German hands and fast becoming a lost art here.

Although in general agreement with Dr. Beilby, it could not be denied, he felt, that the Germans had shown great genius as chemists, especially on the organic side; we had very little to show in comparison with their achievements, whatever our latent ability might be.

In conclusion, he could but insist on the thesis he had sought to drive home that day: that it were time that the Society woke up and intervened actively in the promotion and protection of chemical industry. A great responsibility devolved upon them which they must not disregard.

The PRESIDENT, referring to Prof. Armstrong's remarks, said he thought it only fair to point out that the Council of this Society had not been by any means asleep, although it had not met with so much encouragement as was hoped for.

VISIT TO THE UNIVERSITY LABORATORIES.

On Thursday evening a large number of the members visited the extensive laboratories of the Victoria University. The party was conducted over the building by the Vice-Chancellor of the University (Professor Weiss), Prof. H. B. Dixon, Sir Ernest Rutherford, and Prof. A. Lapworth. In Prof. Dixon's private laboratory some of the members were afforded an opportunity of seeing the apparatus used for experiments on the adiabatic compression of gases, and an experiment with electrolytic gas was shown.

Prof. H. B. DIXON then gave a short lecture on gaseous combustion. The passage of an explosion wave, resulting from the ignition of a mixture of carbon monoxide and oxygen, through a coil of tubing 25 feet long was shown. The conditions of combustion of ethylene, methane, and cyanogen in oxygen were then dealt with, and the lecturer described some experiments which had been made to determine the specific heats of gases at high temperatures, by measuring the velocity of sound in a long silica tube. The combustion of coal gas

in air was next dealt with, to illustrate the propagation of explosions in coal mines, and it was shown experimentally how a flame would pass quietly and smoothly along a wide tube when started at the open end, but when the mixture was ignited at the closed end, the flame travelled smoothly for a certain distance and then moved more rapidly and with explosive violence. The presence of a barrier of incombustible dust in the tube had no appreciable effect in checking the flame. The failure of the dust barrier might be due to the fact that the flame travelled so slowly that it could pass over it, or so rapidly that it could jump over or pass through the barrier. For treating coal mines it would probably be safer to "salt" the mine throughout. Finally, experiments were shown to demonstrate the propagation of flame down a column of combustible gas mixture by means of dusts; these experiments disproved the old theory that the presence of inert dusts increases the inflammability of gases.

Sir ERNEST RUTHERFORD gave a demonstration, in the Physical Lecture Theatre, of some properties of radioactive matter. An α -ray tube was exhibited and the phosphorescence produced on a zinc sulphide screen, on willemite, and on kunzite, was shown. It was stated that recent experiments had demonstrated the production of hydrogen in addition to helium from an α -ray tube. The condensation of radium emanation by means of liquid air, and its absorption by charcoal were then shown, and also the effect of heat in increasing the radiation from tubes activated by radium. The production of X-rays from a Coolidge tube under different current densities was shown, and it was explained that the penetrating power of the rays increases with the voltage applied up to 145,000 volts, and then remains constant within practical limits. Even the maximum penetrating power is only three-tenths that of γ -radiation rays.

Prof. W. J. POPE next gave a demonstration of some optical properties of crystals. A number of instances of the "interference figures" of doubly refracting crystals were projected on the screen. These included sections of calc spar, quartz, natural and artificial rubies, sanidine, barytes, titanite, aragonite (showing crystal twinning), and mica, the overlapping faces being evident in the last case. Artificial twinning was shown by using superposed sheets of mica. Many of these interference figures were also shown in the form of colour photographs, the fidelity of the reproduction indicating to what perfection the science of colour photography has now been developed. The lecturer then showed examples of polymorphism, the transformation of mercuric iodide and of ammonium nitrate being demonstrated by optical projection. Lastly, a number of instances were shown of liquid crystals or doubly refracting liquids, the conversion of the solid into a refracting liquid, and finally into non-refracting liquid, by application of heat, being demonstrated in the case of a number of cholesterol esters (acetate, benzoate, cinnamate, amide), anisaldehyde, *p*-azoxyanisole, *p*-azoxyphenetol, and *p*-azoxybenzoic ester.

At the close of the demonstrations, the President expressed the very hearty thanks of the Society to the University and to the Lecturers, for affording them a most fascinating evening's entertainment.

FRIDAY, JULY 16TH.

THE ECONOMIC UTILISATION OF COAL AND THE PRODUCTION OF CHEAP POWER.

BY WALTER F. REID.

There is no need, at this time and in this country, to emphasise the importance of mechanical power,

Not only our economic prosperity, but also our national existence depend upon it. Although it is but 150 years since the introduction of the steam-engine, yet the effect upon mankind has been so great as to revolutionise the lives and habits of all civilised nations. It is difficult for us now to realise the great advantages that have accrued to us through the substitution of mechanical for manual work. The father of scientific writers, Aristotle, said more than two thousand years ago: "When the shuttle can work totally unaided we may perhaps put a stop to slavery, not before." The automatic looms of this great city still require a little help to keep them going; but steam does the bulk of the work. Now, here in Manchester, I would like to allude to a new invention which, possibly, will do away with the spinning as well as the weaving of textiles. It is a process for the production of textile fabrics such as are now woven, from a solution of cellulose. The pattern of the fabric is engraved upon rollers. They use chiefly muslin patterns now. The solution is spread upon the cylinder and a knife scrapes the surplus off. It is then hardened and wound off. The dyeing is done in the solution of the cellulose. That process of manufacture has a great advantage, as the fabric is not acted upon by water, and many ladies' hats are now trimmed with it in Paris. But now, before the possibilities of steam are nearly exhausted, a rival force appears upon the scene in the shape of electricity. At present the two forces often work hand in hand, and more electricity is still produced by steam than by any other power; but steam is rapidly losing its supremacy, and it behoves us, if we can, to look ahead and see what the effect of the coming changes may be upon those industries in which we are interested. In considering the various sources of power, we must bear in mind that theoretically one form of energy is convertible into any other form; as von Helmholtz puts it: "As electric energy is of the same order as mechanical energy, these two varieties can be transformed integrally the one into the other." It was from von Helmholtz that I first learned a little of mechanics, and he made many experiments in connection with the conservation of energy, but one remark he made I shall never forget: "There is always a loss we cannot account for." In the British Isles the chief source of energy is, of course, coal. Hitherto we have drawn most lavishly upon our supplies of this important raw material, not only using it wastefully ourselves, but also exporting large quantities, even to our keenest trade rivals. Voices have been raised in warning against too lavish a use of the valuable resources with which nature has endowed us; and a Royal Commission, after a long and thorough investigation, has come to the conclusion that our stores of mineral fuel will suffice for many generations to come. Even assuming the correctness of this statement, there may still be cause for uneasiness in connection with some of our most important industries. It is very satisfactory to us, as we live to-day, to have these stores of energy still, but the idea is that we ought not really to deplete the world of stores that cannot be replaced. But, as Professor Louis pointed out to the Royal Commission, we find, though there has been a larger use of coal, our stores of coal are not decreasing, through the discovery of new stores of coal, the Kent coal for instance. While the cost of coal to the manufacturer is increasing from year to year, the facilities for transporting manufactured goods from one country to another are increasing rapidly, so that foreign competition presses more and more closely upon us. Part of the increased cost of coal is due to the increased depth of our mines, and part to the increase in the cost of labour and the expense of the numerous Government restrictions and

regulations that have been introduced of late years. That point is of very great importance. I had it from mine-owners that the cost of the Government regulations comes to a great deal per ton of coal. I need not mention the proportion, but the cost of providing against explosions is very great. There are many countries whose coal resources have scarcely been touched, and who possess more abundant resources than ourselves. At the International Geological Congress last year Mr. D. B. Dowling gave an interesting estimate of the coal resources of the world, from which the following figures are taken:—

	Million tons.
North America	5,073,431
Asia	1,279,586
Europe	784,190
Oceania	170,410
Africa	57,839
South America	32,097
	7,397,553

I think I ought to refer to the statement that cotton is absolutely necessary for the production of high explosive shells. The fact is that no cotton is used in the production of those shells. If people would only speak of the branches of science with which they are acquainted, it would be very much better. I do know what I am speaking about, for all the powder being used in this war is made by a process which I invented. Undoubtedly, the production of coal is an extremely important feature in the present war. I am very sorry to say, some of our friends in South Wales do not realise the importance of this. The greater part of this store of coal is bituminous, the quantity of anthracite coal available in Europe being:—

	Million tons.
Russia	37,599
British Isles:—	
S. Wales	8,685
Scotland	2,300
Ireland	172
	11,357
France	1,635
Netherlands	320
Italy	141
Portugal	20

Outside Europe the estimated reserves of anthracite are:—

	Million tons.
United States	19,684
Canada	2,185
South America	700
Zulu and Natal	10,700
South Africa besides	960

The stores of fuel available for mankind are clearly enormous and, if they were uniformly distributed, no nation would have any cause for anxiety. Recent events have, however, shown that no nation can with safety depend upon its neighbours for the supply of any raw material. Coal products are now indispensable as materials for the manufacture of high explosive shells and, from this point of view, it will be interesting to compare the coal production of the chief countries of the world. The latest returns available are for 1913, when the coal produced was:—

	Tons.
China	14,000,000
India	15,744,423
Japan (1912)	19,515,235
New South Wales	10,587,734
New Zealand (1912)	2,177,815
Austria-Hungary	43,743,000
Belgium	22,858,450
France	42,671,000
Germany	278,627,497
Italy (1912)	683,812
Russia	25,772,700
Spain (1912)	3,126,006
Sweden	363,965
United Kingdom	292,202,067
Canada (West)	7,072,051
Canada (East)	8,801,216
Mexico	1,000,900
United States	562,595,519
S. Africa and other countries	12,365,770

The total output of coal in the whole world during 1913 was, therefore, 1,363,878,110 tons. In 1909 it was 1,093,663,143 tons, which shows an increase during that period of about 25%. Taking these figures as a basis, and assuming that Germany controls about one-half the coal output of France, as well as that of Belgium, then the coal output at the disposal of the central empires is 366,564,447 tons, as compared with 411,238,173 tons available for ourselves and our allies. The way in which these vast quantities of coal are utilised is of the greatest national importance at the present moment. For the production of power alone the supply is ample, for in 1905 Dr. Beilby estimated the consumption for this purpose at 52 million tons. But he also states that the average consumption of coal for steam-engines is 5 lb. per indicated horse-power per hour, while it should not exceed 2 lb. I need scarcely say, if we could increase the use of gas for power, it would be of very great advantage. I know that the Coal Smoke Abatement Society receive many letters from manufacturers, thanking them for assistance given in preventing the waste of fuel in the form of smoke. There is no doubt that the atmosphere of London has improved very much of late years. I would also like to refer to a method, which is a model of technical research and is due to Dr. Carpenter, for eliminating the last trace of sulphur from the gas in our cities. The great reproach of the use of gas in the cities has hitherto been that it still contains sulphur. In the future we shall be in a very happy state as regards the use of gas for fires. Prof. Bone has also introduced to us a method of burning gas which is of benefit and I hope he will tell us a little more about it. More than one-half of the coal used for the production of steam power is therefore wasted. Even if we adopt the most economical steam plant available this method of producing power is still wasteful compared with other methods of utilising fuel that are now in practical use. Ten years ago Dr. Beilby estimated that the 52 million tons used for power could be reduced to 11 millions by using gas. It will scarcely be disputed that the gas engine is theoretically a more efficient means of producing power from coal than the steam-engine; but difficulties in the case of large installations have limited the application of this power to smaller units. For large power stations the steam turbine still maintains its position and has done much to check waste in fuel, so far as steam power is concerned. Sir Charles Parsons states that the highest efficiency realised by any steam engine up to the present is about 12½ lb. of steam per kilowatt-hour, which is equivalent to 9.9 lb. per shaft horse-power, or a little over 1 lb. of good coal burnt under a good boiler. By superheating the steam a slight additional economy may be effected, to the extent of about 1% for every 14° C. increase of temperature of the steam delivered to the engine. Beyond a certain temperature, however, the deterioration of the plant more than counterbalances the increase in efficiency.

Quite recently the steam consumption in turbines has been still further diminished. Mr. Emil Gareke, of the British Electric Federation, Ltd., whose organising ability has done so much for electric traction in London, informs me that his Company is now building sets of 5000 k.w. capacity, which will show a steam consumption of about 11 lb. of steam per kilowatt on full load. Mr. Gareke has also been good enough to send me a table illustrating the diminution which has taken place in the cost of producing electricity at the Power Station of the St. Pancras Borough Council during the last 24 years.

I am much indebted to Mr. Gareke for picking out a typical station in London in which the

increase in efficiency is something enormous. You know London, and know how the underground railways have been co-ordinated, to their advantage. This great economy has been largely due to Mr. Gareke's exertions.

Lb. of steam per k.w. required by generating plant.

Type of engine.	Date installed.	K.W.	Full load.
Reciprocating	1891	80	25
Do.	1896	130	26.6
Do.	1899	500	23.1
Do.	1903	450	19.5
Turbo D.C.	1906	1000	17
Turbo Alt.	1909	2200	16.15
"Ljungstrom" Alt.	1914	1000	12.75
Do. (guaranteed)	1915	5000	11.8

While the output of electricity per lb. of coal is increasing in a satisfactory manner the actual cost must, to a great extent, depend upon the price of the coal on the spot. In the London district the price obtained per unit varies from 1.96d. to 2.62d. Such prices are prohibitive for chemical work.

There is one thing I would like to say about the London Electric Generating Companies. We cannot get the London Companies to assist. If you want to start an electrolytic industry they will make no reduction in their rates. If you want to start an industry, which might become a very great one, they will not meet you.

For comparison some of the prices charged per unit in the districts where coal is produced will be of interest: Barnsley 1.78d., Bradford 1.14d., Dewsbury 1.87d., Halifax 1.48d., Huddersfield 1.32d., Leeds 1.12d., Rotherham 1.3d., Sheffield 1.13d., and Wakefield 1.45d. The price received for energy for all purposes by the Yorkshire Electric Power Company was 0.55d. per unit.

When we compare these prices with those paid in other great cities of the world we find great differences, as may be seen from the following selection: Paris 5.1d., Berlin 1.7d., Hamburg 3.08d., New York 2.6d., Boston 2.7d., Chicago 1.09d., Buenos Aires 2.75d.

In the great majority of the cases quoted the power is derived from coal mined and transported in the usual manner. In the light of modern technical progress it does not appear necessary that the coal should be mined and brought to the surface at great expense. An enormous saving could be effected by extracting the coal from the face of the seam by mechanical means and converting it into gas in the mine. Power could be produced from the gas on the spot and transmitted to any required distance by electricity. It is just possible, if an alteration were made in the getting of coal and the production of gas, the price might be reduced by one half. The electric current produced in this way might well compete with that derived from water power in a distant country. Even with coal mined in the usual way, gas power appears to be the cheapest form of energy generally available to us in England. The value of the by-products and the inferior quality of the coal that can be used do much to diminish the actual cost of the power. It seems to me almost stupid that when only the power of the coal is required one should raise the coal, ash and all, from the mine by mechanical means, when it is possible to produce gas in the mine that would raise itself. It could quite easily be done. There is not the slightest doubt in my mind, that it can be done, but I know it is very up-hill work to try to introduce

a new method. To a Society of which Dr. Ludwig Mond was President, Mond power gas needs no introduction. It has stood the test of time and, where cheap slack coal is obtainable and the installation is sufficiently large for the recovery of the by-products, it is probably the cheapest source of power now available. About nine-tenths of a pound of common slack will develop one horse-power, and the hot gases from the engine can also be utilised.

I may mention that one of the developments in the use of gas is that the hot waste products of combustion from the gas engine are further utilised for the production of power.

In plant of this description a special feature is made of the recovery of the by-products, especially the ammonia. The Moore gas producer claims to do this effectually and at a minimum cost. Ordinary town's gas is generally too expensive to compete with producer gas in the case of large installations; but, for small units it has great advantages. With gas costing 1s. per 1000 cub. ft. each brake horse-power costs about 0.21d. per hour.

One cannot dogmatise with regard to the source of power in any particular instance. One must go into the conditions of the case. I have factories with engines that have been in fifty years and it does not pay me to take them out. If I took them out I would have to scrap the engines and take the boilers out and buy gas or electric engines. I hope you do not expect me to generalise, but only to show what can be done, if one starts with money in one's pocket for a new installation.

Gas produced from other materials than coal has been successfully used as a source of power. Peat has completely supplanted coal for the last four years in an important factory at Portadown, in Ireland, with a saving in cost of more than 50%. Many plants for producing power from waste wood, tan, and other waste products have been erected and worked with profit to the manufacturers concerned; but such materials are not available in such quantities as to provide a general source of cheap power. In some cases the by-products are very valuable, and such plant might be worked at a loss as regards the power, but at a profit as regards the whole undertaking, and by-products. One could recover acetone, alcohol, acetic acid, etc., and the value of these products would contribute towards the cost of the power. In some cases, where wood waste is produced one may have to pay for its removal; the special conditions differ in each case. However cheap these materials may be at the moment, when a demand for them arises the price increases. For this reason I do not include oil among cheap sources of power. The chemist is devoting his attention to oils of all descriptions, and better uses will be found for them than burning them as a source of energy. It may be contended that oil can be used very much more cheaply than other things. But our oil stores are getting very rapidly depleted, much more rapidly than coal, and recent advances in chemistry show that even mineral oils can be used for building up chemical products, for which they have not been so used in the past. You may take oil as a raw material, and by putting it through a number of processes you may finally get valuable products. I have tried a number of experiments, especially in producing a substitute for petrol. A simple solar oil has produced 75% of spirit, as used in the ordinary motor-car. Therefore, I do not include oil in my sources of cheap power.

Hitherto I have spoken of gas engines of the reciprocating type; but the gas turbine has now arrived, and has come to stay. The difficulties arising from the action of the high temperature on the turbine blades are being surmounted.

Here, in the city where Crossley's have their factory, I need not say much about that, but the reciprocating gas engine may be superseded; the gas turbine has arrived and will be used more and more. The wear of the turbine blades has been diminished by a very profuse "scavenging" with a current of air. It seems to me that in that way, whilst they may not have actually surmounted the difficulty, they are on the way to it, and to get larger units. I believe there is a 1000 h.p. gas turbine being used at the present moment.

Natural gas as a source of power possesses great importance in some countries; but the small occurrence of that useful product in this country precludes its use on a commercial scale.

There is only one place in England where natural gas is being used for lighting. That gas has a peculiar composition and contains a larger proportion of methane than any other natural gas with which I am acquainted. This also might serve as a raw material for important organic chemical products.

I come now to our great competitor as a means of power production—water power. The French have rightly named it "La Houille Blanche," White Coal. For many purposes, especially for the production of electricity, it has no rival, and it is fortunate for those who have to compete with it that the chief sources of water power are generally situated at a distance from industrial centres. The cost of water power depends to a great extent upon the natural features of the locality, and especially the capital expenditure, which in some cases is very considerable. I have seen estimates of cost in which the cost of renewal of plant was obviously too low and, in some localities, interruptions in working are frequent. In places where the water supply in summer is mainly dependent upon the melting of glaciers or snow-fields, regularity of working may be obtained without too heavy an expenditure on storage reservoirs.

We do not hear very much about stoppages in working in such cases. I was in an installation in the Alps one day when flood water came down, and the work was stopped suddenly. With the water came a forest of trees, some of them a foot in diameter. But the channel was cleared in twenty-four hours and work started again. But longer interruptions take place in some cases from the want of water, not from the excess of it.

In Great Britain the catchment areas of our rivers are too small, and the height of our mountains is insufficient to yield the amount of power obtainable in some continental countries. In Scotland there are a number of localities where small installations might be possible; but it must not be forgotten that the percentage of general charges rises very rapidly when the installation is too small. An interesting article on Highland Water Power was published by Mr. A. Newlands in 1912, together with a map indicating the chief localities where water power might be made available. Mr. Newlands has published some interesting information which I am sure he will be pleased to send to anyone who asks him. He is engineer to the Highland Railway Company. Water is available in different localities and, for small powers, might be utilised. To keep the people in the Highlands will be a very great advantage, and if anything can be done to utilise this available water power for small industries, I think it ought to be done. The British Science Guild recently published an article on the Conservation of Water Power, in which I constructed a map showing those areas in Great Britain and Ireland in which the altitude exceeds 1000 feet, and the rainfall is more than 60 in. per annum. Those areas are the most favourable for water power,

and would be still further improved by a judicious scheme of afforestation.

I think it would be wise if the Government could see their way to take control of these water areas so that we did not get the state of things which exists in some countries, where the water powers have been snapped up and are held by people who ask a great price for them. It is a new development with which the Government should deal soon. Later on it will be too late.

The greatest water power that we possess is undoubtedly that of the waves. I do not refer to the tidal movement of the ocean, although the energy to be derived from that source would be considerable, but to the ceaseless pulsation of the sea upon our shores. The average height of the Atlantic waves is above 5 feet, and the interval between two waves about 20 seconds. A wave 5 feet high and 150 feet long produces energy equal to 10 horse-power, or 30 horse-power per minute. It is quite marvellous, if one examines the figures, to see how real the power-content of waves is. As coal gets dearer there are many spots about the coast where I think the waves might be utilised. Many inventors have devised methods for utilising wave power, some of which would, no doubt, be effective: but the stimulus of dear coal did not then exist, nor had the electric transmission of power been worked out. When a simple and cheap method of storing energy is discovered, both wave and wind power will become useful substitutes for coal, which will then occupy the more important position of a raw material for countless chemical industries.

I would like to point out with regard to lighting, that there are several other points that I have not referred to in consumption of coal for the production of light. For producing light we consume an amount of energy that is extremely wasteful. There are lights in nature where but a small proportion of the energy is lost. For instance, there are the fire-fly and the glow-worm. We have there a very small consumption of mechanical energy, and I think, in time to come, chemists will be able to produce a substance of that kind, so that you can carry in your waistcoat pocket the means of producing abundant light.

The utilisation of coal by burning is a most barbarous method. Those who come after us will be surprised that we used it in that way. I think there is only one substance now being produced by the direct chemical treatment of coal. It is made in Germany and called montan wax. It has a melting point of 90° C. I think, in time, we shall be utilising the different constituent parts of the coal without first destroying the coal by heating it.

DISCUSSION.

Professor W. A. BONE said they had heard so much recently about the importance of acquiring more trade in aniline dyes, that manufacturers were apt to forget the much greater importance of the raw material which formed the basis of the dyeing industry. He thought that chemists were less alive than engineers to the importance of fuel economy, but before the greater part of the realisable economies could be achieved, chemists would have to play a leading part.

With regard to power production, he advocated the establishment in every large industrial concern of a special department of fuel control, inasmuch as the cost, in apparatus and staff, of such a department was trivial compared with the saving of fuel which could be effected. In the iron and steel industry, it was now possible on a modern plant, comprising by-product coking ovens, blast furnaces, steel furnaces, and rolling

mills, to smelt the iron ore, convert the pig iron into steel, and finally to roll the ingots into rails, plates, or girders with the expenditure of no more coal than had to be charged into the coke ovens to provide the coke requisite for the blast furnace, and even this achievement did not exhaust all the economies that were possible in the manufacture of steel under an efficient fuel control.

Although he was not much in favour of Government intervention, or the calling in of Government "aid," as it was sometimes euphemistically called, in matters relating to industrial operations (except of course to safeguard the life and health of the worker), he called attention to the very valuable reports upon coal and its uses which had been issued from time to time within recent years by the United States Geological Survey and Bureau of Mines, as well as by the University of Illinois and the Canadian Government. He thought that the British Government ought to organise, through and in association with University Departments of Fuel Technology, a systematic survey of British coals from a chemical point of view. People were so apt to speak of coal as though it were a chemically uniform material, whose composition and behaviour varied within quite narrow limits, and those who acted on any such supposition often made very costly mistakes. And in view of future uses of coal, other than as a mere combustible, such a survey seemed almost imperative, and he hoped that the Society of Chemical Industry would see that steps were taken to initiate it.

In response to Mr. Reid's suggestion that he should say something about "surface combustion" developments, time did not permit of going into details, but surface combustion boilers had now been working quite satisfactorily on coke oven gas for two or three years, giving a very high evaporation per square foot of heating surface and an over-all efficiency of fully 90% in the net calorific value of the gas. The practical limit for the cooling of the combustion products in the system seemed to be about 120° C. It could be substantially lower but for the sulphur compounds in the gas. The economies realisable by the proper adoption of surface combustion methods in high temperature furnace work were unapproached by any other system he had yet come across.

Prof. HENRY LOUIS said that Mr. Reid had fairly covered the subject of the wastage that was taking place in the utilisation of our great national source of energy, but he had confined himself to one-third only of the whole question of the waste of coal. Coal was used for the generation of power, for the production of heat, and in metallurgical operations; Dr. Bone had alluded to the possibility of economies in the last-named, and there were many other directions in which the metallurgist could learn to economise. The same might be said as to the use of coal as a source of heat: for example, the central heating of blocks of buildings, as carried out on the Continent, might be quoted. He proposed, however, to follow Mr. Reid, and to confine his remarks to economies in the use of coal as a source of power, in which form coal formed the basis of practically all our British industries. Coal had risen sharply in price lately, but the general tendency for many years had been upwards; Prof. Louis had given the subject close attention, and his conviction was that manufacturers must make up their minds to face an increased cost of coal in the future. Probably 75% of the first cost of coal was labour; one of the very few results of the war that could safely be predicted was that labour, already powerful, would become a far more potent factor for good or ill than it had been in the past. It was quite true that an ex-

cessive price of coal would be the death-knell of many British industries, and might even bring about the decadence of the nation; it would certainly produce conditions under which the coal miner would suffer along with the rest of the nation. Unfortunately, however, as South Wales was showing them to-day, the coal miners' demands would not be restrained in the slightest by any considerations of national welfare, and no risk of future disaster would have the slightest influence on the coal miners and their leaders. These considerations weighed with him when he warned them not to expect cheap coal in the future. Other items of cost were also likely to go up; for example, pit timber, which had cost on the average something like 6d. per ton of coal wrought, was now much dearer than it had been, and here too it was probable that higher prices would rule in the future. The same might be said of practically every other item on the cost sheet. As regards the Government regulations, to which Mr. Reid had referred, some were no doubt beneficial and tended to make for increased safety, but some were unnecessary and unduly onerous. It was a common complaint amongst colliery managers that their days were taken up in signing blue paper forms when they ought to be underground looking after the safety of their pits.

Mr. Reid had referred to the utilisation of peat, but he (Professor Louis) thought that he had laid barely enough stress upon this subject. In proof of its importance he referred to a recent publication by the Canadian Department of Mines ("Peat, Lignite and Coal," by B. F. Haanel), in which the possibility of the economical generation of power from peat was clearly brought out, and accounts given of the places in Germany and elsewhere, where this was actually being done.

Water-power, where available, was an admirable source of energy, and its fuller utilisation would powerfully supplement our coal resources. He had had a good deal to do at various times with water-power schemes in Scandinavia, and he had on more than one occasion been offered high tension electric current, delivered to factory terminals alongside deep water harbours, for about 30s. per kilowatt-year all the year round.

Perhaps Mr. Reid's main thesis was that the gas-engine and not the steam-engine was to be the engine of the future. Personally he had his doubts on that point. On a really large scale he thought that to-day it was as cheap to generate electric current by steam as by gas, and smaller industries, that could not deal with such large units, would probably be better served by central electric power supply stations. A good example of this class of work was to be found in the operations of the great Electric Supply Company which supplied the counties of Northumberland and Durham. The main generating stations used turbo-generators, but at any point on the system where there was surplus power available, *e.g.*, at a coke-oven or blast-furnace plant, the Supply Company was prepared to purchase current. It might easily happen that a large works or a large colliery on the system found it advantageous to lay down its own generating station for its normal requirements, with the further advantage that in cases of breakdown or of emergency, it could get current from the mains of the Supply Company; smaller works found it preferable to rely wholly upon the latter. He believed he was right in saying that there was no longer a single steam engine in any of the shipyards on Tyne-side, electricity having everywhere replaced steam. His own view as regards gas *versus* steam-engines was that both must continue side by side; some coals are best adapted to steam-raising, some to the generation of gas, and he himself thought that

there was an ample field for both methods for some time to come.

Mr. Reid's suggestion of gasifying coal underground was no doubt attractive, but he feared it was impracticable. As the law now stands, it would be illegal to put in a gas generator underground, and there was a good deal to be said for this prohibition. Whilst it could be made quite safe under normal conditions, anything going wrong, a breakdown of the fan, a change in ventilating conditions, etc., might easily flood the workings with carbon monoxide, and this was too grave a danger to risk. Furthermore, the cost of underground generators would be formidable; anyone who had had to do with steam boilers underground knew how much more expensive it was to generate steam below than above ground, and how much more had to be spent on up-keep. Finally the cost of winding coal was a very small proportion of the total, and this was the only saving that would be effected; men would still have to ride, pumping and ventilation would still be required, so that very little saving would be really effected.

There was one very serious element of waste that Mr. Reid had not touched upon, perhaps the most serious because the most easily prevented, and that was the waste of small coal in the pit, which went on to an outrageous extent. In collieries in the Midlands coal was loaded not with the shovel but with forks with 1½-inch tines, and similar waste took place in South Wales. He had no exact figures, but he estimated that in these districts about 15% of the coal was being absolutely wasted and left in the pit, where it often constituted a source of danger. This coal was just as good in composition as the coal that was brought up, though of course not so saleable. It was simply left in the pit, because if it were brought up, the men would insist upon being paid for it at full hewing price, which was more than its market value. On account of the system of payment arranged between the colliery owners and the men, a national asset was being deliberately and irretrievably wasted. Here, surely, was a case where Government ought to interfere. They did not do so because such interference might lose them votes, and so it was better that the nation should suffer. There was no reason why this coal, which after all was the property of the nation in the ultimate sense, should be wasted except the apathy of the Government. The nation had divested itself of the ownership of its minerals, wisely and properly, as he held, but it was with the object that these minerals should be worked for the advantage of the nation, and the nation was fully entitled to interfere when its assets were being wasted without benefit to anyone. This was perhaps the readiest and one of the most important methods of fuel economy that could be suggested.

Dr. CHARLES CARPENTER considered the remarks of Professor Louis a valuable addendum to the paper they had just heard read. Remembering the importance of the coal fields as a national asset, it was essential that they should be utilised as well as developed to the greatest advantage. If the control of mines had been placed in similar hands to those which alkali makers worked under, he thought there would be little cause for complaint. His belief that an export duty should be re-imposed upon coal, had been confirmed by the opinions expressed to him by agents and dealers in coal on a very large scale. The return from such a duty might advantageously be applied to objects of national importance, as for instance the upkeep of a Navy on a scale essential for our protection. Mr. Reid had very forcibly drawn attention to the importance of substituting gaseous for solid fuel. His remarks were particularly

applicable to chemical industry, as the advantages derived in control of temperature and simplicity of working were so much greater than was possible under any other system. With regard to the de-sulphurising process referred to by him, it might interest the meeting to know that they were now trying the waste material picked out at the pit's mouth for increasing the production of sulphuric acid.

Mr. H. L. TERRY suggested that a systematic survey and analysis of British coals would be of great value. For example, the percentage of phosphorus in coal was seldom reported in analyses in this country, but frequently it was of great importance that it should be known. As regards montan wax, he was under the impression that it was extracted from certain German lignites by means of a solvent.

Mr. J. A. WEIL said he believed that montan wax was produced at Halle.

The PRESIDENT said with regard to low temperature distillation of coal, it seemed to him that when the technical difficulties were overcome there would be a very valuable method for the economic utilisation of fuel. He asked Mr. Reid if he could give them any information as to any direct method of converting the chemical energy of coal into electrical energy. As regards the production of cheap power, he did not note that Mr. Reid had referred to what was, to his mind, a valuable source of cheap power, namely, alcohol. We could produce alcohol cheaply and the use of it for combustion must come.

Mr. D. BROWN remarked that Mr. Reid spoke of cotton as not being used for explosives. Was it not used, he asked, for propelling explosives?

Mr. J. A. WEIL said that in a large central station in Hungary, gas engines of 2100 h.p. were in use and were supplying current over a very wide area.

Mr. THOMAS TYRER said that Mr. Reid's reference to alcohol suggested that since the commencement of the war, consideration of the alcohol question from the fuel point of view had been held up. Some time ago an International Conference was promoted by the Union of Motor Manufacturers and Users. One result was the appointment of a very strong committee under the chairmanship of the Hon. Arthur Stanley, M.P., and the executive direction of Lieutenant-Colonel Sir Charles Bedford. Besides motor manufacturers, there were chemists representing this Society. sanguine hopes were entertained that the development committee would liberally assist this movement for the production and utilisation of cheap alcohol. Immense resources lay within the Empire, as was shown in the "Fuel" issue of the "Times" in 1914. Increased facilities for the use of alcohol for industry and research had been granted (see this Journal, 1914, 880, 1119), but very much more was required to place technologists and researchers on an equality with Germany in particular. Even America, with its laws and regulations based on ours, was much more liberal in the conditions for useful arts and science. The high officials of the Excise and Customs were entirely sympathetic and appreciative, but the executive officers were by no means so as a rule, and administered the letter and not the spirit of the regulations. One result of present conditions must be united action and pressure by this and cognate Societies at the earliest moment possible. Again, one must refer to the almost infamous waste of the enormous Imperial resources in alcohol, and one thing urgently needed was unification of procedure and taxation throughout the Empire.

Mr. W. THOMSON asked if it was not the fact that cotton was used for the manufacture of gun-cotton for propelling the shot from the gun. If

that were so, a supply of cotton was extremely important to a belligerent nation.

Mr. REID thought his remarks had been misunderstood. It was known to every chemist that cotton was used for making guncotton, as the name implied. But it was not used for high-explosive shells.

Mr. THOMSON: It is said that the products of a bale of cotton are used in propelling one of the big shells.

Mr. REID replied that the subject was not included in the scope of his paper and he could not say more about it now.

Replying to other points raised in the discussion, Mr. Reid agreed with what Professor Henderson had said in regard to low temperature distillation of coal. That process produced very valuable products, and those products of the more complex structures were of the most value to chemists. He hoped that in the future we should distil no coal at all. He agreed with Professor Henderson that it would be a great advance if the energy of coal could be converted directly into electricity. About 80% of energy was now recovered, and there was the loss of energy in the turbine. He agreed with what Professor Louis had said, but he pointed out that, from the theoretical point of view, there must be some waste. Much of the energy that was being produced now at the large stations was produced by steam. He quite agreed that alcohol could be got in quantity and might be used. Alcohol was being made, at present, chiefly from products grown by agriculturists, and most of them food products. Waste wood could be converted into alcohol; they were doing that in the United States, and this did not involve a loss of food products. It might possibly be made best and cheapest of all from acetylene, but the acetylene must be produced cheaply. Calcium carbide was possible as a source of power, if as cheaply made as in Norway or Sweden. There would be cases where the cheapness of the energy would not be the test so much as the portability and the lightness of it. There had been great difficulty about the use of alcohol. He instanced a case in which its use in an engine had resulted in so much injury to the cylinders that it had been abandoned. There were probably impurities in the alcohol, but with pure alcohol there was still difficulty. There were two ways in which that might be avoided. One was by adding to the spirit something to prevent the production of the injurious substances that acted on the steel; the other was by superheating the alcohol before it was utilised. With regard to what Professor Bone had said, the fact of using 90% of the heat available in the gas was something they might look forward to in the future, with some hope, when they got over the difficulties with regard to the impurities in the gas.

Professor Louis, in his very interesting contribution, said that he (Mr. Reid) had only touched one-third of the subject of coal. That was so. He did not intend to go into the whole field, for it was a very wide field. He had tried to limit his paper to the special applications of power. It was the case that in this country we were handicapped, as regards foreign competition, by our own Government. The reason he had left out further references to peat, was that in this country coal was used so generally, that he did not think the use of peat instead of coal was likely to become general at the present moment. He had not the slightest doubt that it could be used. There were places in Germany where coal was scarce, and undoubtedly, where that was the case, peat was good and gave a very valuable by-product. In Canada coal was not available in some districts, and where peat was available

it was commonly used. The cheap water power that Professor Louis mentioned, was a serious competitor in the production of power.

The cost of carriage of materials was very considerable. By the time coal reached the industrial centres the carriage helped a good deal to increase the effect of competition. The waste of the small coal should be stopped. New markets would be opened, and he really thought a tax on coal exported would be a considerable assistance. Every other country imposed export taxes.

Mr. TYRER said that the changes introduced into the programme of the Annual Meeting had added considerably to the duties of the presidential office, and he proposed that a very hearty vote of thanks be accorded to their President for having so ably conducted the various meetings during the past three days.

Mr. Wm. THOMSON seconded, and the vote was carried with great enthusiasm.

The PRESIDENT thanked the members very heartily for their vote, and said he was particularly proud to have occupied the chair at what had been, he was sure, a most successful meeting. He regarded this as the first of a new type of Annual Meetings of the Society, at which the picnic element had been largely displaced by the consideration of very important matters.

VISIT TO TRAFFORD PARK.

Trafford Park occupies an area of about 1200 acres, to the west of Manchester, and is bounded on the north by the Ship Canal. The first works were erected on the estate in about 1898, and now nearly half the area is occupied by factories or warehouses, each factory being connected by its own siding with the canal and railways. Nearly one hundred firms now have sites on the estate, and over a million tons of raw and manufactured goods was carried over the Park during 1914.

The members were conveyed to the estate by the Corporation motor buses, and were first shown the Cotton Safes. These are large buildings divided into a number of compartments by double vertical walls, and provided with adequate means for dealing with outbreaks of fire. Each compartment has a capacity of four to five thousand bales of cotton.

The works of the Ford Motor Company were next visited. Here members saw in progress the various operations in the assembling of the cars, of which the company turns out more than 100 per diem.

After a rapid tour through a part of the works of the British Westinghouse Electrical Manufacturing Co., a visit was paid to the iron works of Messrs. Redpath, Brown & Co., where the cutting, drilling, and rivetting of girders was witnessed.

The members were entertained at tea at Trafford Hall, where they were welcomed on behalf of the Trafford Park Estate Company by Sir Walter Royce, to whom a very hearty vote of thanks was accorded.

The party then proceeded to Barton Bridge, where they embarked on a tug, which carried them along the Canal and back to the City, passing up one of the Manchester Docks *en route*.

On Friday evening a most successful Smoking Concert was given at the Grand Hotel, an excellent musical entertainment being provided. The members were honoured by the presence of M. le Comte de Chardonnet, who was received most enthusiastically, and who, in a graceful speech, expressed his pleasure at being present. At the close of the evening, on the motion of Mr. Tyrer, seconded by the President, a hearty vote of thanks was accorded to the Manchester Section for having entertained them so well during the past days. Mr. Hübner and Mr. Vlies replied.

SATURDAY, JULY 17TH.

VISITS TO WORKS, ETC.

MANCHESTER SEWAGE WORKS.

The system adopted in these works consists of anaerobic fermentation in open septic tanks, followed by oxidation of the effluent by single or double contact on aerobic bacteria beds. The septic tanks at Davyhulme have a total capacity of 16,000,000 gallons. The screened sewage requires 16 hours in which to pass through the septic tanks. The average daily flow of sewage through the works exceeds 40,000,000 gallons. The sludge produced is forced into storage tanks on the banks of the Ship Canal, whence it flows by gravity into the sludge steamer and is deposited at sea.

The members who visited these works were conducted by Dr. G. J. Fowler, Mr. E. Arden, and the Engineer in charge. In addition to the process described above, they were shown the experimental plant used for the production of "activated sludge" (see this Journal, 1914, 523, 1122). The process has been adopted by the City of Milwaukee, U.S.A., and is giving most satisfactory results. Since heat accelerates the process, it is proposed to warm the Manchester sewage by pumping it through the condensers of the new Corporation Power Station, adjoining.

SALFORD CORPORATION SEWAGE WORKS.

These works are situated at Weaste, on the borders of the Ship Canal. The total volume of sewage dealt with amounts, in dry weather, to about 11,000,000 gallons per day. After rough screening, it is treated with lime and ferrous sulphate, and the resulting effluent is passed through percolating filters varying in depth from 6 to 9 feet. The sludge from the precipitation tanks is deposited at sea beyond the Mersey Bar.

MANCHESTER CORPORATION ELECTRICITY UNDERTAKING.

Manchester was first supplied with electric current in 1893 from the Dickinson Street Station, and in 1901 from Bloom Street, the latter station being necessitated by the increased demand for tramways and general purposes. The combined installed plant capacity is 14,000 k.w., and it is worked on continuous current, low tension system, with a generating voltage of 420-550.

The Stuart Street Station was constructed to deal with the supply to certain out-districts and to provide for the tramway extensions. It has an installed capacity of 66,000 k.w. and employs chiefly turbine plants, the largest unit being rated at 15,000 k.w. It is worked on the high-tension, three-phase, alternating current system at 6600 volts.

The Art Gallery, the John Rylands Library, and the Cheetham Hospital and Library were also open for the inspection of members.

By the courtesy of the President and Committee of the Engineers Club, members of the Society were privileged to use the Club during their stay in Manchester.

Communication.

THE PRECIPITATION OF TRINITROTOLUENE FROM CONCENTRATED ACID SOLUTION BY MEANS OF WATER.

BY W. MCHUTCHISON AND R. WRIGHT.

The following experiments on the precipitation of trinitrotoluene from its solution in concen-

trated acids by the addition of water, were carried out at the request of Mr. E. de Barry Barnett, of the explosives works at Hackney Wick. The object was to determine the minimum quantity of water necessary for the complete separation of the explosive from its mother liquor, so that in the process of manufacture, unnecessary dilution of the nitrating acid—and the consequent expense involved in its recovery by evaporation—might be avoided. The results obtained are published in the hope that they may be of service to others engaged in the preparation of this important explosive.

Throughout the work, the crude commercial product alone was used, and the experimental method adopted was as follows:—An acid mixture containing by weight 80% H_2SO_4 , 10% HNO_3 and 10% H_2O , was prepared by mixing the requisite amounts of the previously analysed concentrated acids. Using this mixture as solvent, two solutions of trinitrotoluene were prepared, one containing enough solid to saturate it at 25° C. and the second about a third of that amount. Both solutions were filtered through glass wool, and their subsequent treatment was the same in the two cases. To each of a series of beakers, containing different quantities of water—each quantity being a multiple of 25 c.c.—25 c.c. of the solution of trinitrotoluene under investigation was added, and the contents of the beakers were then well stirred and allowed to stand overnight so as to attain room temperature. The separate lots of trinitrotoluene precipitated by different quantities of water, were then collected in Gooch crucibles lined with asbestos, drained as free as possible from adherent acid, washed in the crucible with a definite quantity of water (150 c.c.), dried at 40°–50° C., and weighed.

Better results are obtained by adding the acid solution to the water than *vice versa*. If the latter plan be followed, the precipitated trinitrotoluene is very apt to be thrown down in compact masses, which are most difficult to wash free from adherent acid.

A sample of undiluted residue acid—supplied by the firm of Nobel—which had been obtained in the actual manufacture of the explosive, was filtered through asbestos, so as to give a clear brown solution, which was then treated precisely as outlined above.

The various results obtained are given in the following tables. It will readily be seen that in every case the maximum amount of precipitation is caused by diluting with about four or five volumes of water, and that extreme dilution actually produces a decrease in the quantity of solid obtained. It is uncertain whether this decrease is due to a slight solubility of trinitrotoluene in pure water, or to the presence of some impurity not completely dissolved in the more concentrated solutions.

Unsaturated solution of trinitrotoluene in acid containing 80% H_2SO_4 , 10% HNO_3 and 10% water.

Volumes of water added to one volume of solution.	Weight of trinitrotoluene precipitated.
$\frac{1}{2}$	0.558 gram.
1	0.637 "
2	0.686 "
3	0.694 "
4	0.707 "
5	0.711 "
6	0.706 "
7	0.709 "
8	0.708 "
20	0.673 "
49	0.627 "

Solution of trinitrotoluene in same acid as above, saturated at 25° C.

Volumes of water added to one volume of solution.	Weight of trinitrotoluene precipitated.
$\frac{1}{2}$	0.997 gram
1	1.078 "
2	1.147 "
3	1.158 "
4	1.199 "
5	1.184 "
6	1.196 "
8	1.198 "
20	1.152 "
40	1.097 "

Nobel's residue acid, saturated at 25° C.

Volume of water added to one volume of solution.	Weight of trinitrotoluene precipitated.
1	2.697 gram
2	2.794 "
3	2.808 "
4	2.836 "
5	2.869 "
7	2.866 "
8	2.831 "
20	2.760 "
40	2.606 "

The required dilution may perhaps be more easily controlled by means of the specific gravity, than by noting the volume of water added. The densities, relative to water, are therefore given for the first few dilutions of Nobel's residue acid, the measurements being made at 17° C.

	Densities.
Original acid	1.850
One vol. of water added	1.489
Two vols.	1.336
Three vols.	1.255
Four vols.	1.207
Five vols.	1.172
Seven vols.	1.104

The residue acid showed the following composition on analysis:— H_2SO_4 , 86.30%; HNO_3 , 6.71%; HNO_2 , 0.50%; H_2O , etc. (diff), 6.49%. About 3 grms. of the acid solution was weighed out in a thin glass bulb, which was then placed in a stoppered bottle containing about 100 c.c. of water, and the bulb broken by shaking. The solution so obtained was filtered free from the precipitated trinitrotoluene and broken glass, and diluted to 250 c.c. Suitable quantities of this solution were taken for analysis, the total acid being estimated by standard sodium carbonate, the nitrous acid by *N*/100 permanganate, the sulphuric acid by precipitation as barium sulphate, and the nitric acid calculated by difference. The results tabulated are the mean of two sets of estimations which showed close agreement with each other.

In conclusion our best thanks are due to Dr. A. W. Stewart for valuable advice and assistance during the progress of the work, and also to Messrs. John W. Leitch and Co., Milnsbridge Chemical Works, Huddersfield, and to Nobel's Explosives Factory, Glasgow, for supplies of trinitrotoluene and residue acid.

BOARD OF INVENTIONS AND RESEARCH.

The Secretary of the Admiralty announces that the arrangements for the organisation of the Inventions Board to assist the Admiralty in co-ordinating and encouraging scientific effort to the requirements of the Naval Service have now been completed. It will comprise: (a) A Central Committee; (b) a Panel of Consultants composed of scientific experts who will advise the main

Committee on questions referred to them. The Central Committee will consist of: Lord Fisher of Kilverstone, G.C.B., O.M. (President), Sir J. J. Thomson, O.M., F.R.S., Hon. Sir C. A. Parsons, K.C.B., F.R.S., and Mr. G. T. Beilby, F.R.S. The Consulting Panel will comprise the following list, which will be added to from time to time if necessary: Professor H. B. Baker, F.R.S., Professor W. G. Bragg, F.R.S., Professor H. C. H. Carpenter, Sir William Crookes, O.M., F.R.S., Mr. W. Duddell, F.R.S., Professor Percy Frankland, F.R.S., Professor Bertram Hopkinson, F.R.S., Sir Oliver Lodge, F.R.S., Professor W. J. Pope, F.R.S., Sir Ernest Rutherford, F.R.S., Mr. G. Gerald Stoney, F.R.S., and Professor the Hon. R. J. Strutt, F.R.S. The Board is accommodated temporarily in the Whitehall Rooms, Hotel Métropole, Whitehall Place, London, S.W., but at an early date will be transferred to permanent offices at Victory House, Cockspur Street, S.W. Communications should be addressed to: The Secretary, Board of Inventions and Research.

GOVERNMENT SCHEME FOR ORGANISING AND DEVELOPING RESEARCH.

Particulars of a "Scheme for the organisation and development of scientific and industrial research" were issued on July 26th by the Board of Education in a document signed by Mr. Arthur Henderson.

The scheme provides for the establishment of:—

(a) A Committee of the Privy Council responsible for the expenditure of any new moneys provided by Parliament for scientific and industrial research;

(b) A small Advisory Council responsible to the Committee of Council and composed mainly of eminent scientific men and men actually engaged in industries dependent upon scientific research.

The Committee of Council will consist of the Lord President, the Chancellor of the Exchequer, the Secretary for Scotland, the President of the Board of Trade, the President of the Board of Education (who will be Vice-President of the Committee), the Chief Secretary for Ireland, together with such other Ministers and individual members of the Council as it may be thought desirable to add.

The first non-official members of the Committee will be:—The Right Hon. Viscount Haldane of Cloan, O.M., K.T., F.R.S., The Right Hon. Arthur H. D. Adland, and The Right Hon. Joseph A. Pease, M.P.

The President of the Board of Education will answer in the House of Commons for the sub-head on the vote, which will be accounted for by the Treasury under Class IV., Vote 7, "Scientific Investigations, etc."

The first members of the Council will be:—The Right Hon. Lord Rayleigh, O.M., F.R.S., LL.D., Mr. G. T. Beilby, F.R.S., LL.D., Mr. W. Duddell, F.R.S., Prof. B. Hopkinson, F.R.S., Prof. J. A. McClelland, F.R.S., Prof. R. Meldola, F.R.S., Mr. R. Threlfall, F.R.S., with Sir William S. McCormick, LL.D., as administrative Chairman.

Scope of the Scheme.—The present scheme is designed to establish a permanent organisation for the promotion of industrial and scientific research.

It is in no way intended that it should replace or interfere with the arrangements which have been or may be made by the War Office or Admiralty or Ministry of Munitions to obtain scientific advice and investigation in connexion with the provision of munitions of war. It is, of course, obvious that at the present moment it is essential that the War Office, the Admiralty, and the Ministry of Munitions should continue to make their own direct arrangements with scientific men and institutions with the least possible delay.

It is clearly desirable that the scheme should operate over the kingdom as a whole with as little regard as possible to the Tweed and the Irish Channel. The research done should be for the kingdom as a whole, and there should be complete liberty to utilise the most effective institutions and investigators available, irrespective of their location in England, Wales, Scotland, or Ireland. There must therefore be a single fund for the assistance of research, under a single responsible body.

It is obvious that the organisation and development of research is a matter which greatly affects the public educational systems of the kingdom. A great part of all research will necessarily be done in universities and colleges which are already aided by the State, and the supply and training of a sufficient number of young persons competent to undertake research can only be secured through the public system of education.

The primary functions of the Advisory Council will be to advise the Committee of Council on—

(i) Proposals for instituting specific researches,

(ii) Proposals for establishing or developing special institutions or departments of existing institutions for the scientific study of problems affecting particular industries and trades,

(iii) The establishment and award of Research Studentships and Fellowships.

The Advisory Council will also be available, if requested, to advise the several Education Departments as to the steps which should be taken for increasing the supply of workers competent to undertake scientific research.

Arrangements will be made by which the Council will keep in close touch with all Government Departments concerned with or interested in scientific research and by which the Council will have regard to the research work which is being done or may be done by the National Physical Laboratory.

It is essential that the Advisory Council should act in intimate co-operation with the Royal Society and the existing scientific or professional associations, societies, and institutes, as well as with the universities, technical institutions, and other institutions in which research is or can be efficiently conducted.

It is proposed to ask the Royal Society and the principal scientific and professional associations, societies, and institutes to undertake the function of initiating proposals for the consideration of the Advisory Council, and a regular procedure for inviting and collecting proposals will be established. The Advisory Council will also be at liberty to receive proposals from individuals and themselves to initiate proposals.

It is contemplated that the Advisory Council will work largely through sub-committees reinforced by suitable experts in the particular branch of science or industry concerned. On these sub-committees it would be desirable as far as possible to enlist the services of persons actually engaged in scientific trades and manufactures dependent on science.

The Advisory Council will proceed to frame a scheme or programme for their own guidance in recommending proposals for research and for the guidance of the Committee of Council in allocating such State funds as may be available. This scheme will naturally be designed to operate over some years in advance, and in framing it the Council must necessarily have due regard to the relative urgency of the problems requiring solution, the supply of trained researchers available for particular pieces of research, and the material facilities in the form of laboratories and equipment which are available or can be provided for specific researches.

Office accommodation and staff will be provided for the Committee and Council by the Board of Education.

Journal and Patent Literature.

PATENT SPECIFICATIONS may be obtained by post by remitting as follows:—

English.—6d. each, to the Comptroller of the Patent Office, Southampton Buildings, Chancery Lane, London, W.C.

United States.—1s. each, to the Secretary of the Society.

French.—1 fr. 05 c. each, as follows: Patents dated 1902 to 1907 inclusive, Belin et Cie., 56, Rue Ferou 8, Paris (6e). Patents from 1908 to date, L'Imprimerie Nationale, 87, Rue Vieille du Temple, Paris.

I.—GENERAL PLANT ; MACHINERY.

PATENTS.

Separating machines; Centrifugal — J. H. Hoseason and T. R. Wollaston, Manchester. Eng. Pats. 12,774, May 25, and 22,224, Nov. 9, 1914.

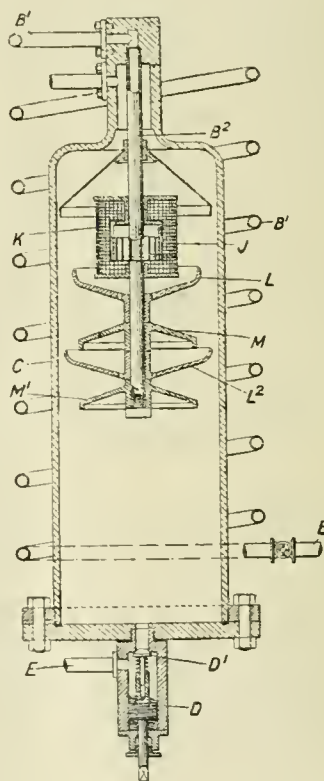
A vertical cylinder, 10, whose height is greater than five times its diameter, is rotated at a high speed about the shaft, 8, and is surrounded by a stationary outer casing, 4, suspended by a spherical joint, 3, which is itself supported by the pillars, 2. The lower part of the casing, 4, has three or more elastic holders, 26, to steady it, and allow it to take up the proper axis of gyration when 10 is rotated. The liquid to be separated is fed at a predetermined speed through the bent pipe, 12, 13, into the outer casing, 4, and is caused by the spiral blades, 11, to pass into the inner cylinder, 10. The rapid rotation causes the liquid to take a long spiral path upwards and allows a very long time for the separation. Finally the clarified liquid passes away by the apertures, 18, into the collecting trough, 17, and is discharged through the pipe, 19. A gauge glass, 14, is provided so that the height to which the cylinder will be filled when at rest, can be adjusted by regulating the feed, it having been found that the separating effect varies with the difference of height of the liquid (when stationary) from the level of the discharges, 18. The residual liquid is withdrawn through the tap, 16, and a hand hole, 15, is provided for removing any deposited solids.—W. H. C.

Catalytic bodies. O. H. Valpy and O. D. Lucas, London. Eng. Pat. 5847, March 7, 1914.

POWDERED metallic oxide or a mixture of oxides is heated with organic compounds of the metal. Suitable proportions for a catalyst for the production of light hydrocarbons from heavy hydrocarbons are: ferric oxide, 32; nickel oxide, 7.5; carbon, 5.5; ferrous oxalate, 40; and nickel oxalate, 15 parts. The mixture is incorporated with 17½% by weight of tar, briquetted, and sintered in an enclosed crucible below the melting point of the metal. The process may be applied to other catalytic metals, *e.g.*, chromium, cobalt, or manganese. The addition of small amounts of aluminium, cerium, magnesium, or

other members of the alkaline-earth class is an advantage in many cases, *e.g.*, a portion of the carbon may be replaced by powdered aluminium to the extent of 1.5% of the total weight of the mixed powders. Thus other suitable mixtures are: (1) Ferric oxide, 35; manganese carbonate, 27; carbon, 3; aluminium, 5; and ferrous oxalate, 30 parts. (2) Ferric oxide, 36; nickel oxide, 15; aluminium, 3; iron tartrate, 30; and nickel acetate, 16. The catalytic bodies so obtained do not appear to lose their efficiency after continued use; in fact in some cases their efficiency appears to increase after a short period of use.—F. W. A.

Refrigerating systems and apparatus therefor. F. W. S. Stokes. London. Eng. Pat. 13,245, May 20, 1914.



IN an ammonia or carbon dioxide refrigerating system with multiple effect compression, the liquid from the condenser passes by pipes, B, B¹, to a multiple effect receiver, C, which it enters by the perforated pipe, B², slotted cylinder, J, and perforated screen, K. The liquid descends over the trays, L, M, L², M¹, and passes to the valve chamber, D. The valve, D¹, opens against an adjustable spring at a predetermined pressure difference, and the liquid passes by pipe, E, to an evaporator, and thence to the compressor. In a modified form of valve, its opening is controlled by the pressure in the condenser in addition to the

spring. The valve may alternatively be placed at the inlet to the receiver.—W. F. F.

Filters for air and gases. Hall and Kay Ltd., D. Hall, and J. H. Kay, Ashton-under-Lyne. Eng. Pat. 15,212, June 25, 1914.

THE filter is composed of flat open frames, with tapering sides covered with filtering fabric, and placed side by side so as to form a filtering chamber with tapering inlet pockets. The frames are assembled and mounted in a casing, so that any one

may be easily removed for cleaning. Stretching-bars are provided to take up any sag of the filtering fabric.—W. F. F.

Suspended solids; Tanks for freeing liquids from —. J. Fieldhouse, Walthamstow, Eng. Pat. 15,651, June 30, 1914. Addition to Eng. Pat. 2213, Jan. 27, 1912 (this J., 1913, 210).

THE liquid is introduced beneath the central cone instead of above it, and may be delivered in an upward or downward direction. Instead of having an inner conical wall, the bottom of the tank is raised and formed into two or more dish-shaped compartments. The central cone is formed either independently of or integrally with the tank, and may have its upper edge extended above the latter. Ventilating pipes are also provided in the walls of the central portion of the tank.

—W. H. C.

Desiccating trays or grids. C. C. Carpenter, London. Eng. Pat. 439, Jan. 11, 1915.

THE tray is formed of wood or other inert material, with parallel channels alternately on opposite sides, and passages in the thickness of the material at right angles to the channels, for the circulation of the drying medium. Alternatively the tray may be built up of notched channel rails separated by intervening laths, giving the same configuration.

—W. F. F.

Desiccating apparatus. S. H. Bunnell, New Canaan, Conn., Assignor to The Griscom-Russell Co. U.S. Pat. 1,141,102, June 1, 1912. Date of appl., May 9, 1914.

HEATED air is introduced tangentially into a vessel of circular horizontal section, so that a circular motion of the air is set up. The liquid to be desiccated is sprayed into the vessel, and the desiccated product is carried away by the air, the circular motion of which is maintained. Cold air is then introduced into the air current to cool rapidly the desiccated product.—W. H. C.

Drying system. W. M. Grosvenor, New York. U.S. Pat. 1,141,705, June 1, 1915. Date of appl., Aug. 17, 1908.

THE material to be dried is placed on a perforated tray in the upper part of the drying chamber, the lower part of which is divided into two vertical conduits, which communicate at the bottom. The air passing up one of these conduits is heated by suitable heating tubes and then passes through the material into the other conduit, in passing down which it is cooled.—W. H. C.

Desiccating process. I. S. and O. E. Merrell, Assignors to Merrell-Soule Co., Syracuse, N.Y. U.S. Pat. 1,141,879, June 1, 1915. Date of appl., Dec. 11, 1914.

THE liquid to be desiccated is injected at a high pressure, as a whirling current of finely divided spray, into a whirling current of air.—W. H. C.

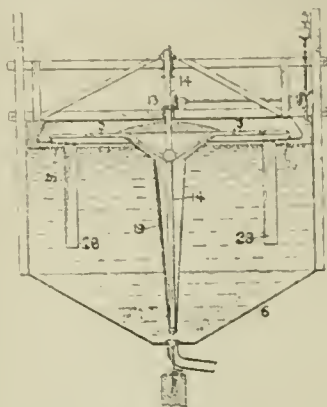
Emulsifying substances; Device for combining and —. J. B. Vogelsang, Webster Groves, Mo. U.S. Pat. 1,140,548, May 25, 1915. Date of appl., June 8, 1914.

THE substances to be emulsified are forced by a fluid under pressure through an injector nozzle into a perforated tube, which has its interior surface roughened and is provided with a removable plug at the front end. The perforated tube is surrounded by a tubular casing.—W. H. C.

Agitator. J. C. King, Assignor to F. Freyler, La Junta, Colo. U.S. Pat. 1,140,465, May 25, 1915. Date of appl., Dec. 5, 1914.

A VERTICAL pipe, 14, having horizontal branches, 3, with curved ends, is surrounded by a conical outer

pipe, 19, and is supported and rotated by the frame, 13, within the tank, 6. The frame and the vertical pipe can be moved up and down. The liquid rises



in the pipe, 14, and is discharged from the ends of the branches, 3, on to the plate, 26, provided with a perforated edge bent upwards. Agitating blades, 28, are suspended from the plate, 26.—W. H. C.

Filter. Oil filter. W. F. Warden, Akron, Ohio. U.S. Pats. (A) 1,140,726 and (B) 1,140,727, May 25, 1915. Dates of appl., Jan. 5 and May 11, 1914.

(A) A NUMBER of concentric annular masses of filtering material are held between an upper and a lower plate, the latter being provided with a central discharge pipe. (B) The filter is fixed in the upper compartment of a tank into which the dirty oil is delivered. The oil passes through the annular filters and is discharged through the central pipe into the lower compartment of the vessel.—W. H. C.

Filtering device. G. A. and A. F. Schütz, Wurzen, Germany. U.S. Pat. 1,141,213, June 1, 1915. Date of appl., Jan. 20, 1915.

A NUMBER of filter plate elements are mounted on a hollow shaft and are rotated within a receptacle, into which compressed air is introduced. Screw conveyors are provided between the filter plates to remove the solids deposited thereon.—W. H. C.

Evaporator. F. M. de Beers, Chicago, Ill. U.S. Pat. 1,140,881, May 25, 1915. Date of appl., Aug. 28, 1913.

THE supply of steam to the space surrounding the heating tubes of the evaporator is controlled by hinged shutters adjusted from without, which are placed between a peripheral steam chest surrounding the heating chamber and the chamber itself.

—W. H. C.

Evaporation of liquids; Process of and apparatus for the —. P. H. Fascio and C. L. Picot. Fr. Pat. 474,140, Nov. 4, 1913.

THE products from the combustion of a solid, liquid, or gaseous fuel are mixed directly with the liquid to be evaporated. The fuel is burnt in a combustion chamber provided with a water jacket, and in the case of solid fuels, the gases are caused to bubble through the liquid in the evaporator. In the case of liquid and gaseous fuels the upper part of the combustion chamber has the form of an injector, and the products of combustion mix with a spray of the liquid to be evaporated withdrawn by the injector action from the upper part of the jacket.—W. H. C.

Absorbing vapours: Apparatus for—P. Schou. First Addition, dated June 2, 1914, to Fr. Pat. 459,589, June 23, 1913 (see Eng. Pat. 16,510 of 1912; this J., 1913, 275). Under Int. Conv., June 18, 1913.

THE porous plate is used only for feeding the absorbing liquid, the distribution being effected by perforated plates and glass tubes, arranged between the plates.—W. H. C.

Chemical reactions between solids or between solids and gases, at a high temperature; Process for carrying out—Soc. Générale des Nitrures. (A) Fr. Pat. 473,918, Oct. 20, 1913, and (B) 1st Addition thereto, dated Oct. 27, 1913. (See also Eng. Pat. 24,731 of 1913; this J., 1914, 421.)

(A) THE high temperature necessary for certain reactions (e.g. the formation of aluminium nitride) is attained by submitting the reaction mixture first to the heating effect produced by the combustion of a portion of the carbon present, or of carbon monoxide, hydrocarbons, or the like, in a conduit of refractory material, and then projecting the heated mixture into an electric arc. (B) The arc is formed in the conduit in which the combustion takes place instead of just in front of it.—W. H. C.

Chemical reactions between solids or between solids and gases, at a high temperature; Process for carrying out—Soc. Générale des Nitrures. Fr. Pat. 474,233, Nov. 11, 1913. (See preceding abstract.)

THE gas carrying the solid particles in suspension is projected tangentially into the arc chamber, so that both the arc and the gas current take a spiral path.—W. H. C.

Pump for corrosive liquids. Comp. Bordelaise des Produits Chimiques, Fr. Pat. 474,097, Oct. 31, 1913.

THE shaft of a centrifugal pump is supported in a long journal, which is provided with a stuffing-box and enters the suction side of the pump to prevent the corrosive liquid from entering the journal. A constant feed lubricator is provided, so that at the moment when the pump is stopped, the lubricant prevents the corrosive liquid from entering the journal.—W. H. C.

Evaporating or drying plants. G. A. Krause. Munich, Germany. Eng. Pat. 22,507, Oct. 6, 1913. Under Int. Conv., Oct. 12, 1912.

SEE Fr. Pat. 463,319 of 1913; this J., 1914, 408.

Drying liquids, damp substances, and the like; Method of and means for—M. Töpfer, Grossschocher, and P. Müller, Vilbel, Germany. Eng. Pat. 19,924, Sept. 3, 1913.

SEE Fr. Pat. 463,992 of 1913; this J., 1914, 63.

Rectifying columns; Cooling plates of—E. Barbet et fils et Cie., Paris. Eng. Pat. 13,599, June 4, 1914. Under Int. Conv., June 4, 1913.

SEE Fr. Pat. 469,979 of 1913; this J., 1915, 16.

Liquids, and gases or vapours; Apparatus for bringing—into contact with each other. K. E. Markel, London. From W. Feld G. m. b. H., Linz on Rhine, Germany. Eng. Pat. 14,240, June 12, 1914.

SEE U.S. Pat. 1,110,914 of 1914; this J., 1914, 999.

Crystals; Method of and apparatus for forming large—Elektrochem. Werke G. m. b. H., Berlin. Eng. Pat. 14,393, June 15, 1914. Under Int. Conv., July 16, 1913.

SEE Ger. Pat. 273,929 of 1913; this J., 1914, 822.

Gases; Purification of—Soc. l'Air Liquide, Paris. Eng. Pat. 15,053, June 23, 1914. Under Int. Conv., July 2, 1913.

SEE Fr. Pat. 471,162 of 1913; this J., 1915, 163.

IIA.—FUEL; GAS; MINERAL OILS AND WAXES.

Gaseous combustion at high pressures. W. A. Bone, H. Davies, H. H. Gray, H. H. Henstock, and J. B. Dawson. Proc. Roy. Soc., 1915, A, 91, 464—465.

THE results obtained by exploding mixtures of methane with less than its own volume of oxygen at initial pressures between 8 and 32 atmospheres, and from experiments upon an equimolecular mixture of ethane and oxygen, were found to support the "hydroxylation" theory of hydrocarbon combustion previously advanced by Bone (this J., 1906, 526, 1209). The relative affinity of methane for oxygen in flames was found to be at least 20 times that of hydrogen, with which latter the affinity of carbon monoxide was comparable. When mixtures corresponding to $\text{CH}_4 + \text{O}_2 + x\text{H}_2$ were fired under high initial pressures, the partial pressures of methane and oxygen being constant and x variable, the distribution of oxygen between the methane and hydrogen varied with x^2 , indicating that, in flames, hydrogen is burnt directly to steam and not indirectly through hydrogen peroxide. When mixtures corresponding to $\text{C}_2\text{H}_4 + \text{O}_2 + x\text{H}_2$ were exploded at high initial pressures, it was found possible to increase the value of x to 8 without causing any deposition of carbon. As the result of experiments in which the whole pressure curves, up to and beyond the attainment of maximum pressure, were recorded by exploding mixtures corresponding to $2\text{H}_2 + \text{O}_2 + 4\text{N}_2$, $2\text{CO} + \text{O}_2 + 4\text{N}_2$, and $\text{CH}_4 + \text{O}_2 + 4\text{N}_2$, under initial pressures of about 50 atmospheres, no direct relation was found to exist between the affinities of the combustible gases for oxygen and the rates at which the maximum pressures were attained.

—W. E. F. P.

Combustible vapours and air; Rate of ignition of mixtures of—M. Hofsäss. J. Gasbeleucht., 1915, 58, 73. J. Gas Lighting, 1915, 130, 698.

AIR from a cylinder was passed through a meter into a carburettor into which the carburetting agent was dropped from a funnel at a speed so regulated that it was immediately vaporised and taken up by the air current. The temperature of the carburettor was kept constant by means of a steam jacket, and the air-gas leaving it was cooled in a coil before being passed into a vessel for the determination of the sp. gr. by the author's method (J. Gas Lighting, 1915, 130, 388), and then burned in a Bunsen burner in which the height of the flame was optically measured. The rates of ignition were calculated from:—(1) The rate of the passage of air through the meter in cm. per second. (2) The efflux velocity in seconds of the air-gas from the sp. gr. apparatus. (3) The height in mm. of the inner cone of the Bunsen flame and calculation of the area of the cone from this measurement and the radius of the burner tube. The following results were obtained:—*Benzene-air gas*:—With 2% benzene the velocity of ignition was 30 cm. per sec., rising to a maximum of 32 cm. per sec., at 3%, and then falling to 13 cm. with 6.5%. *Heptane-air gas* gave a maximum velocity of 54 cm. per sec. at about 2.3%, falling to about 28 cm. at 5%. *Pentane-air gas* gave a maximum of 57 cm. per sec. for 2.5%, falling to 42 cm. for 4.3%. *Gasoline-air gas*:—For gas of sp. gr. 1.03 the

velocity was about 68 cm. per sec., rising to a slightly higher maximum for gas of sp. gr. 1.035, and thence falling to 47 cm. per sec. for gas of sp. gr. 1.06. *Benzoline-air gas*:—For gas of sp. gr. 1.03 the velocity was 28 cm. per sec., rising to a maximum of 31 cm. for gas of sp. gr. 1.037, and thence falling to 16 cm. for gas of about sp. gr. 1.06. (See also this J., 1915, 214).—C. A. M.

Annual report on alkali, etc., works. See VII.

PATENTS.

Liquid fuel, and process of manufacturing same. H. Plauson, St. Petersburg. Eng. Pat. 17,729, Aug. 1, 1913.

COAL, charcoal, etc., is disintegrated so that it will pass through a sieve of mesh 35,000 to 40,000 per sq. in. The powder is ground with water or a liquid hydrocarbon under great pressure, or at a very high speed, to obtain an emulsion. The process is hastened by the addition of 1 to 3% of a natural colloid (soap, milk, casein, gelatin, albumin, indiarubber, etc.) The colloidal solution of coal thus obtained may be used as fuel in internal combustion engines.—F. W. A.

Peat; Utilisation of —. T. Rigby, Dumfries, and N. Testrup, and Wetcarbonizing, Ltd., London. Eng. Pat. 5853, March 7, 1914.

IN order to maintain a supply of peat during cold periods, it is stored in excavations below the level to which frost can extend.—F. W. A.

Fuel briquettes; Composite — for heating and production of cement, clinker, or ash. E. Eaton, London. Eng. Pat. 14,013, June 10, 1914.

A MIXTURE is prepared containing: chalk, 40%; small coal, coke, ashes, clinker, or carbonaceous matter, 40%; clay, 12%; solidified tar, 8%. The mass is ground in a disintegrator to which steam is admitted, and then moulded. The briquette ash is valuable for cement manufacture.—F. W. A.

Coal dust; Method of agglomerating — to obtain briquettes or other combustibles burning without smoke. H. Josse. Fr. Pat. 473,872, Oct. 17, 1913.

ABOUT 920 parts of anthracite or a similar coal is incorporated with about 65 parts of gas pitch (preferably dry), 5 parts of powdered wood charcoal, and 10 parts of a vegetable agglutinant, such as flour, and the mixture is heated in a muffle furnace until no more smoke is evolved from the pitch.—C. A. M.

Coke; Manufacture of —. A. McD. Duckham, Ashted, Surrey. Eng. Pat. 17,502, July 23, 1914.

A VERTICAL retort, tapering upwards, is fed from a hopper having a ram at its discharge end, which exerts a continuous pressure on the descending charge except when withdrawn momentarily to admit fuel. The coke is removed continuously at the bottom of the retort by an endless travelling band, and the volatile products are withdrawn from the side of the retort at different levels.—W. F. F.

Gas-producer. E. A. W. Jefferies and G. H. Isley, Assignors to Morgan Construction Co., Worcester, Mass. U.S. Pat. 1,142,100, June 8, 1915. Date of appl., March 2, 1908.

THE upper stationary part of the producer casing dips into a revolving annular pan, which forms a water seal and carries a central hopper. The lower part of the casing is rotatable and is enclosed by an extension of the fixed upper part.—W. F. F.

Gas-producer. W. B. Chapman, Assignor to Chapman Engineering Co., New York. U.S. Pat. 1,142,144, June 8, 1915. Date of appl., May 3, 1912.

THE producer containing the burning fuel is pro-

vided with a movable eccentric chamber, open at the bottom, containing fresh fuel, which presses on the burning fuel. A vertical U-shaped agitator is worked horizontally below the body of fresh fuel.—W. F. F.

Gas-producer. N. Latta, Milwaukee, Wis., Assignor to Allis-Chalmers Manufacturing Co. U.S. Pat. 1,142,524, June 8, 1915. Date of appl., May 16, 1910.

LIQUID fuel is directed against an inclined wall in a vertical chamber, from which it runs on to an oppositely inclined wall on the opposite side of the chamber. Air is introduced below the second inclined wall, the ratio between fuel and air being regulated by a pressure-actuated device. The gas is withdrawn from the top of the chamber.—W. F. F.

Gas-producer. P. G. Schmidt, Olympia, Wash. U.S. Pat. 1,142,633, June 8, 1915. Date of appl., Feb. 17, 1913. Renewed May 6, 1915.

AIR is supplied to the fuel through the grate bars, and also from an annular conduit around the casing through radial nozzles. The gas is collected by a central tube depending from the casing cover, and having its mouth below the level of the radial nozzles.—W. F. F.

Gas-producer with automatic discharge. C. M. Stein et Cie. Fr. Pat. 473,932, Oct. 23, 1913.

THE conical revolving grate of a vertical producer is provided with teeth or ribs projecting outwards, and the flared lower end of the producer is similarly provided with ribs projecting inwards. The axis of rotation of the grate is eccentric to the producer axis, thus facilitating the breaking and discharge of clinker.—W. F. F.

Water-gas; Manufacture of —. Soc. pour l'Exploit. des Proc. de Production de Gaz Industriels. Fr. Pat. 473,937, June 22, 1914. Under Int. Conv., June 26, 1913.

THE gas-producer is divided vertically by a partition into two chambers with conical ends. The air is passed through both chambers in parallel and the steam subsequently passed through the chambers in series by the operation of suitable valves. The direction of the current of steam is reversed on the next occasion to equalise the temperatures in the two chambers.—W. F. F.

Ammonia; Removal of — from coal gases and the like. N. Schuster, and British Coke Ovens, Ltd., Westminster. Eng. Pat. 6061, March 10, 1914.

THE crude gas is purified by passing it through a scrubber and cooler, condenser, and tar extractor, and then through an exhauster to a cooler and saturator. The ammoniacal liquor from the condenser, separated from tar, is pumped at about 230° F. (110° C.) to an ammonia still, where it meets part of the purified gas from the pressure side of the exhauster, heated to 212°–750° F. (100°–400° C.). The ammonia-laden gas then re-enters the main on the suction side of the exhauster. The gas main eventually discharges into the saturator where the ammonia is converted into sulphate.—W. F. F.

Paraffin hydrocarbons; Separating and purifying solid —. P. M. Justice, London. From Allgem. Ges. f. Chem. Ind. m. b. H., Berlin. Eng. Pat. 6345, Mar. 12, 1914. (See also Ger. Pat. 276,991; this J., 1914, 1149.)

A MIXTURE of solid and liquid paraffin hydrocarbons is treated with an amount of aromatic hydrocarbons dissolved in liquid sulphur dioxide sufficient to dissolve the liquid paraffin hydrocarbons.—F. W. A.

Gasolene and naphtha from crude oils, petroleum products, tar oil, or similar products; Process for the production of—. P. Danckwardt, near Dardanelle, Ark. U.S. Pat. 1,141,529, June 1, 1915. Date of appl. Mar. 4, 1914.

A HEATED liquid not volatile under the conditions of the operation or soluble in the crude oil, etc., is sprayed into the vapour space of the retort; the liquid is then withdrawn from the retort, passed through a heater, and again introduced into the retort, the vapours from the oil being meanwhile continuously condensed.—C. A. M.

Liquid hydrocarbons; Apparatus for obtaining—. E. Schill, Assignor to Continental Gas Compressing Corporation, New York. U.S. Pat. 1,142,275, June 8, 1915. Date of appl., June 1, 1914.

NATURAL gas mixtures containing gasoline, pentane, and methane are injected through a nozzle into a compressor, and the compressed gases received in a collector and passed through two condensers, consisting of separate passages, in which the gasoline and pentane are respectively liquefied. Means are provided for expanding the separated methane and for passing the cold expanded gas through tubes in either of the condensers.—C. A. M.

Liquid hydrocarbons; Apparatus for obtaining—. G. C. Maag, Assignor to Continental Gas Compressing Corporation, New York. U.S. Pat. 1,142,525, June 8, 1915. Date of appl., June 11, 1914.

A GASEOUS mixture of gasoline, pentane, and methane is passed from a compressor within which liquid is sprayed, to a liquid-collecting tank and thence in series through a gasoline condenser and a pentane condenser. The residual gas is expanded and conducted at regulated temperatures back through the pentane condenser and the gasoline condenser.—W. F. F.

Petroleum emulsions; Treater for—. *Apparatus for treating emulsions. Apparatus for dehydrating petroleum oil*. R. E. Laird and J. H. Raney, Taft, Cal., Assignors to Raney-Laird Petroleum Dehydrating Co., Los Angeles, Cal. U.S. Pats. (A) 1,142,759, (B) 1,142,760, and (C) 1,142,761, June 8, 1915. Dates of appl., July 22, July 22, and Oct. 26, 1914.

(A) PETROLEUM emulsions are separated by treatment with an electric current in a cylindrical shell, which is divided into upper and lower compartments by a pan in which are fixed hollow outer electrodes to form an open communication between the compartments. On the inner walls of these electrodes there is a series of inward projections, whilst inner electrodes with projections on their outer surfaces are placed in each of the outer electrodes. (B) The emulsions are treated with a current of high alternating potential, which can be successively impressed on a number of the electrodes. Means are provided for varying the effective diameter of the inner electrodes, which for this purpose may consist of slotted pipes surrounded by springs engaging a series of blades projecting through the slots, whilst a central rod carrying a series of cones is passed down the pipe to expand the blades. (C) Alternating electromotive force is connected with or disconnected from the electrodes by means of a distributor, which is driven by a synchronous motor, so as to utilise a portion of the current at each alternation.—C. A. M.

Asphalt; Process of manufacturing—. R. Wallbaum, Berlin. Eng. Pat. 20,116, Sept. 5, 1913. Under Int. Conv., Dec. 4, 1912.

SEE Fr. Pat. 462,658 of 1913; this J., 1914, 315.

Hydrocarbons; Process for the manufacture of—. R. Hense, Berlin. Eng. Pat. 20,188, Sept. 6, 1913.

SEE Fr. Pat. 462,935 of 1913; this J., 1914, 347.

Hydrocarbons and derivatives thereof; Manufacture of—. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen, Germany. Eng. Pat. 20,488, Sept. 10, 1913.

SEE Fr. Pat. 468,427 of 1914; this J., 1914, 984.

Aluminium chloride; Manufacture of— [from residues obtained in treating mineral oils]. A. M. McAfee, Bayonne, U.S.A. Eng. Pat. 22,923, Nov. 23, 1914. Under Int. Conv., Feb. 12, 1914.

SEE U.S. Pat. 1,099,096 of 1914; this J., 1914, 783.

Catalytic bodies [for producing light hydrocarbons from heavy hydrocarbons.] Eng. Pat. 5847. See I.

IIb.—DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Estimation of high temperatures by the method of colour identity. Paterson and Dudding. See XXIII.

PATENTS.

[Glass] colour screens for artificially producing daylight. A. G. Glasgow, Richmond, Va., U.S.A. From E. J. Brady, Philadelphia, U.S.A. Eng. Pat. 20,827, Oct. 10, 1914.

BY the use of nickel along with copper or cobalt, or both, a blue glass is produced giving with artificial light a close approximation to the colour of daylight. The following representative formula is given:—Sand, 0.208 lb.; potassium carbonate, 0.091 lb.; calcium carbonate, 0.025 lb.; potassium nitrate, 0.0167 lb. To two-thirds of a pound of this mixture is added 4 grains of black nickel oxide, Ni_2O_3 , and 15 grains of black copper oxide.—B.V.S.

[Electric] conductors; Method of treating—. R. Jacoby, Berlin, Assignor to General Electric Co., New York. U.S. Pat. 1,142,172, June 8, 1915. Date of appl., April 11, 1914.

SEE Ger. Pat. 276,037 of 1913; this J., 1914, 1150.

III.—TAR AND TAR PRODUCTS.

Thermometers; The emergent stem correction for— in creosote oil distillation flasks. U.S. Bureau of Standards. J. Franklin Inst., 1915, 179, 711—712.

WITH a particular type of mercury thermometer, the average corrections (reliable to $1^\circ\text{C}.$) found for the ordinary side neck distillation flask were 4.5° , 6.0° , 10.5° and 15.5° at 200° , 250° , 300° and $350^\circ\text{C}.$, respectively. When the same thermometer was used in different flasks, the greatest difference in the stem corrections found was $2^\circ\text{C}.$ Reliable results (within 1 or $2^\circ\text{C}.$) were obtained by determining the total correction (scale and emergent stem) at two points by reading the thermometer in the vapours of boiling naphthalene ($218^\circ\text{C}.$) and anthracene ($340^\circ\text{C}.$) in succession, and interpolating for intermediate points. A mercurial thermometer, about 40 cm. long, and having a continuous scale and graduated stem, was found the most suitable for use with distillation flasks.—W. E. F. P.

Nitration of mixed dihalogenbenzenes. A. F. Holleman. Rec. trav. chim. Pays-Bas, 1915, 34, 204—234.

A QUANTITATIVE study of the products of nitration of *o*- and *p*-dihalogenbenzenes has enabled the author to represent by numerical ratios the relative

influence of the halogens in determining substitution in the benzene nucleus. From the nitration of *p*-chlorobromobenzene and *o*-chlorobromobenzene the ratio of the directive influences of chlorine and bromine was found to be 1:0.96 and 1:0.80 respectively. From the mean ratio 1:0.88 the proportions of the isomers formed on nitration can be predicted with some accuracy. From the nitration of *o*-chloro-iodobenzene the ratio Cl:I was found to be 1:1.84, and from the nitration of bromo-iodobenzene the ratio Br:I was found to be 1:1.75. Some uncertainty due to the liberation of iodine exists in connection with the figures for the iodo derivatives. From the ratios Cl:Br=1:0.80 and Cl:I=1:1.84 the calculated ratio Br:I is 1:2.3, whilst the ratio found by nitration was 1:1.75. This discrepancy leads to a difference of 6.1% between the calculated (69.7%) and the observed (63.6%) proportion of the two bromo-iodonitrobenzenes, 1,2,3 and 1,2,5, formed on nitration of *o*-bromo-iodobenzene. Difficulties in estimating the exact proportions of the products formed may account largely for the difference. The principle may be applied to calculate, e.g., the proportions of the isomeric nitrobromotoluenes formed on nitrating bromotoluenes, after first making a quantitative study of the nitration of *p*-chlorobromobenzene and *p*-chlorotoluene.—E. W. L.

Nitro-derivatives of naphthalene; Theory of nitrating mixtures in its application to the—A. Sapozhnikov. J. Russ. Phys. Chem. Soc., 1914, 46, 1102—1110. J. Chem. Soc., 1915, 108, i, 393—394.

The author discusses the results of Patart's investigation of the nitration of naphthalene (Mém. Poudres et de Salp., 9, 11) in the light of the theory of the action of nitrating mixtures developed by him in connection with the nitration of cellulose (this J., 1907, 34; 1909, 747). If the results are expressed in the form of a triangular diagram, it is found that here too the distribution of the different degrees of nitration in the diagram corresponds moderately well with the vapour pressure curves of the nitric acid and consequently with the condition of the acid in the mixtures. For example, all the points corresponding with tetranitronaphthalene are found in that region of the acid mixtures where all the nitric acid exists in the form of free monohydrate, HNO_3 . If the lines of the diagram representing equimolecular proportions of nitric and sulphuric acids are considered, the degree to which the naphthalene is nitrated alters with the relative proportion of water present: with from 0 to 25% of water, tetranitronaphthalene is obtained; with 25—50%, trinitronaphthalene; with 50—60%, di- and tri-nitronaphthalenes; with 60—65%, dinitronaphthalene, and with a still greater proportion, the mononitro-derivative. The similarity between the diagrams for the nitro-derivatives of naphthalene and cellulose no longer holds with acid mixtures approaching pure water or pure sulphuric acid. In general, nitration of cellulose is impossible when the acid contains more than 60—65 mol. % of water, whereas naphthalene may be nitrated by mixtures containing 75—80 mol. % of water. Increase of the sulphuric acid beyond a certain limit renders nitration impossible, since the excess of sulphuric acid decomposes the nitrated products; in the case of naphthalene, the latter is carbonised by an excessive proportion of sulphuric acid in the nitrating mixture. When naphthalene is nitrated to a high degree, the oxides of nitrogen liberated oxidise the nitro-products and diminish the yield.

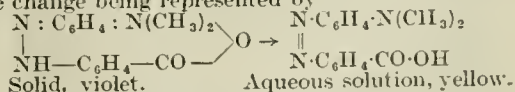
Nitro compounds; Modified reduction method for the volumetric determination of—A. J. Berry and C. K. Colwell. Chem. News, 1915, 112, 1—2.

In the determination of nitro compounds by

reduction with stannous chloride, the authors determine the excess of stannous chloride by a method originally used by Weil (Chem. News, 1871, 23, 49) for determining copper, and based on the reaction: $-2\text{CuCl}_2 + \text{SnCl}_2 = \text{Cu}_2\text{Cl}_2 + \text{SnCl}_4$. A known quantity of standard stannous chloride solution is added to a solution of a known quantity of the nitro compound strongly acidified with hydrochloric acid, and the mixture boiled gently for a quarter of an hour while a slow current of carbon dioxide is passed through. The liquid is then titrated at the boiling point with standard cupric sulphate solution strongly acidified with hydrochloric acid. The course of the reaction is indicated by the discharge of the colour of the copper solution, but its end must be determined exactly by testing with mercuric chloride solution, which ceases to give a precipitate as soon as all the stannous chloride has been converted into the stannic compound. The external tests with mercuric chloride may be dispensed with by using hydrobromic instead of hydrochloric acid, i.e., by the addition of potassium bromide to the solution, of the nitro compound and stannous chloride and to the acid cupric solution used, which then assumes a deep brownish-violet colour discharged by reduction with stannous salt. The end point of the titration is indicated by an orange-yellow colour, and to ensure consistent results a dilute solution of potassium bichromate is used as a colour standard.—W. N. B.

Picric acid; Acidimetric determination of — and the interatomic change of the indicator methyl-red. S. Minovici and C. Kollo. Bull. Acad. Sci. Roumanie, 1914—15, 3, 61—71. J. Chem. Soc., 1915, 108, ii., 383.

When picric acid is titrated with alkali, using either lacmoid or phenolphthalein as indicator, an excess of alkali above that theoretically necessary is required to bring about the colour change. If, however, methyl-red (*p*-dimethylaminoazobenzene-*o*-carboxylic acid) is used, the colour change is sharp, and the amount of alkali required agrees exactly with the amount required theoretically. The colour change of methyl-red has been examined by means of measurements of its absorption spectrum in aqueous alcohol solution, and also in the presence of sodium hydroxide and hydrochloric acid. The results are of a similar nature to those found by Hantzsch for helianthin, the change being represented by



Acetylnaphthols [hydroxynaphthyl methyl ketones]; Transformations in the group of the—O. N. Witt and O. Braun. Ber., 1914, 47, 3216—3232. J. Chem. Soc., 1915, 108, i, 414—416.

The acetyl-*a*-naphthol obtained originally by the action of glacial acetic acid and zinc chloride on *a*-naphthol (this J., 1888, 204) has been identified as 2-acetyl-*a*-naphthol. The failure of the indophenol reaction presented the only difficulty in assuming the presence of a free *para*-position, but it is now shown that this is merely a matter of choosing the right oxidising agent, for ammoniacal silver oxide produces the desired effect. The entry of the acetyl group into the *ortho*-position in preference to the *para*, is explained by recognising that the primary product is really *a*-naphthyl acetate, which undergoes subsequent rearrangement. As a practical result, the yield of 2-acetyl-*a*-naphthol has been increased to 80% by using acetic anhydride in addition to the acetic acid and zinc chloride. On recrystallising the crude, apple-green compound, m. pt. 101°—103°C, the colour was sometimes darker, sometimes

paler, and the m. pt. gradually sank to 98°—99° C., the alterations being due, no doubt, to the existence of two tautomers, one yellow, the other colourless. The latter m. pt. was recorded by Gattermann for the pale yellow acetylnaphthol which he obtained by the hydrolysis with aluminium chloride of 4-acetyl-*a*-naphthyl ethyl ether prepared by the Friedel-Crafts reaction. Gattermann assigned the *para*-configuration to this acetyl-*a*-naphthol, but the colour and low m. pt. are against this. It is now shown that the compound is, indeed, the older *ortho*-derivative.

The authors repeated the Friedel-Crafts reaction as carried out by Gattermann in carbon bisulphide. The product was dissolved in ether and exhausted, first by sodium carbonate which removed 4-acetyl-*a*-naphthol, m.pt. 198° C., and also a diacetyl-*a*-naphthol, m.pt. 140° C., then with dilute sodium hydroxide which extracted *a*-naphthol, leaving in the ethereal layer the 4-acetyl-*a*-naphthyl ethyl ether, m.pt. 78°—79° C. This showed that aluminium chloride, under certain conditions, may not only hydrolyse the ether, but even disrupt it to *a*-naphthol and then cause the re-introduction of an acetyl group into the 2- or 4-position with respect to this, or even of two acetyl groups. By moderating the reaction, using benzene instead of carbon bisulphide, the 4-acetyl ether has been obtained in a better yield and the hydrolysis of this, in the same medium, has led to a 80% yield of 4-acetyl-*a*-naphthol. 4-Acetyl-*a*-naphthol crystallises in colourless prisms, m. pt. 198° C., and forms an oxime, m. pt. 164° C., and a phenylhydrazone, m. pt. 133° C. The high m. pt., the lack of colour, the formation of typical *o*-azo-dyes and of phthalic acid, confirm the constitution. The above diacetyl-*a*-naphthol yields phthalic acid on oxidation and does not react with diazonium salts, and is therefore the 2,4-compound. 2,4-Diacetyl-*a*-naphthol forms long, slender, colourless needles, m. pt. 140° C., and is more soluble in toluene than the 4-acetyl compound. It yields the 2-mono-oxime, m. pt. 212° C., and a dioxime, m. pt. 220° C. In the *β*-naphthol series, Gattermann had prepared acetyl-*β*-naphthyl methyl and ethyl ethers. The authors condensed *β*-naphthyl methyl ether ("nerolin") with acetyl chloride by the Friedel-Crafts process in benzene. Following the above plan, the sodium carbonate extract yielded an acetyl-*β*-naphthol, m. pt. 64°—65° C., and a diacetyl-*β*-naphthol, whilst the sodium hydroxide solution contained *β*-naphthol and the remaining ether. Gattermann's acetyl-*β*-naphthyl methyl ether, m. pt. 57·5°—58° C., which gave the above acetyl-*β*-naphthol in 78% yield on hydrolysis with aluminium chloride. The latter yielded phthalic acid on oxidation, formed azo-dyes, and readily condensed with hydrazine to give a methyl-*β*-naphthindazole. The compound is therefore 3-acetyl-*β*-naphthol. The diacetyl derivative m. pt. 165° C., also gave azo-dyes, but oxidised to trimellitic acid. It is, most probably, 3,6-diacetyl-*β*-naphthol. *β*-Naphthyl acetate when heated with zinc chloride, acetic acid, and acetic anhydride, at 150°—160° C., gave a tarry mass, from which 6-acetyl-*β*-naphthol [6-hydroxy-*β*-naphthyl methyl ketone] was isolated in 5% yield. This crystallised in hexagonal prisms, m. pt. 171° C.; it yielded trimellitic acid on oxidation.

Annual report on alkali, etc., works. See VII.

Determination of nitrogen by Kjeldahl's method. Nolte. See XXIII.

PATENTS.

Reactions in presence of alkali; Carrying out of —. [Preparation of Alizarin, etc.] J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen, Germany. Eng. Pat. 20,664, Sept. 12, 1913.

THE product obtained by mixing an alkali

hydroxide with half a molecular proportion of methyl or ethyl alcohol in absence of air exhibits great reactivity, and may be used in place of fused alkali for the production of Alizarin, etc. The reaction commences on exposure of the mixture to air at the ordinary or a higher temperature. An alternative method is to spread a thin, homogeneous mixture of the alkali hydroxide (e.g., KOH) and the substance (e.g., 2-amino-anthraquinone) in the air, and spray with an alcohol. The velocity of the reaction is sufficiently high to enable it to be carried out on an endless travelling band, the alcohol being recovered.—F. W. A.

Aromatic amines; Manufacture of —. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen, Germany. Eng. Pats. 13,149 and 15,334, May 28 and June 26, 1914. SEE Ger. Pat. 282,568 of 1913; this J., 1915, 708.

IV.—COLOURING MATTERS AND DYES.

British Dyes, Limited.

THE board of directors of British Dyes (Limited) are establishing a Research Department, and have invited Dr. G. T. Morgan, F.R.S., to become the head of the Department. They have resolved to appoint a Technical Committee, which will consist of the following:—Dr. M. O. Forster, F.R.S. (Chairman), Dr. J. C. Cain, Dr. G. T. Morgan, F.R.S., Mr. J. Turner.

They have also resolved to appoint an Advisory Council, under the chairmanship of Prof. R. Meldola, F.R.S., and the following have been invited to become members:—Prof. J. N. Collie, F.R.S., Prof. A. W. Crossley, F.R.S., Prof. P. F. Frankland, F.R.S., Prof. A. G. Green, F.R.S., Prof. G. G. Henderson, Prof. J. T. Hewitt, F.R.S., Prof. F. S. Kipping, F.R.S., Prof. A. Lapworth, F.R.S., Prof. A. G. Perkin, F.R.S., Prof. W. H. Perkin, F.R.S., Prof. W. J. Pope, F.R.S., Prof. J. F. Thorpe, F.R.S., Prof. W. P. Wynne, F.R.S. The members of the Technical Committee will *ex officio* be members of the Advisory Council.

At a meeting of the shareholders of the company, held at Manchester on July 14th, it was announced that the company had received in cash from paid-up capital on the ordinary shares and on loan for the Government £1,018,000, whilst the preliminary expenses were about £9000. It was estimated that £422,000 would be paid for the purchase of the Huddersfield works of Messrs. Read, Holliday & Sons, leaving a balance of £597,000. The Read Holliday business had been purchased and carried on in behalf of the company since they gave notice to purchase. The output of dyes had already been doubled as compared with the average for 1914, and further plant, was in course of erection. It was essential to increase largely the capacity of the plant particularly for the manufacture of intermediate products, and they were now looking for a site for the establishment of new works.

Chlorophyll pigment; Physico-chemical studies on the synthesis of a —. Albert and A. Mary. *Monit. Scien.*, 1915, 5, 121—128.

PREVIOUS researches of the authors indicated that chlorophyll is a product arising from the polymerisation and oxidation of a substance similar to aniline. On adding nitric acid, drop by drop, to a very strong alcoholic solution of aniline, a whitish deposit is formed adhering to the sides of the vessel and turning from a pale rose to a vivid rose-colour (leuc-aniline); then, with considerable evolution of heat, a brisk effervescence ensues and the entire mass simultaneously assumes a fine green colour.

The following equation appears to represent the reaction:—



The phenyl group nucleus entering into the formation of the chlorophyll may be represented as $6(\text{C}_6\text{H}_7)$. After the termination of the reaction the sides of the test-tube remain coloured green and reddish-brown, and a dark reddish-brown residue is found at the bottom. On shaking with benzene a greenish solution is obtained, which on exposure to light and air tends to turn red with formation of a brownish, resinous, adhesive deposit. Upon evaporation away from the light the sides of the tube become covered with small, rather soft crystals which in places form glistening tufts or dense masses, reddish or brownish in transmitted and dark green in reflected light. These crystals are synthetic chlorophyll. In order to check the reaction after the formation of the green pigment, sodium bicarbonate solution is added till the contents of the test-tube are slightly alkaline. This yields beautiful emerald-green solutions from which the whole of the colouring matter is readily extracted by benzene. Unless this extraction is conducted sufficiently quickly, the green colour readily changes to reddish or brownish or ochre—the colours of dying and dead leaves, and all the stages of oxidation through which natural chlorophyll passes in the course of three seasons can be observed in a few minutes. One of the essential characteristics of chlorophyll is its dissociation by hydrochloric acid into bluish-green phyllocyanic acid (phyllocyanin) and brownish phyloxanthin. If a solution of synthetic chlorophyll in benzene is poured on to pure hydrochloric acid, a brownish coloured zone first appears where the two liquids meet. After one to two hours this zone becomes surmounted by a ring of emerald-green and, after fifteen hours, the benzene is nearly completely decolorised, whilst the acid becomes charged with a greenish pigment (phyllocyanin in process of undergoing alteration), and a brownish deposit (phyloxanthin) is formed on the sides of the tube. Synthetic chlorophyll, like the natural substance, is insoluble in water but soluble in alcohol, ether, petroleum oil, and benzene. The crystals obtained from benzene solutions of the natural substance and of the synthetic product are exactly similar.

Genesis and regeneration of phytochrome. On triturating the whitish or yellowish leaves of *Cichorium endivia* (developed in darkness) with alcohol, a yellow solution is obtained containing besides the xanthophyll formed, traces of the chemical radicle of chlorophyll. The extract on treatment with Chenal's nitric acid (containing nitrous acid) reacts violently with production of a reddish coloration accompanied by evolution of nitrous fumes. This reaction is identical with that shown by aniline on similar treatment if, as happens frequently, the reaction is sufficiently energetic at the outset to pass from the green to the red colour stage. If diluted Chenal's acid or a mixture of hydrochloric acid and Chenal's acid is used, the colour of the alcoholic extract on cooling changes to a rose tint and two distinct colour rings are formed, viz., a green one below, where the acid and extract meet, and a vivid rose one higher up. This reaction resembles that observed on treating a weak alcoholic solution of aniline with a small quantity of weak nitric acid containing nitrous acid. On adding iron filings to an acetic acid solution of chlorophyll (from ivy) and subsequently removing the iron acetate formed by repeated precipitation with potassium ferrocyanide and filtration, a pale, acid, amber-coloured liquid is obtained. This solution upon the addition of a few drops of Chenal's nitric acid yields a green coloration which by further addition of the acid is at once turned light reddish brown.

These colorations represent an exact reproduction of the stages of the formation and subsequent changes of the synthetic pigment.

Pigments of bacteria chromogens. The pigments formed in certain nitrogenous vehicles by the action of bacteria may be regarded as a bridge between the chlorophyll group and the aniline colours. Several species (*Bac. viridis*, *Bact. viride*, etc.) produce true chlorophyll. In a medium of beef tea and glycerin the introduction of *Bac. olearius fluorescens* produces a brownish green, dichroic pigment. The same or a similar pigment is produced by the introduction of *Saccharomyces cerevisiae* into a solution of sugar and aniline sulphate.

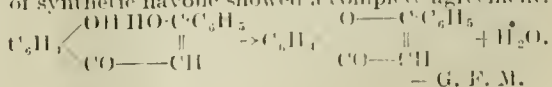
Fremy's reaction. This reaction has for its object the separation of phyllocyanic acid (phyllocyanin) and phyloxanthin, which is effected by treating chlorophyll with a mixture of ether and slightly diluted hydrochloric acid. After shaking two layers of fluid are formed—a yellow ethereal solution of phyloxanthin resting on a greenish-blue solution of phyllocyanin in hydrochloric acid. Fremy's reaction can be obtained with the synthetic chlorophyll in the nascent state, i.e., by adding the ether to a mixture of aniline solution and oxidising agent (from which chlorophyll is prepared synthetically as described above) at the moment when the formation of green pigment is just commencing.

Spectroscopic observations. The hydrochloric acid solutions of synthetic chlorophyll show certain differences from those of natural chlorophyll obtained from *Sigimbrium nasturtium*, *Pinus sylvestris*, *Asparagus officinalis*, and *Viola tricolor*, but solutions in alcohol, ether, or benzene appear to give the same results as those prepared from *Pinus sylvestris*, *Asparagus officinalis*, and *Viola tricolor*. The spectra of certain aniline colours and those of chlorophyll solutions exhibit several identical or closely similar features, indicative of distinct analogies in their molecular constitution.

Willstätter's hypothesis. According to Willstätter and others the molecule of chlorophyll contains certain inorganic elements, more especially magnesium, as integral constituents. This assumption appears to be based mainly upon the results of analysis of the ash of chlorophyll obtained from different sources. The authors conclude from the spectroscopic results obtained with chlorophyll solutions containing no magnesia whatever, that the latter is not an integral constituent of chlorophyll. Their view is that chlorophyll contains six phenyl radicles, so that it represents a polymericide of aniline in which the proportion of nitrogen has been reduced by oxidation. All the characteristic reactions of natural chlorophyll can be obtained with aniline treated with oxidising agents as described.—W. N. B.

Flavone: Occurrence of—as the *farina* of the *primula*. H. Müller. Chem. Soc. Trans., 1915, 107, 872—878.

THE mealy secretion which is found on the leaves and flower stalks of many species of *primula*, forms on crystallisation from light petroleum silky crystalline tufts, m.pt. 99—100°C., having the composition $\text{C}_{15}\text{H}_{10}\text{O}_2$. On hydrolysis with barium hydroxide in methyl alcoholic solution it yields acetophenone, and a substance, $\text{C}_{13}\text{H}_{12}\text{O}_2$, m.pt. 120°C., which by reason of its conversion on further hydrolysis into acetophenone and salicylic acid, is *o*-hydroxydibenzoylmethane. Since the original substance is derived from this by elimination of water, it seemed probable that it is flavone, and a comparison of its properties with those of synthetic flavone showed a complete agreement.



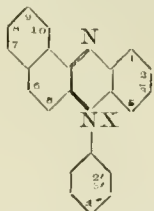
— G. F. M.

Isoquercetone. M. Nierenstein. Chem. Soc. Trans., 1915, 107, 869—872.

HYDROXYQUERCETIN, obtained from quercetin, by reduction of its oxidation product quercetone with zinc dust and acetic anhydride and subsequent hydrolysis of the acetyl derivative, yields on oxidation with *p*-benzoquinone an orthoquinone, isoquercetone, analogous to the similar oxidation product, gossypetone, obtained from gossypetin, an isomeride of hydroxyquercetin. Isoquercetone resembles gossypetone in general properties and colour reactions, but differs in its dyeing qualities. It forms a chocolate brown lake with chromium, greenish brown with aluminium, brick red with tin, and greenish brown with iron. Its tetramethyl ether, $C_{15}H_{14}O_4(OC(CH_3)_3)_4$, prepared by the action of the theoretical quantity of diazomethane on isoquercetone, forms yellow needles, m.pt. 212° — 244° C. Excess of diazomethane leads to the formation of 7,8-methylenedioxy-3,5,3',4'-tetramethoxyflavone, yellow needles, m.pt. 192° — 193° C. Tetra-acetylisoquercetone melts at 240° — 242° C.—G. F. M.

Quinoneimide dyes. V. Constitution and colour of the mono-amines derived from phenylnaphthophenazonium. F. Kehrmann, R. Speitel, and E. Grandmougin. Ber., 1914, 47, 3205—3215. J. Chem. Soc., 1915, 108, i., 463.

PHENYLNAPHTHOPHENAZONIUM (annexed formula) can give rise to thirteen mono-amino-derivatives, of which nine are known in the form of salts and one



in the form of a salt of the acetyl compound, the best known being rosinduline, the 6-amine. A systematic study has been made of the colours and absorption spectra of these substances. The salts were obtained in varying concentrations of sulphuric acid, and the spectra were tabulated. The isomerides fall into four groups, the individual members of which are constitutionally and optically similar, but differ widely from those of the other groups. The four isomerides in which the amino-groups occupy positions, 7, 8, 9, and 10, that is, are attached to the benzenoid part of the naphthalene residue, form the first group. Of these, the 7-, 8-, and 9-amines form blue to bluish-green mono-acid salts, lemon-yellow di-acid salts, and blood-red tri-acid salts. The 10-amine forms only mono- and di-salts, the azine nitrogen atom in the *peri*-position, owing to steric hindrance, being incapable of salt formation. They all form unstable pseudo-bases under the influence of concentrated alkali hydroxides. A second, incomplete group consists of the 2- and 3-amines; these form violet-red mono-acid salts, orange-red to yellowish-green di-acid salts, and violet tri-acid salts. The 3'- and 4'-amines form a third group in which the yellow mono- and di-salts are almost optically identical, but differ in solubility, whilst the tri-salts are violet. The optical behaviour of these does not differ to any important extent from that of the un-substituted phenylnaphthophenazonium, which is in agreement with the rule that salt formation at remote amino-groups scarcely influences the absorption. The 6-amine, rosinduline, the substituent being in the quinonoid part of the naphthalene residue, and the 5-amine, comprise a fourth group, characterised by the intense yellowish-red or blood-red colours of

the anhydride forms of the bases, and by the red mono-salts, green di-salts, and red to violet-red tri-salts. The isomerides, 7, 8, 9, 10, 3', and 4', are undoubtedly *ortho*-quinonoid, which is in agreement with the fact that the di- and tri-salts are practically optically identical with the mono- and di-salts of the unsubstituted parent. Rosinduline and Nietzki and Otto's isorosinduline, the 6- and 3-amines, like aposafranine, are *para*-quinonoid in the free state and in their mono- and di-salts, but *ortho*-quinonoid in their tri-salt. The 2-amine, finally, is certainly *ortho*-quinonoid in its di- and tri-salts, but may be *para*-quinonoid in its mono-salt, which would be unique.

PATENTS.

Azo colouring matters; Manufacture of—. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen, Germany. Eng. Pat. 13,455, June 2, 1914.

SEE Fr. Pat. 472,893 of 1914; this J., 1915, 486.

Monoazo dyestuffs dyeing on mordant; Manufacture of—. J. R. Geigy, Soc. Anon. Eng. Pat. 22,070, Nov. 5, 1914. Under Int. Conv., Nov. 10, 1913.

SEE Ger. Pat. 278,613 of 1913; this J., 1915, 273.

Gallocyanines; Manufacture of condensation products of—. Durand and Huguenin S. A., Basle, Switzerland. Eng. Pat. 22,247, Nov. 9, 1914. Under Int. Conv., Nov. 14, 1913.

SEE Ger. Pat. 273,685 of 1913; this J., 1914, 784.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Papyrus and paper manufacture. W. Beam. Wellcome Tropical Research Lab., Khartoum, Chem. Section, Bull. No. 2, March, 1915, 4 pages.

The successful commercial application of papyrus as material for paper manufacture would appear to depend on the preparation in the country of origin, without the expenditure of chemicals, of a material containing the useful fibres in a concentrated form for export, largely freed from the cellular tissue in which they are embedded in the raw plant. If papyrus stems, either green or dry, be digested with water at 142° — 150° C. for 3—6 hours, then removed and beaten in a stream of water, practically the whole of the soluble and cellular matters can be washed out, leaving the fibrovascular bundles almost free. This material, though slightly darker in colour than the original, yields a perfectly white pulp when boiled with caustic soda and bleached in the usual manner. Stems containing 8% of moisture yielded 40.5% of prepared material (dry) when digested for 6 hours at 140° C., and 37.5% when digested for 3 hours at 150° C. On boiling and bleaching, these half-stuffs yielded 55.2 and 51.8% respectively of dry bleached pulp. The value of the prepared papyrus is estimated at £5 per ton at the paper mill and the cost of transport at £2 per ton. —J. F. B.

PATENTS.

Osier bark [fibre]; Method and apparatus for utilising—. Oesterr. Filzkorkwerke Ges., Krasna on Beeya, Austria. Eng. Pat. 6555, Mar. 11, 1914. Under Int. Conv., Mar. 11, 1913.

THE bark of osier willows of one year's growth is steamed under a slight pressure, then pickled in a bath containing about 3% of soap and 1%

of soda. The wet material is passed between fluted rollers, situated in a hollander trough, which feed it to the hollander roll constructed with blunt metal knives working on a rough stone bed-plate. The action of the roll crushes and scrapes the shreds of bark, separating the long fibres suitable for textile purposes, which are picked out of the liquid by means of a rocking rake. These fibres are treated with steam saturated with glycerin, and dried in the air. The mass of short fibres and cellular matter left in the hollander is discharged into a mixing chest and thence to a settling tank provided with a false sieve-bottom; the cellular matter passes with the water through the sieve and is recovered in filter-presses, then dried and ground as a substitute for cork meal. The fibrous matter is removed from the upper part of the tank by means of dipping-moulds and is then treated in presses for the production of briquettes suitable for insulating purposes.—J. F. B.

Cellulose esters; Process of manufacturing solid or liquid solutions of —. W. Plinatus, Paris. Eng. Pat. 16,940, July 23, 1913.

CELLULOSE esters, *e.g.*, nitrocellulose, are incorporated with non-volatile organic acid esters of polyhydric alcohols, completely or partially esterified, *e.g.*, the glyceryl esters of butyric or benzoic acid, or esters of glycol, and the mixture is milled between heated rolls until a homogeneous mass is obtained, having physical properties depending on the relative proportions of the components. Camphor, resins, balsams, etc., may be added to the mixture of cellulose ester and appropriate non-volatile ester of a polyhydric alcohol to modify the properties of the product. (Reference is directed in pursuance of Sect. 7, Sub-sect. 4, of the Patents and Designs Act, 1907, to Eng. Pats. 1313 of 1865, 6858 of 1896, 13,131 of 1900, 9791 of 1906, 8915 of 1909, 8990 and 13,239 of 1912; this J., 1897, 355; 1901, 741; 1907, 610; 1909, 1271; 1912, 1120; 1913, 823.)—J. F. B.

Viscose; Process for the preparation of a saline solution of —. Soc. Anon. Soie de St.-Chamond, St.-Chamond, France. Eng. Pat. 24,291, Dec. 18, 1914. Under Int. Conv., Dec. 26, 1913.

CELLULOSE xanthate is dissolved in a solution of an acid salt of a weak acid, *e.g.*, a bicarbonate, bisulphite, or acid phosphate, in order to neutralise the free and part of the combined soda in the xanthate, so that it may approximate to the neutral xanthate. The proportions recommended are: NaHSO_3 , 10—15; NaHCO_3 , 8—12; or Na_2HPO_4 , 13—20 kilos. per 100 kilos. of cellulose.—F. W. A.

Paper-coating composition and method of making the same. A. A. Dunham, Bainbridge, N.Y., Assignor to Casein Co. of America, New York. U.S. Pat. 1,141,951, June 8, 1915. Date of appl., May 9, 1911.

STARCH is treated with a hydrolysing agent, neutralised with ammonia, and mixed—with or without drying—with casein, a substance which dissolves casein, and a large proportion of a suitable mineral base, together with water, the modifying action upon the starch being arrested at a suitable point.—J. R.

Fibrous material; Method of eliminating fat from raw or treated — with fat solvents. C. Netz und Co., Breslau, and F. Koch, Grolitz, Germany. Eng. Pat. 21,114, Sept. 18, 1913.

SEE Ger. Pat. 267,487, of 1913; this J., 1914, 72.

Esters of cellulose, soluble in acetone; Process for the manufacture of acid —. Knoll und Co., Ludwigshafen, Germany. Eng. Pat. 16,905, July 23, 1913. Under Int. Conv., Aug. 1, 1912.

SEE Fr. Pat. 453,835 of 1913; this J., 1913, 785.

Paper having shaded (cloudy) colour; Manufacture on the paper machine of —. Farbw. vorm. Meister, Lucius, und Brüning, Höchst, Germany. Eng. Pat. 6227, Mar 11, 1911. Under Int. Conv., Apr. 18, 1913.

SEE Fr. Pat. 469,358 of 1911; this J., 1915, 25.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

PATENTS.

Cellulose or other similar fibrous material, either in the pulpy, spun or woven condition; Apparatus and process for the treatment or bleaching of —. H. Arledter, Frodsham. Eng. Pat. 6677, Mar. 17, 1914. Addition to Eng. Pat. 16,085 of 1912 (this J., 1913, 865).

WHEN the apparatus described in the original patent and in Eng. Pat. 2018 of 1910 (this J., 1911, 205) is used for bleaching, the gases withdrawn by the vacuum pump from the upper part of the apparatus are returned to it through coils placed in the lower part, after having been re-oxygenated while out of contact with the liquid by passage through a sparking apparatus; means are also provided for renewing the supply of air or chlorine gas as required. The agitation of the pulp or of the liquor surrounding the goods may be continued by the passage of the gas alone, the circulating pump and heater roll being stopped. Acids or acid gases may be introduced at a suitable stage of the process.—J. F. B.

Chromium mordanting of animal fibres or fibrous materials; Process of —. H. E. Wood, Huddersfield. Eng. Pat. 855, Jan. 19, 1915.

Wool, etc., is boiled with a solution containing up to 1.5% of bichromate and 2 to 4% of sulphuric acid for three quarters of an hour, about 2% of sodium sulphite is added, and the boiling continued for half an hour; the material is thus mordanted in a single bath, and need not be washed. More even and fast dyeings are obtained with alizarin, anthracene and natural colouring matters, *e.g.*, fine blue ungreenable shades can be obtained with logwood.—F. W. A.

Dyeing-machine; Circulating —. T. Allsop and W. W. Sibson, Assignors to The Philadelphia Drying Machinery Co., Philadelphia, Pa. U.S. Pat. 1,142,176, June 8, 1915. Date of appl., Apr. 25, 1914.

THE dye-liquor is circulated in a tank containing a rotatable perforated drum for the material to be dyed. The drum consists of central and outer cylindrical perforated sections, the space between which is divided by radial partitions, with arrangements for circulating the dye-liquor.—F. W. A.

Dyeing furs, hairs, or the like; Process for —. A. G. Bloxam, London. From Act.-Ges. f. Anilinfabr., Treptow, Germany. Eng. Pat. 20,793, Sept. 15, 1913.

SEE Fr. Pat. 462,824 of 1913; this J., 1914, 309.

Fabrics; Process of rendering gelatin insoluble on —. E. T. J. Watremez, Brussels. Eng. Pat. 25,714, Nov. 10, 1913. Under Int. Conv., Nov. 11, 1912.

SEE Ger. Pat. 271,251 and Fr. Pat. 464,729; this J., 1914, 480, 481.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Alkali, etc., works; Fifty-first annual report on — by the Chief Inspector. Proceedings during the year 1914, etc. pp. 126. Price 8d.

THE number of works registered in England, Ireland, and Wales was 1356 (including 68 "alkali" works), and in Scotland 170; this makes a net increase of 32 for the United Kingdom. The increase is again associated largely with the manufacture of sulphate of ammonia and with the distillation of tar. There was a general tendency towards a smaller proportion of acid in the waste gases discharged into the air, further improvement occurring from the extended adoption of mechanical appliances in place of manual labour in operations liable to cause local escape of acid gases or fumes, especially as regards bleaching powder and superphosphate manufacture and extraction of copper by the wet process; but irregularities have arisen through withdrawal of many of the best skilled process men for military service. The acidity of gases of "all chimneys" was equivalent to 1.012 grain SO_3 per cb. ft., as compared with 1.198 grain during 1913. No occasion for prosecution arose during the year, but in three cases back fees for non-registration of processes were accepted in lieu of proceedings being taken.

Discussing the industrial outlook, with reference to the need for development on scientific lines, it is suggested that the severe and organised competition which may be anticipated at the close of the war can only be met by supplementing our traditional methods by combined effort on the productive side. When the reputation of a British product in a foreign market suffers through inequalities in the deliveries from different British works, it may be expedient for the more advanced producers to consider the propriety of endeavouring to raise the general standard, so as to improve the reputation of the British product as a whole, and it is considered that much could be done by a properly staffed centre for research and advice, apart from and supplementary to proper works control. For example, some of the sulphate of ammonia produced in this country prior to the war has been said by foreign consumers to compare unfavourably, in a marked degree, with the product received from Germany, and it is suggested that the question of efficient production, especially with the prospect of more severe competition from synthetic fertilisers, should be taken up without delay by centralised effort, since questions of advantageous utilisation and the opening of new markets involve that of producing cheap sulphate of high quality.

Alkali and copper (wet process) works. The aggregate quantity of salt decomposed at alkali works was below the corresponding quantity for 1913, activity being somewhat restricted during the early part of the year. Accumulated experience has shown that while the mechanical furnaces in use in the wet process copper works have distinct commercial advantages, more efficient condensing plant is necessary, owing to the reduced consumption of fuel and consequent smaller volume of gases diluting the discharge from the condensers. *Cement works.* Further extension in the use of the rotary kiln occurred during 1914, and the improved conditions brought about by the adoption of this and other modern types of kilns are specially noted. In the south-east of England the industry, although fairly active during the first half of the year, has been seriously affected by current events. Further progress was made in arresting more efficiently the fume generated in *smelting works*, whilst the acidity of

the chimney gases was less than in the preceding year. The use of water sprays has reduced the escape of solid particles from the chimneys of copper smelting works, and the sulphurous acid gas from zinc blende calciners (this J., 1914, 861) is being utilised on an increasing scale for the manufacture of sulphuric acid.

Sulphuric acid works were generally busy throughout the year and during the later months were working under high pressure owing to the requirements of the military authorities. Three plants working with reduced chamber space have been brought into operation, and attention is drawn to the closer and more skilled supervision entailed by this system. The use of mechanical burners continues to extend. A fatality due to oxides of nitrogen occurred at a works during a stoppage for repairs to Gay-Lussac towers. The towers were not disconnected from the chambers, but acid was run down them for 3 days, and 10 days later a workman entered one of the towers to remove some timber supports; he finished his work and returned home apparently well, but later collapsed. The importance of taking precautions against the insidious toxic effects of oxides of nitrogen, towards which susceptibility varies with the individual, is again emphasised (see Report for 1912; this J., 1913, 787); the tower should have been ventilated by a downward draught, and a "safety-pipe" should have been used instead of an oxide of iron respirator. A "Mills-Packard tower chamber" (this J., 1914, 692) has been under practical trial at one works, with encouraging results. In the Widnes district, the use of nitric acid in place of nitre is said to be extending. The productive capacity of works for the manufacture of sulphuric acid by contact processes has been pressed to the uttermost since the outbreak of war. The Kessler system of concentration was brought into increased use, fans instead of steam jets for draught purposes being now generally adopted. The use of the cascade system was also further extended, and it is pointed out that in this system it is essential to give attention to the relative draught on the fire flue and on the flue for removal of the acid vapours, to prevent the possibility of acid fume passing to the chimney. The necessity for arranging the outlet for uncondensed gases and fumes in such position that the escaping gases should be harmless and inoffensive where discharged, apart from the Act limit of 1.5 grain SO_3 per cb. ft., is also noted.

Operations in *chemical manure works* were fully maintained during 1914. The quantities of manure materials, expressed in tons, imported into the United Kingdom during the years 1912—1914 were:—

	1914.	1913.	1912.
Gauno	39,285	25,548	14,115
Mineral phosphates	555,605	539,016	520,270
Nitrate of soda	171,910	140,926	123,580

The imports of mineral phosphates are the highest recorded. The Lütgen system for handling and "conditioning" superphosphate has been adopted at one works. In this system, the hot superphosphate, as mechanically cut from the den, is raised by an elevator and falls on a rapidly revolving knife which comminates it; the material is then blown by a fan into a secondary den or store, where it deposits as a fine dry powder, the den having louvres on the top, with canvas screens to prevent the escape of dust. The exports of ammonium sulphate in 1914 amounted to 314,000 tons, as compared with an estimated home consumption (for all purposes, including manure manufacture) of 106,000 tons. The dislocation of

foreign trade during the latter part of the year had a direct and substantial influence on the figures. The corresponding figures for 1913 were 325,000 tons and 97,000 tons respectively.

Sulphate and muriate (chloride) of ammonia, and gas liquor works. The further increase in the number of these works is due to new registrations in gas works, coke oven works, and producer-gas works. The amount of ammonia recovered in the United Kingdom (expressed as tons of sulphate) was:—

	1914.	1913.	1912.
Gas works	175,930	182,180	172,094
Iron works	16,008	19,956	17,026
Shale works	62,749	63,061	62,207
Coke oven works	137,430	133,816	104,932
Producer-gas and carbonsising works (bone and coal)	34,295	33,605	32,040
Total	426,412	432,618	388,308

The decreased rate of sulphate production is attributed to the disturbing influence of the war. "Direct" methods of manufacture continued to give satisfaction in coke oven works and gas works, where new plants of widely varying capacity have been put into operation. Comment is again made upon the serious loss of ammonia which is liable to occur during the prolonged storage of gas liquor and also to the increase in the proportion of fixed ammonia due to oxidation of the sulphur compounds present. The proposal to minimise these evils by covering the ammoniacal liquor with a layer of suitable oil is considered worthy of attention. "Hurdle" grids have been used at one or two oxide of iron purifiers for sulphate plants, but the gas has a tendency to ascend upwards and alongside the wooden uprights, besides which the spent oxide is often difficult to remove, so that wear and tear is apparently greater than with the ordinary grids. The cost of dealing with hydrogen sulphide by oxide of iron purification at a works in the south-eastern district, producing 1000 tons of sulphate per annum, averaged 4½d. per ton of sulphate made during the last year. The yellow colour noticed occasionally in sulphate of ammonia is due to arsenic in the acid precipitated as As_2S_3 ; about 0.01%. As gave a very slight colour to the salt, while 0.03% gave a strong colour. If the acid contained traces of copper, as well as arsenic, there was a tendency to form a grey-brown salt, and when larger quantities of copper were present, the salt became a dark grey. In one instance, a yellowish-brown scum on the saturator contained 25.5% CdS . A sheet lead depositing chamber, in connection with a Claus sulphur recovery plant, has remained in excellent condition after more than 6 years of service, and it is considered that the advantages of this form of chamber are not sufficiently recognised. During the last 3 months of the year the town of Middlesbrough was supplied with illuminating gas from a neighbouring coke oven works, the operations in the gas works being limited to the purification of the crude gas prior to distribution.

Excessive activity characterised *nitric acid works* during the latter part of the year, chiefly owing to extended requirements for naval and military purposes. Considerable extensions of plant were put into operation in different parts of the country. A serious explosion, attended by the loss of 10 lives, occurred at a *picric acid works* early in December; it is attributed to the accidental sparking of picric acid dust (see this J., 1915, 152). An increase of two *muriatic acid works* over 1913 arose from the development of processes for the production of substituted organic compounds involving the formation of hydrogen chloride as a by-product.

Tin plate flux works were more adversely affected during the year than any other class of works registered under the Act. The general average escape of hydrogen chloride was reduced from 0.114 grain per cb. ft. in 1913 to 0.085 grain; but improved methods are still needed in the treatment of scruff, the loss of thousands of pounds' worth of material being involved; it is thought the question calls for combined inquiry and could best be taken in hand by centralised effort, as suggested above. Operations at *tar works* were seriously affected in the latter part of the year, owing to the influence of war conditions on the export of tar products and of materials in the preparation of which tar products are used. An increased utilisation of the hot vapours rising from tar, during distillation, for heating a fresh charge of crude tar, is reported, and the more extended use of continuous distillation plant for production of pitch and volatile products.

Zinc and zinc residue works. During the latter part of the year especially, much activity prevailed, and attention is drawn to the importance of the new situation in this industry, caused by the war. Continued attention was given to the conditions influencing the formation of fume, the means for preventing the escape of fume, and the best methods of dealing with the solid material obtained by such means. Further experiments were made on the fume-arresting efficiency of various types of iron "prolong" (this J., 1911, 860), with special regard to the form favoured at each works, and temperature conditions were studied in detail. Owing to the wide difference of practice obtaining at various works, it has been found difficult to state principles capable of general application, but lines for suggested improvement are indicated. The form of prolong favoured where oxide or "ashes" are distilled is a cone having a removable cap and divided horizontally into two compartments by a shelf; the gases return over the shelf and are discharged through a wide slotted hole close to the furnace front and well under the ventilation hood. The prolong is constructed to fit the receiver to which it is attached, and its weight is supported by suitable bars hung in front of the furnace. When granular zinc alone is distilled, coke packing is introduced into the upper compartment. The results of the various temperature tests are presented in tables and graphs. Very similar temperature gradients were observed in works utilising mainly ore and in those where zinc "ashes" containing volatile chlorides formed the bulk of the charge, although the weights of fume arrested in the two classes of operation were as 2 to 1. The proportion of fume evolved appears to depend on the volume of gas formed, that is on the proportion of oxide present in the charge, and, for the same class of operation, would seem to be closely related to the heat of the furnace. The greater part of the volatilised chlorine is in the form of zinc chloride, and preliminary experiments showed that on simple treatment with water, the bulk of the chloride could be extracted from the fume and skimmings and recovered, instead of ultimately escaping into the air. The metallic residue could be dried, without risk of firing, before returning to the furnace with a subsequent charge. Hot water should not be used in washing the fume. With a charge of "ashes," the vapours discharged from the receivers during the "steaming stage" were acid to methyl orange and contained free hydrochloric acid, whereas when the charge consisted mainly of ore, the vapours were alkaline, containing free ammonia. *Arsenic works.* The producers of arsenious acid in Cornwall and Devon are apprehensive as to how their trade may be affected by the war; in 1913 the United States consumed 7200 tons of arsenic, most of which

was imported from Europe, but the war will probably lead to an increase in the American output.

In Scotland, the number of works registered was 3 more than in 1913. 61,712 tons of bones and phosphates was dissolved, as compared with 63,150 tons in 1913, and 130,435 tons of pyrites burned, as against 137,350 tons in 1913. The production of ammonium salts (expressed as sulphate) and pitch amounted to 122,058 tons and 151,608 tons respectively, the corresponding figures for 1913 being 125,446 and 174,884 tons. The lower production of sulphate during 1914 was due to the marked reduction in recovery from blast-furnace gases. A fatality is reported in connection with the cleaning of a "saturator"; it was probably due to the use of a galvanised pail (this J., 1914, 895), and another death occurred during the cleansing of a tar still into which men were allowed to enter with the valves open and before the safety-pipe had been cut out, so that one was overpowered by the fumes of pitch from an adjoining still.—F. SODN.

Sulphuric acid; Production of — in the United States in 1914. Eng. and Min. J., June 19, 1915.

THE production of sulphuric acid in the United States in 1914 was equivalent to 3,762,417 short tons of 50° B. acid, valued at \$24,163,331; this is exclusive of 21,993 tons of fuming acid, valued at \$316,596, but includes the "by-product acid" made by zinc and copper smelters. This by-product acid was equivalent to 950,798 tons of 50° B. acid, valued at \$5,190,293; nearly three-fifths of the by-product acid is credited to the zinc smelting works.

Argon; Production of —. F. S. Washburn. Chem. News, 1915, 112, 29.

THE cyanamide process has been used recently in America as a means of producing argon in quantity. Nitrogen obtained from the air by the copper process, is repeatedly passed through the cyanamide furnaces, until concentrated argon remains as the residual gas. Thousands of cubic feet of this gas is being sold for the use of the electric lamp industry, chiefly in America, but some is exported.

Phosphoric acid; Colorimetric determination of —. E. Riegler. Bull. Acad. Sci. Roumanie, 1914, 2, 272—275. J. Chem. Soc., 1915, 108, ii., 368—369.

A COLORIMETRIC method is described depending on the blue coloration produced when ammonium phosphomolybdate is reduced by warming with a solution of hydrazine sulphate; the intensity of the colour is proportional to the amount of phosphoric acid present. A comparison solution is prepared by dissolving 0.505 gm. of crystallised disodium phosphate in 100 c.c. of water. One c.c. of this solution is placed in a graduated centrifuge tube, 1 c.c. of nitric acid (sp. gr. 1.125) and a quantity of 30% ammonium nitrate added to fill the tube to the tenth mark, then the tube is heated and 2 c.c. of 3% ammonium molybdate solution is added, thoroughly mixed, and the solution centrifuged for two minutes. The clear solution is poured off, and the precipitate shaken with 30% ammonium nitrate solution and again centrifuged for two minutes, and the clear solution poured off. The precipitate is then washed into a 100 c.c. flask by means of a 2% solution of hydrazine sulphate (20 c.c.), and the solution warmed. The flask is then cooled, and filled to the mark with distilled water; 1 c.c. of this solution is equivalent to 0.00001 gm. P_2O_5 . The solution to be analysed is treated in the same manner, and the two solutions are compared in a colorimeter.

Copper; Determination of — in commercial copper sulphate. G. Incze. Z. anal. Chem., 1915, 54, 252—255.

TEN grms. of the copper sulphate is dissolved in water, the solution diluted to 500 c.c., and 50 c.c. then treated with 52 c.c. of standardised thio-sulphate solution containing thiocyanate, which precipitates the copper as cuprous thiocyanate; the excess of the thio-sulphate is then titrated with iodine solution. The reactions proceed according to the equations: $8CuSO_4 + Na_2S_2O_3 + 5H_2O = 1Cu_2SO_4 + Na_2SO_4 + 5H_2SO_4$, and $4Cu_2SO_4 + 8NH_4CNS = 8CuCNS + 4(NH_4)_2SO_4$. The thio-sulphate solution is prepared by dissolving 19.878 grms. of the salt and 8 grms. of ammonium thiocyanate in 1 litre of water; the iodine solution contains 1.0178 grms. of iodine and 5 grms. of potassium iodide per litre. One c.c. of the thio-sulphate solution should require exactly 10 c.c. of the iodine solution. The percentage of copper sulphate in the sample is found by deducting 20 from the number of c.c. of iodine solution required for the titration and dividing the remainder by 5. The presence of iron salts in the copper sulphate does not interfere with the determination.—W. P. S.

Copper in commercial copper sulphate (containing iron); Comparison of methods for the determination of —. L. von Wissell and F. Küsspert. Landw. Versuchs-stat., 1915, 86, 277—286. J. Chem. Soc., 1915, 108, ii., 376—377.

TRUSTWORTHY results may be obtained by precipitating the copper as sulphide from an acid solution, and subsequently converting the sulphide into oxide; by precipitating the copper by the addition of sodium thio-sulphate to its acid solution; or by treating the copper sulphate solution with a slight excess of ammonia, separating the ferric hydroxide, and precipitating the copper by heating the ammoniacal solution, but a more convenient and less tedious method consists in precipitating the copper as thiocyanate from a solution containing sulphurous acid. The latter method is, therefore, recommended for the estimation of copper in the copper sulphate sold for use as an insecticide, which usually contains a quantity of iron salts.

Copper nitrate; Temperature of decomposition of —. L. Rolla. Gaz. Chim. Ital., 1915, 45, I., 444—450.

A MIXTURE of nitrogen dioxide (NO_2) and oxygen, obtained by the decomposition of lead nitrate, was led for 2 hours over a weighed quantity of copper oxide kept at a constant temperature (from 70° to 300° C.). At 250° C. and higher temperatures the copper oxide showed no gain in weight, and hence the temperature of complete decomposition of copper nitrate at atmospheric pressure is given as 250° C.—A. S.

Ammonium bromide; Action of — on metallic iodides. II. I. Guareschi. Atti R. Accad. Sci. Torino, 1915, 50, 354—360. J. Chem. Soc., 1915, 108, ii., 365. (Compare this J., 1915, 548.)

WHEN heated in a long, narrow tube of hard glass with ammonium bromide, all metallic iodides, even those which, like silver iodide, withstand very high temperatures without decomposition, yield free iodine; the reactions taking place are expressed by the equations: $MI + NH_4Br = MBr + NH_4I$ and $2NH_4I = 2NH_3 + H_2 + I_2$. In many, but not in all cases the ammonium bromide may be replaced by the chloride. By means of this reaction, as little as 0.0001 gm. of potassium iodide may be detected, even when mixed with very large proportions of the chloride or bromide of an alkali or alkaline-earth metal. Double iodides, such as $HgI_2 \cdot 2KI$, $HgI_2 \cdot CdI_2$, $ZnI_2 \cdot KI$,

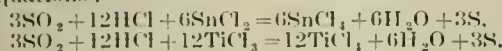
give free iodine more readily when heated with ammonium bromide than when heated alone. Silver iodide gives the reaction when mixed with silver bromide, except when the latter is in very large excess. Silver chloride prevents the detection of silver iodide in the dry way, but the following procedure gives certain results, even when the iodide is present only in traces: the mixture is shaken with about ten times its weight of ammonium bromide and twenty times its weight of water, the decanted liquid being tested for iodine by either chlorine water and starch or chlorine water and chloroform. The double iodide, $\text{HgI}_2 \cdot 2\text{AgI}$, responds readily to this reaction, liberation of iodine taking place in presence of silver bromide or lead bromide, but not when silver chloride is present. With lead iodide, the reaction is not prevented by silver iodide, mercuric iodide, or lead chloride or bromide. When a mixture of silver and ammonium bromides is heated, it fuses, boils, and yields a reddish-brown sublimate, ammonia, but not bromine, being set free. The sublimate is soluble in hot absolute alcohol, which subsequently deposits it as a red powder.

Hydrogen peroxide: Behaviour of — towards salts. P. V. Kazanecki. J. Russ. Phys. Chem. Soc., 1914, 46, 1110—1127. J. Chem. Soc., 1915, 108, ii., 334.

With carbonates of the alkali metals, hydrogen peroxide forms unstable compounds, such as $\text{C}_2\text{O}_3 \cdot 2\text{H}_2\text{O}$, $\text{K}_2\text{C}_2\text{O}_3 \cdot 2\text{H}_2\text{O}$, $\frac{1}{2}\text{H}_2\text{O}$, $\text{Na}_2\text{C}_2\text{O}_3 \cdot \frac{1}{2}\text{H}_2\text{O}$, which exhibit the properties of peroxides. Magnesium carbonate and hydrogen peroxide in solution give the compound $\text{MgO}_2 \cdot \frac{1}{2}\text{MgCO}_3 \cdot \frac{1}{2}\text{H}_2\text{O}$. All these compounds yield ozone with concentrated sulphuric acid, and chlorine with concentrated hydrochloric acid; from neutral potassium iodide solution they liberate iodine slowly. The increased solubility of salts in hydrogen peroxide solution has been observed by various investigators. In the case of potassium sulphate, this increase is related linearly to the proportion of hydrogen peroxide, the presence of 72.6 grms. of the latter per 100 c.c. raising the solubility of the sulphate from 1.11 grms. to 67.22 grms. per 100 c.c. of solution. That the peroxide and sulphate interact is shown by cryoscopic and conductivity measurements.

Sulphur dioxide: Oxidising properties of —. J. A. Smythe and W. Wardlaw. Proc. Durham Phil. Soc., 1913-14, 5, 187—201. J. Chem. Soc., 1915, 108, ii., 235.

The authors have studied the oxidising action of sulphur dioxide on the lower chlorides of tin, titanium, mercury, and iron. Stannous and titanous chlorides were oxidised in warm, strongly acid solution to stannic and titanous chlorides respectively, the sulphur dioxide being reduced to hydrogen sulphide. In solutions not too strongly acid, the corresponding sulphides were accordingly precipitated, otherwise sulphur was formed in quantities corresponding with the equations:



In concentrated hydrochloric acid, mercurous chloride was slowly but completely oxidised, with the deposition of sulphur; no hydrogen sulphide was formed. Ferrous chloride was also oxidised in strong acid solution, but only to the extent of about 7% on the average, and increase in the total concentration of the iron lessened the relative amount of ferric salt. The sulphur dioxide was reduced to sulphur. The reaction is not a balanced one, but appears to be brought to a standstill by direct inhibition by the ferric chloride. When more than 14% of the total iron was in the ferric

state, no sulphur was deposited on heating in sulphur dioxide, and no oxidation took place at all. It is suggested that the oxidising action of sulphur dioxide in the above cases, which is only manifested in presence of concentrated hydrochloric acid, may be due to the intermediate formation of thionyl chloride.

Colloidal ferric hydroxide; Negative —. F. Powis. Chem. Soc. Trans., 1915, 107, 818—824.

COLLOIDAL ferric hydroxide was changed from positive to negative by adding it, with continuous shaking, to a suitably dilute solution of sodium hydroxide, and it was also prepared directly as a negative colloid by allowing the particles to form in the presence of a dilute solution of sodium hydroxide. Coagulation occurred when equivalent quantities of the positive and negative colloids were mixed. The potential difference at the surface of colloidal particles is considered to be caused by the adsorption of ions from the solution, that observed with the dialysed colloids usually employed being due to residual traces of electrolyte; the sign of the potential difference is considered to depend on whether cations or anions are in excess in the layers nearest the particles.—F. SODN.

Nitrogen tetroxide; Constitution of — and of the products formed from it by a limited quantity of water. G. Oddo. Gaz. Chim. Ital., 1915, 45, 1., 413—443.

NITROGEN tetroxide prepared by heating lead nitrate, and also the commercial product were used in the experiments. After drying with phosphorus pentoxide and fractionating, the portion distilling at 22°—23° C., with partial dissociation, was collected and was further purified by crystallisation three times in a mixture of ice and salt or ice and hydrochloric acid. The pure product is a clear red liquid at the ordinary temperature; it solidifies at —9.04° C., with an appreciable decrease of volume, to a colourless mass, and on allowing the temperature to rise this becomes yellowish and melts to a yellow liquid, which, however, gradually becomes red at the ordinary temperature. The tetroxide dissolves with approximately the normal molecular weight in nitrobenzene; in benzene it shows a tendency to polymerise and in glacial acetic acid to become dissociated into NO_2 . From the results of a series of cryoscopic measurements it is concluded that in presence of a limited quantity of water nitrogen tetroxide is converted into an addition compound of nitrous and nitric acids, to which the name, nitrosic acid, and the

formula, $\text{ON}(\text{OH})\text{<O>N.OH}$, are ascribed. Nitrogen tetroxide, $\text{ON}\text{<O>NO}$, is regarded as the

anhydride of nitrosic acid. Organic nitrosates are considered to be salts of nitrosic acid, and the acid salts, $\text{KNO}_3 \cdot \text{HNO}_3$ and $\text{KNO}_3 \cdot 2\text{HNO}_3$, as salts of the analogous acids, dinitric acid,

$\text{ON}(\text{OH})\text{<O>NO}(\text{OH})$, and trinitric acid, $\text{ON}(\text{OH})\text{<O>N}(\text{OH})\text{<O>NO}(\text{OH})$.—A. S.

Hydrogen phosphide; Determination of —. H. Reckleben. Z. anal. Chem., 1915, 54, 241—252.

ACCURATE results may be obtained in the gasometric determination of hydrogen phosphide in mixtures of this gas with hydrogen by absorbing it in $N/2$ iodine solution, hypochlorite solution, hypobromite solution, concentrated potassium iodate solution, $N/1$ silver nitrate solution, mercuric chloride solution, or mercurous salt solutions,

The following solutions may also be used for the absorption, provided that the residual hydrogen is treated with a reagent to remove volatile substances (chlorine, bromine, ammonia, etc.) introduced from the solution:—Chlorine water (containing not more than 0.16% Cl), saturated bromine water, acidified *N*/5 bromide-bromate solution, ammoniacal silver solution, cuprous chloride containing hydrochloric acid, and acidified *N*/2 permanganate solution. A mixture of hydrogen phosphide and hydrogen, such as is obtained by the action of potassium hydroxide on phosphorus, may be stored over saturated sodium chloride solution for a long time without undergoing change; this solution should be used in the measuring burette.

—W. P. S.

Boron trichloride. *A greaseless gas-valve.* A. Stock and O. Priess. Ber., 1914, 47, 3109—3115. J. Chem. Soc., 1915, 108, ii., 339—340.

Boron trichloride was obtained by the action of chlorine on Moissan's boron in a glass tube, the temperature being so regulated that the glass was attacked as little as possible. The crude product, condensed at -80°C ., was shaken with mercury, and then freed from traces of hydrogen chloride and silicon chloride by fractional distillation in a high vacuum, from a bath at -78°C .. The early fractions, condensed by liquid air, contained hydrogen chloride, which influenced the vapour pressure at 0°C . far more than the melting point, whilst the silicon chloride collected in the end fractions. The following constants of a pure fraction were observed; m.pt. -107°C ., b.pt. 13°C . at 764 mm. (room temperature 10°C .).

Boron trichloride does not attack hot mercury, nor does it combine with chlorine, even at -80°C .. It reacts energetically with fats, and therefore a valve was designed which had no greased taps to be exposed to the vapour (see fig.). A and B are solid glass floats, resting by three feet on the enlargement in the tubes, and ground at the top to fit into the ground constriction. C and D connect the other pieces of apparatus. The bulb, E, contains clean mercury. When A and B have fallen, C communicates with D. By raising the mercury in F, the floats are forced into the constrictions, to make a gas-tight seal with a thin film of mercury. The floats are made to fall again by exhausting E and opening the tap, G.

Boron hydrides. V. Action of chlorine and bromine on B_2H_6 and $\text{B}_{10}\text{H}_{14}$. Valency of boron. A. Stock, E. Kuss, and O. Priess. Ber., 1914, 47, 3115—3149. J. Chem. Soc., 1915, 108, ii., 340—342. (Compare this J., 1913, 22; 1911, 549.)

SOME improvements in the preparation of B_2H_6 are described. They consist chiefly in passing the crude gas through a tube at -40°C ., whereby white crystals of $\text{B}_{10}\text{H}_{14}$, m.pt. 99.5°C ., are collected, then through a large U-tube at -80°C ., in which a little B_2H_6 , some silicon hydride, and, chiefly, B_6H_{12} , are condensed, and finally

the main bulk of the gas is condensed by cooling with liquid air. The yields obtained from 100 grms. of "magnesium boride" were B_2H_6 , 95 c.c. (0° and 760 mm.), and $\text{B}_{10}\text{H}_{14}$, 0.02 gm. The apparatus for the conversion of B_2H_6 by heat into B_2H_4 was also improved, and the B_2H_4 which was pumped off from the liquid air condensation was condensed in a bath made by stirring liquid air into alcohol until the mass was almost solid. Such a bath maintains a temperature of -125° to -115°C . for some hours in a Dewar vessel. B_2H_4 condenses in needles when cooled slowly, and is not attacked by dry oxygen to any extent after some days at ordinary temperatures. Traces of moisture, however, decompose it at once, but hydrogen sulphide has no action, even at 100°C .. It inflames if the liquid is suddenly brought into the air (for example, when a breakage occurs). The action of bromine and chlorine on the solid $\text{B}_{10}\text{H}_{14}$ was very sluggish; replacement of hydrogen, and not addition, was the rule. Thus, when the solid was left in a large excess of bromine for six months, the residue, after evaporation, had a formula between $\text{B}_{10}\text{H}_{12}\text{Br}_2$ and $\text{B}_{10}\text{H}_{11}\text{Br}_3$, and apparent individuals were isolated by fractional crystallisation from a mixture of benzene and light petroleum. The alkaline solutions of these compounds reduced permanganate, and then yielded B_2H_6 on acidifying. The acid solutions also reduced permanganate, and gradually evolved B_2H_6 , and other, unknown, evil-smelling boron compounds. In studying the action of chlorine and bromine on B_2H_6 it was found that chlorine causes explosions at the ordinary temperature, whereas bromine reacts very slowly, even in the light, but completely in a few hours at 100°C .; the reaction is one of substitution. Excess of halogen always leads to the unimolecular haloids BCl_3 and BBr_3 , and not to B_2Cl_6 and B_2Br_6 . When B_2H_6 was treated with about one-third of the quantity of bromine required for complete reaction, the products were not the middle brominated compounds, like $\text{B}_2\text{H}_4\text{Br}_2$, but almost exclusively the extremes, $\text{B}_2\text{H}_6\text{Br}$ and BBr_3 . The action of halogens on an excess of B_2H_6 appears to lead, first, to the production of such derivatives as $\text{B}_2\text{H}_4\text{X}_2$ and $\text{B}_2\text{H}_3\text{X}_3$, and then these speedily decompose and rearrange themselves into $\text{B}_2\text{H}_5\text{X}$ and B_2H_6 on the one hand, and into BX_3 on the other. The monochloride, $\text{B}_2\text{H}_5\text{Cl}$, is a spontaneously inflammable gas. The monobromide, $\text{B}_2\text{H}_5\text{Br}$, m.pt. -104°C ., b.pt. about 10°C . at 760 mm., is a colourless gas with irritating odour, which burns with a pale, greenish flame, and fumes in the air, owing to the reaction with water. $\text{B}_2\text{H}_5\text{Br} + 3\text{H}_2\text{O} = \text{B}_2\text{O}_3 + \text{HBr} + 5\text{H}_2$. It reacts immediately with potassium hydroxide, like B_2H_6 , to form the hypoborate, KOBH_3 (this J., 1914, 549).

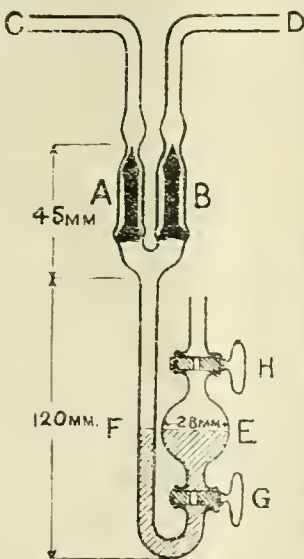
These experiments prove that the highest, negative (hydrogen) valency of boron is four. The positive (oxygen, halogen) valency is three, although many substances have been described in which the valency is supposed to be five.

Boron tribromide. A. Stock and E. Kuss. Ber., 1914, 47, 3113—3115. J. Chem. Soc., 1915, 108, ii., 340.

BORON tribromide, m.pt. -46° , b.pt. 90.1°C . at 740 mm., was obtained by passing bromine vapour over boron at a dull red heat, shaking the product with mercury, and then fractionating under atmospheric pressure with a Hahn column (this J., 1910, 300, 842). It attacks fats of all kinds as energetically as the chloride.

PATENTS.

Sulphuric and other acids; Apparatus for concentrating. P. L. Pfannenschmidt and R. Moss, Dewsbury. Eng. Pat. 13,642, June 5, 1914. THE acid passes along an open cascade formed of



shallow square trays, which are subjected to the heating effect of waste gases from a furnace, and on issuing falls against ascending hot air in a concentrating chamber and against ascending cold air in a cooling chamber, the same current of air being used in each. The two chambers are fitted with perforated square plates, whereby the acid is converted into a fine spray. The apparatus may be made of fused silica, "neutral iron," artificial ceramic material, etc.—J. R.

Phosphoric acid; Process of manufacturing —. F. C. Schmitz, New York. U.S. Pat. 1,142,371, June 8, 1915. Date of appl., Feb. 4, 1914.

THE phosphoric gases evolved from a molten mixture of phosphatic material with a flux and a reducing agent, are passed into absorbing towers, thus yielding an aqueous solution of phosphoric acid; or, preceding the absorption, the phosphorus is oxidised to pentoxide by mixing the gases with air or oxygen. Solid impurities are removed by passing the gases through a body of liquid before absorption.—J. R.

Phosphoric acid; Process for making —. J. W. Burroughs, Irvington, N.Y. U.S. Pat. 1,142,397, June 8, 1915. Date of appl., March 18, 1914.

PHOSPHATIC material is fused with a flux in a furnace, and the resulting phosphoric gas decomposed by treatment with an appropriate substance, e.g., water, the change being accelerated by local cooling.—J. R.

Aluminous compounds; Manufacture of —. H. Spence, W. B. Llewellyn, and P. Spence and Sons, Ltd., Manchester. Eng. Pat. 9148, April 11, 1914.

THE process described in Eng. Pat. 23,036 of 1904 (this J., 1905, 1066) is modified (a) by preparing the solution, e.g., by the action of sulphuric acid on bauxite, so as to contain an excess of 5–10% Al_2O_3 beyond that required to form normal aluminium sulphate, (b) by adding a much reduced quantity of potassium salt (about 2 mols. K_2SO_4 to 3 mols. Fe_2O_3), and (c) by maintaining the temperature during the process at about 50° C. Under these conditions, the solution remains basic without adding lime, and there is very little loss of Al_2O_3 and SO_3 in the form of insoluble basic compounds.—F. SODN.

Nitrate of soda; A two stage evaporation process for recovering — from liquors containing it and sodium chloride in solution and an apparatus for carrying out such process. Gibbs and Co., Valparaiso, Kestner Evaporator and Engineering Co., Ltd., and I. B. Hobshawm, London, and J. L. Grigioni, Richmond. Eng. Pat. 12,475, May 20, 1911.

THE liquor is concentrated in an evaporator till the b.pt. is raised to a predetermined temperature at which practically the whole of the sodium chloride separates, whereupon the hot supernatant liquor is transferred to another evaporator and concentrated further. By suitably adjusting the pressures, the vapour from the first evaporator may be utilised to maintain the liquor in the second evaporator at the b.pt. Pure sodium nitrate or sodium nitrate containing any desired amount of sodium chloride may be obtained.—J. R.

Oxides of nitrogen; Manufacture of — and of catalysts to be employed in such manufacture. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen, Germany. Eng. Pat. 13,848, June 8, 1914.

A MIXTURE of ammonia and oxygen or air is passed over a heated catalytic agent containing an oxide of a metal of the iron group (e.g., iron, manganese,

chromium, uranium) and an oxide of bismuth, either of which may be replaced by an oxide of a rare-earth metal; or a mixture of three or more such oxides may be used. Any binding material employed should not contain large quantities of non-metallic elements, metalloids, or their compounds. The catalyst is used in layers of small lumps, and a yield of oxides of nitrogen of 90% is obtained. As an example, 15 parts of ferric nitrate and 1 part of lanthanum nitrate are dissolved in water and precipitated with ammonia. The precipitate is formed into lumps, which are dried at 250° C. and then heated to 600° C.; the catalyst is then used at 700° C.—J. R.

Ammonia; Production of —. F. W. de Jahn, Assignor to General Chemical Co., New York. U.S. Pat. 1,141,948, June 8, 1915. Date of appl., July 8, 1914.

GASEOUS mixtures containing nitrogen and hydrogen under a pressure less than 100 atmospheres are passed over a heated catalyst containing cobalt, sodium, and nitrogen.—J. R.

Salt; Process for the manufacture of —. C. L. Weil, Assignor to Diamond Crystal Salt Co., St. Clair, Mich. U.S. Pat. 1,141,999, June 8, 1915. Date of appl., May 13, 1911.

HOT saturated brine is allowed to evaporate in an atmosphere of controlled composition, and the size of the grain is regulated by a rippling agitation of the brine caused by jets of air directed in various ways against the surface.—J. R.

Hydrogen peroxide; Apparatus for manufacturing —. Henkel und Co., Düsseldorf, Germany. Eng. Pat. 22,714, Nov. 18, 1914. Under Int. Conv., Dec. 17, 1913.

A TUBULAR high-pressure vessel of suitable metal is coated inside with a thin layer of cathode material (e.g., silver amalgam and copper amalgam), and contains an axially disposed anode, covered with a diaphragm tube (of asbestos fabric, for instance), whilst a surrounding cooling jacket serves to cool both cathode and electrolyte. The concentration of the electrolyte may be increased by circulating it through a single apparatus or by passing it consecutively through several apparatus connected electrically in series. The apparatus is a modification of that described in Eng. Pat. 10,476 of 1913 (see Fr. Pat. 457,696 of 1913; this J., 1913, 1010).—F. SODN.

Carbon; Manufacture of chemically pure, finely divided —. H. Plauson, Petrograd. Eng. Pat. 17,731, Aug. 1, 1913.

GROUND wood charcoal is passed through a sieve with 35,000 to 40,000 openings per sq. inch, and treated successively with strong sulphuric, nitric, and hydrofluoric acids, washing with water following each treatment; the final washing, in which alkali may be used, must be very thorough. The resulting pure carbon powder is brought into colloidal solution by known methods (e.g., by means of tannin, or by mechanical means), and subsequently may be precipitated by the addition of acids, etc. The product, after drying and heating in hydrogen or nitrogen, or *in vacuo*, is suitable for technical purposes, including use as a black colouring material.—J. R.

Graphite; Process for converting coke into —. H. Plauson, Petrograd. Eng. Pat. 17,732, Aug. 1, 1913.

FINELY disintegrated coke powder, which may have been previously purified by treatment with mineral acids (see Eng. Pat. 17,731; preceding), when rendered colloidal by known methods yields graphite; the addition of 1% to 3% of a natural

colloid, or of aldehydes, tannin, tungstic or chromic acid, etc., facilitates the conversion. Colloidal graphite may thus be obtained directly in oil; but for purposes of separation, water or a thin liquid hydrocarbon (*e.g.*, kerosene or ligroin) should be employed. When clay powder is mixed with the coke powder, in order to improve the plasticity, the clay is also rendered colloidal. (Reference is directed, in pursuance of Sect. 7, Sub-sect. 4, of the Patents and Designs Act, 1907, to Eng. Pats. 3198 of 1898 and 7776 and 27,312 of 1907; this J., 1899, 259; 1907, 971; 1908, 940.)
—J. R.

Hydrogen; Manufacture of — J. Y. Johnson, London. From Badische Anilin u. Soda Fabrik, Ludwigshafen, Germany. Eng. Pat. 16,494, July 10, 1914. Addition to Eng. Pat. 27,955, Dec. 4, 1912 (see Fr. Pat. 459,918 of 1913; this J., 1914, 24).

MIXTURES of carbon monoxide and steam are passed over a catalyst consisting of spathic iron ore or hydroxide iron ores, which may be made into lumps by means of aluminium hydroxide or some other binding agent. The catalyst must not be heated above 650° C. either during the reaction or beforehand.—J. R.

Bromine; Process of making — E. O. Barstow, Assignor to The Dow Chemical Co., Midland, Mich. U.S. Pats. (A) 1,141,921 and (B) 1,141,922, June 8, 1915. Dates of appl., Nov. 6 and 7, 1911.

(A) CHLORINE is caused to react with iron bromide solution of such strength that the resulting bromine collects as a liquid layer which is separated and freed from chlorine by agitation with more iron bromide solution. (B) Sulphuric acid is added to a solution of a bromide and a bromate of such strength that the resulting bromine collects as a liquid layer.—J. R.

Nitric acid; Manufacture of — C. Uebel, Heidelberg, Germany. U.S. Pat. 1,141,994, June 8, 1915. Date of appl., Sept. 16, 1913.

SEE Fr. Pat. 461,452 of 1913; this J., 1914, 200.

Zeolites; Manufacture of — P. de Brünn, Düsseldorf, Germany. Eng. Pats. 15,090 and 15,539, June 30 and July 5, 1913.

SEE Addition of Sept. 27, 1913, to Fr. Pat. 455,391 of 1913; this J., 1914, 372.

Double silicates; Manufacture of — P. de Brünn, Düsseldorf, Germany. Eng. Pat. 19,191, Aug. 23, 1913. Under Int. Conv., Aug. 26, 1912. SEE Fr. Pat. 464,018 of 1913; this J., 1914, 500.

Nitrides; Manufacture of — Gebr. Giuliani G. m. b. H., Ludwigshafen on Rhine, Germany. Eng. Pat. 22,837, Oct. 9, 1913. Under Int. Conv., Dec. 6, 1912.

SEE Fr. Pat. 463,232 of 1913; this J., 1914, 421.

Nitrogenous gases; Process for the absorption of dilute—by water. F. Häusser, Herringen, Germany. Eng. Pat. 7419, Mar. 24, 1914.

SEE Fr. Pat. 469,649 of 1914; this J., 1915, 80.

Lead oxide; Method of and apparatus for producing — E. Barthelmeß, Neuss on Rhine, Germany. Eng. Pat. 9333, Apr. 15, 1914. Under Int. Conv., Dec. 10, 1913.

SEE Fr. Pat. 466,129 of 1913; this J., 1914, 593.

Alkaline nitrates; Process of decomposition of — C. K. Mills, London. From Soc. Anon. des Poudres et Nitrates, Spy, Belgium. Eng. Pat. 14,357, June 15, 1914.

SEE Fr. Pat. 473,133 of 1914; this J., 1915, 551.

Carbonic acid; Processes for the manufacture of aqueous solutions of — L. Sarason, Meran, Austria. Eng. Pat. 14,862, June 20, 1914.

SEE Fr. Pat. 473,625 of 1914; this J., 1915, 731.

Hydrous alkali metal silicate; Manufacture of — E. A. Paterson, Thorold, Canada. Eng. Pat. 24,099, Dec. 15, 1914. Under Int. Conv., Dec. 17, 1913.

SEE U.S. Pat. 1,111,918 of 1914; this J., 1914, 1154.

Barium oxide; Method of preparing — L. E. Saunders, Niagara Falls, N.Y. Reissue No. 13,924, dated June 8, 1915 (date of appl., April 28, 1915), of U.S. Pat. 1,112,721, Oct. 6, 1914.

SEE this J., 1914, 1088.

Radioactive substances; Manufacture, isolation, and enrichment of—by adsorption from solutions. E. Ebler, Heidelberg, Germany. U.S. Pat. 1,142,153, June 8, 1915. Date of appl., Dec. 8, 1913.

SEE Addition of Dec. 1, 1913 to Fr. Pat. 440,236 of 1912; this J., 1914, 644.

Radioactive ores and intermediate products; Method of treating — E. Ebler, Heidelberg, Germany. U.S. Pat. 1,142,154, June 8, 1915. Date of appl., Dec. 8, 1913.

SEE Fr. Pat. 467,330 of 1914; this J., 1914, 864.

Process of carrying out chemical reactions between solids or between solids and gases, at a high temperature. Fr. Pat. 473,918 and First Addition thereto, and Fr. Pat. 474,233. See I.

Carrying out reactions in presence of alkali. Eng. Pat. 20,664. See III.

VIII.—GLASS; CERAMICS.

Quartz glass; Diffusion and absorption of hydrogen in — H. Wüstner, Ann. Physik, 1915, [iv.], 46, 1095—1129. J. Chem. Soc., 1915, 108, ii., 319.

THE rate of diffusion of hydrogen through fused quartz was measured between 300° and 1000° C., and at a pressure of 800 to 900 atmospheres. The relationship between the coefficient of diffusion and the temperature is exponential in character. The coefficient at 1000° C. is of the same order of magnitude as the coefficient of diffusion through water at the ordinary temperature. From experiments made with a different form of apparatus at a pressure of 3 atmospheres, it is found that the rate of diffusion at 1000° C. is approximately proportional to the pressure. Comparable results in diffusion experiments can only be obtained when fresh quartz is used for each measurement. The absorption of hydrogen was also examined by experiments with fibrous quartz (diameter of fibres 0.01 cm.). The absorption-coefficient increases from about 0.0055 at 300° to about 0.011 at 900° C.; at 1000° C. it seems to be somewhat smaller than at 900° C.

PATENTS.

Glass; Method of and apparatus for delivering measured quantities of molten — L. W. Proeger, J. I. Kay, R. D. Totten, and R. C. Powell, Pittsburgh, Pa., U.S.A. Eng. Pat. 14,731, June 19, 1914.

A CHARGE of glass, preferably less than that required for the article to be formed, is accumulated close to the main body of molten glass, and allowed to discharge from a chamber having a relatively wide discharge opening. The discharged mass is freed below and on its sides so that it falls in the form of a freely moving mass, connected

with the main bulk of the molten glass by an elongated thread, which is cut off at a point where substantially the lowest portion of the mass was situated prior to its discharge, the severing device serving to close the discharge opening.—W. C. H.

Glass and crystal [tank] furnace. J. Maillart-Norbert and E. L. R. L. Daltroff. Fr. Pat. 474,277, Nov. 11, 1913.

SUCCESSIVE tanks for melting, fining, and working are arranged in a circle around a central burner, and communicate with one another in such a way as to ensure complete circulation of the material and uniform heating. The central burner consists of three concentric spaces, the central space and outer ring being supplied respectively with primary air, drawn in at the dome of the furnace and passing through concentric spaces under the floor of the furnace, and secondary air drawn in at the lower part of the furnace and circulating through concentric spaces before reaching the burner; the gas is supplied to the middle ring through other concentric spaces. A regenerative system, consisting of concentric flues, is interposed between the working chamber of the furnace and the chimney. When the tank is worked without regeneration, a burner, *e.g.*, of the Meker type, is arranged in the upper part of the dome of the furnace, the flame striking against a block of refractory material, round which the glass moves during its fining.—W. C. H.

[Glass] colour screens for artificially producing daylight. Eng. Pat. 20,827. See IIb.

IX.—BUILDING MATERIALS.

Portland cement; Petrographic study of—. R. J. Colony. School Mines Quart., 1914, 36, 1—21.

A SOLUTION of calcium hydroxide evaporating spontaneously in an atmosphere free from carbon dioxide deposits crystals of spherulitic habit. Free residual primary calcium hydroxide in cement and concrete was found to have a similar form and structure. In addition to fragments of residual clinker, isotropic hydrated grains, and crystalline calcium hydroxide, another component ("primary colloid") was observed in fresh cement; it was present in small areas, intimately mixed with the calcium hydroxide, and possessing a lamelloid structure. Within 5—6 days after gauging the cement, a secondary transformation occurred, resulting in the formation of a dense, structureless mass ("amorphous constituent") which obscured everything except the fragments of residual clinker, and apparently resulted from the interaction of the other three primary hydration products. At this stage, practically no free calcium hydroxide could be identified, except as a lining of vesicles and cavities. The development of the amorphous constituent was arrested by rapid drying out or hardening in air. After storing cement under water for a long time, the amorphous constituent was found to undergo partial crystallisation, the products being secondary crystalline calcium hydroxide, calcite, and zeolitic matter. Specimens of cement in which disintegration was evident showed but small patches of the amorphous constituent, irregularly distributed through large areas of crystalline calcium hydroxide. A good cement or concrete should have the following petrographic characters: Presence of the amorphous constituent in complete development, with fragments of residual clinker; a minimum quantity of residual calcium hydroxide; fine and even texture of matrix; minimum degree of carbonation; absence of cracks, voids, and cavities; firm contact between matrix and aggregate.—W. R. S.

Annual report on alkali, etc. works. See VII.

PATENTS.

Cement from blast-furnace slag; Method and apparatus for producing—. W. Lessing, Menzenberg, Germany. Eng. Pat. 19,191, Aug. 23, 1913.

THE liquid slag is projected into a rotating inclined cooling drum by means of a scattering wheel disposed transversely in front of the drum. Air is admitted to the latter at its discharge end, and withdrawn at the opposite end by a chimney above the scattering wheel. The steam generated from the cooling water in the drum-jacket is delivered to the interior of the drum to render the slag more friable. A water-cooled shoot projects from underneath the wheel into the drum.—W. R. S.

Cementitious material for bonding new cement to existing cement or like structures and for other uses; Manufacture of—. H. Wade, London. From The Master Builders' Co., Cleveland, Ohio. U.S.A. Eng. Pat. 13,478, June 2, 1914. (See also Eng. Pat. 28,857 of 1911; this J., 1912, 1079.)

PARTICLES of iron (15—20 mesh size) which have been previously coated with a thin film of magnetic oxide by heating to low redness in air for a few minutes, are mixed with cement and water. The existing structure is coated with the mixture and the new cement work added before the latter hardens.—W. E. F. P.

Cement; Artificial-stone—. G. Capece, Providence, R.I. U.S. Pat. 1,441,610, June 1, 1915. Date of appl., July 31, 1914.

THE cement consists of beeswax, 1.8 grms., rosin 4.3 grms., varnish 0.3 grm., powdered lead 3.15 grms., powdered brick 2.9 grms., and Portland cement 15.1 grms.—W. C. H.

Cement, concrete, and the like; Waterproofing compound for—. F. R. Stelm, Assignor to Enamel Concrete Co., Des Moines, Iowa. U.S. Pat. 1,441,848, June 1, 1915. Date of appl., Jan. 22, 1912.

A MIXTURE of 60 galls. of kerosene oil, 10 lb. of spermaceti wax, and 2½ galls. of cottonseed oil is heated to about 180° F. (about 80° C.) until the spermaceti wax is dissolved. The compound may be mixed with about 12 parts of water.—W. C. H.

Cement; Magnesian— and process of manufacture. M. Schoelzky. Fr. Pat. 473,955, June 23, 1914. Under Int. Conv., June 23, 1913.

THE base of the cement is magnesium oxide and sulphate with which calcined calcium bisulphate is mixed together with some alum, preferably potash alum, and some *Radix Althææ*.—W. C. H.

Bricks or light stone; Manufacture of— by means of blast-furnace slag. C. H. Schol. Second Addition, dated May 23, 1914, to Fr. Pat. 437,595, Nov. 25, 1911 (this J., 1912, 538; 1913, 1012).

IN place of blast-furnace slag, clinker from gas producers and slags from cupolas, slags produced in the extraction of lead, copper, etc., and pieces of rocks or natural stones, not sufficiently resistant in the raw state, such as tufa, etc., may be used. In order to produce porous, bulky pieces of slag, the molten material is introduced by a slag channel direct into a stream of water, which may be hot.—W. C. H.

Plastic composition [magnesia cement]; Process for producing a—. W. G. F. Siegmund, Baltimore, Md., U.S.A. Eng. Pat. 15,038, June 23, 1914. See U.S. Pat. 1,102,358 of 1914; this J., 1914, 1089.

Silicious material; Processes of treating — to produce hydraulic cement and alkali therefrom. H. E. Brown, Kingston, N.Y., U.S.A. Eng. Pat. 2466 of 1915, date of appl. June 2, 1914.

SEE Fr. Pat. 473,279 of 1914; this J., 1915, 553.

Composite fuel briquettes for heating and production of cement, clinker, or ash. Eng. Pat. 14,013. See HA.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Steels; The superficial deformations of [mild] — quenched at moderate temperatures. B. Bogitch. Comptes rend., 1915, 160, 768—771.

By heating test-pieces of mild steel, 4 cm. square and 1 cm. thick, and polished on one side, to temperatures between 215° and 360° C., and quenching them in water, ridges visible to the naked eye were formed on the polished faces, as previously observed by Zschokke (Rev. de Mét., 1910). Although depending mainly on the temperature of the test-piece at the time of quenching, the phenomenon was found to be modified by the duration of heating, the temperature of the quenching bath, and the dimensions of the sample.—W. E. F. P.

Steel production in Great Britain in 1914.

The British Iron Trade Association reports the total production of steel in Great Britain in the year 1914 at 7,835,113 long tons. This is 171,237 tons more than in 1913, and is the largest make of steel ever reported. In 1914 there was a smaller make of pig iron, the proportion of steel to pig having increased from 73.1% in 1913 to 87.0% last year.

The total production of ingots and direct castings for the year was as follows:—

	Acid.	Basic.	Total.
	Tons.	Tons.	Tons.
Bessemer	797,072	482,444	1,279,516
Open hearth	3,680,848	2,874,749	6,555,597
Total	4,477,920	3,357,193	7,835,113
Total, 1913	4,860,154	2,803,722	7,663,876

Since 1905 the proportion of open hearth steel to the total has increased from 65.9% to 83.7%, while there was a decrease from 34.1% to 16.3% in the proportion of converter steel.

Zinc; Electrolytic deposition of — at the surface of the solution. A. A. Titov and S. M. Levi. J. Russ. Phys. Chem. Soc., 1914, 46, 909—934. J. Chem. Soc., 1915, 108, ii., 312—313.

THE authors have investigated the phenomenon studied by Freundlich and Novikov (this J., 1910, 762), according to whom, electrolysis of a zinc solution, the surface of which is covered with oil, leads to the separation of a superficial film of the metal. It is found that this film-formation occurs on electrolysis, not only of zinc sulphate solution, but also of solutions of the chloride and acetate, provided these are sufficiently acidified. The phenomenon is favoured by a low concentration of hydrogen ions, and increase of the latter results eventually in hindrance, or even prevention, of the growth of the film. The formation of the film is retarded by the appearance of spongy zinc, and all measures taken to prevent the deposition of the metal in this form are advantageous. The best films are obtained when the zinc is precipitated in a bright, finely crystalline condition, a coarsely

crystalline or dark deposit opposing the formation of films. The latter are obtained within wide limits of variation of the current density and of the concentration of the solution, and the lower the concentration the lower the permissible current density. With constant voltage, the current density remains more or less constant during the deposition of the film only at the periphery of the latter, and diminishes rapidly at the lower surface.

Manganese and bismuth; Alloys of —. N. Parravano and U. Perret. Gaz. Chim. Ital., 1915, 45, I., 390—394.

EXAMINATION of manganese-bismuth alloys showed that the two metals are only partially miscible in the liquid state, and yield a compound, MnBi, which is formed by a peritectic reaction at about 150° C. In the case of alloys composed of two layers, these were found to contain 30 and 93% Mn respectively, values which differ somewhat from those found by Bekier (Ind. Zeits. Metallg., 1911, 7, 83).—A. S.

Flotation tests on ores from Bisbee and Cobalt. H. J. French. School Mines Quart., 1914, 36, 57—67.

THE following factors were investigated: Variety and amount of oil, amount of acid, time and speed of agitation, temperature of solution, size of ore particles. *Bisbee ore* contained 4.34% of copper as sulphide and 1.70% as malachite. Pine-tar oil (sp. gr. 0.98) gave the maximum extraction with a minimum weight of froth. The addition of more than 0.3% of sulphuric acid was useless, but without acid the extraction was reduced by two-thirds. Good results were obtained with ore of 100—150 mesh size by 10 minutes' agitation at 50°—65° C. *Coniagas (Cobalt) silver ore.* (Ag 13.6 oz. per ton.) Pine-tar oil was far superior to eight other oils tried. By adding the oil in fractions and agitating for longer periods good extractions were obtained with a smaller oil consumption.—W. R. S.

Annual report on alkali, etc., works. See VII.

PATENTS.

Furnace; Reheating —. Eickworth und Sturm Ges. m. b. H., Dortmund, Germany. Eng. Pat. 5875, Mar. 7, 1911. Under Int. Conv., Jan. 3, 1914.

IN a reheating furnace of the kind in which the hot gases are caused to pass above and below a horizontal hearth or partition and thus divided into two independently regulable streams, the hearth is placed in the cool zone of the furnace and does not extend into the hot zone.—W. E. F. P.

Brass; Furnace for melting metals, especially —. A. Ollier. Fr. Pat. 473,924, Oct. 22, 1913.

IN a tilting crucible furnace burning solid fuel under forced draught, the covered crucible projects above the brickwork and rests on a support of fire-brick.—W. R. S.

Tungsten [wire]; Manufacture of —. British Thomson-Houston Co., Ltd., London. From General Electric Co., Schenectady, N.Y., U.S.A. Eng. Pat. 13,076, May 27, 1914.

DRAWN tungsten wire prepared according to Eng. Pats. 21,513 of 1906, 23,499 of 1909, 8031 of 1910 and 9877 of 1912 (this J., 1907, 1132; 1911, 291, 946; 1912, 1133) is ductile and pliable, but too resilient to take a permanent set without heating, and gradually loses its ductility when maintained in an incandescent state. According to the present invention, these defects are obviated by heating the drawn wire first in an oxidising atmosphere and then in a vacuum, or in nitrogen or a mixture of nitrogen and hydrogen, with or without air or water vapour.—W. E. F. P.

[Tungsten] metal wire: *Manufacture of*—British Thomson-Houston Co., Ltd., London, From General Electric Co., Schenectady, N.Y., U.S.A. Eng. Pat. 13,549, June 3, 1914.

To avoid contamination of the metal, tungsten wire which, to facilitate drawing, has been provided with an adherent coating of graphite or other carbonaceous material, is first heated to a comparatively low temperature while in contact with an oxidising agent and then to a high temperature in a non-oxidising or reducing atmosphere.

—W. E. F. P.

Metal [e.g., nickel] adsorptions: Manufacture of—Elektro-Osmose A.-G. (Graf Schwerin Ges.), Frankfurt, Germany. Eng. Pat. 15,267, June 25, 1914. Under Int. Conv., April 29, 1914. (See also Eng. Pat. 29,049 of 1912; this J., 1913, 842; 1912, 1201.)

A NICKEL adsorption suitable for use as a catalyst is prepared by subjecting an aqueous suspension of silicic acid to the action of an electric arc between nickel electrodes.—W. R. S.

Tin plate: Process for producing lacquered—especially for canning purposes. K. Miyazaki, Tokyo. Eng. Pat. 16,713, July 14, 1914.

ORDINARY tin plate is cleaned with a dilute solution of alkali, the latter neutralised, the plate treated with alcohol, and then coated with lacquer obtained from *Rhus vernicifera* and containing a small proportion (10%) of dissolved shellac. After remaining for 24 hours in a closed air chamber within which a humidity of 75–95% and a temperature of not less than 10° C. are maintained, the coated plate is heated to 120°–180° C. for 1½–2 hours.—W. E. F. P.

Copper matte: Process of bessemerising—J. B. Herreshoff, jun., New York. Eng. Pat. 2219 of 1915, date of appl., May 26, 1914.

SLAG composed mainly of copper silicate, obtained during the refining of blister copper in reverberatory furnaces, is used as silicious material in the converter.—W. E. F. P.

Ores: Apparatus for the water concentration of—W. M. Martin, Redruth. Eng. Pat. 2814, Feb. 22, 1915.

IN the apparatus previously described (see Eng. Pat. 15,442 of 1914; this J., 1915, 620) a surface may be used frosted to grains of different sizes by blasting with correspondingly sized sand, or a frosted corrugated surface with waves about $\frac{3}{4}$ in. long and $\frac{1}{4}$ in. deep, may be used. The frosted surface may be tilted to remove the values, or may be mounted on a rotating table with flutes or grooves at right angles to the flow of pulp.—W. R. S.

[Ore] concentrator. C. F. Paige, Assignor to A. W. Jones, Oakland, Cal. U.S. Pat. 1,140,761, May 25, 1915. Date of appl., May 5, 1914.

ORE pulp is fed in at one end of a shallow, slightly inclined chamber, provided with baffles, and water and air are introduced at the opposite end. The concentrate is discharged through an opening in the bottom of the pan, and the gangue and excess of water through an adjustable overflow opening. Air is also introduced through the concentrate discharge opening, and carries back any flocculent gangue that may have accompanied the concentrate into the collecting pocket.—W. H. C.

Ore-concentrating apparatus. J. M. Callow, Salt Lake City, Utah, Assignor to Metals Recovery Co. U.S. Pat. 1,141,377, June 1, 1915. Date of appl., Oct. 6, 1913.

THE apparatus consists of a series of tanks, each

containing in its lower portion a casing spaced apart from the tank. Gas is supplied under pressure to the space below a body of porous material within the casing, and the pulp and a frothing agent are delivered just above the porous material. The heavy material which settles in the space between the inner casing and the tank is delivered into the next tank. The froth overflows into a gutter formed by an inner conical lining in the upper part of the tank.—W. R. S.

Alkali and alkaline-earth metals: Electrolyte for the production of—C. E. Acker, Assignor to The Nitrogen Co., New York. U.S. Pat. 1,112,220, June 8, 1915. Date of appl., Oct. 30, 1914.

THE essential constituent of the electrolyte is a fused cyanogen compound of the metal to be produced, sodium cyanide being used for the production of sodium.—W. E. F. P.

Tin ore: Extraction of tin from—G. Michaud and E. Delasson. Fr. Pat. 173,712, June 18, 1914.

FINELY powdered cassiterite is heated with excess of carbon to about 600° C., and the reduced metal is dissolved in acid.—W. R. S.

Tin ores: Treatment of—A. B. Stodart. Fr. Pat. 473,973, Oct. 24, 1913.

TIN ores containing galena are calcined in presence of a nitrate; the resulting lead sulphate may be extracted with caustic alkali. If pyrites is present, the ore is first roasted at a low temperature and washed to remove ferric oxide.—W. R. S.

Zinc ores: Treatment of—with sulphur dioxide. Erzverwertungs-Ges. m. b. H. Fr. Pat. 174,306, June 30, 1911.

THE roasted ore is treated with a solution of zinc bisulphite to convert zinc oxide into the normal sulphite, and the latter is dissolved as bisulphite by the action of sulphur dioxide.—W. R. S.

Steel: Preparing—for painting. G. D. Feidt, Philadelphia, U.S.A. Eng. Pat. 20,621, Oct. 6, 1914. Under Int. Conv., Feb. 4, 1914.

SEE U.S. Pat. 1,109,670 of 1914; this J., 1914, 1013.

Zinciferous materials: Process for the treatment of—H. Specketer, Griesheim, Germany. Eng. Pat. 20,039, Sept. 4, 1913. Under Int. Conv., Sept. 7, 1912.

SEE Fr. Pat. 461,905 of 1913; this J., 1914, 205.

Zinc from zinciferous materials: Process for recovering—F. C. W. Timm, Hamburg. Eng. Pat. 22,519, Oct. 6, 1913. Under Int. Conv., Oct. 8, 1912.

SEE Ger. Pat. 268,427 of 1912; this J., 1914, 143.

Smelting furnaces. A. Niewerth, Berlin. Eng. Pat. 21,738, Sept. 26, 1913.

SEE U.S. Pat. 1,081,287 of 1913; this J., 1914, 87.

Furnaces: Siemens-Martin—Eickworth und Sturm Ges. m. b. H., Dortmund, Germany. Eng. Pat. 5651, Mar. 5, 1914. Under Int. Conv., April 16, 1913.

SEE Fr. Pat. 469,859 of 1914; this J., 1915, 35.

Metals from ores or slags and other furnace products: Process for the recovery of—A. Mond, London. From W. Troeller, Bad Homburg, Germany. Eng. Pat. 7113, Mar. 20, 1914.

SEE Fr. Pat. 469,862 of 1914; this J., 1915, 36.

Copper matte: Process of bessemerizing—J. B. Herreshoff, jun., New York. Eng. Pat. 12,916, May 26, 1914.

SEE U.S. Pat. 1,103,925 of 1914; this J., 1914, 870.

Rust-preventing agents; Production of ——. Mannesmannröhren-Werke, Düsseldorf, Germany. Eng. Pat. 13,440, June 2, 1914. Under. Int. Conv., Feb. 5, 1914.

SEE Fr. Pat. 472,884 of 1914; this J., 1915, 562.

Ores; Treatment of subdivided — for agglomerating or reducing them, and apparatus therefor. G. Gröndal, Djursholm, and H. Nilsson, Nyhammar, Sweden. U.S. Pat. 1,142,324, June 8, 1915. Date of appl., May 23, 1914.

SEE Fr. Pat. 473,218 of 1913; this J., 1915, 559.

Method and apparatus for producing cement from blast-furnace slag. Eng. Pat. 19,191. See IX.

XI.—ELECTRO-CHEMISTRY.

PATENTS.

Separating suspended particles from gaseous bodies by means of high tension electricity; Method of and apparatus for ——. E. Möller, Brackwede, Germany. Eng. Pat. 18,357, Aug. 12, 1913. Under Int. Conv., Aug. 13, 1912.

SEE Fr. Pat. 461,370 of 1913; this J., 1914, 206.

Electrically separating suspended bodies from electrically non-conducting, especially gaseous fluids; Process and apparatus for ——. E. Möller, Brackwede, Germany. Eng. Pat. 19,732, Sept. 1, 1913. Under Int. Conv., Aug. 31, 1912.

SEE Addition of July 31, 1913, to Fr. Pat. 449,337 of 1912; this J., 1914, 601.

Treater for petroleum emulsions. Apparatus for treating emulsions. Apparatus for dehydrating petroleum oil. U.S. Pats. 1,142,759—1,142,761. See IIa.

Apparatus for manufacturing hydrogen peroxide. Eng. Pat. 22,714. See VII.

XII.—FATS; OILS; WAXES.

Glycerides of hydroxystearic and ricinoleic acids and the accompanying polymerisation; Action of zinc chloride on ——. S. Fokin, J. Russ. Phys. Chem. Soc., 1914, 46, 1027—1042. J. Chem. Soc., 1915, 108, i, 374.

THE polymerisation of the triglyceride of ricinoleic acid by treatment with zinc chloride leads, with intermediate formation of triglycerides of linolic acid with conjugated double linkings, to compounds which exhibit the physical properties of caoutchouc and are polyrenes of a special type. Chinese wood oil (this J., 1913, 496) undergoes change in the same way as castor oil when treated with zinc chloride, but it appears probable that the linolic (elæomargaric) acid present in this oil contains allenic double linkings.

Lime seeds; Oil from ——. H. A. Tempany. Agric. News. Chem. and Drug., July 3, 1915.

DRIED lime seeds from citrus fruits contain 1.11% N/, 0.58% P₂O₅, 0.35% K₂O, and 9.3% moisture; they are thus of lower fertilising value than the majority of seeds, and as regards feeding value, they are deficient in protein but rich in carbohydrates. The seeds yield 34.4% of a dark yellow, viscous oil of about the consistence of olive oil. When extracted by solvents it has a very bitter taste. It might be used as a lubricant or for soap-making. The lime crop in Dominica in 1914 yielded 388,000 barrels of fruit, containing some 470 metric tons of seed.

*Seeds of *Marytynia Louisiana* (unicorn, or devil's claws); Utilisation of* ——. E. H. S. Bailey and W. S. Long. Oil, Paint, and Drug. Rep., July 5, 1915.

THE plants of *Marytynia Louisiana* grow in great abundance in Western Kansas, Colorado, Texas, and New Mexico, in extremely dry climates. Analysis of the seeds gave the following figures:—Ether extract, 60.8%; protein (factor 6.25), 23.2%; starch, 4.36; moisture, 3.66; crude fibre, 1.51; ash, 3.68%. The oil had a refractive index of 1.4767 at 15.5° C., iodine value 122.5, saponif. value 197.1 to 198.6, sp. gr. at 15.5° C., 0.9157. It is very similar to olive oil.

Heneicosoic acid. H. R. Le Sueur and J. C. Withers. Chem. Soc. Trans., 1915, 107, 736—739. (See also this J., 1915, 151.)

THE prolonged action of boiling hydrochloric acid and amalgamated zinc converts μ -ketoheneicosoic acid and θ -ketomargaric acid into heneicosoic acid and margaric acid respectively. Heneicosoic acid, (CH₃(CH₂)₁₉CO₂H, m. pt. 73°—74° C., crystallises from acetone in stellar aggregates of stout needles and gives a methyl ester, m. pt. 49° C., crystallising from methyl alcohol in thin lustrous scales, heneicosoamide, m. pt. 110° C., crystallising from acetone in needles, α -bromoheneicosoic acid, m. pt. 65.5°—66.6° C., and α -hydroxyheneicosoic acid, m. pt. 93°—94° C.—T. C.

PATENTS.

Palm fruit and the like; Machinery for treating — and making palm oil or like product therefrom. E. R. Royston, Liverpool. From R. Y. Sewell, viâ Akassa, W. Africa. Eng. Pat. 6365, Mar. 13, 1914.

THE material is beaten and crushed by horizontal beaters or rollers in an upper chamber having a rotatable perforated bottom. Beneath this is a second chamber, preferably cylindrical, containing a boiler heated by fire from beneath. The crushed material is forced by the rollers against guide plates, and falls through the perforations into the water in the boiler, in which there is a cock at the required level for drawing off the separated oil.—C. A. M.

Oils and fats of all kinds; Process of refining ——. S. Morgenstern. Fr. Pat. 473,761, June 19, 1914.

WASTE fats, etc., are partially or completely saponified by alkalis or alkaline-earth bases in an autoclave, and then heated for a long time at above 150° C. under such conditions that vapours are prevented from escaping. The product is sufficiently decolorised and deodorised for use in soap manufacture.—C. A. M.

Sugar-cane wax; Deodorising ——. The Cane Wax and Chemical Co., Ltd., and M. S. Salamon, London. Eng. Pat. 1332, Jan. 27, 1915.

THE wax is treated for about 2 to 6 hours with superheated steam (101° to 120° C.) at atmospheric pressure. A light coloured, resinous, odorous compound distils, leaving an odourless non-viscous residue, which may be used as a substitute for carnauba wax or beeswax.—C. A. M.

Soap; Liquid colloidal — and process of making it. E. F. Rousseau. First Addition, dated Sept. 8, 1913, to Fr. Pat. 472,587, Aug. 9, 1913 (this J., 1915, 560).

OILS or fats are saponified with an excess of potassium hydroxide and the excess of alkali is neutralised by the addition of hot or cold water, an albuminous substance, preferably colloidal or amorphous casein, and a fatty acid, such as oleic or stearic acid.—C. A. M.

Fats and oils and naphtha acids; Method of refining — S. Morgenstern, Leipzig, Germany. Eng. Pat. 11,571, June 17, 1914.

SEE Fr. Pat. 173,761 of 1914; preceding.

Hydrogenisation of oils; Process for the — G. Calvert, London. U.S. Pat. 1,142,668, June 8, 1915. Date of appl., Aug. 26, 1914.

SEE Eng. Pat. 5967 of 1914; this J., 1915, 431.

Oil filter. U.S. Pat. 1,140,727. See I.

Plastic substance useful as a rubber substitute. Fr. Pat. 171,220. See XIV.

Process of treating cottonseed. U.S. Pat. 1,141,104. See XIXA.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Painting phenomena; A study of some curious — H. A. Gardner. J. Franklin Inst., 1915, 179, 681—695.

Mildew. From specimens of mildew removed from various painted wood surfaces, the principal types of fungi isolated were found to be species of *Aspergillus* (black) and *Penicillium* (green), the former being more hardy than the latter, which appeared dormant unless constantly moistened. The development of the fungi was favoured by paint coatings which were soft and liable to retain moisture (white lead paints), but resisted by those having firm, hard, waterproof surfaces (composite paints containing white lead and zinc oxide). The "washing" of painted wood surfaces was found due to the presence of "foots" and moisture in the linseed oil employed, the latter being decomposed into fatty acids and glycerin by the action of enzymes and micro-organisms in the foots; the phenomenon occurred with both lead and zinc pigments. The rusting or brown spotting of painted wood is regarded as due to the solvent action exerted on the pigment by water-soluble matter exuded from the wood, or by fatty acids (including formic acid) resulting from the use of inferior oil. The use of composite paints, with a basis of white lead but containing sufficient zinc oxide to produce a firm, hard film, and of properly clarified or sterilised linseed oil, is recommended as a means of preventing many painting defects.—W. E. F. P.

Resin of Picea vulgaris, L., var. Montana schur. H. Binder. Arch. Pharm., 1914, 252, 547—589. J. Chem. Soc., 1915, 108, i., 430—431.

THE resins of *Picea vulgaris*, Transylvanian pine, and Jura turpentine are not identical. The crude resin of *Picea vulgaris* employed by the author was a mixture of resin, particles of wood, pine-needles, and sand; it had a bitter taste and an intense odour of vanillin (this substance was detected by colour reactions). The examination was conducted along four lines: (1) isolation of crystals from the crude resin by physical and mechanical methods, (2) isolation of crystals from the fused resin by similar methods, (3) isolation of all the constituents of the crude resin by Tschirch's method, and (4) a similar treatment of the fused resin. A separation of the constituents, by physical and mechanical methods only, is impossible. The crystalline substances obtained by (1) and (2), by the successive operations of solution in cold 70% alcohol, filtration, and fractional crystallisation, are different from those obtained by (3) and (4), and are shown to be mixtures. The examination of the resin by Tschirch's method

gave the following results. The ethereal solution of the resin was exhaustively extracted with 1% ammonium carbonate, 1% sodium carbonate, and 1% potassium hydroxide successively; the residue, after removal of volatile matter by distillation with steam, consists of resene. Much better results and more rapid separations are obtained with the fused than with the crude resin. The 1% ammonium carbonate extracts (fifteen repetitions are necessary) contain α -piceapimaric acid, $C_{20}H_{30}O_2$, monoclinic crystals, m.pt. 161° — 166° C., $[\alpha]_D^{20} = -22.5'$ in alcohol ($c = 1.656$), acid value 189.70 (direct method) and 193.07 (indirect), saponification value variable, iodine value 81.4; it exhibits the phytosterol colour reactions. An amorphous acid m.pt. 101 — 116° , $[\alpha]_D^{20} = -8.9'$ in alcohol ($c = 1.226$), and an acid, m.pt. 80 — 86° C., $[\alpha]_D^{20} = -14.53'$ ($c = 1.9017$), are also present in the ammonium carbonate extracts. The 1% sodium carbonate extracts (19 repetitions) contain three isomeric piceapimaric acids, $C_{20}H_{30}O_2$. The β -acid is precipitable from its alcoholic solution by lead acetate; it crystallises in monoclinic leaflets, m.pt. 156° — 157° , $[\alpha]_D^{20} = -21.44'$ in alcohol ($c = 5.861$), acid value 189.51 (direct) and 175.50 (indirect), iodine value 76.92; its lead salt is insoluble in ether. γ -Piceapimaric acid, which is not precipitated from its alcoholic solution by lead acetate, crystallises in leaflets, m.pt. 151° — 153° C., $[\alpha]_D^{20} = -1.17'$ in alcohol ($c = 1.66$), acid value 186.61 (direct) and 187.77 (indirect), iodine value 83.78; its lead salt is insoluble in ether. δ -Piceapimaric acid, crystals, m.pt. 161° — 162° C., $[\alpha]_D^{20} = -17.8'$ in alcohol ($c = 2.043$), acid value 191.25 (direct) and 182.35 (indirect), iodine value 87.15; its lead salt is soluble in alcohol and in ether. All three isomerides exhibit colour reactions with the phytosterol reagents. The 1% potassium hydroxide extracts do not contain any acidic substances. Since it is not certain that the rotatory power of a resin acid is the same at different concentrations, the author recommends that the rotations of all resin acids should be measured in alcoholic solution ($c = 5$).

PATENTS.

Lead; Process of treating — [in the manufacture of white lead], C. Ellis, Montclair, N.J., Assignor to Ellis-Foster Co. U.S. Pat. 1,141,177, June 1, 1915. Date of appl., July 31, 1911.

MOLTEN lead is forced out from a receptacle under pressure in thin streams impinging upon each other, and the spray is treated with a jet of steam. —W. R. S.

Resins; Method of manufacturing phenol-aldehyde — soluble in oil, and varnishes therefrom, Chem. Fabriken K. Albert, and L. Berend, Amöneburg, Germany. Eng. Pat. 15,875, July 2, 1911.

PHENOL-ALDEHYDE resins are, when fusible, melted with, and when infusible or difficultly fusible heated with, natural or artificial resins or fatty oils or mixtures thereof, until a homogeneous resinous mass is obtained which remains clear when cold, is soluble in fatty oils, and is not precipitated from solution by the addition of benzine or turpentine. Examples: (1) 100 grms. of a fusible, insoluble resin, obtained by condensing 100 grms. of crude phenol with 35 grms. of trioxymethylene, is heated with 100 grms. of colophony for half-an-hour to 210 — 220° C., until a resinous mass, clear when cold, and which when boiled with linseed oil at 300° C. is not precipitated by benzine or turpentine, is obtained. (2) 100 grms. of carbolie acid is heated with 80 grms. of 40% formaldehyde and 0.5 gm. of hydrochloric acid for several hours to 115° C. until a resinous mass which sets when cold is formed. The supernatant liquid is poured off, and the residue heated with

20 grms. of wood oil and 20 grms. of cumarone resin, until a resin is obtained which remains clear on cooling, and is applicable as an oil varnish.

—E. W. L.

Resinous composition [for insulation], and process of making the same. E. S. Dawson, jun., Schenectady, N.Y., Assignor to General Electric Co. U.S. Pat. 1,141,944, June 8, 1915. Date of appl., April 9, 1914.

A MIXED ester of a polyhydric alcohol (glycerol) and a polybasic acid (phthalic acid) and a monobasic acid (oleic acid), is incorporated with a neutral oil ester (castor oil) to obtain a flexible resin convertible by heat into an infusible insoluble resin, from which the castor oil or other oily ester cannot be extracted.—C. A. M.

Material for use in manufacture of linoleum, stone-wood flooring and the like and dynamite: Oleaginous filling and absorbent—. L. Zinsser, Murr, Germany. Eng. Pat. 17,113, July 22, 1914.

FINELY ground arachis nut shells are used as a substitute for wood meal or cork meal.—C. A. M.

Elastic masses; Process of manufacture of—. Wenjait-Ges. m. b. H. Fr. Pat. 473,603, May 27, 1914.

ELASTIC masses suitable for moulding at high temperatures are formed by heating together phenol, or its homologues, with mixtures of fatty and/or resin soaps and aldehydes, the latter being in part replaceable by ketones or aldoses. Cellulose, or albuminous substances such as glue, gelatin, etc., may be added to the masses, before evaporation of the water of condensation. Examples of such masses are:—(1) phenol, 33; potash soap, 22; sodium resinate, 6; and formaldehyde (40%), 33 parts; (2) phenol, 33; magnesium soap, 10; sodium resinate, 5; formaldehyde (40%), 20; and sugar, 10 parts; (3) phenol, 33; lead soap, 12; magnesium resinate, 5; formaldehyde (40%), 33; and cellulose, 8 parts; (4) phenol, 30; calcium soap, 10; potassium resinate, 5; formaldehyde (40%), 30; and glue or gelatin, 10 parts.—E. W. L.

Manufacture of chemically pure, finely-divided carbon. Eng. Pat. 17,731. See VII.

Process of producing lacquered tin plate especially for canning purposes. Eng. Pat. 16,743. See X.

Production of phenolic condensation products capable of acting as poisons to marine growths, bacteria, etc. Eng. Pat. 11,391. See XIXB.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Latex of Hevea Braziliensis. Müll. Arg.; Presence of acetaldehyde and hydrocyanic acid in—. M. Kerbosch. Rec. trav. chim. Pays-Bas. 1915. 34, 235—238.

ACETALDEHYDE was found in the steam distillate of fresh *Hevea* latex (0.006 gm. per litre of latex), which had been rendered acid—if not already so—by the addition of tartaric acid. The quantity was less in latex obtained from the trees whilst the leaves were falling. The presence of hydrocyanic acid in the steam distillate was also demonstrated by the Prussian blue reaction.

—E. W. L.

Action of zinc chloride on glycerides of hydroxystearic and ricinoleic acids, and the accompanying polymerisation. Fokin. See XII.

PATENTS.

Rubber latex; Apparatus for treating—. A. Woosnam, London. From R. S. Algar, Talawakelle, Ceylon. Eng. Pat. 6215, March 11, 1914.

SMOKE from a furnace is passed through a pipe into a chamber in which is an open pan containing the latex, and is distributed by means of a baffle within the pan. A horizontal cylindrical drum provided with perforations, grooves, etc., rotates within the pan and churns the latex with the smoke.—C. A. M.

Rubber thread; Composition for the manufacture of—. W. P. Bradley, Middletown, Conn., U.S.A. Eng. Pat. 14,355, June 15, 1914. Under Int. Conv., Jan. 21, 1914.

With the object of protecting the finished rubber thread from the destructive influences of light, heat, and atmospheric oxygen, from 2 to 7% of lampblack and from 2 to 7% of ceresin wax are added to the rubber mixing.—E. W. L.

Rubber; Process of regeneration of [vulcanised]—. C. E. Anquetil. Fr. Pat. 473,787, Oct. 14, 1913.

VULCANISED rubber waste is saturated with a chlorine derivative of ethylene or methylene, for example trichloroethylene, either by exposure to its vapour in a chamber heated to 60° C., or by immersion in the liquid for not longer than 2 hours. The mass becomes very friable under this treatment, and can readily be freed from impurities by crushing it and passing it through a sieve. The portion which passes the sieve is dissolved in one of the usual solvents and the rubber precipitated by pouring the solution into a mixture of alcohol and acetone. The process of solution can be carried out in less than two hours.—E. W. L.

Rubber; Process for the manufacture of—. A. Haas. Fr. Pat. 473,971, Oct. 24, 1913.

STARCHY material, such as the mixture of starch and dextrin obtained from potatoes, is heated in a hermetically closed vessel with about 1% of rubber latex at 40° C. for several days. The fermented product is ejected by means of compressed air from the fermentation vessel into another containing a mixture of tetrachloroethane (2 parts) and trichloroethylene (1 part). By means of a steam-coil the temperature is raised to 80° C., and under this treatment the mass becomes completely anhydrous. The pressure generated in the second vessel by escaping gases drives the now fluid mass through a pipe into a third vessel, containing a solid "hydrocarbon" (such as camphor or its substitutes) to the amount of 4% of the original starchy material. The product is finally drawn off from the third vessel and freed from the solvents by distillation. The residue possesses "all the properties of rubber."—E. W. L.

Drying apparatus for rubber-coated tissues, with recovery of the benzine. E. Bataille. Fr. Pat. 474,003, June 24, 1914.

THE air space above or surrounding a proofed fabric from which solvent is being evaporated is completely enclosed, and facilities are provided for inspecting the fabric after passing the spreading knife. The vapour of the solvent is recovered in a closed system, in which the vapour-laden air from the drying chamber is first drawn by a fan through a refrigerator, where much of the solvent is condensed, then forced by the fan through a second refrigerator where more is eliminated. The residual air is then re-heated and passed again into the drying chamber.—E. W. L.

Plastic substance, useful as a substitute for rubber. E. Serre. Fr. Pat. 471,220, Nov. 8, 1913.

IN the preparation of a chlorosulphide rubber

substitute (factice) the oil undergoing treatment with sulphur monochloride is mixed with a "moderator," the function of which is to reduce any dichloride present, and at the same time absorb any excess of monochloride remaining after the reaction, and compensate, by the dilatation of one of its constituents (retene), the contraction of the mass on solidification. For example, 820 parts by weight of cotton seed oil is mixed with 20 parts of a moderator, consisting of flowers of sulphur, 1; sylvestrene or pinene, 2; cottonseed oil, 12; and retene 5 parts; and vulcanised with 160 parts of sulphur chloride. The product may be used for filling motor tyres.—E. W. L.

Plastic compositions: Process of manufacturing —. W. Pinatus. Paris. Eng. Pat. 12,142. May 24, 1913.

SEE Fr. Pat. 465,018 of 1913; this J., 1914, 559.

Leather or rubber substitute. Eng. Pat. 13,128. See XV.

XV.—LEATHER; BONE; HORN; GLUE.

Tanning substances: Peptonisation phenomena in solutions of —. W. Moeller. Kolloid. Zeits., 1915, 18, 69—76. J. Chem. Soc., 1915, 108, i., 438.

THE nature of tanning solutions and of the tanning process is discussed and a theory is suggested according to which these solutions contain peptonised colloids which are coagulated in contact with hide substance. The conclusions drawn by the author from an investigation of the properties of solutions of tanning substances of the most varied kinds, is that all these solutions contain peptonised gels, and also a substance which acts as peptoniser. True solutions have no tanning properties. In the tanning process, the peptoniser is absorbed by the hide substance, and this results in the coagulation of the gel which is deposited on the skin fibres. The properties of the different tanning substances are dependent on the equilibrium between the peptoniser and the peptonised gel, and the properties of the tanned hide on the nature and quantity of the coagulated gel which separates out on the fibres. In so far as the resulting leather is concerned, the peptoniser is only of secondary importance.

Ellagic acid; Formation of — from galloyl-glycine by *Penicillium*. M. Nierenstein. Biochem. J., 1915, 9, 240—244.

AN aqueous solution of galloyl-glycine and sodium carbonate was saturated with carbon dioxide and then inoculated with *Penicillium* that had been cultivated in a tannic acid solution containing sugar. After 78 hours a precipitate began to form; after 22 days' further incubation, the precipitate was collected, washed, crystallised from pyridine, and found to be ellagic acid.—E. H. T.

PATENTS.

Leather or rubber substitute, and process of making the same. E. B. Cook. Danvers, Mass., U.S.A. Eng. Pat. 13,128, May 28, 1914. Under Int. Conv., May 31, 1913.

A LEATHER or rubber substitute which can be used for soles, tyres, mats, etc., is made by mixing leather fibre with a vulcanisable rubber compound in a rubber grinding mill. The mill rollers are heated sufficiently to soften the rubber without burning the leather fibre. The product is subsequently vulcanised.—F. C. T.

Leather and similar products; Manufacture of —. Chem. Technol. Studienges. First Addition, dated June 10, 1914, to Fr. Pat. 452,380, Dec. 11, 1912 (this J., 1913, 668). Under Int. Conv., June 23, 1913.

THE process may be applied to fibrous materials of all kinds; felt after impregnation is difficult to distinguish from leather similarly treated. The material is saturated with a solution of asphaltum in benzene, and then immersed in molten petroleum tar containing a small quantity of a mineral or drying oil, until completely impregnated.—F. C. T.

Skins: Process for degreasing —. J. Filhol. First Addition, dated Oct. 23, 1913, to Fr. Pat. 462,280, Nov. 18, 1912 (this J., 1914, 326).

SKINS are degreased by treatment with an aqueous emulsion of tetrachloroethane. An emulsifier such as saponin is used.—F. C. T.

Tanning processes: Chrome —. F. Hirsch. Vienna. Eng. Pat. 5863, Mar. 7, 1914. Under Int. Conv., Mar. 8, 1913.

SEE Ger. Pat. 271,585 of 1913; this J., 1914, 559.

Tanning process: Chrome —. F. Hirsch, Vienna. Eng. Pat. 7467, Mar. 21, 1914. Under Int. Conv., Oct. 14, 1913. Addition to Eng. Pat. 5863 of 1914, dated Mar. 8, 1913.

SEE Ger. Pat. 274,549 of 1913; this J., 1914, 759.

XVI.—SOILS; FERTILISERS.

Soils; Chemical analysis of —. A. A. J. von Sigmond. Intern. Mitt. Bodenk., 1914, 4, 336. J. Chem. Soc., 1915, 108, ii., 388.

FROM the results of analyses by different methods for ascertaining the maximum solubility of soil constituents, the conclusion is drawn that it is desirable to employ Hilgard's method of extracting soils with hydrochloric acid (sp. gr. 1.115) on a boiling water-bath for 120 hours. By this method, in which 100 c.c. of acid is used with 10 grms. of air-dried soil, greater amounts of nearly all the constituents are dissolved than by the official American method, by boiling for one hour with acid of the same strength as that employed by Hilgard, and by the Russian method of heating for 10 hours on a water-bath with 10% hydrochloric acid.

Soils; Chemical analysis of —. B. A. Mitscherlich. Intern. Mitt. Bodenk., 1914, 4, 321. J. Chem. Soc., 1915, 108, ii., 388.

IN extracting soils with acid of a given strength the amount of active agent is not the same at the end as at the beginning, and will be quite different with different soils. It would, therefore, be preferable to make the acidity of a constant strength at the end of the extraction, instead of at the beginning, by adding during the extraction so much acid as is used up. The continuous-extraction method has the advantage that the dissolved salts, being removed, do not interfere.

Soil; Conditions of fertility of — at different depths. A. von Nostitz. Landwirt. Jahrb., 1914, 48, 113—152. Bull. Bureau Agric. Intell., 1915, 8, 542—544.

RYE was grown in pots containing a loamy sand, a sandy loam, and a clay loam, the first-named being divided into two layers of 10 and 20 inches, and the two latter in three layers of 10 inches. Similar experiments in eight pots were made with the same soils, with the addition of artificial fertilisers, viz., 4 grms. monocalcium phosphate,

10 grms. calcium carbonate, 1.44 grms. potassium sulphate, 1.19 grms. potassium chloride, 0.5 gm. magnesium sulphate, and in addition each pot received three applications of 300 c.c. of a 1% solution of sodium nitrate. As regards the weights of straw, grain, and roots, the results proved conclusively that the productivity of the soil diminished markedly with the depth, and that the addition of artificial fertilisers decreased this difference without altogether eliminating it. The mineral matter contained in the crop did not always vary with the depth, and in some cases it varied inversely. The analyses of the plants in the manured series showed little variation in the percentage of nitrogen and ash, and no regularity in the potash content; the phosphorus content was always lowest in the plants grown in the deepest soil. The total weights of nitrogen, phosphoric acid, lime, magnesia, and potash were always highest in the plants grown in surface soil, and diminished with the depth. The relative infertility of the lower layers is ascribed to the smaller number of bacteria, and to their deficiency in humus, nitrogen, and phosphoric acid.—E. H. T.

Humic bodies; Formation of— from organic substances. W. B. Bottomley. *Biochem. J.*, 1915, 9, 260—268.

WHEN boiled with dilute (3%) hydrochloric acid, sucrose, dextrose, and levulose give solutions which undergo various colour changes and from which a brown deposit of humic acid and humin separates. (Humin is the insoluble organic residue left when soil is extracted with alkali.) In each case humic acid separates first but its quantity diminishes as that of humin increases; it resembles very closely the humic acid extracted from soils but it has a different composition, containing more carbon and less oxygen. When natural humic acid from soil is purified with alcohol its composition is practically identical with that of the artificial product. Humic acid and humin are also formed when sugars are boiled with organic acids, the rate of change varying with the nature and concentration of the acid used. Humic bodies also result from the action of heat on sugars, the humic acid again being formed before the humin. Obtained from this source the acid is not alkali-soluble after it has been dried at 100° C. Proteins containing carbohydrate give, on hydrolysis, humic acid with very little humin, but the presence of carbohydrate is a necessary condition. It is considered possible that the mode of origin of the two groups, humic acid and humin, in the soil may be similar to their production by heating sugars.—E. H. T.

Humus; Formation of— from vegetable compounds. A. Trousoff. *Selskoie Khoziaistvo i Lesovodstvo*, 1914, 74, 233—246. *Bull. Bureau Agric. Intell.*, 1915, 6, 540—541.

EXPERIMENTS on the action of acids, alkalis, and certain salts upon some common carbohydrates showed that the production of humus was effected by the non-oxidising acids and bases only. The reactions include decomposition of the molecules of the carbohydrate, dehydration by the acid, and intra-molecular oxidation. Experiments on the influence of temperature indicate that the formation of humus is probably an intermediate stage in the carbonisation of the substance. Aldehydes and ketones only promote the formation of humus when they are associated with other compounds, e.g., polyhydric alcohols. Thus humus formation in the laboratory involves a definite series of reactions, and its origin in nature is held to be of a similar kind, though in this case micro-organisms take the place of the acids and bases.—E. H. T.

Calcium and magnesium carbonates; Effects of— on ammonification. Lime-magnesia ratio. I. W. P. Kelley. *Centr. Bakt. Par.*, 1914, ii., 42, 519—526. *J. Chem. Soc.*, 1915, 108, i., 483—484.

EXPERIMENTS were made on the ammonification of dried blood and soya-bean cake mixed with various soils (laterites), to which different amounts of calcium and magnesium carbonates (separately and mixed) were added. Although most of the soils contained an excess of magnesium over calcium, addition of calcium carbonate produced only slight stimulation, whilst in many cases magnesium carbonate produced considerable stimulation. In these soils, therefore, the lime-magnesia ratio seems to have little or no importance in relation to ammonification. In accordance with the observations of Lipman that the effect of magnesium carbonate sometimes depends on the nature of the nitrogenous material, it was found that the stimulation induced by magnesium carbonate was more marked with dried blood than in the case of soya-bean cake. Experiments with a soil composed largely of coral sand showed that relatively small amounts of magnesium carbonate depressed the yield of ammonia from dried blood. In four other soils magnesium carbonate had a depressing effect in two, and a stimulating effect in the other two. Dolomite and limestone had very little effect, if any. In Hawaiian soils, the magnesium present is largely in the form of hydrous silicates.

Calcium and magnesium carbonates; Effects of— on nitrification. Lime-magnesia ratio. II. W. P. Kelley. *Centr. Bakt. Par.*, 1914, ii., 42, 577—582. *J. Chem. Soc.*, 1915, 108, i., 484.

THE results of some nitrification experiments showed considerable stimulation with calcium carbonate, in others none at all. Magnesium carbonate was toxic in five of the soils, and had very little effect in the others. In the soils and with the nitrogenous materials with which calcium carbonate was most stimulating, magnesium carbonate was most toxic. Dolomite was not toxic in any of the soils, and in one of the soils produced marked stimulation, whilst magnesium carbonate, in the same soil, was extremely toxic. In all of the soils employed, except perhaps the coral soil (see preceding abstract), the soluble organic salts of magnesium, produced from the magnesium carbonate and organic acids in the soil, would probably become fixed to a considerable extent, with liberation of potassium, sodium, and calcium, so that the concentration of the different constituents in the soil solution would be greatly changed by adding magnesium carbonate, and this would affect bacterial action. In the coral soil, it is probable that addition of magnesium carbonate would result in an excess of magnesium in the soil solution over the other bases; hence the toxicity to ammonification. The slight effect of calcium carbonate in the soils containing only very small amounts of carbonate is attributed to the large amounts of iron and aluminium hydroxides present (Ashby, this J., 1907, 1247).

Arsenic; Influence of— on the nitrogen-fixing powers of the soil. J. E. Greaves and H. P. Anderson. *Centr. Bakt. Par.*, 1914, ii., 42, 244—254. *J. Chem. Soc.*, 1915, 108, i., 484—485.

THE nitrogen-fixing power of soils is stimulated by arsenic in the form of lead and sodium arsenates, arsenic trisulphide, and zinc arsenite, the greatest stimulation being produced by lead arsenate and the least by zinc arsenite. Paris-green has no stimulating action in any of the concentrations employed, and is very toxic when the amount reaches 120 per million. Lead arsenate is not toxic in concentrations of 400 per million. Soils containing large amounts of organic matter fix as much

nitrogen in presence of arsenic, and without mannitol, as in presence of mannitol without arsenic. Only one type of azotobacter was isolated which was stimulated by arsenic, the stimulation being due to the organism utilising more economically its source of carbon in presence than in absence of arsenic. In soils the stimulating effect of arsenic may be due, in part, to the destruction of injurious species.

Azotobacter ; Soil organic matter as a culture medium for —. F. A. Mockeridge. *Biochem. J.*, 1915, 9, 272—283.

THE investigation consisted in determining the nitrogen-fixing power of azotobacter when grown in a medium containing various organic compounds, of a non-nitrogenous nature, which are normally present in the soil. These organisms appear to utilise humates as a source of energy only when they are provided with nitrogen already fixed, but they readily absorb polysaccharides (starch, dextrin, gum arabic, etc.), sugars (including the pentoses, arabinose and xylose), alcohols, and fatty and vegetable acids in the form of neutral salts. The availability of glucosides is apparently restricted by their decomposition products. Benzene derivatives, e.g., phenylacetic acid, benzyl alcohol, quinol, etc., were unavailable, either owing to their stable nature or to the harmful character of their secondary products. As azotobacter absorb oxygen and eliminate carbon dioxide, the food absorbed probably undergoes slow combustion. This view receives confirmation from the fact that the substances which gave the greatest yield of nitrogen fixed per unit of material consumed, viz., the carbohydrates, also possess the greatest heats of combustion. It is concluded that any ordinary fertile soil contains abundant food material for the growth of azotobacter.—E. H. T.

Azotobacter cultures ; Value of — for the determination of the lime requirement of woodland. F. Weis and C. H. Bornebusch. *Det forstlige Forsgsvaesen in Danmark*, 1914, 4, 319—337. *Bull. Bureau Agric. Intell.*, 1915, 6, 546—548.

H. R. CHRISTENSEN's method of cultivating azotobacter in Beijerinck's nutritive solution, modified by substituting 5 grms. of the soil under examination for the calcium carbonate, affords a ready means of ascertaining the lime requirement of a woodland, since the calcium compounds that promote the development of azotobacter in this medium are apparently the same which conduce to the formation of a good mould and stimulate the development of forest trees, particularly beeches.

—E. H. T.

Annual report on alkali, etc., works. See VII.

Colorimetric determination of phosphoric acid. Riegler. See VII.

XVII.—SUGARS ; STARCHES ; GUMS.

Beet ; Distribution of invertase in the tissues of the — at different stages of vegetation. H. Colin. *Comptes rend.*, 1915, 160, 777—779. (See also this J., 1914, 1217).

IN the first year of growth the leaves, whether green or etiolated, are rich in invertase, and the leaf-stalks contain quantities which diminish practically to nil as the root is approached. Only in case of insufficient aeration does invertase appear in the root and give rise to considerable amounts of invert sugar. If the root elaborates sucrose from reducing sugars supplied by the leaf-stalks, this synthesis cannot be the work of an invertase similar to that so easily detected in the leaves. Sucrose can only accumulate in the

foliage of beet when its rate of formation is greater than the rate of hydrolysis by the invertase present, and this is the case during exposure to light (ep. loc. cit.). Roots carefully preserved for second year's growth show scarcely any increase in their content of reducing sugar, nor can any invertase be detected ; this remains true after vegetation has commenced and until the seeds are ripe. The sugar therefore migrates from the root in the form of sucrose and is hydrolysed in the aerial tissues of the plant. The quantity of invertase in these tissues is least near the root and greatest in the inflorescence.—J. H. L.

Sweet potatoes ; Nature of the sugars found in the tubers of —. K. Miyake. *J. Biol. Chem.*, 1915, 21, 503—506.

SWEET potato tubers were found to contain dextrose, levulose, and sucrose, but not maltose, galactose, mannose, or pentoses.—W. P. S.

Sugars ; Action of normal and basic lead acetate on — and Rubner's test for dextrose and lactose. H. Rogerson. *Biochem. J.*, 1915, 9, 214—252.

THE action of normal and basic lead acetate upon various sugars in cold and hot solution, with and without the addition of alkalis, was examined. The normal acetate gave no reaction in the cold, but produced certain colour changes on heating to boiling. The basic salt gave more pronounced colorations, but even in this case the changes were insufficient for analytical purposes. Rubner's test for dextrose and lactose (1885) consists in adding lead acetate to a dilute solution, and then ammonia drop by drop till a permanent precipitate is formed. On standing, the liquid turns yellow and then flesh-red, heat hastening the change. Applying this test to a variety of sugars, it was found to be useless as a means of distinguishing them.—E. H. T.

Carbohydrates ; Action of hydrochloric acid gas on —. XV. T. Panzer. *Z. physiol. Chem.*, 1915, 94, 10—72.

EXPERIMENTS described indicate that the absorption of dry hydrogen chloride by carbohydrates under the conditions observed in previous investigations (see this J., 1915, 443) is not purely physical. The finely ground and carefully dried carbohydrates were exposed for 24 hours to a slow current of dry hydrogen chloride and then for 1 hour to a current of dry air. The products were weighed, and either analysed directly or kept *in vacuo* in presence of sulphuric acid and alkali until they ceased to lose weight, and then analysed. All the carbohydrates investigated absorbed amounts of hydrochloric acid which varied widely in parallel tests (e.g., galactose absorbed 0.6—12%) and which rarely approached molecular proportions. The increase in weight was in many cases not fully accounted for by the acid absorbed. Levulose and sucrose were charred by the acid, whereas galactose, maltose, lactose, starch, and dextrin underwent no change in appearance. The absorbed acid was almost completely liberated when the products were dissolved in water. The products subjected to the vacuum treatment retained part of their chlorine, and lost other volatile matters besides hydrochloric acid ; e.g., in some cases the product from galactose weighed slightly less, after the treatment *in vacuo*, than the original sugar, and yet contained 2—4% of chlorine.—J. H. L.

PATENTS.

Liquids [sugar syrups] ; Apparatus for evaporating or concentrating —. E. Shaw. *London. Eng. Pats.* 13,602, June 4, 1914, and 128, Jan. 4, 1915.

THE syrup is forced downwards through a spiral

passage of increasing cross-section, formed by a spiral plate between a cylinder and an internal inverted frustum of a cone. A steam jacket surrounds the cylinder, and the vapour from the liquid as it issues from the lower end of the passage, rises and escapes through the interior of the cone. The cylinder is prolonged downwards beyond the end of the cone, and the liquid flows along the wall to an exit.—W. F. F.

Sugar juices; Method of and apparatus for clarifying — W. J. Mellersh-Jackson. London. From Kopke Clarifier Co., Ltd., Honolulu, Hawaii. Eng. Pat. 29,610, Dec. 23, 1913.

SEE Fr. Pat. 467,981 of 1914; this J., 1914, 1023.

Deodorising sugar cane wax. Eng. Pat. 1332. See XII.

XVIII.—FERMENTATION INDUSTRIES.

Malt; Distribution of phosphoric acid in — F. Schönfeld and H. Krumhaar. Woch. Brau., 1915, 32, 101–103, 114–116.

IN investigating the state of combination of the inorganic phosphoric acid in malt, the action of enzymes during extraction must be avoided. The following procedure is recommended as much preferable to that followed by Adler (see this J., 1912, 697) who boiled the ground malt with alcohol for several hours to destroy the enzymes. One part of finely ground malt is shaken with 10 parts of water for 2 hours at 0° C., and immediately transferred to a filter containing a little kieselguhr. Of the clear filtrate 100 c.c. is evaporated to dryness and incinerated, and after separation of the silica, the phosphoric acid, lime, and magnesia are determined. Another 100 c.c. is made distinctly alkaline with ammonia, and after standing overnight the crystalline precipitate is collected, washed, and its content of phosphoric acid, lime, and magnesia determined. The filtrate from the ammonia precipitate is treated with magnesia mixture and the phosphate precipitate collected after about 20 hours. This method was applied to three different malts. The aqueous extracts contained 38–73% of the total phosphorus, 37–46% of the total magnesium, and 60–84% of the total calcium of the malts. Ammonia precipitated 89–96% of the magnesium contained in the extracts and 13–86% of the calcium. Hence in some cases most of the calcium in the extract is in a non-ionised condition, possibly combined as saccharate. In calculating the amount of phosphoric acid combined with alkaline earths in the extract, it must be borne in mind that only one-third of the phosphoric acid originally combined with the calcium (as dihydrogen phosphate) is contained in the ammonia precipitate (as tricalcium phosphate). In the case of magnesia, the compound originally present is probably $MgHPO_4$, which is precipitated by ammonia as $MgNH_4PO_4$, so that the whole of its phosphoric acid is present in the precipitate.—J. H. L.

Oryzanin; Significance of — for the nutrition of fermentative organisms. K. Kuroko. J. Coll. Agric., Imp. Univ., Tokyo, 1915, 5, 305–324.

ORYZANIN is a constituent of the outer portions of unpolished rice and possesses remedial properties with respect to beri-beri. According to Suzuki it is an indispensable constituent of feeding stuffs generally, without which they lose their nutritive value. The author found that, when added to the extent of 0.01–0.1%, it accelerates the growth and fermentation of yeasts in beer-wort, koji extract, and especially in artificial media such as Hayduck's or Nägeli's solutions, its stimulating

action being much greater than that of peptone, asparagin, etc. The accelerating action exerted by "indifferent matters," such as malt-culms, on distillery fermentations is attributed by the author to the action of oryzamin.—J. H. L.

Yeast; Influence of light on the budding of — L. Buchta. Zentralbl. Bakt. u. Parasitenk., 11, 340–351. Woch. Brau., 1915, 32, 108.

Sacch. cerevisiae and *Sacch. Ludwigii* were investigated in single cell cultures. In diffused daylight and in electric light, reproduction was about half as rapid as in the dark. The inhibitive influence of blue light was clearly demonstrated, whereas red light was without any action except perhaps a slightly favourable one. Reproduction was arrested by exposure for 10 seconds to ultra-violet rays, and the cells were killed by exposure for 3 minutes. Budding proceeded as rapidly in infra-red rays as in the dark.—J. H. L.

Yeast; Fermentation waste, and a new process for pressing — W. Scott. J. Inst. Brew., 1915, 21, 391–410.

IN the recovery of beer from yeast, the sooner the separation is effected the better is the quality of the yeast and the pressings, for the relatively high temperature of the yeast when removed from the vats leads to rapid deterioration. The large amount of gas in freshly skimmed yeast (80% of its volume), however, greatly retards the cooling of the yeast in bulk, and also places a limit to the rate at which it can be pressed in the ordinary yeast press. By the use of compressed air, in the process described (see also Eng. Pat. 21,925 of 1913; this J., 1914, 978), it is possible to reduce the whole of the yeast, including that intended for pitching, to a moisture content of 70%, within about an hour after it has been skimmed, and in the hottest weather the pressings can be used with perfect safety. Various modifications of the plant are described, to suit different conditions. The yeast is transferred from the vats to a cylindrical aluminium vessel capable of sustaining an internal working pressure of 45 lb. per sq. in. This receptacle, which in some cases will do duty for 20 yeast backs, is mounted on trolleys or slung from a runway so that it can be moved to different vats in turn. When full it is closed, and compressed air is admitted from the top, whereby the yeast is forced to the press, which is of special construction and requires no pump or other moving machinery attached to it. The filtrate from the plates of the press is collected in a closed channel and can thus be forced back into the fermentation vats without extra labour and without exposure. In some cases a special closed receptacle is provided to hold the recovered beer from the press, before it is returned to the vats. The advantage of using compressed air is that the freshly skimmed yeast can be handled and pressed when in its lightest state, and injury to the cells from the pulsations and unequal pressures of a pump is avoided. The pressed yeast is excellent for pitching if used immediately, and will keep longer than ordinary "liquid yeast." It may be cooled by circulating water through the hollow plates of the press or may be washed in a special press.—J. H. L.

Peptone; Preparation of — by decomposition of the cells of beer yeast, and the rôle of this peptone in fermentation. E. Vlahuta. Bull. Acad. Sci. Roumanie, 1914–15, 3, 123–131. J. Chem. Soc., 1915, 108, 1, 485.

THE author is of the opinion that a peptone obtainable from yeast cells is capable of bringing about fermentation. This peptone was obtained by adding in small quantities 100 grms. of fresh yeast, which had been submitted to 50–100 atmos. pressure, to 70% sulphuric acid. The acid was

kept cold by a freezing mixture, and after all the yeast had been added, the emulsion was allowed to remain in the freezing mixture for three hours, and then allowed to come to atmospheric temperature, where it remained for three days. The emulsion was then added, drop by drop, to 1500 c.c. of ice-cooled water, and barium hydroxide was added until a faintly alkaline solution was obtained. The barium sulphate was removed by filtration, and the excess of barium hydroxide carefully precipitated by the addition of the exact amount of dilute sulphuric acid. In this way, a yellowish, faintly acid solution of peptone was obtained, which gave the biuret and all other reactions of protein substances. The fermentative action was tested by taking 20 c.c. of the solution, adding 0.2 c.c. of toluene and quantities of dextrose or sucrose, and measuring the volume of carbon dioxide liberated in a measured time. Definite fermentation occurred, the action being about one-fortieth that of Buchner's preparations.

Acetaldehyde: Formation of—by atmospheric oxygen in the alcoholic fermentation of sugar. E. Buchner, K. Langheld, and S. Skraup. Ber., 1914, 47, 2550—2555. J. Chem. Soc., 1915, 108, i., 486.

THE small quantities of acetaldehyde which can be detected in the fermentation of sugar by yeast extract, in the presence of sodium phosphate, depend for their formation on the access of air, and the occurrence of this substance is prevented by the application of an atmosphere of hydrogen or nitrogen. Acetaldehyde is therefore only of secondary formation in alcoholic fermentation, and is not an essential intermediate product (compare Kostytschev, this J., 1912, 553, 741).

Proteolytic enzymes: Chemistry of the—. E. Herzfeld. Biochem. Zeits., 1915, 68, 402—485. J. Chem. Soc., 1915, 108, i., 468—469. (See also this J., 1914, 707.)

PEPSIN dialysates give the biuret reaction, whereas the trypsin dialysates do not. The former may therefore be compared with the peptones, and the latter with amino-acids. There was a diminution of the dialysable substances in acid (in the case of pepsin) and alkaline (in the case of trypsin) solutions, which was also marked when the enzymes were allowed to act on proteins. These facts lead the author to the conclusion that the dialysable degradation products, such as peptones and amino-acids, play a part in the hydrolysis of proteins. It was found experimentally (using the dialysis method) that peptones alone can accelerate the proteolytic processes, and there was a certain specific character in their actions; thus, silk peptone could bring about degradation of raw silk, but not of other proteins, and an egg-peptone could cause greater hydrolysis with egg-albumin than with other proteins. A similar catalytic action could also be demonstrated when a synthetic polypeptide was employed (leucylglycine), and a constituent of the peptide could also catalytically bring about the hydrolysis of the peptide; thus both leucine and glycine could bring about hydrolysis of leucylglycine. Furthermore, pure amino-acids and mixtures of the same could play the part of a proteolytic enzyme when acting on proteins. The amount of degradation produced was diminished in the presence of 0.5% sodium carbonate. The property was not found in all amino-acids. It was present with glycine, alanine, glutamic acid, leucine, phenylalanine, but absent with aspartic acid and tryptophan. The course of hydrolysis was also traced when glycine was allowed to act on a coagulable protein (egg-white). The protein, after varying intervals of incubation, was coagulated, and the non-coagulable substances

estimated by the glycine reaction. When sufficient amounts of glycine were employed, the amounts of these increased progressively for a certain time, and then diminished, and the latter fact was taken to indicate that a synthesis takes place when a certain concentration is reached. It is claimed by the author that the protein degradation products in an enzyme preparation play an important, although not the sole, part in the catalysis. It is shown also that heated enzymes can also produce a certain amount of degradation. Enzymes generally are regarded as degradation products.

Reductase: Influence of heat, light, and radium radiations on the activity of—. D. F. Harris and H. J. M. Creighton. J. Biol. Chem., 1915, 24, 303—308.

HEAT inhibits the activity of reductase, as measured by the reducing action of the enzyme on oxy-haemoglobin; the degree of inhibition increases slowly with the temperature, until at 70°—75° C. the inhibition is complete and permanent. Light and radium radiations have no appreciable influence on the activity of reductase.—W. P. S.

Enzymes: Weakening of—. II. L. Lichtwitz. Z. physiol. Chem., 1915, 94, 73—78.

IN confirmation of earlier results (see this J., 1912, 506) the author found that solutions of sucrose or invert-sugar were fermented more rapidly than equivalent solutions of the mixed sugars. The experiments were made with 100 c.c. portions of yeast-water containing 20 grms. of total sugar (calculated as invert-sugar) and seeded with 8 million cells of a wine yeast. When, after about 3 weeks, the pure sucrose solutions were completely fermented, the solutions of mixed sucrose and invert-sugar still contained 2—4% of sugar consisting chiefly of uninvverted sucrose. The two phases of the fermentation, previously described (*loc. cit.*), were again observed; but the statement that the influence of invert-sugar in weakening the invertase-activity of yeast persists after the invert-sugar has been removed, was not confirmed.—J. H. L.

Beer: Importance of lactic acid in the production of malt and—. R. Wahl. Amer. Soc. Brewing Technol., Chicago Sec., March, 1915. J. Inst. Brew., 1915, 21, 460—465.

THE peptase of malt is present in barley in an inactive state. During the steeping process the lactic bacteria which are always present adhering to the husks, penetrate into the grain, and when the temperature rises during germination they produce lactic acid, which renders the peptase active and converts insoluble neutral phosphates into soluble acid phosphates. To assist these natural processes the author has proposed (see this J., 1913, 879) to add a culture of lactic bacteria to the barley in the steeping tank after it has been freed from foreign organisms as completely as possible by washing; this improves the appearance, flavour, mellowness, and particularly the peptic power of the malt. The artificial acidification of mashes by means of *B. Delbrücki* (see this J., 1911, 1141), applied to the production of lager beer worts, has produced an increase of 1—2% in the yield; but precautions are necessary to prevent excessive peptonisation, which is liable to impair the fulness of flavour of the beer. The remarkable improvement in the stability of bottle beer, attained by addition, in the chip cask or at a later stage, of proteolytic enzymes, such as animal pepsin, which decompose the complex proteins liable to cause haze or sediment (see Wallerstein, this J., 1911, 916), may also be brought about by using, instead of foreign enzymes, an extract of malt made in presence of bacterial lactic acid and containing the malt peptase in an active state.

To ensure the complete stability of bottle beer, especially when it is subject to agitation during transport, the air should be expelled from the neck of the bottles by causing sufficient foaming when the bottles are being filled.—J. H. L.

[Beer.] *Note on the determination of original gravity.* J. L. Baker and H. F. E. Hulton. J. Inst. Brew., 1915, 21, 389–391.

To avoid loss of alcohol during filtration of beer before the determination of original gravity, the authors employ a shortened funnel resting in the mouth of a "filter jar" and covered with a clock glass. If the funnel is not covered serious errors may arise, especially when filtration is slow, as in the case of waste beer, bottoms, etc. (See also this J., 1915, 96.)—J. H. L.

Beers; Influence of the mashing process, acidity, duration of storage, and race of yeast, on the ester-content of —. W. Windisch, R. Reimers, and F. Hirschbruch. Woch. Brau., 1915, 32, 1–3, 9–12, 17–18.

THE flavour of beer is considerably influenced by the presence of esters, particularly those of the higher alcohols. Ehrlich has shown that yeast produces the higher alcohols from amino-acids (see this J., 1907, 480; 1909, 848; 1911, 231; 1912, 506), and may also cause them to combine with acids, some yeasts possessing the latter capacity in much greater degree than others (see this J., 1914, 879). The formation of esters in beer will therefore depend on the quantity of amino-acids in the wort and the capacity of the yeast for producing alcohols therefrom and inducing them to combine with acids to form esters; these functions are fulfilled only by yeasts of vigorous fermentative activity. The following method was adopted as an approximate means of comparing the amounts of volatile esters in different worts and beers:—200 c.c. of the sample (not freed from carbon dioxide) was distilled to a syrupy consistence in a partial vacuum, and the distillate was caught in 96% alcohol cooled to -10° or -12° C. The distillate was titrated with N/100 sodium hydroxide solution to determine its free acidity, then boiled for 1 hour under a reflux condenser with an excess of 30 c.c. of the alkali, and afterwards titrated back with acid. The number of c.c. of N/100 alkali required for the hydrolysis of the esters in the distillate from 200 c.c. of beer or wort is referred to as the saponification number. The removal of carbon dioxide or even the exposure of beers to the air for a short time before their distillation, very greatly diminished the saponification numbers obtained (in some cases by 50%). The escape of gas from beer is therefore associated with loss of esters. In comparative brewings, with different modifications of the decoction method of mashing, the unfermented worts gave a saponification number of 0 in all cases. The values immediately after the primary fermentation ranged from 9.2 to 21.8, the highest values corresponding to the worts prepared with artificial acidification of the mash by addition of lactic acid or cultures of *B. Delbrückii*. After storage for 3–5 weeks the beers gave higher and more uniform values, ranging from 20.7 to 26.0. The acidity is evidently a factor of great importance for the production of esters; it favours the formation of amino-acids from proteins and possibly the esterification process itself. Variation of the quantity of yeast used for pitching was found to have no influence on the saponification number of the beers, although in some cases there must have been scarcely any reproduction of yeast and therefore scarcely any demand for amino-acids. The absolute quantity

of esters in beers is very small and those of most importance for the flavour are probably not the fatty acid esters. Ehrlich found esters of succinic acid amongst the products of the decomposition of glutamic acid by yeast. Some further experiments in which malt mash was acidified by means of a butyric ferment (*Granulobacter saccharobutyricum*) gave rise to worts with saponification numbers of 17.5–25.4 and to beers of unpleasantly pronounced flavour.—J. H. L.

[Brewing.] *Interaction between acid phosphates and the carbonates, sulphates, and chlorides of calcium and magnesium at various concentrations.* H. von Hest. Woch. Brau., 1914, 31, 389. J. Inst. Brew., 1915, 21, 460.

EXPERIMENTS showed that the insoluble tricalcium and trimagnesium phosphates, formed from the acid salts at high temperatures, are reconverted into the latter as the solutions cool. If brewery worts are separated from the sludge when hot they will accordingly contain less alkaline-earth phosphates than if they are left in contact with the sludge on the cooler.—J. H. L.

Methyl alcohol; Determination of — in presence of ethyl alcohol. W. A. R. Wilks. Wellcome Tropical Research Lab., Khartoum, Chem. Sect. Bull. No. 1, Oct., 1914, 5 pages.

THE following modification of the process described by Thorpe and Holmes (this J., 1904, 208) is proposed with the object of reducing the action of the oxidising mixture on the ethyl alcohol and preventing loss of methyl alcohol by evaporation. A solution of 30 grms. of potassium bichromate in 150 c.c. of water is placed in the oxidation flask and cooled with a freezing mixture; 50 c.c. of the solution of the alcohols is then added, followed by the gradual addition of a mixture of 20 c.c. of sulphuric acid and 20 c.c. of water, this mixture having been cooled previously. The oxidation is allowed to proceed for 18 hours, and the carbon dioxide then collected as described. Under these conditions, methyl alcohol is oxidised completely; with ethyl alcohol alone, the subtractive correction is 0.0040 gm. CO₂ per gm. of the alcohol. —W. P. S.

Methyl alcohol in alcoholic beverages; Detection of —. T. Takahashi. J. Coll. Agric., Imp. Univ., Tokyo, 1915, 5, 301–303.

THE Japanese Government prescribe Denigès' colorimetric method (this J., 1910, 451, 585) as a first test, to be confirmed by the following modification of Aweng's method (this J., 1912, 296):—200 c.c. of the sample is treated with 3 grms. of calcium carbonate and distilled, with the aid of a fractionating column, below 80° C. The distillation is repeated at as low a temperature as possible (65–70° C.), and 10 c.c. of distillate is shaken for 2–3 mins. with 250 c.c. of 1% potassium permanganate solution and 10 c.c. of sulphuric acid, then decolorised with an 8% solution of oxalic acid and again distilled. When the distillate ceases to give a dark red colour (acetaldehyde) with Rimini's or Jean's reagent (this J., 1898, 697, 1076) it is collected so long as it gives a blue colour (formaldehyde). It is redistilled after addition of 3 grms. of calcium carbonate, and then mixed with an excess of ammonia and evaporated. The official method prescribes evaporation from a water-bath below 80° C., but the author recommends evaporation under reduced pressure, 15–20 mm., from a bath below 45° C. One drop of the liquid is then mixed with a drop of concentrated mercuric chloride solution on a microscope slide under observation (cp. Aweng, loc. cit.).—J. H. L.

PATENTS.

Fermentation; Processes and apparatus for —. R. Blum, Stuttgart, Germany. Eng. Pat. 6519. Mar. 11, 1914. Under Int. Conv., Apr. 1, 1913. SEE Fr. Pat. 469,667 of 1911; this J., 1915, 46.

Sterilising receptacles of wood or pulp materials consisting of cellulose or its substitutes. Eng. Pat. 13,690. See XIXB.

XIXA.—FOODS.

Milk; Reaction and calcium content of — as factors in the coagulation process. T. H. Milroy. Biochem. J., 1915, 9, 215—229.

DURING the coagulation of milk with rennin, the acidity (hydrogen ion concentration) remains constant, but it is increased by adding calcium chloride and lowered by adding alkali oxalate. Fresh milk that has been pre-heated below the boiling point for one hour, shows an increased acidity and, owing to the separation of triacalcium phosphate, a lower calcium content. Such milk is only very slowly acted upon by rennin, but its coagulability is raised by adding calcium chloride, or by increasing the acidity by means of sodium acetate and acetic acid. The calcium chloride exerts an action beyond that of influencing the acidity.—E. H. T.

Milk; Determination of the degree of homogenisation of —. O. von Sobbe. Milchwirtschaftl. Zentr., 1914, 43, 503—506. Bull. Bureau Agric. Intell., 1915, 6, 542—541.

250 c.c. samples of treated and untreated milk are placed in graduated tubes and allowed to stand for 72 hours at room temperature. Each sample is then divided into three layers, of 50, 150, and 50 c.c. respectively, and the fat-content of each of these is determined by Gerber's method, except in the case of the lowest layer, or untreated milk, when Köhler's method is preferable. Prior to the analysis, each sample is treated with formalin (1 drop to 100 c.c. of milk). The fat content of the lowest layer expressed as a percentage of that of the original milk is termed the degree of homogenisation.—E. H. T.

Colouring matters in foodstuffs. New Canadian regulations. Ch. of Comm. J., July, 1915.

NEW regulations governing the use of colouring matter in foods have been promulgated under the Canada Adulteration Act by an Order of January 4th, 1915. It is provided that the following articles may be artificially coloured, if only harmless colouring matter is used, without a declaration to that effect on the label or elsewhere, although such colouring substance shall in no case be employed to conceal damage or to appear to enhance the value of the product: Full whole-milk cheese; confectionery, including jelly powders; flavouring extract of lemon; ice cream and ices; butter. In the case of spirits, vinegar, sauces, fermented beverages not subject to excise requirements, and so-called "temperance" beverages, the use of caramel only is permitted without declaration of such colouring. The use of artificial colouring must be stated on the label in easily legible type in the case of all other food products.

The following substances are provisionally considered to fall within the definition of harmless colouring materials: Caramel; cochineal; saffron; chlorophyll and innocuous vegetable colour extractives; certain coal-tar dyes not containing arsenic in excess of 10 parts As_2O_3 per million, calculated on the actual weight of colouring matter, and not containing heavy metals (except

iron), when used in quantities not exceeding 2 grains per lb. (1 part in 3500). The use of copper salts in the greening of peas is permitted, provided the amount of copper (expressed as metallic copper) in the peas does not exceed 80 parts (by weight) per million in the drained peas or 10 parts per million in the liquid.

Nature of the sugars found in the tubers of sweet potatoes. Miyake. See XVII.

PATENTS.

Tea and the like; Machinery for drying —. A. G. D. Young, Edinburgh. From M. H. Hotchkis, Jalpaiguri, India. Eng. Pat. 13,098, May 28, 1914.

AIR is drawn, successively, by means of a fan, through an aero-condenser, a chamber heated by live steam, and a chamber heated by a furnace, and is then conducted to the drying chambers, means being provided for regulating the supply and temperature of the air to the latter chambers. Waste steam from an engine is condensed in the aero-condenser, steam injectors being provided for removing the condensed water and maintaining a slightly diminished pressure in the condenser. The three parts of the heating apparatus may be used separately or in conjunction with one another. —W. P. S.

Food products; Process and apparatus for drying —. W. D. Edwards and T. E. Koehler, Portland, Oreg., U.S.A. Eng. Pat. 15,662, June 30, 1914.

THE material, such as fruits and vegetables, is first cooked or else cut up and immersed in cold water. It is then dried in heated humidified air, either still or in motion, at a constant temperature and degree of saturation. In this way the cell structure of the food is not destroyed, and when placed in water again the food is capable of re-absorbing it and returning to its natural appearance and taste. Some foods require to be steamed or sweated after the drying process, in order to maintain the cell structure.—J. H. J.

Cottonseed; Process of treating —. A. B. Carr, Atlanta, Ga., Assignor to The Procter and Gamble Co., Cincinnati, Ohio. U.S. Pat. 1,141,104, June 1, 1915. Date of appl., July 24, 1913.

THE unhulled seeds are heated to about 130° to 180°, so as to cook the kernels partially, without oxidation, and then cooled to a temperature (80° to 40°) insufficient for the cooking process to continue after storage.—C. A. M.

Cotton-seed meal, cotton-seed meats, and cotton-seed flour; Process of treating —. J. G. Falls, Memphis, Tenn. U.S. Pat. 1,142,243, June 8, 1915. Date of appl., Aug. 23, 1913.

COTTONSEED meal, meat, or flour, is subjected to a high temperature, sufficient to remove the disagreeable odour and taste, but not sufficient to burn the material, and is then mixed with other foods.—J. H. J.

Syrup from cider and other fruit-juices; Process for making —. H. C. Gore, Takoma Park, Md. U.S. Pat. 1,141,458, June 1, 1915. Date of appl., Oct. 7, 1914. (Dedicated to the public.)

THE fruit juice is nearly neutralised with milk-of-lime, then heated to 212° F. (100° C.), and filtered while hot; the filtrate is concentrated and the crystalline calcium malate which separates is removed by filtration.—W. P. S.

Milk; Process of pasteurising —. J. F. Lester, Assignor to R. Merrifield, New York. U.S. Pat. 1,141,566, June 1, 1915. Date of appl., Aug. 2, 1912.

MILK is heated to a pasteurising temperature, then

filtered, and sealed in suitable containers, the milk being maintained at a pasteurising temperature during the latter operations. The containers and their contents are again heated, and then cooled.—W. P. S.

Liquids, organic or fermentable [e.g., milk]: Process for the auto-stabilisation of—. M. Faucher. Fr. Pat. 473,865, Oct. 16, 1913.

ONE or more metallic couples are suspended from the cover of the vessel containing the liquid, e.g., milk, and extend into the latter. The couples may consist of iron and aluminium rods and are connected together at the points where they are secured to the cover. A glass vessel may be used for containing the liquid, or a metal vessel may itself form one of the elements of the couple.—W. P. S.

Food product [from algaroba fruit]: Process of producing a—. E. J. Mooklar. Honolulu, Hawaii. U.S. Pat. 1,141,816, June 1, 1915. Date of appl., Dec. 11, 1913.

PODS and beans of the algaroba tree are dried at 205° C. until the sugar present crystallises; they are then ground, the powder is roasted, extracted with water, and the extract filtered and evaporated to dryness.—W. P. S.

Pectin substances for confectionery: Extraction of—. H. A. Deroy and J. Remotte. First Addition, dated May 28, 1914, to Fr. Pat. 473,316, May 9, 1914 (this J., 1915, 507).

A KIND of caramel and dry extract are obtained by the evaporation of apple juice and of extracted apple marc.—W. P. S.

Process of producing lacquered tin plate especially for canning purposes. Eng. Pat. 16,743. See X.

Sterilising receptacles of wood or pulp materials consisting of cellulose or its substitutes. Eng. Pat. 13,690. See XIXB.

XIXB.—WATER PURIFICATION; SANITATION.

Arsenious gases producible by Penicillium moulds: Composition of the—. P. Klason. Ber., 1914, 47, 2634—2642. J. Chem. Soc., 1915, 108, i., 486.

A SUMMARY is given of the investigations on the subject since the first mention by Gmelin in 1839 of the possibility of poisoning by wallpapers coloured with arsenic compounds, such as Schweinfurt-green. The view has been expressed by various workers that the volatile compound containing arsenic is diethylarsine, but a repetition of the earlier work, in which the gas was absorbed, as previously, by mercuric chloride solution, and also by nitric acid, indicates that the gaseous product is diethyleacodyl oxide, $[\text{As}(\text{C}_2\text{H}_5)_2]\text{O}$; absorption by mercuric chloride gives an additive compound, or causes oxidation to ethyleacodylic acid if the solution of mercuric chloride is dilute, whilst nitric acid effects oxidation to ethyleacodylic acid. The diethyleacodyl oxide is unaccompanied by any trace of arsine, for the latter, even in minute quantity, gives a pale yellow coloration with a 1% mercuric chloride solution, whereas the gases formed by the culture give with a solution of this concentration a colourless liquid and a crystalline deposit of mercurous chloride.

PATENTS.

Seepage: Apparatus for purifying—. G. W. and J. F. Naylor. Denby Dale, Yorks. Eng. Pat. 20,259, Sept. 28, 1914.

A TANK has a false bottom of porous tiles, so supported that the air space below each row of tiles is separate from the adjoining air space. Air

under pressure is admitted through horizontal pipes laid below each row of tiles. The tiles may be supported directly on the floor of the tank or may fit in trays. The air pipes may support the trays or the tiles, or may have short upright branches supporting the tiles or trays. The pipes and branches have perforations for the passage of the air to the under side of the tiles.—J. H. J.

Ozone: Apparatus for the sterilisation of liquids by—. J. Steynis. Bay Shore, N.Y., U.S.A. Eng. Pat. 23,681, Dec. 7, 1914. Under Int. Conv., Dec. 6, 1913.

THE sterilising chamber is cylindrical and the water to be treated is fed in at the bottom through four pipes entering the cylinder tangentially, so as to give the water a whirling motion. These pipes are connected to the pipes from the ozoniser by means of safety reservoirs in order to prevent the access of water to the ozoniser. The bottoms of these reservoirs open over discharge pipes and are kept closed by valves when working. When the flow of water ceases for any reason, the suction on the valve fails, the valve drops, and any water accumulated in the reservoir runs away by the discharge pipe.—J. H. J.

Sterilising receptacles of wood or pulp materials consisting of cellulose or its substitutes. A. R. Ling and H. B. Wooldridge. London, and R. Stewart, Luton. Eng. Pat. 13,690, June 5, 1914.

RECEPTACLES of wood, or pulp materials consisting of cellulose or its substitutes, which come in contact with foodstuffs or beverages, e.g., brewery casks or vats, and cellulose pulp for filtering beer, are sterilised by treatment with commercial hydrogen peroxide (12 vol. strength), which penetrates the material.—F. W. A.

Filler. H. Reisert, Cologne, Germany. U.S. Pat. 1,142,270, June 8, 1915. Date of appl., April 11, 1914.

A NUMBER of reservoir chambers are constructed below a series of filter beds. Compressed air is introduced into the reservoir chambers for the purpose of rapidly forcing the filtered water back through the filter beds, to cleanse them. Ducts through which workmen can pass are formed between the reservoirs.—W. H. C.

Water: Process of antisepticising—. G. Ornstein, Assignor to Electro-Bleaching Gas Co., New York. U.S. Pat. 1,142,361, June 8, 1915. Date of appl., Feb. 14, 1913.

A SMALL portion of the water is caused to flow downwards through a tower filled with suitable material, and a current of chlorine gas from a cylinder of liquid chlorine passed upwards through the tower. The gas is absorbed by the water as it trickles down the tower in thin films. The chlorinated water is then united with the bulk of the water in the main.—J. H. J.

Air: Regeneration of impure—, particularly for use in connection with respiratory apparatus. A. B. Dräger, Lübeck, Germany. Eng. Pat. 6328, March 12, 1914.

A READILY deoxidisable fluid, such as a strong solution of hydrogen peroxide, contained in a cylinder, is allowed to escape in small amounts by means of a screw plunger; it drops on to a catalyst, such as potassium permanganate, contained in a tube communicating with a pipe receiving the expired air already freed from carbon dioxide by passing through an absorbing cartridge. The mixture of oxygen and air passes into a bag and then returns through another absorbing cartridge to the mouth. The deoxidised fluid collects in the bottom of the bag whence it can be let out from time to time. The apparatus

may be arranged for personal use or for use in living rooms. —J. H. J.

Phenolic condensation products capable of acting as poisons to marine growths, bacteria, and the like; Production of —. A. Heinemann, London. Eng. Pat. 11,394, May 8, 1914.

A PHENOL-FORMALDEHYDE condensation product is heated until liquid and the desired quantity of cacodylic acid stirred in. The product is soluble in the usual solvents for condensation products. It may be employed to prevent the growth of bacteria and in the making of paints and varnishes used as protective coatings against sea water, as it is effective in poisoning marine growths attaching themselves to the exposed surface.

—J. H. J.

[Destructor] furnaces. T. K. Irwin, London. Eng. Pat. 12,514, May 21, 1914.

A DESTROYER furnace has a mechanically operated grate, which projects beyond the furnace on opposite sides. The refuse is fed by a toothed wheel from a hopper on to the front of the grate and is conveyed through the furnace where it is burned in a current of air, which is preheated by passing it through the hot clinker before the latter is discharged into a truck on the opposite side of the furnace. A combustion chamber formed above the furnace serves to ensure the complete combustion of any partly burned gaseous products.—W. H. C.

Dust removing apparatus; Noxious —. E. Cattani and C. F. Keel, Freiburg, Switzerland. Eng. Pat. 17,447, July 23, 1914. Under Int. Conv., July 31, 1913.

IN A dust exhaust apparatus, the air and the collected dust pass through a suction pipe into a dust filter, from which the air passes on into the pressure chamber of the suction machine. From here either the whole or a portion of the air passes through a flexible tube furnished with a nozzle and is directed to the spot from which the dust is to be removed. This blast of air assists in the removal of the dust and in directing it into the hood of the exhaust apparatus. The process is applicable to collecting the dust from grinding operations or from a surface of any shape.—J. H. J.

Sterilising water by means of ozone; Apparatus for generating ozone and for —. H. Gruner, Paris. Eng. Pat. 18,025, July 30, 1914. Under Int. Conv., Sept. 9, 1913.

SEE Fr. Pat. 473,181 of 1913; this J., 1915, 509.

Potable water free from bacteria; Process for obtaining —. Suerofilter u. Wasserreinigungs-Ges. m.b.H. Fr. Pat. 474,290, June 30, 1914.

SEE Ger. Pat. 281,810 of 1913; this J., 1915, 731.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Hashish; Tests for —. W. Beam, Wellcome Tropical Research Lab., Khartoum, Chem. Sect. Bull. No. 3, April, 1915, 2 pages.

MANY specimens of hashish were found to yield a rich purple coloration when the petroleum spirit extract of the substance was evaporated at the ordinary temperature with the addition of a small quantity of alcoholic potassium hydroxide solution, whilst other samples failed to give a reaction: the ordinary extract of *Cannabis indica* of the pharmacopoeia failed to respond to this test, and it seems that the influence of soil, climate, method of cultivation and curing have a

considerable influence on the chemical composition of the plant. All hashish and other *Cannabis indica* preparations, however, responded to the following test:—The substance was extracted with cold petroleum spirit, the extract evaporated at the ordinary temperature, and the residue treated with a few c.c. of absolute alcohol saturated with dry hydrochloric acid gas. A bright cherry red coloration was obtained which disappeared on dilution with alcohol or water. Tests were made with a number of other plant extracts, and over 200 alkaloids, glucosides, etc., but in no case was a similar reaction obtained. Certain volatile oils, e.g., origanum and santal oils, gave a reaction, but the coloration was much less intense for similar amounts of material.—W. P. S.

Gloriosa superba; The constituents of —. H. W. B. Clewer, S. J. Green, and F. Tutin. Chem. Soc. Trans., 1915, 107, 835—846.

A QUANTITY of 42.52 kilos, of the dried, ground tubers of *Gloriosa superba* Linn. (the Superb Lily), collected in Ceylon, was extracted with alcohol, the solvent evaporated, and the residue distilled with steam, when 3.8 grms. of a pale essential oil, b. pt. 150°—250° C. at 15 mm., and containing furfural, was obtained. The aqueous liquid and dark resinous material left after distillation were examined separately, and the following substances were isolated and identified: benzoic and salicylic acids; 2-hydroxy-6-methoxybenzoic acid, m. pt. 135° C., giving a violet coloration with ferric chloride and yielding on methylation methyl 2,6-dimethoxybenzoate, m. pt. 88° C., which could not be hydrolysed by alcoholic potassium hydroxide; choline; dextrose; palmitic acid and a mixture of unsaturated acids; a hydrocarbon, m. pt. 63°—65° C.; a fatty alcohol, m. pt. 77° C.; a mixture of phytosterols containing stigmasterol; a mixture of phytosterols containing stigmasterol-glucoside, and a mixture of alkaloids which consisted chiefly of colchicine, $C_{22}H_{25}O_6N$, together with small amounts of two other crystalline bases. The dried tubers contain 0.3% of colchicine, to which their toxic properties are essentially due. Colchicine crystallises from ethyl acetate in small, soft, pale yellow needles, m. pt. 155°—157° C., which is considerably higher than the m. pt. previously recorded for the amorphous powder.

—T. C.

Thyroid: Isolation of the compound containing iodine which occurs in the —. E. C. Kendall. J. Amer. Med. Assoc. Pharm. J., 1915, 95, 2.

HYDROLYSIS of the proteins of the thyroid, by means of sodium hydroxide and alcohol, gave rise to a complex mixture, part of which is soluble in acid. By further hydrolysis of this latter portion a crystalline iodo compound, m. pt. about 220° C., has been isolated, which appears to be a di-iodo-dihydroxyindole. It is believed to be the substance to which the physiological activity of the gland is due, since it exhibits the typical effects of the desiccated thyroid.

Methylanthracene from frangula-emodin. N. Krasovskii. J. Russ. Phys. Chem. Soc., 1914, 46, 1067—1075. J. Chem. Soc., 1915, 108, i, 420.

THE author prepared synthetically 1- and 2-methylanthracenes and several of their derivatives, and compared the melting points with those of the corresponding compounds obtained from frangula-emodin. The conclusion is drawn that the latter yields 2-methylanthracene. On further purification, the methylanthracene from cathartemodin, and the methylanthraquinone and anthraquinonecarboxylic acid prepared from it, were found to have melting points identical with those of the 2-methylanthracene derivatives.

Antigens; Detection and concentration of—by ultrafiltration, pressure dialysis, etc., with special reference to diphtheria and tetanus toxins. A. T. Glenny and G. S. Walpole. *Biochem. J.* 1915, 9, 298—308. (See also page 819.)

As antigens do not traverse collodion-water membranes these can be used for the routine purification and concentration of toxins, and also for the preliminary examination of the specificity or otherwise of the toxic constituents of any cultural fluid. The purification and concentration of diphtheria toxin is performed by means of dialysis under pressure, acidifying, centrifuging, and re-dissolving the precipitate in a trace of alkali. With these membranes, mallein and tuberculin were readily separated from glycerol and adherent nitrogenous matter, and tetanus toxin was purified by ultrafiltration followed by pressure dialysis.—E. H. T.

Essential oils; Variation with temperature of the refractive index and density of—K. Irk. *Pharm. Zentr.*, 1914, 55, 789—793, 831—837. *J. Chem. Soc.*, 1915, 108, ii., 380.

THE accuracy with which the index of refraction can be measured renders it of value as a characteristic of an essential oil, although the range of indices is so narrow. The alteration of n_D for 1° C. was given by Harvey and Wilkie (*Chem. and Drug.*, 1910, 76, 442) as 0.00046, and by Schimmel und Co. as 0.00035. The author has examined fifty-three oils, and finds the value, from 10°—30° C., 0.00038 to 0.00052, or, as a mean, 0.00044. The value of the density of an essential oil as a characteristic is also discussed, and, in view of the varying standards to which this constant is referred, the influence of temperature has been determined in the case of nearly fifty oils. The mean alteration for 1° is found to be: between sp. gr. at 15°/4° (vac.) and sp. gr. at 20°/4° C. (vac.), 0.00076; between sp. gr. at 15°/15° and sp. gr. at 20°/15° C., 0.000746; and between sp. gr. at 15°/15° C. and sp. gr. at 20°/20° C., 0.000598.

Copaiba balsam; Examination of officinal—E. Deussen. *Arch. Pharm.*, 1914, 252, 590—600. *J. Chem. Soc.*, 1915, 108, ii., 385.

TURNER'S colour reaction, as described in the German Pharmacopœia for the detection of gurjun balsam in copaiba balsam, gives quite misleading information. The author has examined twelve samples of Maracaibo balsam. According to Turner's test, two of them were adulterated and one was suspect. Optical examination, however, showed that none of them was pure. The solubility in chloroform and in absolute alcohol, the density, and the amount of the residue after distillation at 100° C., give useful information, but the most searching test is an optical one. The author's method of examining copaiba balsams is as follows. The balsam is distilled with steam as completely as possible, the oil in the distillate is dried with sodium sulphate and filtered, and its rotation determined. The specific rotary power, calculated for a 10-cm. tube, must lie between -2.5 and -14° if the original balsam was unadulterated; balsams, the oils from which are more or less dextrorotatory, are certainly adulterated. Adulterated balsams which fail to respond to Turner's reaction may give positive results if the oils are separated and fractionated; one or other of the fractions will respond to Turner's test, as modified by Deussen and Eger (compare this *J.*, 1912, 700).

Linalools; Isomeric—and the fission of inactive linalool into the optical antipodes. V. Paolini and L. Divizia. *Atti R. Accad. Lincei*, 1914, [v], 23, ii., 171—176. *J. Chem. Soc.*, 1915, 108, i., 424.

To prepare pure linalool, the alcohol is treated with an excess of sodium in 2—3 vols. of light

petroleum; the sodium salt is converted into phthalate, and this is precipitated as hydrogen phthalate on acidification. A concentrated alcoholic solution of the phthalate is treated with the calculated quantity of strychnine, and the strychnine salt, $C_6H_4(CO_2C_{10}H_{17})(CO_2H, C_{21}H_{22}O_2N_2)$, is crystallised. Samples of dextro- and of laevorotatory linalool from various sources all gave a strychnine salt of m. pt. 143°—144° C. (previously softening), and on saponification the strychnine salts all yielded linalool of b. pt. 197°—198° C., sp. gr. 0.869, $n_D=0.870$. Synthetic linalool prepared from geraniol is practically inactive. By recrystallisation of the strychnine salt the authors isolated the optical antipodes. The less soluble strychnine salt has m. pt. 155°—156° C., and yields on saponification *d*-linalool, $[a]_D=+1.70^\circ$, whilst from the salt in the mother-liquor *l*-linalool of $[a]_D=-1.60^\circ$ was obtained.

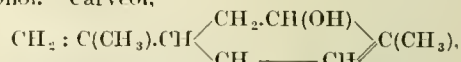
α - and β -Santalols. V. Paolini and L. Divizia. *Atti R. Accad. Lincei*, 1914, [v], 23, ii., 226—230. *J. Chem. Soc.*, 1915, 108, i., 424—425.

IF the mixture of α - and β -santalols which occurs in commerce is carefully fractionated, a partial separation of the two isomerides can be effected, and the crude products can be purified by converting each of them into the hydrogen phthalate, and this again into the strychnine salt (compare preceding abstract); after repeated recrystallisation of the strychnine salt, saponification yields the pure isomeride.

The strychnine phthalate of β -santalol, $C_6H_4(CO_2C_{15}H_{23})(CO_2H, C_{21}H_{22}O_2N_2)$, has $[a]_D=-30.43^\circ$, m. pt. 134°—135° C., and the β -santalol obtained from it has b. pt. 168°—169° C. at 10 mm., sp. gr. at 15° 0.9729, $n_D^{15}=1.5092$, $[a]_D=-42.00^\circ$. The strychnine phthalate of α -santalol has m. pt. 155° C., $[a]_D=-1.40^\circ$. The α -santalol prepared from it has b. pt. 159° C. at 10 mm., sp. gr. at 15° 0.979, $n_D^{15}=1.499$, $[a]_D=+1.10^\circ$.

Limonene; Autoxidation of—A. Blumann and O. Zeitschel. *Ber.*, 1914, 47, 2623—2628. *J. Chem. Soc.*, 1915, 108, i., 426—427.

WHEN purified limonene, sp. gr. at 15° 0.845, $a_{100}^{15}=+108^\circ$, is exposed to the air in the presence of water in a loosely closed vessel for two and a-half months, crystals of m. pt. about 60° C. form on the walls above the surface of the liquid and a resinous layer of unknown nature is deposited at the bottom. Amongst the products which are volatile in steam, were identified carvone and carveol, both optically inactive. The latter has not previously been obtained in a pure condition, the purification in this case being effected by successive conversion into the benzoate, hydrolysis, conversion into the phenylurethane, and final hydrolysis. The mother liquors of the phenylurethane yielded a small quantity of an unidentified active alcohol. Carveol,



has sp. gr. at 15° 0.9578, b. pt. 108°—110° C. at 11 mm., 226°—227° C. at 751 mm., $n_D^{15}=1.4961$. ON oxidation it was converted into carvone and on dehydration by heating with zinc chloride or diluted sulphuric acid gave *p*-cymene. When shaken with 5% sulphuric acid for seventeen hours it underwent hydration to a substance, $C_{10}H_{16}O$, needles, m. pt. 132°—133° C.

Alkylaminopurines; Synthesis of—2-Oxy-8-thiopurine, 2-oxy-8-methyl-mercaptopurine, 2-oxy-8-methylaminopurine, and 2-oxy-6,9-dimethyl-8-thiopurine. C. O. Johns. *J. Biol. Chem.*, 1915, 21, 319—323.

WHEN 2-oxy-5,6-diaminopyrimidine is heated with thiourea or ammonium thiocyanate at 185° C.,

2-oxy-8-thiopurine is obtained; the latter substance forms minute prismatic crystals when its ammoniacal solution is acidified with acetic acid. On warming a suspension of 2-oxy-8-thiopurine in alcohol containing methyl iodide, alkylation takes place at the sulphur atom, and 2-oxy-8-methylmercaptapurine is formed. This compound reacts readily with methylamine at 100° C., with the production of 2-oxy-8-methylaminopurine. 2-Oxy-6,9-dimethyl-8-thiopurine may be prepared by heating 2-oxy-4-methyl-5-amino-6-methylaminopyrimidine with thiourea at 180° C. for 1 hour; the mixture is then dissolved in hot dilute ammonia, the solution treated with blood-charcoal, filtered, and the filtrate acidified with acetic acid, when the purine is precipitated as a light coloured powder. It is slightly soluble in hot alcohol and water, but insoluble in benzene. When evaporated with nitric acid it gives a yellow residue which turns red on treatment with ammonia.—W. P. S.

Hexamethylenetetramine trichloroacetate. L. Vanino. Arch. Pharm., 1914, 252, 400. J. Chem. Soc., 1915, 108, i., 385.

TRICHLOROACETIC acid, about 81.7 grms., is triturated with 5 c.c. of water, and the mixture is added to an aqueous solution of hexamethylenetetramine (70 grms. in 115 c.c.); by keeping the solution in a freezing mixture, hexamethylenetetramine trichloroacetate, $C_6H_{12}N_4.CCl_3.CO_2H$, is rapidly precipitated. A solution of the concentration 1:400 completely prevents bacterial growth and has about the same anti-bacterial action as that of a 1:80,000 solution of formaldehyde.

Hexamethylenetetramine: Compounds of—. L. Vanino and A. Schinner. Arch. Pharm., 1914, 252, 449—459. J. Chem. Soc., 1915, 108, i., 385—386.

CONTRARY to statements in the literature, hexamethylenetetramine and salts of copper, cadmium, iron, cobalt, and nickel in aqueous solution readily yield additive compounds provided the solution is sufficiently concentrated. The brownish-yellow cuprichloride, $C_6H_{12}N_4.2CuCl_2$, green cupriacetate, $C_6H_{12}N_4.2Cu(OAc)_2$, cobaltnitrate, $2C_6H_{12}N_4.Co(NO_3)_2.9H_2O$, red, crystalline powder, nickelnitrate, $2C_6H_{12}N_4.Ni(NO_3)_2.9H_2O$, green powder, cadmisulphate, $C_6H_{12}N_4.CdSO_4.6H_2O$, colourless, prismatic crystals, manganochloride, $2C_6H_{12}N_4.MnCl_2.8H_2O$, colourless, prismatic crystals, calch chloride, $2C_6H_{12}N_4.CaCl_2.6H_2O$, colourless, crystalline powder, and mercurcyanide, $C_6H_{12}N_4.3Hg(CN)_2.1\frac{1}{2}H_2O$, colourless, hexagonal crystals, have been prepared. Hexamethylenetetramine in dry benzene reacts with an excess of phthaloyl chloride to form a gelatinous precipitate; this is converted by drying into a colourless, horny substance, which appears to have the composition



Tetramethylenediurea diperoxide. Hydrogen peroxide. II. C. von Girsawald and H. Siegens. Ber., 1914, 47, 2461—2469. J. Chem. Soc., 1915, 108, i., 387—388. (See also this J., 1912, 1058.)

WHEN a solution of the condensation product of formaldehyde and urea in nitric acid is treated with hydrogen peroxide, or when a mixture of urea, 30% hydrogen peroxide, and 35% formaldehyde solution is treated in the cold with nitric acid (sp. gr. 1.4), tetramethylenediurea diperoxide separates in needles, m.p. above 175° C. (decomp.). The new substance is sparingly soluble in most solvents, but dissolves in nitric and sulphuric acids; when boiled with dilute acids or alkalis it is quantitatively resolved into its constituents or their decomposition products;

it explodes when heated directly by a flame. Hydrazine, formaldehyde, and hydrogen peroxide also condense, giving an organic peroxidic substance.

Cinnamic acid: Detection of—. D. Schenk and H. Burmeister. Pharm. Zeit., 1915, 60, 213—211. J. Chem. Soc., 1915, 108, ii., 382.

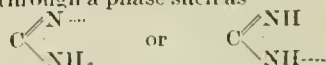
THE test recommended depends on the oxidation of the cinnamic acid to benzaldehyde, and the identification of this by its odour and by its reaction with phenol and sulphuric acid. The substance to be tested is acidified with phosphoric acid and extracted with ether; the ethereal solution is then shaken with sodium carbonate solution, the aqueous layer is separated, extracted twice with ether (this is essential, particularly in the case of fruit juices, in order to remove small quantities of furfural compounds), and very dilute potassium permanganate solution is added, drop by drop, until the pink colour is only just discharged. The solution is now extracted with ether, the ethereal solution is treated with 10 drops of an ethereal 5% phenol solution, allowed to evaporate at the ordinary temperature, and a few drops of concentrated sulphuric acid are added to the residue. A yellow coloration is obtained, even when the quantity of benzaldehyde formed from the cinnamic acid is too small to be identified by its odour. The furfural compounds which may be present give, if not removed completely, a faint orange coloration, which cannot be mistaken for that yielded by benzaldehyde. Benzoic acid, if present in addition to cinnamic acid, may be detected by a test described by Fleury (this J., 1913, 1127).

Dibromomethyl ether, and dibromo- and di-iodomethane: New method of preparation of—. V. E. Tischtschenko and I. L. Rabcevitsh-Zubkovski. J. Russ. Phys. Chem. Soc., 1914, 46, 705—708. J. Chem. Soc., 1915, 108, i., 370.

PURE dibromomethyl ether may be obtained in 60% yield by adding red phosphorus, trioxymethylene, and bromine gradually, with agitation and cooling, to water, the trioxymethylene being taken in somewhat less than the theoretical quantity: $2P + 10Br + 3H_2O + 10CH_2O = 2H_3PO_4 + 5(CH_2Br)_2O$. Dibromomethane may be prepared in highly pure condition and in about 60% yield by the action of aluminium bromide on dibromomethyl ether, the mixture being heated gradually to 175°—180° C. Di-iodomethane may be obtained similarly by heating aluminium iodide and di-iodomethyl ether together gradually to 120° C.

Cyanamide: Relation of— to urea. Constitution of cyanamide and the mechanism of its polymerisation. Constitution of carbamides. II. E. A. Werner. Chem. Soc. Trans., 1915, 107, 715—728.

THE author considers that an explanation based on the tautomeric nature of cyanamide is more in accord with the observed facts in regard to the accelerating influence of acids and bases on the polymerisation of this substance than is the ionic hypothesis suggested by Grube and Krüger (this J., 1914, 75) and Morrell and Burgen (this J., 1913, 1155). The acidic form, $NH:C:NH$, may be supposed to pass into the basic form, $CN.NH_2$, or vice versa through a phase such as



and by the union of two of such structures di-cyanodiamide would be formed. The action of nitrous acid on cyanamide affords evidence of the existence of an equilibrium mixture of the two forms in solution, as whilst with sodium nitrite and acetic acid no gas was liberated, when sulphuric acid was used less than half the theoretical quantity of nitrogen was liberated, and much cyanamide

remained unchanged, presumably the imino-form, whilst the amino-form had been immediately decomposed. Cyanamide is very resistant to hydrolysis, a fact which tends to show that it does not stand to urea in the relation of nitrile to amide and affords further evidence in favour of

the author's urea formula $\text{NH} : \text{C} \begin{smallmatrix} \text{NH}_3 \\ \diagup \\ \text{O} \end{smallmatrix}$. Dihite

acids lead far more to polymerisation than hydrolysis, which appears only to occur quantitatively when sufficient acid is present to convert completely the urea into its salt, and so little water that this salt is not dissociated. Thus, whilst nitric acid in moist ether gives an almost theoretical yield of urea nitrate, fuming hydrochloric acid leaves the cyanamide unchanged, the amount of water being here sufficient to prevent the formation of urea hydrochloride. Cyanamide cannot therefore be hydrolysed to urea in the free state (cyclic structure) and hence the hydrolysis does not take the normal course, as would be expected if urea had the "carbamide" structure.

—G. F. M.

Anhydrous solids ; Preparation of —. W. R. G. Atkins and E. G. Wilson. Chem. Soc. Trans., 1915, 107, 916—918.

THE material is distilled with a mixture of anhydrous benzene and absolute alcohol, as in Young's method for the preparation of anhydrous liquids. Dehydration is complete when the boiling point (68.25°C.) of the alcohol-benzene binary mixture of constant boiling point is reached. Anhydrous levulose, maltose, and starch have been prepared in this way.—F. SODN.

Determination of nitrogen by Kjeldahl's method. Nolte. See XXIII.

PATENTS.

Acetaldehyde from acetylene ; Process for the manufacture of —. Consortium f. Elektrochem. Industrie G. m. b. H., Nuremberg, Germany. Eng. Pat. 17,017, Nov. 28, 1913. Addition to Eng. Pat. 16,848 of 1913, dated July 27, 1912.

SEE Fr. Pat. 460,553 of 1913 ; this J., 1914, 42.

Acetic acid ; Manufacture of — [from acetaldehyde]. Consortium f. Elektrochem. Ind., Nürnberg, Germany. Eng. Pat. 7,418, Mar. 24, 1914. Under Int. Conv., July 25, 1913.

SEE Fr. Pat. 460,971 of 1913 ; this J., 1914, 42.

Acetylene ; Manufacture of haloid hydrogen additive products of —. G. W. Johnson, London. From Chem. Fabr. Griesheim-Elektron, Frankfurt, Germany. Eng. Pat. 21,134, Sept. 18, 1913.

SEE Fr. Pat. 462,711 of 1913 ; this J., 1914, 277.

Ethane from ethylene and hydrogen ; Process for the production of pure — by the aid of catalytic agents. Elektrochemische Werke G. m. b. H., Berlin. Eng. Pat. 23,347, Oct. 15, 1913. Under Int. Conv., Oct. 15, 1912.

SEE Ger. Pat. 265,171 of 1912 ; this J., 1913, 1087.

Anhydrides ; Manufacture of organic acid —, or of mixtures of such anhydrides with their acids. R. Müller, and Deutsche Celluloid Fabrik, Eilenburg, Germany. Eng. Pat. 5773, March 6, 1914.

SEE Fr. Pat. 468,963 of 1914 ; this J., 1914, 985.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

PATENT.

Photographic colour printing process. J. E. Thornton, London. Eng. Pat. 13,711, June 5, 1914.

THE paper or other material on which a coloured

print is desired, is provided with a multi-coloured layer of sensitised colloid. The colloid may be gelatin, fish glue, albumin, gum, starch, or a mixture of these and may be sensitised with silver salts or bichromate. The colloid is coloured, in regular or irregular patterns of dots or lines or both, with dyes which are fast to the colloid or can be mordanted, but which do not render it insoluble. Two methods may be used for applying the colloid, etc., to the support. The dyed colloid may be applied by means of an intaglio roller or similar device, a separate printing being required for each colour and very accurate registration being necessary ; or the colloid may be first applied as a uniform coating and then coloured by successive application of the various dyes ; by printing in crossed lines and dyeing the remaining spaces by treatment of the whole surface, the necessity of accurate registration is avoided. In either method the sensitiser, if silver salts, is applied with the colloid, but, if bichromate, may be added by subsequent soaking. After exposure through a coloured negative the print is developed so as to remove the unexposed parts ; where bichromate has been used as sensitiser this is done by washing as in the carbon process ; where silver has been used the print is first developed and fixed in the usual way, then treated with bichromate or other suitable substance to bleach the silver image and harden the colloid in proportion to the amount of image, and finally washed from the back to remove the unexposed parts. A fineness of grain of about 200 to the inch is recommended.—B. V. S.

XXII.—EXPLOSIVES ; MATCHES.

Theory of nitrating mixtures in its application to the nitro-derivatives of naphthalene. Saposhnikov. See III.

PATENTS.

Explosive substances. Explosives [; Stabilisers for —]. H. Stoltzenberg, Breslau, Germany. Eng. Pats. (A) 5736 and (B) 5737, Mar. 6, 1914.

(A) EXPLOSIVES detonating when heated or under percussion are obtained by causing betaine to combine with acids rich in oxygen such as nitrous, nitric, chromic, chloric, perchloric, or permanganic acids. For example by evaporating betaine with permanganic acid a crystalline compound, Bet. HMnO_4 , is obtained, which is soluble in water and detonates at 120°C. or under percussion. (B) Betaine or compounds of betaine are incorporated with explosives to increase the stability by combining with liberated oxides of nitrogen to form addition compounds, which may be heated above their melting point without decomposing. Examples of such nitrate explosives are:—Amikronite, containing nitroglycerin, 25 ; betaine nitrate, 36 ; wheat flour, 38.5 ; and betaine, 0.5%. Sommiol, containing ammonium nitrate, 94 ; rosin, 3 ; and betaine, 3%.—C. A. M.

Explosives suitable for use in firearms. W. Macnab, London, and B. J. Flürscheim, Fleet. Eng. Pat. 24,702 of 1913, date of appl., May 29, 1914.

A POLYNITRO derivative of an aromatic amine, containing at least 4 nitro groups, is mixed with a non-explosive colloid (gelatin, rubber, kauri gum) or with a nitrate (barium nitrate, urea nitrate) or nitro-guanidine, or mixtures of one or more of these in approximately specified proportions. Examples:—(1) Tetranitro-aniline, 90 ; gelatin, 10 parts. (2) Tetranitro-aniline, 70 to 80 ; urea nitrate, 25 to 15 ; india-rubber, 5 parts. (3) Tetranitro-aniline, 85 to 90 ; barium nitrate, 10 to 5 ; and kauri gum, 5 parts.—C. A. M.

Explosives. G. Spica, Venice. Eng. Pat. 44,004, June 10, 1914.

SEE FR. Pat. 473,261 of 1914: this J., 1915, 576.

Oleaginous filling and absorbent material for use in the manufacture of linoleum and the like and dynamite. Eng. Pat. 17,413. See XIII.

XXIII.—ANALYTICAL PROCESSES.

High temperatures: Estimation of — by the method of colour identity. C. C. Paterson and B. P. Dudding. Nat. Phys. Lab. Phil. Mag., 1915, 30, 34—63.

A PRELIMINARY note is given of a method by which the "true" as distinguished from the "black body" temperatures of incandescent substances, such as metal or carbon, radiating in the open, were obtained with fair accuracy (1—2%) which, in the authors' opinion, will be increased as the result of further investigation. In this method, by which the correct result for melting platinum was obtained, the total luminous radiation (white light) from a black body is made identical in colour with that from the substance under examination, by adjusting the temperature of the former until colour identity is obtained in the field of a Lummer-Brodhun photometer. Consideration of the principal factors and limitations of the method showed that accurate results were obtainable so long as the bodies employed acted as "grey" bodies throughout the visible spectrum. Formulae were deduced, connecting the temperatures of carbon and tungsten filaments with their respective lumens per watt, and found to hold good from the lowest to the highest values of the latter; and with ordinary incandescence lamps the method was found to be practically independent of the cooling at the ends of the filaments. The colour of the radiation from melting platinum was found to be the same as that from a carbon filament lamp operating at 2.6 lumens per watt, or 4.7 watts per mean spherical candle, or approximately 3.8 watts per mean horizontal candle.—W. E. F. P.

Collodion membranes: Use of — for ultra-filtration and pressure dialysis. G. S. Walpole. Biochem. J., 1915, 9, 284—297.

CYLINDRICAL bags of collodion are made by pouring an alcohol-ether collodion solution into test-tubes. After evaporation of the solvent, the tube is immersed in water for a time, and then the collodion lining can be easily removed; it should be stored under water. Such membranes can be used for the filtration of tetanus and diphtheria toxins, but they lack uniformity and do not withstand pressures above 2 atm. Flat membranes can be made with remarkable uniformity by pouring the collodion solution on to a levelled glass plate, and removing the film under water. Films made to a standard pattern were found to retain quantitatively all the antigens experimented with; they filtered rapidly and were highly permeable to salts and water. They may be used in the construction of a continuous apparatus, e.g., a filter press for the filtration and pressure dialysis of toxins (see page 816).—E. H. T.

Tungsten and tungsten-chromium compounds. [Determination of tungsten.] V. K. Kantschev. J. Russ. Phys. Chem. Soc., 1914, 46, 729—742. J. Chem. Soc., 1915, 108, ii., 349—350.

The following method of estimating tungsten gives exact results, and is far more rapid than that given by von Knorre (this J., 1905, 292). Excess of colourless benzidine hydrochloride solution is added to a hot solution of the tungstic compound, and the precipitate formed filtered off and washed

with a small quantity of water. The filter and precipitate are mixed with water in an Erlenmeyer flask, and titrated at 60° C. with *N*/10 sodium hydroxide solution in presence of phenolphthalein, the contents of the flask being boiled when the end-point is approached in order to prevent the action of atmospheric carbon dioxide on the indicator. Since the benzidine tungstate is readily hydrolysed, the result of the titration gives the total tungstic acid.

Bromine and chlorine: Determination of — in organic compounds. P. W. Robertson. Chem. Soc. Trans., 1915, 107, 902—907.

ORGANIC substances containing bromine or chlorine give up the halogen completely in a volatile form when heated with a mixture of chromic and sulphuric acids, bromine and hydrobromic acid being formed in the first, and chlorine, hydrochloric acid, and chromyl chloride in the second case. Sufficient of the substance to give halogen equivalent to about 9 c.c. of *N*/10 silver nitrate is weighed into a flask of about 70 c.c. capacity with a ground glass stopper fitted with inlet and exit tubes, 4 to 6 grms. of chromic acid is added, and the exit tube connected to a Pégot absorption tube containing 10 c.c. of 10% sodium hydroxide solution and 10 c.c. of hydrogen peroxide solution, to which is connected a second absorption tube containing sodium hydroxide solution, 25 to 30 c.c. of sulphuric acid is added through the inlet tube and a slow current of dry air passed through. The flask is gradually heated after the initial reaction is over, the reaction being completed in 45 to 60 minutes. The contents of the absorption tubes are then acidified with nitric acid, 10 c.c. of *N*/10 silver nitrate added, and the excess titrated with standard thioeyanate. If chlorine is present, the chromate formed is decomposed by heating the alkaline peroxide solution to boiling before acidifying, and the silver chloride is filtered off before titrating. To obtain accurate results the standard solutions must be standardised by making a blank experiment with potassium bromide. With certain bromo-hydrocarbons some of the substance sublimes unchanged from the reaction vessel. This source of error is obviated by placing a short tube containing platinised asbestos between the reaction vessel and the absorption vessel and burning the volatile matter in a stream of oxygen. The results of analyses of a number of organic halogen compounds are tabulated and indicate that the method is capable of giving very accurate results. The method is not applicable to the determination of iodine.—T. C.

Emergent stem correction for thermometers in cresosote oil distillation flasks. See III.

Modified reduction method for the volumetric determination of nitro-compounds. Berry and Colwell. See III.

Acidimetric determination of picric acid, and the interatomic change of the indicator, methyl-red. Minovici and Kollo. See III.

Colorimetric determination of phosphoric acid. Riegler. See VII.

Determination of copper in commercial copper sulphate. Incze. See VII.

Determination of copper in commercial copper sulphate (containing iron). Von Wissell and Küssert. See VII.

Action of ammonium bromide on metallic iodides. Guareschi. See VII.

- Determination of hydrogen phosphide.* Reckleben. See VII.
- Diffusion and absorption of hydrogen in quartz glass.* Wüstner. See VIII.
- Chemical analysis of soils.* (1) Von Sigmond. (2) Mitscherlich. See XVI.
- Action of normal and basic lead acetate on sugars, and Kubner's test for dextrose and lactose.* Rogerson. See XVII.
- Determination of methyl alcohol in presence of ethyl alcohol.* Wilks. See XVIII.
- Detection of methyl alcohol in alcoholic beverages.* Takahashi. See XVIII.
- Determination of the degree of homogenisation of milk.* Von Sobbe. See XIXa.
- Tests for hashish.* Beam. See XX.
- Detection and concentration of antigens by ultra-filtration, pressure-dialysis, etc., with special reference to diphtheria and tetanus toxins.* Glenny and Walpole. See XX.
- Examination of official copaiba balsam.* Deussen. See XX.
- Detection of cinnamic acid.* Schenk and Burmeister. See XX.

PATENT.

- Quantitative analysis of gaseous mixtures; Means for use in the —.* Siemens Bros. and Co., Ltd., London. From Siemens und Halske A.-G., Nonnendamm, Germany. Eng. Pat. 6767, Mar. 17, 1914. Addition to Eng. Pat. 28,943, Dec. 16, 1912.

SEE Ger. Pat. 278,676 of 1913; this J., 1915, 380.

Trade Report.

Allied Government contracts. Board of Trade, July 19, 1915.

THE Board of Trade announces that applications for permission to export to Allied countries goods of which the export is prohibited by Proclamation will receive special consideration if it can be clearly shown that the goods are destined for the use, directly or indirectly, of the Allied Government concerned or its military or naval forces. Such applications must be made to the Secretary, Commission Internationale de Ravitaillement, India House, Kingsway, W.C. The Commission will not recognise as evidence of the official destination of the goods, documents issued by provincial military or naval officers, other local authorities, or Government contractors in the country to which the goods are to be exported, unless such documents are formally approved in writing by the competent Department of the Government concerned.

Applications for permission to export goods which are ordered by firms or individuals in an Allied country for purely industrial purposes, and which are not destined for the use of an Allied Government or its military or naval forces should be made in the ordinary manner to the Secretary, War Trade Department, 4, Central Buildings, Westminster, S.W.

Book Received.

PRACTICAL WHITE SUGAR MANUFACTURE. By H. C. PRINSEN GEERLIGS, Ph.D. Norman Rodger, St. Dunstan's Hill, London, E.C. 184 pages. 10½ × 6½ in. Price 12s.

THIS volume supplements the author's previous

work on "Cane Sugar and its Manufacture." for it deals with those operations in the sugar factory which determine the colour and purity of the finished product, namely, the clarification of the juice and syrup; boiling, curing, and finishing the white sugar; materials required in the manufacture of same. Well known processes of clarification are described in order to omit nothing essential, but the more recent methods of clarification are fully described. The latter include interesting modifications of the double carbonation process devised by Battelle and Weinrich, the Norit process, and others. The choice of a method might seem difficult in view of the numerous processes described, yet is mainly decided by local circumstances. If the factory is to produce white sugar permanently, the transparency of the juice and syrup is of even greater importance than their colour, so that a filtration system of clarification should be adopted, the choice lying between single and double carbonation. On the other hand, if both white and raw sugars must be produced from time to time, it is desirable that the apparatus for clarification should be applicable in both cases. Complete filtration of the juice must now be abandoned and the usual defecation with lime when producing raw sugar must be supplemented by a powerful bleaching action when white sugar is to be made. In either case, the purification of the juice due to the removal of non-sugars is of minor importance. The author expresses a much more favourable opinion of single carbonation than in his earlier work, for he now regards single carbonation as advisable in factories definitely intended for white sugar manufacture, although the more costly double carbonation is the ideal method for white sugar.

The advantages and disadvantages of the different systems of clarification are described, and a chapter is devoted to the comparative costs. The daily working expenses depend on the cost of the necessary chemicals in different countries, also on the number and pay of the workmen, all of which are variable factors. The quantities of materials required for treating juice from 1000 tons of cane by the different systems, are stated so that the working cost may be easily calculated in any given locality. This is illustrated by an example from a Java factory indicating the cost of materials and labour when producing white sugar by two alternative methods, viz., by sulphitation and by double carbonation.

Part II. deals with the vacuum pan, crystallisers, and centrifugals when treating syrup intended for white sugar. This section includes outline schemes for producing one grade only, or different grades of white sugar, and calculations of capacities of vacuum pans and crystallisers in each scheme.

Part III. deals with the composition of the materials required for white sugar production and methods of analysing same.

The manufacture of pure white sugar direct from the cane is the result of much patient work in the factory and the laboratory. Dr. Geerligs has here reduced it to a simple mathematical formula. He clearly indicates that the technique of white sugar manufacture is daily progressing, but his comprehensive survey of past and present methods and appliances forms a valuable and very practical guide to our Colonial sugar producers and their chemists. The work should also interest chemists in allied industries and commercial men connected with the sugar market. The publisher has done his part in producing this volume, which is well illustrated and indexed.

T. H. P. H.

Journal of the Society of Chemical Industry.

No. 15, Vol. XXXIV.

AUGUST 16, 1915.

No. 15, Vol. XXXIV.

Official Notice.

NEW CLASSIFICATION OF THE MEMBERS OF THE SOCIETY.

(See this Journal, July 31st, 1915, 745).

Out of 2500 possible replies to the Council's Classification circular, already 1500 have been received. The information furnished will be of the greatest service. The President cordially thanks those members who have so promptly responded to his request, and asks those who have not yet sent in their cards, to post them without delay, so that the work of sorting and classification may be commenced.

Canadian Section.

Meeting held at Toronto, on Friday, 26th February, 1915.

PROF. J. W. BAIN IN THE CHAIR.

BAKING QUALITIES OF FLOURS FROM GRADES OF WHEAT FROM THE CANADIAN WESTERN PROVINCES.

BY PROF. R. HARCOURT.

Practically all the wheat grown in Western Canada is sold on the basis of its "grade." The

Canada Grain Act divides grain into five general classes, which it names: "No grade," "condemned," "rejected," "commercial grade," and "statutory grade." Parliament has defined four grades of western spring wheat, viz., No. 1, hard, and Nos. 1, 2, and 3, Northern, whilst the Standards Board has also defined three grades, Nos. 4, 5, and 6, Northern. Wheat of any of the six grades of Northern may fall under the general categories of "no grade," "condemned," or "rejected."

For some years the author has milled the wheats on a small experimental mill and made comparative baking tests of the flours produced. The quantity of wheat milled does not afford a good basis to determine the yield of flour which the wheat is capable of producing, consequently no figures are given on this important aspect of the subject. The baking tests were made under conditions as uniform as possible. Each loaf was made from 340 grms. of flour. The quality of the bread is expressed by allowing 100 marks each for colour, texture, and appearance of the bread from the highest grade of wheat in each series, and then giving the others a higher mark in proportion as they were better than the standard, or lower if poorer in quality. The following are the results for the crops of four different years. While the results of only one test are given, many others were made and these are representative figures.

In most cases No. 4 Northern is as low a quality as it will be profitable to mill. The amount of wheat grading No. 1 is becoming less and less and from a practical point is not an important grade. Indeed during some years we were unable to procure a sample. In the case of the 1911 crop the highest grade, No. 1 Northern, did not give as strong a flour as Nos. 2, 3, and 4 Northern. This was well recognised in the trade. Why it was so much poorer than lower grades is not evident, but it was a larger and plumper berry and apparently more starchy. The summer of 1912 was a very wet one; even through the harvesting and threshing season there was much rain and some wheat was graded tough. The excessive volume of the loaf from No. 4 Northern

Results of baking tests made with flour from the various grades of wheat of four different years.

Name.	Wet gluten, %	Water absorp- tion, %.	Weight of loaf.	Size of loaf.	Quality of bread.		
					Colour.	Texture.	Appearance.
Cargo.			(Crop 1911)				
No. 1 Northern ..	37.53	67.6	505	2580	100.0	100.0	100.0
" 2 " ..	38.17	69.4	507	2980	103.0	105.0	105.0
" 3 " ..	42.33	67.1	500	2990	103.0	102.0	104.0
" 4 " ..	38.33	73.7	518	2920	104.0	104.0	104.0
" 5 " ..	37.40	77.0	535	2600	96.0	99.0	103.0
" 6 " ..	35.97	77.1	538	2140	92.0	90.0	90.0
			(Crop 1912)				
No. 1 Hard	41.03	65.8	502	2780	100.0	100.0	100.0
" 1 Northern ..	41.23	70.6	523	2850	100.0	100.0	100.0
" 2 " ..	43.80	73.7	527	2900	100.0	99.5	101.0
" 3 " ..	40.40	73.7	529	2750	95.0	98.0	94.0
" 4 " ..	41.45	72.3	519	3030	98.0	101.0	105.0
			(Crop 1913)				
No. 1 Hard	36.20	70.0	517	2670	100.0	100.0	100.0
" 1 Northern ..	38.30	69.4	522	2620	99.5	90.0	100.0
" 2 " ..	36.45	69.4	523	2620	99.0	98.0	98.0
" 3 " ..	36.70	73.2	525	2580	99.0	97.0	97.0
" 4 " ..	37.30	72.3	523	2520	98.0	95.0	96.0
			(Crop 1914)				
No. 1 Northern ..	39.95	64.7	500	2900	100.0	100.0	100.0
" 2 " ..	43.35	63.2	504	2900	100.0	102.0	98.0
" 3 " ..	44.20	65.3	504	2900	99.0	97.0	99.0
" 4 " ..	40.20	69.4	522	2740	95.0	90.0	95.0
" 5 " ..	36.50	71.2	533	2310	90.0	80.0	80.0
" 6 " ..	40.0	74.1	536	2490	90.0	82.0	85.0

was characteristic of the crop. In 1913 and 1914 the quality of the flour appeared to fall off with the lower grades. In all these cases no attempt was made to determine the yield of flour. This is an important point and one which must be taken into consideration in arriving at any just valuation of the different grades of wheat.

Yorkshire Section.

ANALYSIS OF TANNING MATERIALS.

REPLY TO DR. CALLAN.

BY H. GARNER BENNETT, M.Sc.

In this Journal, 1915, p. 646, some criticism is offered by Dr. Callan as to the detannisation effected in the method of tannin analysis recently suggested by the writer (this J., 1914, 1182).

In testing for complete detannisation Callan uses the metaphosphoric salt and gelatin test devised by Stiasny, and states that this "will not show 150 mgms. of gallic acid in 50 c.c., which is about the maximum amount of gallic acid likely to be present in a detannised solution even after concentrating to half its volume." Both points involved in this statement may be seriously questioned.

1. The writer finds that a 0.3% solution of gallic acid (*i.e.*, 150 mgms. for 50 c.c.) gives a distinct turbidity with Stiasny's test, indicating the apparent presence of tannin. A solution of gallic acid any stronger than this, *e.g.*, a 0.5% solution, will give a very decidedly positive result with Stiasny's test, which is useless therefore for distinguishing tannin from gallic acid in such solutions. Indeed, Stiasny himself has, in correspondence with the writer, repudiated his own test as "unreliable in the presence of gallic acid." Further, tests with solutions of catechin (the typical non-tannin of the catechol tans) have shown that Stiasny's test is even more unreliable in the presence of catechin than in the presence of gallic acid, decidedly positive results being obtained in solutions containing less than 0.3% catechin.

2. It is by no means certain that the gallic acid (or catechin) in non-tan filtrates never exceeds 0.3%. In the present official method of analysis the total non-tannins are such as frequently to

exceed this, especially in the cases of babla, lentisco, and gambier; and in the first and last of these the proportion of gallic acid and catechin respectively of the total non-tannins is known to be very large, and may easily exceed 0.3% in the non-tan filtrates. Further, in the author's method of analysis, although the dilution is greater, the proportion of non-tans absorbed by the hide powder is also much less, so that in this case also the percentage of astringent non-tans may easily reach the point at which positive results are obtained with Stiasny's test. In the author's method the non-tannins estimated are often more than double the amount estimated in the present official method. Again, if these non-tan filtrates are to be concentrated to half their volume before the test is applied, there is no doubt whatever that 0.3% solutions of gallic acid and of catechin will be obtained with many materials.

3. It seems to the writer that the official test for detannisation with a 1% gelatin 10% salt solution is sufficiently delicate for its purpose. It will detect one part in 100,000 parts water of gallo-tannic acid, which tannin is fairly typical of the commercially important pyrogallol group. Even with the extra dilution proposed by the writer this test involves a maximum error of about 0.1%. An error of this order is negligible compared with the errors of up to 12.0% which are avoided by the author's method of analysis. Well may Dr. Callan conclude concerning this method that "in all probability the gain in accuracy owing to the reduced absorption of non-tans is more than the error introduced by the non-absorption of traces of tannin." This is particularly true when the latter error has not yet been demonstrated. When errors of up to 12.0% can be shown with a maximum experimental error of 0.1%, the search for a more stringent test for tan seems to border upon the absurd. All the tests for tan yet devised, more delicate than the gelatin-salt test, have been found to give a positive result also with the astringent non-tans, which fact condemns them in testing for complete detannisation.

4. In the same paper Callan records experiments with the author's method and German hide powder. It seems futile to combine a method devised to reduce the absorption of non-tans, with a hide powder calculated to increase such absorption. The strong affinity of German hide powder for non-tannins has been so often proved and is so generally known, that its use with any method of analysis is now thoroughly discredited.

Journal and Patent Literature.

PATENT SPECIFICATIONS may be obtained by post by remitting as follows:—

English.—6d. each, to the Comptroller of the Patent Office, Southampton Buildings, Chancery Lane, London, W.C.

United States.—1s. each, to the Secretary of the Society.

French.—1 fr. 05 c. each as follows: Patents dated 1902 to 1907 inclusive, Belin et Cie., Rue Ferou 8, Paris, (6e); Patents from 1908 to date, L'Imprimerie Nationale, 87, Rue Vieille du Temple, Paris.

I.—GENERAL; PLANT; MACHINERY.

PATENTS.

Catalytic reactions and catalytic agents for use therein. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen, Germany. Eng. Pat. 8462, April 3, 1914.

A COMPLEX, insoluble compound containing one or more easily replaceable bases, *e.g.*, an artificial silicate such as sodium aluminate-silicate ("Permunit"), is treated with a salt of a catalytic metal such as palladium, nickel, copper, zinc, or vanadium, and the salt reduced with hydrogen. The catalytic agents thus produced may be used

for the hardening of oils, the hydrogenation or dehydrogenation of organic compounds, etc. A contact mass containing a vanadium salt, prepared in this way, may be used to produce sulphuric anhydride.—W. F. F.

Catalyzer containing silicon and process for making the same. N. Sulzberger, New York. U.S. Pat. 1,143,332, June 15, 1915. Date of appl. Feb. 25, 1914.

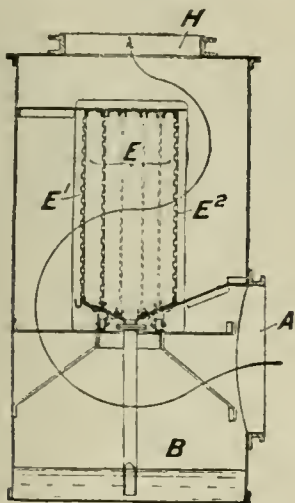
A SILICATE of a catalytic metal (such as nickel silicate) is reduced by means of a reducing agent (such as hydrogen) free from anti-catalytic material.—W. N. B.

Evaporators. J. F. P. Kestner, Lille, France. Eng. Pat. 12,124, May 16, 1914.

A VERTICAL tube evaporator of the climbing film type is combined with a double-chamber separator, in such manner that the upper ends of the vertical tubes of the evaporator are at all times above the highest level of the liquid in the separator. Two evaporators may be combined with one separator, and valves are provided so that the liquid being evaporated may circulate through one or both of the evaporators and one or both of the chambers of the separator.—W. H. C.

Separating liquids from gases and vapours; Apparatus for —. H. E. Theisen, Munich, Germany. Eng. Pat. 5905, March 9, 1914. Under Int. Conv., Jan. 2, 1914.

THE gas enters the cylindrical apparatus through A, and deposits most of the liquid during its passage through the large "rest chamber," B.



It then follows an S-shaped path and passes through nozzle-like perforations in the baffle-plates, E. The latter are fixed between the plates, E¹, E², the whole forming a chamber, which can be withdrawn through an opening at the side of the outer casing. The gas escapes through the upper opening, H.—W. H. C.

Filters. E. G. Adlam, Bristol. Eng. Pat. 2323, Feb. 13, 1915.

CIRCULAR blocks of compressed pulp arranged in layers are separated by plates having circular corrugations; the plates carry outer cylindrical portions which unite to form the casing, and inner cylindrical tubes which form a discontinuous central passage. Liquid entering by the annular space between the casing and the blocks passes radially inwards over the corrugated plates, from which it is directed by baffles on to the filter blocks, the filtered liquid passing from the blocks into the central passage.—W. F. F.

Filters. E. A. Andrews, Birmingham, and A. E. Owen, Darlaston, Staffs. Eng. Pat. 18,096, July 31, 1914.

THE filtering medium is carried in a circular tray divided into radial compartments and having a wire gauze bottom. The tray is rotated over a system of stationary jets through which water is delivered in order to clean the filtering medium.

—W. F. F.

Crushing and fine grinding of hard substances; Process and apparatus for effecting the preliminary —. E. C. R. Marks, London. From P. Kretzmann, Hankow, China. Eng. Pat. 6601, March 16, 1914.

A CURRENT of air is used to separate the fine from the coarse particles as they leave the preliminary coarse-grinding apparatus. The finer particles are carried forward by the current of air into the fine-grinding mill and the coarser ones are returned to the preliminary coarse-grinding apparatus.—W. H. C.

Mixing, stirring, or agitating apparatus. A. E. and E. S. Allen, Liverpool. Eng. Pat. 15,304, June 26, 1914.

A RECEPTACLE, hemispherical in its lower part, is provided with a horizontal rotating shaft passing through the centre of the sphere, and carrying stirrers or beaters, so shaped that they sweep practically the whole of the spherical surface.

—W. F. F.

Stirring, mixing and aerating liquids, powders and grains, and dissolving or lixiviating powdery, granular, fibrous and the like substances. W. Janensch, Charlottenburg, Germany. Eng. Pat. 14,340, June 15, 1914.

BY means of intermittent impulses a current of air, with or without liquid, is forced into or sucked through a tube ending near the bottom of a vessel containing the liquid and other materials, etc., to be mixed.—W. F. F.

Inflammable liquids; Method and apparatus for storing and delivering —. H. Hoffmann Apparatebau-Ges. m. b. H., Frankfort, Germany. Eng. Pat. 12,328, May 19, 1914. Under Int. Conv., May 19, 1913.

THE air which enters the storage vessel to replace the liquid withdrawn, is caused to bubble through a small chamber filled with the inflammable liquid, whereby it becomes saturated with the vapour to such a degree that a non-explosive mixture is formed. When the storage vessel is being filled with inflammable liquid, the air which is expelled, escapes without passing through the saturator.

—W. H. C.

Combustible gases and vapours; Handling and treating —. W. M. Grosvenor, Ridgewood, N.J. U.S. Pat. 1,143,623, June 22, 1915. Date of appl., June 27, 1911.

TO recover the solvent vapour evolved from material in drying operations, the process is carried out in two stages; in the first the proportion of vapour in the medium surrounding the material is kept above the upper explosive limit, and in the second it is kept below the lower limit.—W. F. F.

Saturating apparatus; Cracker-pipe for [treating gases with liquids in] —. F. Tschudy, Birmingham, Alabama. U.S. Pat. 1,135,472, April 13, 1915. Date of appl., Sept. 21, 1914.

A CIRCULAR hood surrounds a central gas supply pipe, so as to form two series of chambers which are open below and separated from each other by radial walls. The lower edges of walls and hood are serrated, and the two series of chambers are alternately open to the axial centre, but closed at the periphery, and *vice versa*, in such manner that the gases to be treated are subjected to a double scrubbing action by passing from one series of chambers, under the radial walls (the primary cracker pipe), into the second series, and thence out, under the lower edge of the hood (the secondary cracker pipe), and upwards through the treating liquid in the saturator.—F. SODN.

Grinding and disintegrating mills. J. Woltersdorf, Arnstadt, Germany. Eng. Pat. 8364, April 2, 1914.
SEE Fr. Pat. 471,661 of 1914; this J., 1915, 410.

Dust from exhaust gases; Apparatus for removing —. F. Valeur, Gmunden, Austria. Eng. Pat. 7683, March 26, 1914.

SEE U.S. Pat. 1,113,848 of 1914; this J., 1914, 1081.

Gases; Apparatus for washing —. J. Armstrong, London. U.S. Pat. 1,143,162, June 15, 1915. Date of appl., Jan. 8, 1913.

SEE Eng. Pat. 821 of 1912; this J., 1913, 184.

Drying and heating apparatus. T., A., T., and F. Coleman, Derby. U.S. Pat. 1,144,640, June 29, 1915. Date of appl., June 11, 1914.

SEE Eng. Pat. 3103 of 1914; this J., 1914, 1192.

IIA.—FUEL; GAS; MINERAL OILS AND WAXES.

Methane; Detection of —. II. O. Hauser and H. Herzfeld. Ber., 1915, 48, 895—896.

METHANE is oxidised with ozone to formaldehyde, which is detected by means of the violet colour developed with Mannich's morphine-sulphuric acid reagent; 0.02 gm. of methane may thus be rapidly detected. The gas to be tested is passed into the anode exit tube of an H-shaped cell with platinum foil electrodes, in which dilute sulphuric acid is being electrolysed with a current of about 2½ amps. The anode of thin sheet platinum is fused longitudinally into one vertical limb of the cell, so that one half of the electrode protrudes and may be cooled by immersing the vessel in ice-water; decomposition of the ozone is thus retarded. The formaldehyde is absorbed in moist glass-wool contained in a bulb-adaptor.—J. R.

Petroleum residuums; Temperature coefficient of expansion of —. H. Rossbacher. J. Ind. Eng. Chem., 1915, 7, 577—578.

THE temperature coefficient of expansion of a petroleum residuum is determined as follows:—The sp. gr. of the sample is first determined in a Hubbard pycnometer (this J., 1911, 201). The pycnometer is then filled with the sample, warmed sufficiently to allow the stopper to be seated, and suspended in a glycerin bath with the top of the stopper projecting just above the level of the bath. The bath is heated slowly through the desired temperature range, and the oil which exudes through the capillary opening in the stopper is removed by wiping. When equilibrium is attained at the higher limit of temperature the pycnometer is wiped clean and weighed. From the data obtained, the coefficient of expansion of the sample can be calculated; the coefficient of cubical expansion of the pycnometer is assumed to be 0.0000156 per 1° F. For a sample of "stanolite" the coefficients per 1° F. found for different temperature ranges were: 60°—212° F., 0.000364; 77°—212° F., 0.000337; 60°—264° F., 0.000378; 77°—264° F., 0.000343. A sample of Mexican residuum of sp. gr. 1.0104 at 77°/77° F. gave the coefficient 0.00032 for the range 77°—160° F.—A. S.

Petroleum distillates; Relations among the physical constants of —. W. F. Rittman and G. Egloff. J. Ind. Eng. Chem., 1915, 7, 578—582.

THE authors determined the distillation range of ve samples of crude oil from California, five from Oklahoma, four from Pennsylvania, two from Oussia, and one from Mexico; the sp. gr., refractive index, viscosity, surface tension, and capillary

constant of the oils and of the distillation fractions, and the molecular weight (by the cryoscopic method with benzene) and carbon and hydrogen content of the fractions were also determined. It is concluded from the results that for the purpose of identifying the type of oil, the results of the distillation test and the sp. gr. are the most important factors. When only small quantities of material are available the sp. gr. determination may be replaced by determination of the refractive index, which varies in the same way as the sp. gr. Determinations of surface tension and of molecular weight by the cryoscopic method appear to be of little value.—A. S.

Petroleum hydrocarbons; Pressure distillation of —. A. P. Bjerregaard. J. Ind. Eng. Chem., 1915, 7, 573—577.

THE apparatus used consisted of a coil of iron pipe, 63 ft. long, in five lengths, 0.6 in. inside diameter and 0.36 in. thick. It was heated in a furnace by means of gas burners, and fitted with a pressure valve. Experiments were made with crude oils and with kerosenes at pressures ranging from 275 to 1400 lb. per sq. in. and temperatures of from 340° to 440° C. The distillation products passed from the coil to a separator in which a pressure of 20—30 lb. per sq. in. was maintained; the tar was run off from the lower part of the separator, and the lighter products passed to a condenser. When the rate of oil feed was 12.25 galls. per hour, no low-boiling products (b. pt. up to 220° C.) were obtained. The yield of low-boiling oils was much greater with a rate of feed of 3.7 galls. per hour than with a rate of 11.5 galls. per hour, and at the lower rate the yield was practically independent of the pressure and of the kind of oil; the tar from one experiment, when again passed through the apparatus, gave about the same yield of low-boiling products as the original oil under similar conditions. At the higher rate of feed, somewhat better yields of low-boiling products were obtained at higher pressures. The best yields of low-boiling oils (b. pt. up to 220° C.) from crude oils were 40.3% at a pressure of 275 lb. per sq. in., and 350° C., and 42.3% at 1000 lb. per sq. in. and 395° C.; the rate of oil feed was 3.7 galls. per hour in both cases. A dense deposit of carbonaceous matter formed in the coil, and the iron became brittle. The low-boiling oils behaved normally when submitted to the ordinary gasoline distillation process with live steam. They contained a considerable proportion of olefines, but no aromatic hydrocarbons could be detected.—A. S.

Hydrogenation of ethylene by means of colloidal platinum. Paal and Schwarz. See XX.

PATENTS.

Fuel; Artificial or block —. H. Faraday, Irlams-o'-th'-Height, Lancs. Eng. Pat. 19,495, Sept. 7, 1914.

GROUND maize (2 parts), powdered sodium chloride (5 to 6 parts), and powdered bituminous coal (up to 100 parts), or bituminous coal (15 parts) and powdered anthracite (to make up 100 parts), are steamed, mechanically mixed, and pressed or moulded into blocks.—C. A. M.

Gas; Utilising smoke box refuse or boiler char for the generation of — and applying the gas so produced for raising steam in locomotive boilers. J. S. Bean and H. Nash, Crewe. Eng. Pats. 14,618, June 18, and 23,516, Dec. 4, 1914.

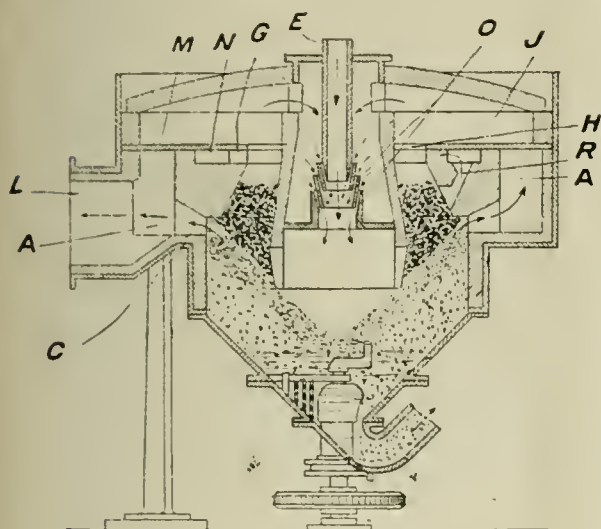
THE refuse is carried by a conveyor direct from the locomotive to a gas producer, and the gas is used for heating feed water, etc.—W. F. F.

Grates for gas generators. S. Barth, Düsseldorf-Obercassel, Germany. Eng. Pat. 24,356, Oct. 27, 1913.

THE liquid-seal trough and grate mounted thereon, are rotated by pawl and ratchet mechanism. The grate is provided with rollers which run on a sinuous cam track, so that the grate is oscillated from side to side during its rotation. Locking pawls are provided to prevent backward movement of the grate.—W. F. F.

Gas producers. B. Versen, Dortmund, Germany. Eng. Pat. 24,329, Oct. 27, 1913.

GAS-PRODUCERS of the type described in Eng. Pat. 16,610 of 1908 (this J., 1909, 972) are modified for use with highly bituminous fuel by disposing



the gas-receiving chamber nearer the combustion zone so that it is more strongly heated. Products of distillation pass through the annular chamber, *a*, to the gas-receiving space, *j*, of the producer, and then to the conical nozzle, *o*, where they meet the air entering by the pipe, *c*. The gas leaves by the pipe, *l*. The chamber, *j*, is strongly heated by the plate, *m*, behind which part of the hot gases circulate through the passages, *h*, *r*, annular channel, *n*, and passages, *g*, back to the chamber, *j*. —W. F. F.

Gas producer. P. G. Schmidt, Olympia, Wash. U.S. Pat. 1,142,914, June 15, 1915. Date of appl., Mar. 29, 1913, renewed May 6, 1915.

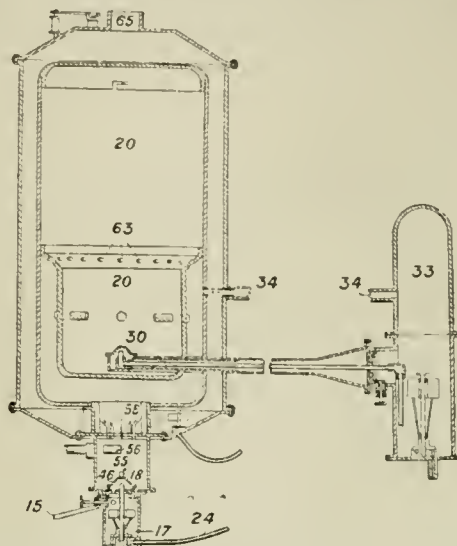
THE main air supply is admitted through the grate to a producer with rotating casing, auxiliary air being admitted through pipes terminating near the periphery in a plane between the top of the fuel and the lower end of a central depending gas collector. The air pipes are so shaped as to offer little resistance to the rotating fuel, and are braced together at their lower ends by an annular, water jacketed member.—W. F. F.

[Gas] retorts; Mouthpieces of —. R. Nübling, Stuttgart, Germany. Eng. Pat. 23,542, Dec. 4, 1914. Under Int. Conv., Jan 23, 1914.

THE mouthpiece and gas-discharge branch are provided with double walls, the annular space being packed with non-conducting material. —W. F. F.

Steam and products of combustion; Apparatus for producing a mixture of —. C. E. Johnson, Hobart, Tasmania. Eng. Pat. 13,770, June 6, 1914. Under Int. Conv., March 9, 1914.

LIQUID fuel is supplied under pressure through the pipe, 24, to the float chamber, 17, while air from a reservoir enters a circular chamber (not shown)



tangentially, part leaving at the periphery and entering the chamber, 18, by the pipe, 15, and part leaving at the centre and entering tangentially by the opening, 56. The mixture of air and fuel is sprayed from the nozzle, 46, ignited by the sparking device, 55, and burns while moving spirally in the chamber, 18. The burning gas passes the vertical baffles, 58, to the holes, 63, and thence to the mixing chamber, 20, where it meets a water spray from the nozzle, 30. The greater part of the mixed steam and combustion gases passes to the outlet, 65, part being led through the pipe, 34, to the chamber, 33, to spray the water from the nozzle, 30.—W. F. F.

Gaseous fuel; Apparatus for producing —. Process for producing gaseous fuel. F. M. Rites, Slaterville Springs, N.Y. (C. H. Gallagher, executor), Assignor to P. C. Rites, Ithaca, N.Y. U.S. Pats. (A) 1,144,788 and (B) 1,144,789, June 29, 1915. Dates of appl., Dec. 3, 1912, and Feb. 5, 1913.

(A) A combustion chamber is provided with a water jacket on all sides except the top, which forms the base of a vaporising chamber containing crude oil. Heavy oil from this chamber and steam from the jacket enter the combustion chamber, the products of partial combustion being then mixed with the lighter oil vapour from the vaporising chamber. (B) Crude oil is partially distilled, the residue is partially burnt to supply heat to the distillation chamber, and the ultimate residue is converted into gas.—W. F. F.

Deodorising waste gases. L. Haas, Vienna. U.S. Pat. 1,144,193, June 22, 1915. Date of appl., Aug. 23, 1910.

THE gases are forced through the spray and foam produced by beating a solution of soap.—W. F. F.

Petroleum; Process and apparatus for distilling —. J. W. van Dyke and W. M. Irish, Assignors to The Atlantic Refining Co., Philadelphia, Pa. U.S. Pat. 1,143,466, June 15, 1915. Date of appl., May 6, 1914.

PETROLEUM consisting mainly of hydrocarbons

with boiling points of about 600° F. (about 315° C.) or above, is distilled and the vapour is divided into numerous streams enclosed between heat-conducting walls. By means of currents of air or other gas, the vapours are cooled sufficiently to condense at least 25 % of the whole, the temperature of the vapours being kept above 212° F. (100° C.). The vapours pass upwards through the cooling passages, which are constricted at their outlets, and thus come in intimate contact with condensed liquid flowing downwards.—W. N. B.

Crude-oil preheater. P. Porges, Vienna. U.S. Pat. 1,144,780, June 29, 1915. Date of appl., Feb. 10, 1914.

THE apparatus consists of a horizontal, cylindrical vessel containing a system of horizontal return-pipes, for the circulation of distillate gases. The inlet ends of the pipes are connected to the vessel by means of a common inlet distributor, fixed to the longitudinal side of the cylinder; the other ends are connected with distributors which are adapted to move freely and provided with outlet pipes for the condensed products extending along the whole length of the vessel.—W. E. F. P.

Liquid hydrocarbons; Treatment of — for the production of lighter hydrocarbons. P. Sabatier and A. Mailhe, Toulouse, France. Eng. Pat. 16,791, July 14, 1914. Under Int. Conv., May 13, 1914.

LIQUID hydrocarbons (e.g. crude petroleum) are converted into volatile hydrocarbons boiling below 150° C. by passing them over a heated catalyst composed of finely divided metals, or metallic oxides (iron oxide) or salts capable of reduction to metals, mixed with a neutral refractory substance free from silica (magnesia, alumina, graphite) and an agglutinant free from silica (glue, dextrin, starch). When the catalyst becomes coated with a carbonaceous deposit it is regenerated by a current of steam, whereby a mixture of hydrogen, carbon dioxide, and carbon monoxide is produced. The resulting oxide may then be reduced to metal by the hydrocarbon vapours as a first stage in the process. The mixture of catalyst, etc., may be moulded into briquettes, etc., and dried.—C. A. M.

Heavy hydrocarbons; Process and apparatus for converting — into light hydrocarbons. P. Porges, S. Strausky, and H. Strache, Vienna. Eng. Pat. 11,420, May 8, 1911. Under Int. Conv., May 8, 1913.

A MIXTURE of the vaporised oil and steam is passed over a catalyst (iron oxide or oxide of another metal capable of forming several oxides), which is heated to 500° to 600° C. When the production of light hydrocarbons begins to diminish the catalyst is regenerated by heating it in a current of air or oxygen.—C. A. M.

Mineral oils; Conversion of higher boiling — into lower boiling products. Continental-Caoutchouc und Gutta-Percha Co., Hanover, Germany. Eng. Pat. 7112, March 20, 1914. Under Int. Conv., March 22, 1913.

HIGH-BOILING mineral oils are converted into low-boiling oils by the action of the products obtained from aluminium halides and hydrocarbons or halogen-alkyls as catalysts. The catalyst may be absorbed in a porous substance such as kieselguhr before use. The light oils are distilled off continuously at about 110° C. and the heavier portions flow back for further treatment.—W. F. F.

Paraffin candles and process of manufacturing same. E. C. R. Marks, London. From E. Burke, Manila, Philippine Islands. Eng. Pat. 14,975, June 23, 1914.

PARAFFIN wax is mixed with about 0.25 % of a

heavy metal salt of an organic acid, such as the lead salt of oleic, stearic, or palmitic acid.—W. F. F.

Peat; Getting or excavating —. T. Rigby, Dumfries, Assignor to Wetcarbonizing, Ltd., London. U.S. Pat. 1,144,249, June 21, 1915. Date of appl., May 11, 1912.

SEE Eng. Pat. 13,281 of 1911; this J., 1912, 631.

Briquetting of carbonised peat and the like. M. Ekenberg, Assignor to Wetcarbonizing, Ltd., London. U.S. Pat. 1,143,951, June 22, 1915. Date of Appl., June 5, 1909.

SEE Eng. Pat. 12,010 of 1909; this J., 1910, 1026.

Coke; Method for the preliminary cooling of incandescence —. W. Walch, Düsseldorf, Germany. Eng. Pat. 17,236, July 21, 1914. Under Int. Conv., Nov. 3, 1913.

SEE Ger. Pat. 275,436 of 1913; this J., 1914, 823.

[Gas] retorts; Method and apparatus for charging —. E. Heiderich, Zeebrugge, Germany. Eng. Pat. 7573, March 25, 1914.

SEE Fr. Pat. 470,216 of 1914; this J., 1915, 166.

Carbon monoxide from gas mixtures; Removal of — whilst using iron or steel vessels. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen, Germany. Eng. Pat. 8030, March 30, 1914.

SEE Ger. Pat. 282,505 of 1913; this J., 1915, 651.

Paraffin; Process of separating — from paraffin oil mixtures, or various paraffins from each other. H. Wade, London. From Triester Mineralöl-Raffinerie, Trieste, Austria. Eng. Pat. 7700, March 26, 1914.

SEE Ger. Pat. 262,153 of 1912; this J., 1913, 902.

Handling and treating combustible gases and vapours. U.S. Pat. 1,143,623. See I.

Cracker pipe for saturating apparatus. U.S. Pat. 1,135,472. See I.

Manufacture of aluminium chloride [from residues from the treatment of oils]. U.S. Pat. 1,144,304. See VII.

Process of producing hydrogen. U.S. Pat. 1,144,730. See VII.

Contrivance for automatically detecting [combustible] gases and vapours. U.S. Pat. 1,143,473. See XXIII.

II.B.—DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Pyroligneous acid; The indicator in —. J. M. Johlin. J. Ind. Eng. Chem., 1915, 7, 596.

No wine-red colour is produced at the neutral point when pure milk of lime is added to pyroligneous acid, but the characteristic colour is obtained when lime containing traces of ferric salts is used. The ethers of pyrogallol and its homologues give similar colour reactions with ferric salts, and it is probable that the so-called indicator present in pyroligneous acid consists of the volatile ethers of pyrogallol and its homologues.—A. S.

PATENTS.

Gas; Burning — for heating purposes. M. W. Pitner, Chicago, U.S.A. Eng. Pat. 12,154, May 16, 1914.

A MIXTURE of gas and air is passed through narrow

and widely separated slots in a thick diaphragm of high heat-conductivity and burnt, whereby the heat is conducted into the material from the edges of the slots so rapidly that flashing back does not occur. (Reference is directed, in pursuance of Sect. 7, Sub-sect. 4, of the Patents and Designs Act, 1907, to Eng. Pat. 25,829 of 1912.)—W. F. F.

Heat-producing compound. W. F. McNabb, Pittsburgh. U.S. Pat. 1,143,295, June 15, 1915. Date of appl., Oct. 23, 1911.

The mixture contains three parts of sodium hydroxide, and one each of potassium persulphate and oxalic acid, with or without the addition of aluminium.—B. N.

Incandescence filaments; Manufacturing —. R. H. Henderson, East Orange, N.J., Assignor to Westinghouse Lamp Co. U.S. Pat. 1,144,595, June 29, 1915. Date of appl., March 25, 1910.

MATERIAL for the filaments is moved longitudinally through a succession of independent sealed chambers, and subjected to different degrees of heat or other physical treatment whilst traversing certain chambers, and to suitable chemical treatment whilst passing through other chambers.

—B. N.

Electric lamps; Incandescent —. C. Gladitz, Westminster. Eng. Pat. 24,029, Oct. 23, 1913.

A METALLIC filament is enclosed in a bulb containing ammonia gas, the bulb being surrounded by a vacuum jacket.—W. F. F.

Electric incandescent lamps and other electric resistances; Wire filaments for —. W. H. Sabine, Portsmouth. Eng. Pat. 15,617, June 30, 1914.

TUNGSTEN or like wire filaments are twisted during manufacture, thereby increasing their electrical resistance.—W. F. F.

Peat; Utilisation of —. T. Rigby, Dumfries, Assignor to Wetcarbonizing, Ltd., London. U.S. Pat. 1,143,319, June 15, 1915. Date of appl., Jan. 23, 1915.

SEE Eng. Pat. 1676 of 1914; this J., 1915, 604.

Peat; Process for the utilisation of —. T. Rigby, Dumfries, and N. Testrup, London, Assignors to Wetcarbonizing, Ltd., London. U.S. Pat. 1,144,250, June 22, 1915. Date of appl., Nov. 23, 1912.

SEE Eng. Pat. 26,349 of 1911; this J., 1913, 353.

III.—TAR AND TAR PRODUCTS.

Nitro-derivatives of toluene and of benzene; Solubility in the solid state of some —. M. Giua. Gaz. Chim. Ital., 1915, 45, 1., 557—566.

SEVEN binary mixtures were examined, viz., α -(2,4,6-) and γ -(2,4,5-)trinitrotoluene, p -mononitrotoluene and 2,6-dinitrotoluene, p -mononitrotoluene and α -trinitrotoluene, α -trinitrotoluene and 1,3-dinitrobenzene, p -mononitrotoluene and 1,3-dinitrobenzene, 2,4-dinitrotoluene and 1,3-dinitrobenzene, and p -mononitrotoluene and diphenylamine. In the last three systems simple eutectic mixtures of the components were formed, but in the others there was evidence of the formation of addition compounds dissociated in the liquid state (see this J., 1914, 687), although only in the case of the system, α - and γ -trinitrotoluene, were the indications quite clear. The detailed results are tabulated and plotted in curves.—A. S.

Halogen compounds; Catalytic reduction of organic —. W. Borsche and G. Heimbürger. Ber., 1915, 48, 452—458.

REDUCTION of unsaturated organic halogen compounds with hydrogen in presence of colloidal palladium led to the formation of saturated halogen-free compounds. It was not found possible to arrest the reaction at the stage at which the ethylenic linkage had been reduced, the halogen remaining intact, as the two reactions apparently proceeded simultaneously. Thus methylenedioxy- ω -chlorostyrolene gave the methylene ether of ethylcatechol, and ω -bromostyrolene gave ethylbenzene. From saturated compounds chlorine was also smoothly removed, benzyl chloride giving toluene, benzal chloride toluene and a small quantity of stilbene dichloride, and benzotrichloride only toluene tetrachloride, $C_6H_5.CCl_2.CCl_2.C_6H_5$. —G. F. M.

Naphthalenemonosulphonic acids. O. N. Witt. Ber., 1915, 48, 713—772.

The statement, frequently found in the literature, that naphthalene- β -monosulphonic acid is not attacked by hydrochloric acid is incorrect, as this compound is gradually decomposed into naphthalene and sulphuric acid by dilute acids. On heating the α -acid with sulphuric acid it is rapidly decomposed, partly to the β -acid, and partly to naphthalene and sulphuric acid, which form the β -acid at a higher temperature. It follows that, although the β -acid is stable at 200° C., it is not possible to obtain complete conversion into β -acid by heating for a longer period; nor is this possible by using 100% sulphuric acid in place of the 93—94% acid generally used in slight excess, unchanged naphthalene remaining in each case. It has been usual to heat for 8—10 hours at 160—180° C. On addition of the sulphonation mixture to salt solution, the β -salt is precipitated fairly pure, containing at the most 5% of the α -salt. Separation of the two acids as the lead salts is complete after seven recrystallisations, but separation as the calcium salts is incomplete. In the usual process the sulphuric acid and naphthalene are mixed cold, giving the α -acid in the first stage of the reaction; the second stage is the hydrolysis of the α -acid, and hence a large excess of sulphuric acid must not be used, only 80 to 100%, at the highest 110%, of the naphthalene used. The author has devised a process in which the first stage is avoided and which has the further advantages that only very small amounts of by-products (dinaphthylsulphones) are obtained, and that an excess of sulphuric acid (160% of the naphthalene) may be used. Suitable amounts are 250 grms. of naphthalene and 400 grms. of sulphuric acid (93.7%), both of which should be as pure as possible; the presence of camphene in the former and of arsenic in the latter has a disturbing influence. The naphthalene is heated to 160° C., and the sulphuric acid added over a suitable period to keep the temperature constant (15 mins. for the above amounts). After heating for a further 5 mins., the mixture is poured into 2 litres of cold water, allowed to stand for 24 hours, and the dinaphthylsulphones filtered off. The β -acid is readily salted out by other acids, and if the filtrate is concentrated to a weight of 925 grms. of b.pt. 115° C., the α -acid present acts in this manner and the pure β -acid trihydrate of m.pt. 83° C. separates on cooling; 80 of the 85% of β -acid formed crystallises in this manner, more being obtained by cooling to 10° C. The β -acid so obtained is much purer than that obtained by pouring into salt solution. In case the dinaphthylsulphones formed (about 2 grms. with above amounts) are not to be separated, the sulphonation mixture is allowed to stand for a short time, and is

then poured into 300 c.c. of water, which give immediately the required concentration for crystallisation. The process is patented.—F. W. A.

Aminonaphthoic acids; The 1,2- and 2,1-.—P. Friedländer and S. Littner. Ber., 1915, 48, 328—333.

THE application to the naphthalene series of many quinoline, quinazoline, and indole syntheses in the benzene series is rendered difficult owing to the inaccessibility of the aminonaphthoic acids. Two of these have now been synthesised as follows:—1-Nitro-2-naphthylamine, on diazotisation and treatment with cuprous cyanide gave 1-nitro-2-naphthonitrile, m.pt. 138° C. This on reduction with iron filings and acetic acid was converted into the corresponding amino-compound, colourless needles, m.pt. 191°—192° C., which on hydrolysis with boiling alcoholic sodium ethoxide gave the sodium salt of the aminonaphthoic acid. The free acid forms small needles, m.pt. 205° C. (with decomp.). Its solutions have a blue fluorescence. 2-Amino-1-naphthoic acid was obtained by the oxidation of naphthistatin with lead peroxide. It forms colourless needles, m.pt. 126° C. (with decomp.). The carboxyl group in this acid is very loosely bound, a solution in hydrochloric acid losing carbon dioxide slowly even in the cold, and rapidly on warming.—G. F. M.

Benzoylanthraquinones. A. Schaarschmidt. Ber., 1915, 48, 831—839.

IN the condensation of 1- and of 2-anthraquinone-carboxylic acid chlorides with aromatic hydrocarbons by means of aluminium chloride, the 2-compound is more readily obtained, the 1-compound being produced in small yield and in an impure state. The benzoylanthraquinones (phthaloylbenzophenones) obtained are colourless. Benzoyl-1-anthraquinone, m.pt. 229° C., dissolves in alkaline hydrosulphite to a red solution. *p*-Tolyl-1-anthraquinone has m.pt. 200° C., and the 2-isomer has m.pt. 181°—182° C.—F. W. A.

Benzoyl-1-anthraquinones or phthaloyl-2,3-benzophenones; Coloured reduction products of.—A. Schaarschmidt. Ber., 1915, 48, 973—978.

WHEN 1 mol. of *p*-chlorobenzoyl-1-anthraquinone in cold, concentrated sulphuric acid is treated with aluminium equivalent to 1 atom of hydrogen, emerald-green needles slowly crystallise out, which are converted by water into a violet-blue substance, m. pt. 220°—222° C., of empirical formula $C_{21}H_{12}O_4Cl$; this is reconverted into the green compound by sulphuric acid stronger than 50%. The blue compound dissolves in inert organic solvents, giving unstable red solutions with a reddish fluorescence, but in solvents containing a hydroxy-, amino-, or carboxyl-group it gives a blue solution without fluorescence. The properties of the blue compound agree with those of a product, analogous to a pinacone, derived from the condensation and reduction of 2 mols. of *p*-chlorobenzoyl-1-anthraquinone, the green compound being the corresponding anhydro-derivative. Similar reduction products are obtainable from all benzoyl-1-anthraquinones but not from benzoyl-2-anthraquinones.—T. C.

Activation of chlorates by formic acid. [Oxidation of indigo, aniline, and anthracene.] Hofmann and Schumpelt. See VII.

Reaction for indole. Baudisch. See XIXB.

PATENTS.

1-Amino-7-naphthol; Manufacture of derivatives of.—J. Y. Johnson. London. From Badische Anilin und Soda Fabrik, Ludwigshafen, Germany. Eng. Pat. 8058 of 1915, date of appl. June 2, 1914.

HALOGENATED benzoyl-1-amino-7-naphthol con-

taining halogen only in the benzene ring are obtained by treating 1-amino-7-naphthol with a halogenated benzoyl chloride in presence or absence of sodium acetate or other compound capable of fixing hydrochloric acid. *o*-Chlorobenzoyl-1-amino-7-naphthol is specially claimed.—F. W. A.

Plastic and elastic material for tarring roads or other purposes; Process for the manufacture of a.—H. Jack. Berlin. Eng. Pat. 24,023, Oct. 23, 1913. Under Int. Conv., Oct. 28, 1912.

SEE Fr. Pat. 460,943 of 1913; this J., 1914, 18.

IV.—COLOURING MATTERS AND DYES.

Fisetin; A new synthesis of.—K. von Auwers and P. Pohl. Ber., 1915, 48, 85—90.

3,4'-DIMETHOXYBENZAL-5-METHOXY-CUMARANONE-2 (Ber., 1905, 38, 268, 3590) is converted, by treatment with chlorine in chloroform solution, into the corresponding dichloride. Boiling dilute, aqueous-alcoholic sodium hydroxide converts this into fisetin trimethyl ether, from which fisetin can be obtained by converting into the acetate and boiling for 4 hours with concentrated hydriodic acid. The yield of fisetin is very small.—T. C.

Osage orange, a substitute for fustic. F. W. Kressmann. J. Amer. Leather Chem. Assoc., 1915, 10, 347—351. (See this J., 1914, 544.)

ON wool mordanted with copper, chromium, or iron, Osage orange gives shades which are a little brighter and purer than fustic colours, and are equally fast to light and washing. Osage orange can replace fustic in all cases for leather dyeing.—F. C. T.

Orcinol; An oxidation product of.—F. Henrich, W. Schmidt, and F. Rossteutscher. Ber., 1915, 48, 483—489.

ALKALINE solutions of orcinol are readily oxidised by atmospheric oxygen, and the dark brown solutions on acidification deposit a brownish red crystalline substance, which when recrystallised from alcohol forms ruby red crystals, m.pt. 178°—181° C. This substance is a hydroxyquinone, derived from ditolyl, of the constitution, $(HO)_2(CH_3)_2C_6H_2 \cdot C_6H_4(O)_2(CH_3)_2(OH)_2$, since on reduction with sulphur dioxide it gives white crystals of a penta-hydroxyditolyl, m.pt. 254° C., a substance having all the properties of a hydroquinone, and being re-oxidised by bichromate to the original quinone. The quinone, moreover, forms a triacetyl-derivative, m.pt. 127° C., and its reduction product a penta-acetyl-derivative, white crystals, m.pt. 155° C.—G. F. M.

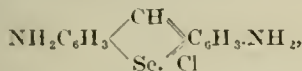
Aminoazo compounds; Salts of some.—L. Casale and M. Casale-Sacchi. Gaz. Chim. Ital., 1915, 45, 1, 490—501.

OF a number of aminoazo compounds examined, derived from α -naphthylamine, all formed stable salts with sulphuric acid, containing 1 mol. each of acid and base; two only of the compounds, viz., 4-*o*-tolylazo-1-naphthylamine and 4-*o*-nitrophenylazo-1-naphthylamine, gave neutral salts composed of 2 mols. of base to 1 mol. of acid. All the compounds formed with hydrochloric acid two series of salts containing 1 and 2 mols. of acid respectively to 1 mol. of base; those of the first series are stable, but those of the second series are transformed rapidly into those of the first on exposure to the air; 4-naphthaleneazo-1-naphthylamine forms an exception, both hydrochlorides being stable. With nitric acid the compounds formed two series of salts: those with 1 mol. of acid are stable and

those with 2 mols. unstable; here also 4-naphthaleneazo-1-naphthylamine gave two stable salts. —A. S.

3,6-Diaminoselenopyronine (3,6-diaminoanthoselenonium). P. Ehrlich and H. Bauer. Ber., 1915, 48, 502—507.

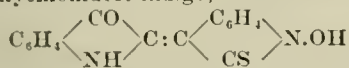
3,6-DIAMINOSELEOPYRONINE was obtained as follows: *p.p'*-Diacetyldiamino-*o.o'*-diaminodiphenylmethane was diazotised, and the acetic acid solution of the diazo-compound treated with potassium selenocyanate. The crude product on warming with concentrated sulphuric acid was simultaneously hydrolysed and oxidised to the colouring matter, which was isolated as hydrochloride of the constitution,



in needles of a greenish metallic lustre. It is slightly soluble in water and alcohol giving red solutions which, unlike those of the sulphur analogue, do not fluoresce. It dyes silk cerise, and tannin-mordanted cotton a bluish-red fast to washing but not to light. Biological tests showed that it exerted only a temporary beneficial action in diseases due to trypanosomes. —G. F. M.

Thioindole derivatives. *A synthesis of indirubin.* Indigoid dyestuffs containing sulphur. I. A. Albert. Ber., 1915, 48, 474—483.

THIOINDOLE derivatives were obtained from *o*-nitrobenzaldehydecyanhydrin by the action of ammonium sulphide on its benzoyl-derivative, whereby *o*-hydroxylaminobenzoylthiomandelamide, $\text{HO.NH.C}_6\text{H}_4\text{CH(OCO.C}_6\text{H}_5\text{).CS.NH}_2$, was produced. This compound on treatment with hydrochloric acid in the cold lost ammonia, and *N*-hydroxy-2-thio-3-benzoyloxindole was formed as a white crystalline product, readily soluble in alcohol. It has no definite melting point but is converted into a violet substance on heating. Treatment with cold sodium hydroxide solution converts it with simultaneous hydrolysis of the benzoyl-group into the sodium salt of a bluish violet colouring matter, which can be precipitated by carbon dioxide and crystallised from carbon bisulphide. It is insoluble in water, soluble in cold caustic alkalis but decomposed on heating. It gives an oxime, and a dark blue benzoyl-derivative. The author assigns to it the constitution 2-indole-3-*N*-hydroxythioindole-indigo,



By the action of sodium sulphide on the thio-oxindole derivative a sulphur-free indigo colouring matter, apparently identical with indirubin, was obtained in 65% yield. —G. F. M.

Determination of indican in urine. Jolles. See XXIII.

Acetilation of chlorates by formic acid. [Oxidation of indigo, aniline, and anthracene.] Hofmann and Schumpelt. See VII.

PATENTS.

Colouring matters of the anthraquinone series; Manufacture of —. J. Y. Johnson. London. From Badische Anilin und Soda Fabrik, Ludwigshafen, Germany. Eng. Pat. 11,360, June 15, 1914. Addition to Eng. Pat. 5534, Mar. 5, 1913.

A 1-ARYLAMINOANTHRAQUINONE containing a methyl group in the *ortho*-position to the amino-group, is treated with sulphuryl chloride instead of with a halogen, as prescribed in the chief patent (see Fr. Pat. 459,105 of 1913; this J., 1913, 1101).

The colouring matter from 1,5-di-*o*-toluido-anthraquinone is specially claimed. —F. W. A.

Anthraquinone dyestuffs; Manufacture of soluble greenish-blue —. Akt.-Ges. f. Anilinfabr., Berlin. Eng. Pat. 7861, May 27, 1915. Under Int. Conv., June 19, 1914. Addition to Eng. Pat. 10,378 of 1914, dated July 11, 1913.

IN the manufacture of soluble greenish-blue dyestuffs by heating 1-amino-4-halogen-anthraquinone-2-sulphonic acids with aromatic amines and water, in presence or absence of an agent for fixing acid, as described in the main patent (see Ger. Pat. 280,646 of 1913; this J., 1915, 545), the addition of copper or copper compounds is not necessary. —F. W. A.

Azo-dyestuffs for wool; Manufacture of new —. P. A. Newton. London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 24,360, Oct. 27, 1913.

THE diazo-compounds of the products obtained by condensing one mol. of 2,4-dinitro-1-chlorobenzene with benzidine- or tolidine-2,2'-disulphonic acid are combined with azo-components generally in use for the production of yellow dyestuffs, *e.g.*, salicylic acid, 1-phenyl-3-methylpyrazolone, etc. Pure yellow dyeings, fast to fulling, sulphur, and light, are obtained on wool from acid baths. —F. W. A.

Trisazo-dyestuff; Manufacture of a —. R. B. Ranford. London. From L. Cassella and Co., Frankfurt, Germany. Eng. Pat. 6900, Mar. 18, 1914.

THE tetrazo compound of *m*-aminophenylazo-2,5,7-aminonaphtholsulphonic acid is combined with two mols. of resorcinol. The new dyestuff gives fine claret shades, fixed without change of shade by after-treatment with formaldehyde. The dyeings so after-treated are very fast to washing and are easily discharged; the dyestuff is particularly suitable for union goods. —F. W. A.

Indigoid vat dyestuffs; Manufacture of new —. P. A. Newton. London. From Farbenfabr. vorm. F. Bayer und Co., Leverkusen, Germany. Eng. Pat. 7916, Mar. 28, 1914.

HALOGENATED isatins or naphthisatins, in which the oxygen of the α -keto group is replaced by readily replaceable substituents, *e.g.*, the anilidogroup, are condensed with 3-phenyl-1-indanone, its substitution products or homologues. 5,7-Dichloro- or dibromo-isatin- α -anilide yields a pure red, and the α -arylates of the halogenated 2,3-naphthisatins yield very pure violets. —F. W. A.

Dyestuffs for furs, hair, etc. A. Erlenbach and K. Marx, Dessau, Assignors to Akt.-Ges. f. Anilinfabr., Berlin, Germany. U.S. Pat. 1,144,181, June 22, 1915. Date of appl., Apr. 25, 1914.

AN inorganic salt of a substituted *p*-diamine, $(4)\text{NH}_2\text{RC}_6\text{H}_4\text{N(alkyl)X(1)}$, in which R is a monovalent inorganic substituent or a hydrogen atom and X is a monovalent organic substituent such as an alkyl group, and an inorganic salt of a 1-alkoxy-2,4-diamine are claimed as new dyestuffs for furs, etc. —F. W. A.

Azo dyestuffs; Manufacture of new —. P. A. Newton. London. From Farbenfabr. vorm. F. Bayer und Co., Leverkusen, Germany. Eng. Pat. 8666, April 6, 1914.

SEE Addition of April 21, 1914, to Fr. Pat. 457,840 of 1913; this J., 1915, 417.

Azo dyestuffs for cotton; Manufacture of new —. P. A. Newton. London. From Farbenfabr. vorm. F. Bayer und Co., Leverkusen, Germany. Eng. Pat. 8043, March 30, 1914.

SEE Fr. Pat. 471,284 of 1914; this J., 1915, 171.

Dyes of the anthraquinone series; Greenish-blue —. W. Herzberg and G. Hoppe. Assignors to Aktienges. f. Anilinfabr., Berlin. U.S. Pat. 1,131,516, Mar. 9, 1915. Date of appl., July 1, 1914. SEE Ger. Pat. 280,646 of 1913; this J., 1915, 545.

Dyes of the anthraquinone series, soluble in water; Manufacture of blue —. Aktienges. für Anilinfabr., Treptow, Germany. Eng. Pat. 10,378, April 27, 1914. Under Int. Conv., July 14, 1913.

SEE Ger. Pat. 280,646 of 1913; this J., 1915, 545.

Vat dyestuffs; Manufacture of —. E. Wray, Biebrich, and F. Hess, Wiesbaden. Assignors to Kalle und Co. A.-G., Biebrich, Germany. U.S. Pat. 1,144,577, June 29, 1915. Date of appl., Oct. 29, 1913.

SEE Fr. Pat. 463,772 of 1913; this J., 1914, 416.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Poplar wood pulp; The special properties of —. T. Hadfield. Paper-Making. 1915, 34, 206.

POPULAR wood pulp prepared by the soda process has proved an excellent substitute for esparto. In the manufacture of the best grades of poplar pulp the knots are bored out before chipping. The chips are digested with 12% of their weight of 70% caustic soda under a steam pressure of 90 lb. for 10–12 hours; higher pressures, up to 160 lb., are sometimes employed, but the concentration of the alkali must then be regulated to avoid injury to the fibre. The pulp is washed in the ordinary way and is bleached with a relatively small consumption of bleaching powder. This process gives a strong pulp of good colour, suitable for making light papers with a silky feel. Under favourable conditions poplar wood yields a higher percentage of cellulose than other woods, viz., 63%; the fibres of poplar pulp prepared by the soda process have superior felting properties as compared with sulphite pulp fibres and have not been tendered by acid digestion. The soda process also eliminates the resinous constituents more perfectly, thus facilitating the beating and the action of the suction-boxes on the machine. Poplar pulp is used in various proportions in the manufacture of printings, "featherweight" printings, art papers, filter and blotting papers, and in all cases where bulk and lightness are desirable. The paper possesses great smoothness and is readily prepared free from acid, being particularly suitable for insulating purposes and wrapping metallic articles.—J. F. B.

Filter paper; Process for toughening ordinary —. W. R. Rankin. Pharm. J., 1915, 95, 36.

To prepare a substitute for the smooth, hardened filter papers of German make (C.S. and S. No. 575), best English filter paper is dipped very quickly in nitric acid of sp. gr. 1.42, drained, and washed in running water until most of the acid is removed; the remainder is neutralised by immersion in 0.5% ammonia solution, the paper is then washed thoroughly, pressed between blotting paper, and dried at 100°C. When dry the paper is again subjected to the treatment; the same acid may be used indefinitely. A shrinkage of about 10% in linear dimensions should be allowed for. Since the cellulose of the paper is nitrated to some extent, excessive temperatures must be avoided in drying. A somewhat inferior substitute may be prepared in a single operation by dipping filter paper in a mixture of 65 parts of sulphuric acid of sp. gr. 1.84 and 35 of nitric acid of sp. gr. 1.42.—J. F. B.

PATENTS.

Fibrous and jelled substances [e.g. paper, hide, etc.]; Process for the treatment [proofing] of —. S. A. C. Kristensen, Copenhagen. Eng. Pat. 12,079, May 15, 1914. Under Int. Conv., Oct. 28, 1913.

THE surface of the material is coated with a mixture of a mineral powder, preferably aluminium powder, together with a fixative, preferably water-glass, on one or both sides, whereby it is rendered fire- and damp-proof and impermeable to air. Before coating, the material may be reinforced by the attachment of wire-gauze and the coating applied over this.—J. F. B.

Cotton-plant; Method of utilising waste substances of the —. M. W. Marsden. Assignor to Economic Power and Products Co., Philadelphia. U.S. Pat. 1,143,587, June 15, 1915. Date of appl., Feb. 28, 1914.

THE stalks, stems, and roots of the plant are disintegrated, and the light and the heavy fibres are separated by suction and gravitation and washed with water. The separate portions are then digested under pressure to remove extractive matter, etc., and are further purified from incrusting matter by treatment with an alkali under higher pressure. By subjecting the fibres to the action of reducing agents, a paper stock of great strength and uniformity is produced.—E. H. T.

Cellulose xanthogenate; Manufacture of solutions of —. L. Lilienfeld, Vienna. Eng. Pat. 14,339, June 15, 1914. Under Int. Conv., July 5, 1913.

CRUDE viscose, preferably poor in alkali as described in Eng. Pat. 1378 of 1912 (this J., 1913, 192) and containing not more than 5% of cellulose or cellulose hydrate, is maintained at 60°–80°C.; a polymerised cellulose xanthogenate separates which is insoluble in water but easily soluble in alkali solutions. The time taken for precipitation depends upon the rate of heating; in the examples given it varies from 40 mins. to 62 mins. The precipitated xanthogenate is thoroughly washed with water until colourless and then dissolved in alkali solution of 8% to 10% strength. The solution is suitable for all purposes for which viscose can be used; it is coagulated by dilute mineral acids, with or without the addition of salts, etc., and the coagulating liquid can be used repeatedly because of the purity of the xanthogenate.—B. V. S.

Acetylcellulose; Solvent for —. W. G. Lindsay, Caldwell, N.J. Assignor to The Celluloid Co., New York. U.S. Pat. 1,143,979, June 22, 1915. Date of appl., May 23, 1912.

A SOLVENT for an acetylcellulose which is freely soluble in acetone contains 60–70 parts by vol. of ethyl acetate and 30–40 parts by vol. of methyl alcohol.—F. W. A.

Sulphite waste liquor; Process of treating — and product thereof. O. W. Knight, Portland, Me. U.S. Pat. 1,143,714, June 22, 1915. Date of appl., Aug. 10, 1914.

A LIQUOR containing a lignone derivative, e.g., fermented waste sulphite liquor, in which at least part of the alcohol has been oxidised to aldehyde, is treated with a phenolic substance in presence or absence of a condensing agent at a temperature sufficient to produce a condensation product.—F. W. A.

Wrapping material. A. H. Kilmer, Leigh, Essex. Eng. Pat. 15,761, June 11, 1914.

COTTON or other textile fabric is treated with viscose by brushing in such a manner that the viscose is absorbed and penetrates the threads and

fibres so as to render the fabric impervious to air. (Reference is directed to Eng. Pats. 17,253 of 1900, 9849 of 1903, 22,311 of 1910, 21,426 of 1911, and 6798 of 1912; this J., 1901, 597; 1904, 439; 1912, 1026, 1027.)—J. F. B.

Viscose; Production of articles or materials from — B. Borzykowski, Charlottenburg-Berlin, Germany. U.S. Pat. 1,143,569, June 15, 1915. Date of appl., May 17, 1913.

SEE Eng. Pat. 12,090 of 1913; this J., 1913, 975.

Paper-pulp or cellulose from bamboo and the like; Process for the production of — J. L. Jardine, Penicuik, Scotland. U.S. Pat. 1,143,401, June 15, 1915. Date of appl., Aug. 6, 1914.

SEE Eng. Pat. 18,371 of 1913; this J., 1914, 1006.

Paper and other absorbent materials; Sizing and colouring of — E. Fues, Hanau, Germany. Eng. Pat. 13,970, June 9, 1914.

SEE Fr. Pat. 473,405 of 1911; this J., 1915, 546.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Dyeing; Theory of — J. Traube. Ber., 1915, 48, 938—946.

AN investigation of 65 dyes showed that basic dyes cause a shrinkage and acid dyes a swelling of a gelatin gel. The basic and highly colloidal Night Blue, for instance, exerts a strong action and the weakly basic Rhodamine B a weak action of the first type. Basic dyes have a tendency to be deposited upon the surface of the gel, whilst acid dyes, when not highly colloidal, remain diffused throughout the gel. The latter condition may be prevented by mordanting, i.e., converting the dye into a colloidal precipitate, or by diminishing the degree of dispersion of the dyestuff, e.g., by addition of acids or acid salts to acid dyestuffs or of alkali to basic dyestuffs. These conclusions were supported by diffusion experiments. Solutions of highly colloidal dyes, such as Congo Blue, were decolorised in a few days, the colour being deposited on the surface of the gel. The effect of adding sodium bisulphate to certain acid dyes and sodium carbonate to certain basic dyes in dyeing processes is interpreted in the light of the above results; and the author shares the view that dyeing is essentially a colloidal process, the fibre being regarded as an electro-negatively charged gel capable of shrinkage or expansion under the influence of basic or acid dyes, which may either aggregate upon the surface of, or diffuse through, the fibre, according to the circumstances outlined above.—J. R.

Chrome brown on wool; Method of developing a fast — M. Fort. J. Soc. Dyers and Col., 1915, 31, 147—148.

WOOL is chromed to produce a green chrome mordant, e.g., with 3% bichromate and 2½% tartar emetic, with a bisulphite after-treatment. It is then dyed in a bath containing 2—3% gallic acid, 4% sodium nitrite, and 5% acetic acid, reckoning on a standard bath thirty times the weight of the wool, the solution being gradually heated to boiling and kept boiling for one hour. The dyeings are fast to light, heavy milling, alkalis, and acids. The shade may be varied by addition of suitable dyestuffs.—F. W. A.

Fastness of basic dyes to rubbing. M. Fort. J. Soc. Dyers and Col., 1915, 31, 148.

ACCORDING to Eng. Pat. 29,479 of 1913 (this J., 1915, 185) tannin-mordanted cotton is treated

with a bath of sodium silicate neutralised with hydrochloric acid. The author has used 5—10% commercial phosphoric acid (50%), alone and in conjunction with aluminium and magnesium salts, to improve fastness to rubbing.—F. W. A.

Tendering of cotton; Copper values and the — by some organic acids in steaming. G. E. Pakington. J. Soc. Dyers and Col., 1915, 31, 119—153.

OF the three organic acids used, oxalic, tartaric, and citric acids in 2% solution, the first-named was found to produce the greatest tendering effect, as measured by the copper value (this J., 1907, 548), which was equivalent to the formation of about 31% of invert sugar. The presence of sodium sulphate diminishes the action of these acids, preventing their hydrolysing action. This result was not expected, as it has been supposed that partial double decomposition occurs between the salt and the organic acid, producing free mineral acid.—F. W. A.

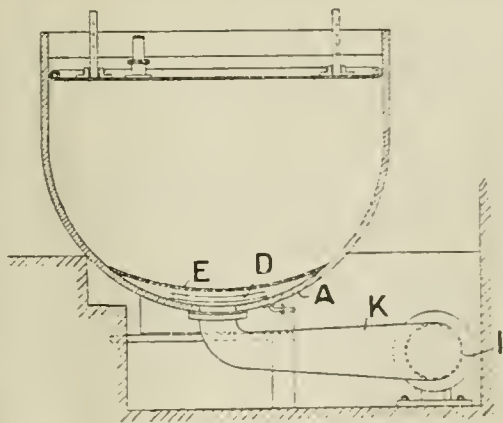
PATENTS.

Dyeing [khaki shades on animal fibres]. B. Keegan. Bradford. Eng. Pat. 20,467, Oct. 2, 1914.

WOOL is treated with a *m*-diamine and a suitable oxidising agent or mordant, the colour being developed by means of an acid. A suitable bath contains *m*-toluylendiamine, 3%; common salt, 1½%; acetic acid (30%), 2%; sodium bichromate, 2·3% of the weight of the material. The wool is thus dyed a pale yellow shade, which is developed to a khaki by subsequent addition of 3% of sulphuric acid (40%) to the bath.—F. W. A.

Dyeing, washing, bleaching, etc.; Apparatus for — O. Luft, Lausitz, Germany. Eng. Pat. 8365, Apr. 2, 1914. Under Int. Conv., Apr. 3, 1913.

A MORE efficient two-compartment vat for the wet treatment of textile goods by means of a circulating reversible flow of liquor, is obtained by constructing



it with a semi-cylindrical bottom, *a*, furnished with heating pipes, *d*, and curved strainer-plates, *e*. The suction or delivery pipe, *k*, which connects the heating chambers of the vat, contains the reversible pump (screw-propeller, *i*), and continually increases in cross-section from the junctions with the bottom of the vat towards the pump itself.—F. W. A.

Dyeing furs, hair, feathers, etc.; Process for — A. G. Bloxam. London. From Chem. Fabr. Griesheim-Elextron, Frankfurt, Germany. Eng. Pat. 5447, April 10, 1915.

FURS, hair, feathers, etc., mordanted or not, are treated with a solution of *m*-hydroxydiphenylamine and a suitable oxidising agent. Raw skins

or skins prepared by washing or "killing" are immersed in a mordanting solution containing 3 grms. of sodium bichromate and 2 grms. of copper sulphate per litre, and then in a dye-bath containing 1.5–3 grms. of *m*-hydroxydiphenylamine, 1.25–2.5 c.c. of caustic soda (28%), and 1 litre of water: 25 c.c. of a 10% solution of bichromate is immediately added, and then 1–2 grms. of sodium perborate. After agitating the skins for half-an-hour, about 5 c.c. of 10% formic acid is added until the liquid is neutral or slightly acid, and the skins are allowed to stand over-night. A deep brown fast to light is obtained.—F. W. A.

Dyeing raw cotton, wool, etc., and apparatus for use therein. G. W. Johnson, London. From Uniform Dyeing Machine Co., Grovesville, N.J., U.S.A. Eng. Pat. 84 of 1915, date of appl., July 21, 1914.

RAW cotton, wool, etc., is made into rolls or bats which are packed on end in a dye-vat and the dye-liquor circulated continuously or in each direction alternately. A perforated tube may be placed in the roll or bat.—F. W. A.

Bleaching solution. A. Lehmann, Rheydt, Germany. U.S. Pat. 1,135,303, April 13, 1915. Date of appl., Nov. 3, 1914.

THE bleaching solution comprises chloride of lime and "kromocoon, a malt product containing the constituents of malt, particularly active diastase and other soluble or colloidal albumen substances, in unaltered natural form."—B. N.

Dyeing hairs, furs, and the like; Preparation for —. A. Erlenbach, Dessau, Germany. U.S. Pat. 1,144,325, June 22, 1915. Date of appl., Feb. 21, 1913.

SEE Addition of May 7, 1912, to Fr. Pat. 413,877 of 1910; this J., 1912, 1121.

Bleaching; Process of preparing textile materials for —. J. L. Jardine, Penicuik, Scotland. U.S. Pat. 1,143,543, June 15, 1915. Date of appl., Feb. 3, 1915.

SEE Eng. Pat. 802 of 1914; this J., 1915, 350.

Printing designs in various colours on fabrics; Process for —. I. Orloff, Moscow, Russia. Eng. Pat. 15,106, June 23, 1914.

SEE Fr. Pat. 472,092 of 1913; this J., 1915, 420. Reference is directed in pursuance of Sect. 7, Sub-sect. 4, of the Patents and Designs Act, 1907, to Eng. Pats. 3550 of 1894, 13,000 of 1896, 3775 of 1898, 15,793 of 1899, 3778 of 1903, 3709 of 1906, 13,896 of 1908, and 7734 of 1909.

Pattern effects upon cotton fabrics; Process for the production of —. G. Heberlein, Wattwil, Switzerland. U.S. Pat. 1,144,655, June 29, 1915. Date of appl., May 29, 1914.

SEE Fr. Pat. 468,642 of 1914; this J., 1914, 960.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Phosphoric acid; Factor to be used for the calculation of the — in Neumann's method. S. L. Jodidi. J. Amer. Chem. Soc., 1915, 37, 1708—1710.

EXPERIMENTS made with sodium, potassium, and ammonium phosphates and phosphoric acid showed that in determining phosphorus by precipitating as phosphomolybdate in an acid solution containing 10% of ammonium nitrate, then boiling the washed precipitate with excess of *N*/2 sodium hydroxide, and titrating the excess of alkali, the

factor 1 c.c. *N*/2 NaOH = 0.554 mgrm. P, prescribed by Neumann (Z. physiol. Chem., 1902-3, 37, 129), gives too low results and should be replaced by the factor 0.57, which gives results close to the truth under the following conditions:—The phosphate solution is treated with 10 c.c. of a mixture of equal volumes of concentrated sulphuric and nitric acids, 75 c.c. of a 50% solution of ammonium nitrate, and enough water to make, with the 10% solution of ammonium molybdate (usually 40 c.c.), a total volume of 250 c.c.; the solution is warmed to 80° C. before adding the molybdate. After shaking vigorously and allowing to stand for 15 mins., the liquid is decanted through a filter, and the precipitate shaken three or four times with 150 c.c. of ice water, the liquid being decanted through the filter. The filter is washed, transferred to the flask containing the precipitate, reduced to pulp with 150 c.c. of distilled water, boiled for 15 or 20 mins. with excess of *N*/2 sodium hydroxide, and the excess of alkali titrated with *N*/2 sulphuric acid.—A. S.

Molybdic acid; Reduction of —. Catalytic action of colloidal metals of the platinum group. XI. C. Paal and H. Büttner. Ber., 1915, 48, 220–222.

EXPERIMENTS described previously on the reduction of ammonium molybdate with hydrogen in the presence of colloidal palladium (this J., 1914, 787) were repeated, working however with somewhat more dilute solutions and using a freshly prepared, very active palladium preparation (see Paal and Amberger, this J., 1904, 208). At the ordinary temperature and pressure absorption of hydrogen corresponding to the formation of molybdenum tetrahydroxide occurred. The hydrosol had a dark reddish brown colour, and after a few hours a fine sediment separated. The absorption of hydrogen was completed in 2–3 days, but recommenced on warming to 50°–60° C., and continued for a further 3 days, the amount absorbed then corresponding to the formation of molybdenum trihydroxide, which separated as a black mud. When dried in hydrogen it formed black, brittle crusts with a bluish sheen.—G. F. M.

Calcium oxide and hydroxide; Change of volume on dissolving — in water. A. Cavazzi. Gaz. Chim. Ital., 1915, 45, I., 529–533.

ONE gm. of calcium oxide dissolved in 1 litre of water at 15° C. produced a diminution of 0.7 c.c. in the volume of the water; under similar conditions 1 gm. of CaO in the form of calcium hydroxide produced a diminution of 0.5 c.c. The expansive force produced by the slaking of quicklime is due to the lower specific gravity of the hydroxide compared with that of the oxide; a given volume of calcium oxide yields rather more than double its volume of hydroxide.—A. S.

Chlorates; Activation of — by formic acid. K. A. Hofmann and K. Schumpelt. Ber., 1915, 48, 816–822.

THE activation of chlorate solutions by osmium tetroxide for the oxidation of amorphous carbon to carbon dioxide (this J., 1913, 697), is due to the formation of formic acid, which has been found to reduce chlorates to chlorine dioxide. The addition of formic acid as such causes the activation of chlorate solutions, only one-sixth of the available oxygen being taken up by the formic acid, the remainder being available for oxidation processes, e.g., of indigo, of aniline, and of anthracene (using 90% formic acid). Acetic acid and other acids do not produce the same effect.—F. W. A.

Ferrocyanides; Volumetric determination of —. B. Campbell. Analyst, 1915, 40, 327–328.

FROM 1.5 to 2 grms. of the finely powdered ferro-

cyanide is heated gently with not less than 30 c.c. of dilute (1:5) sulphuric acid until the ferrocyanogen complex is decomposed. The liquid is cooled and diluted, and 5 grms. of zinc (of known iron content) added. After solution of the zinc the iron is reduced to the ferrous state, and the solution titrated with $N/10$ potassium permanganate solution (1 c.c. = 0.0122 grm. $K_2Fe(CN)_6 \cdot 3H_2O$). An allowance of 0.05 c.c. is made for the 5 grms. of zinc. The method gives good results with ferrocyanides containing carbonate or sulphate.—C. A. M.

Disodium hydrogen arsenate, lead nitrate, and water at 25° C.; Equilibrium in the system—B. E. Curry and T. O. Smith. J. Amer. Chem. Soc., 1915, 37, 1685–1688.

COMMERCIAL lead arsenate is mostly made from disodium hydrogen arsenate and lead nitrate or acetate, preferably the former. A study of mixtures of disodium hydrogen arsenate, lead nitrate, and water at 25° C. showed that only one compound, $PbHAsO_4$, is formed. Commercial products usually contain more lead and less arsenic than $PbHAsO_4$.—A. S.

Hydrazine; Contribution to the knowledge of—W. Schlenk and T. Weichsfelder. Ber., 1915, 48, 669–676.

SODIUM hydrazide, $NH_2 \cdot NHNa$, was obtained in the form of white leaflets by the action of sodium on anhydrous hydrazine in an atmosphere of dry nitrogen. It is a dangerously explosive substance, and decomposes with powerful detonation in the presence of the merest traces of air or moisture. It is likewise violently decomposed by alcohol. A case of isomerism of hydrazine derivatives was observed in the case of methylhydrazine hydrate, $NH_2 \cdot NH_2(CH_3)OH$, and a compound of hydrazine and methyl alcohol, $NH_2 \cdot NH_2(OCH_3)$, analogous to hydrazine hydrate. This alkyl-oxide was formed by mixing the two constituents, and on cooling with solid carbon dioxide it separated in colourless needles.—G. F. M.

PATENTS.

Sulphuric anhydride; Manufacture of—, and of catalytic agents for use in said manufacture. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen, Germany. Eng. Pat. 23,541, Oct. 17, 1913.

SULPHURIC anhydride is obtained by passing mixed sulphur dioxide and oxygen over a catalyst, consisting of vanadic acid precipitated on finely ground pumice or similar carrier. For example, a mixture of 200 parts of moist pumice powder and 14 parts of ammonium vanadate is moulded to the desired shape, heated at 300° C. to expel the ammonia, and then at 440° C. in gases containing sulphur dioxide to produce cohesion; or a mixture of 316 parts of kieselguhr with an aqueous solution of 50 parts of ammonium vanadate and 56 parts of caustic potash is evaporated nearly to dryness, and the residue formed into granules and heated at 480° C., first in gases containing sulphur dioxide and afterwards in air.—B. V. S.

Ammonia [from nitrogen and hydrogen]; Catalyst for the production of—and process of making the same. F. W. de Jahn, Assignor to General Chemical Co., New York. U.S. Pat. 1,143,366, June 15, 1915. Date of appl., June 30, 1914.

A CATALYST suitable for use in the synthesis of ammonia is prepared by reducing nickel oxide with hydrogen, adding metallic sodium, and treating the product with ammonia.—F. SODN.

Chlorates of alkalis and alkaline earths; [Electrolytic] production of—W. Laib, Rittman, Assignor to The Ohio Salt Co., Wadsworth, Ohio. U.S. Pat. 1,143,586, June 15, 1915. Date of appl., Sept. 12, 1914.

A SOLUTION of an alkali or alkaline-earth chloride (e.g., potassium chloride and a potassium derivative of chromic acid) is electrolysed at a low temperature in a cell with a graphite anode, and the electrolysis is continued in another cell with a platinum anode at a higher temperature, produced by the current itself. The liquor is run off and crystallised.—E. H. T.

Aluminium chloride; Manufacture of—[from residues from the treatment of oils]. A. McD. McAfee, New York. U.S. Pat. 1,144,304, June 22, 1915. Date of appl., Mar. 2, 1915.

RESIDUES arising from the treatment of oil with anhydrous aluminium chloride, are extracted with a solvent to remove the oil, then treated with a limited amount of water, and the resulting concentrated solution of hydrated aluminium chloride is decomposed into hydrochloric acid and alumina by heating. The alumina is mixed with carbon and treated with hydrochloric acid gas at a high temperature.—W. N. B.

Alkali-metal cyanide; Process for the production of—H. Freeman, Vancouver, British Columbia. U.S. Pat. 1,143,952, June 22, 1915. Date of appl., Oct. 13, 1914.

A SOLUTION of crude alkali cyanide is heated with ferrous hydroxide, the resulting ferrocyanide purified by crystallisation, and the dehydrated product re-converted into alkali cyanide by fusing with alkali metal, in contact with molten lead.—F. SODN.

Nitrate of lime; Process for cooling and reducing—I. Hechenbleikner, Great Falls, S.C. Assignor to Southern Electro-Chemical Co., New York. U.S. Pat. 1,143,625, June 22, 1915. Date of appl., Aug. 13, 1914.

"FLUID nitrate of lime" is collected into pools around which a cooling medium is circulated. The cakes so formed are detached from the moulds by heating the walls, and then pulverised and conveyed away in a current of air.—W. F. F.

Zinc oxide; Process of making pure—and recovering substances from waste and like liquors [especially those of the wet copper extraction process]. W. Asef, Philadelphia, Pa. U.S. Pat. 1,135,981, April 20, 1915. Date of appl., July 19, 1913.

A LIQUOR containing zinc and also iron, alkali chloride and sulphate, manganese, cobalt, and nickel is treated with alkali or alkaline-earth carbonate or hydroxide, to precipitate zinc and iron compounds, and the mixture is subjected to an oxidising agent, such as air, and diluted with more of the original liquor, in order to precipitate all the iron as ferric hydroxide and redissolve the precipitated zinc compounds. Manganese, cobalt, and nickel are removed from the separated liquor by precipitating with hypochlorite, and the filtrate is again treated with caustic alkali or alkali carbonate to precipitate the zinc as crude hydroxide or basic carbonate. Some of the filtrate (containing alkali chloride and sulphate) from this latter operation is then treated with liquor obtained by dissolving previously precipitated crude zinc oxide in caustic alkali, and, after filtering off impurities and boiling, the solution is further diluted with more of the same filtrate, and the mixture is boiled and agitated. The zincate is thus decomposed, pure zinc oxide being precipitated, and the caustic alkali and alkali

chloride and sulphate are recovered by evaporating the filtrate. In the absence of iron compounds the process is simplified accordingly.—F. SODN.

Zinc sulphate; Production of —. R. B. Llopert, Cordoba, Argentina. U.S. Pat. 1,142,795, June 15, 1915. Date of appl., April 2, 1915.

A MIXTURE of zinc sulphide and iron sulphide (e.g., a blende) with zinc carbonate or oxide, or a mixture of zinc sulphide, zinc oxide, and sulphur, is heated in an oxidising atmosphere, at a temperature below that of dull redness, preferably at 400°–500° C.—F. SODN.

Perborate of zinc; Manufacture of —. Henkel und Co., Düsseldorf, Germany. Eng. Pat. 3477, Feb. 10, 1914. Under Int. Conv., Feb. 27, 1913.

ZINC perborate is produced by fusing together a zinc salt and an alkali perborate. (See also Eng. Pat. 3388 of 1914; this J., 1914, 961.)

—B. V. S.

Silicate glasses and the like; Treatment of —, and preparation of useful products [water-glass, etc.] therefrom. J. W. Spensley, J. W. Battersby, and E. S. Holmes, Manchester. Eng. Pat. 11,959, May 14, 1914.

LUMPS of silicate glass are rendered soluble by being ground in the presence of water in machines of the ball-mill type. The rolling and grinding action disintegrates the lumps and converts them into a mass, which contains a certain proportion of water, and is readily soluble. The balls may be of flint, or of lumps of the artificially prepared silicate glass itself. The soluble product may be run out of the machine either into water to form a solution, or may be allowed to solidify and then broken up and dissolved in water. Disinfectants, soap, or other materials may be supplied to the machine and mixed with the silicate during the grinding, to obtain a powder consisting of dry, soluble, pulverulent silicate, mixed with soda ash, soap powder, or other materials, and containing say 20 to 40% of the silicate.—W. C. H.

[Nickel] catalysts; Manufacture of —. D. Wesson, Montclair, N.J., Assignor to The Southern Cotton Oil Co., New York. U.S. Pat. 1,143,339, June 15, 1915. Date of appl., July 6, 1912.

A SOLUTION of a nickel salt is treated with an ammonium compound (e.g., ammonia solution), the precipitate is applied to an inert carrier, heated to expel volatile compounds, and the nickel reduced by heating in hydrogen.—E. H. T.

Nickel hydroxide; Preparation of —. J. C. Woodruff, Bayonne, N.J., Assignor to The Southern Cotton Oil Co., New York. U.S. Pat. 1,143,343, June 15, 1915. Date of appl., Jan. 29, 1913.

NICKEL hydroxide is precipitated by adding the theoretical amount of ammonia solution to a 1% solution of a nickel salt at above 90° C.—E. H. T.

Nitrogen; Process of fixing atmospheric —. S. Peacock, Chicago, Ill., Assignor to Agricultural Research Corporation, N.Y. U.S. Pat. 1,143,132, Date of appl., Nov. 5, 1912.

THE oxide of a metal capable of fixing nitrogen is heated with carbon in a furnace fed with free nitrogen, air, and fuel. A sufficient excess of carbon is used to prevent formation of carbon dioxide. The charge is introduced at one end of a closed chamber or rotary furnace, where it meets a burning mass of carbonaceous fuel injected with air; it travels through the chamber and is removed at the other end together with the combustion products.—E. H. T.

Hydrogen; Process of producing —. K. Schaefer, Charlottenburg, Assignor to Berlin-Anhaltische Maschinenbau A.-G., Berlin. U.S. Pat. 1,144,730, June 29, 1915. Date of appl., July 14, 1914.

HYDROGEN is made by passing a reducing gas and steam alternately through a layer of refractory material and then through a mass of iron consisting of two zones, the inner containing bars or big lumps and the outer one small pieces.—E. H. T.

Nitrogen with oxygen; Production of compounds of —. A. Classen, Aix-la-Chapelle, Germany. Eng. Pat. 7866, March 28, 1914.

SEE Fr. Pat. 470,916 of 1914; this J., 1915, 176.

Aluminium nitride; Process of manufacture of —. A. Badin, Assignor to Soc. Générale des Nitrures, Paris. U.S. Pat. 1,143,482, June 15, 1915. Date of appl., Feb. 2, 1915.

SEE Eng. Pat. 24,533 of 1914; this J., 1915, 423.

Cyanogen compounds; Method of producing —. C. Beindl, Munich, Germany. U.S. Pat. 1,144,457, June 29, 1915. Date of appl., Sept. 1, 1910.

SEE Ger. Pat. 216,264 of 1908; this J., 1909, 1314.

Hydrogen peroxide; Apparatus for the continuous production, by synthesis, of —. W. Weber, Assignor to Henkel und Co., Düsseldorf, Germany. U.S. Pat. 1,144,271, June 22, 1915. Date of appl., Dec. 5, 1914.

SEE Eng. Pat. 22,714 of 1914; this J., 1915, 799.

Catalytic reactions and catalytic agents for use therein. Eng. Pat. 8462. See I.

Cracker-pipe for saturating apparatus. U.S. Pat. 1,135,472. See I.

Process of treating complex sulphide ores. U.S. Pat. 1,144,480. See X.

VIII.—GLASS; CERAMICS.

PATENTS.

Glass. O. Schott, Assignor to Schott und Gen., Jena, Germany. U.S. Pat. 1,143,732, June 22, 1915. Date of appl., Dec. 10, 1914.

GLASS containing at least 50% of silicic acid, and having as its other components, 4 to 15% of alumina, 5 to 15% of boric acid, 4 to 14% of alkali, not more than 7.8% of magnesia, nor 15.9% of zinc oxide, nor 30% of baryta, and lime. The total percentage of lime, magnesia, zinc oxide, and baryta is equivalent to from 3 to 11% of lime, the total percentage of alumina, lime, and the quantity of lime equivalent to the percentages of magnesia, zinc oxide, and baryta being at least half and at most five times that of the boric acid.

—W. C. H.

Glass; Process for making a compound of —. H. M. Brookfield, New York. U.S. Pat. 1,143,885, June 22, 1915. Date of appl., Jan. 27, 1912; renewed May 10, 1915.

ABOUT 100 parts of ground cullet from a glass containing lime, is thoroughly mixed with 30 parts of calcium oxide and the mixture fused at approximately 2500° F. (1370° C.).—W. C. H.

Glass and batch for making the same. H. A. Schnelbach, Stenbenville, Ohio, Assignor to Macheth-Evans Glass Co., Pittsburgh, Pa. U.S. Pat. 1,143,788, June 22, 1915. Date of appl., July 20, 1912.

A SEMI-TRANSLUCENT glass, containing undecomposed sulphate, is made by fusing together in a

batch, a foundation mixture, capable of producing a substantially colourless glass, with compounds containing aluminium, fluorine, and a sulphate; the amount of aluminium is in excess of that of the fluorine, and the fluorine in excess of the sulphur in the sulphate, the aluminium, fluorine, and sulphur together comprising less than 10% of the total batch.—W. C. H.

Sand and like washing and separating machine. O. N. Rikof, London. Eng. Pat. 14,014, June 10, 1914.

SAND is fed continuously by an automatic device with an adjustable regulator into one end of a revolving washing drum, through which water flows in the opposite direction. From this drum the sand passes to a series of concentric screening drums, in which it is washed further with fresh water and separated into various grades. The fine sand and dirty water then pass on to a slowly revolving cone mounted on a horizontal shaft and having outside tapering pockets which receive the fine sand, whilst the dirty water overflows and runs away; the sand is discharged by gravity during the revolution of the cone. Overlapping plates are arranged in the preliminary washing drum to trap materials which settle quickly in water, while the water and light foreign particles pass to suitable outlets. The different drums are connected to an end plate, so that each drum has at least one end open for the introduction of water pipes. The narrow ends of the tapering pockets on the cone are open for the overflow of water and light suspended foreign matter, and the wide ends of the pockets are closed.—W. C. H.

Vitrified objects: Process of making —. C. W. Thomas, East Downington, Assignor to Silica Stone Works, Glenloch, Pa. U.S. Pat. 1,144,395, June 29, 1915. Date of appl., Nov. 16, 1911.

ABOUT 6 parts of water, 66 parts of sand, and 34 parts of glass are mixed and subjected to heavy pressure to form the mass into clots, which are gradually heated, first under oxidising and then under reducing conditions, to a temperature increasing from about 1800° F. to 2100° F. (about 980° to 1205° C.), the final form being impressed upon the clots by pressure less than that used in making the clots and insufficient to reduce materially their volume.—W. C. H.

Plaster composition and process of making the same. H. S. Spackman, Ardmore, Pa., and E. W. Lazell, Portland, Oreg. U.S. Pat. 1,142,989, June 15, 1915. Date of appl., May 22, 1912.

A MIXTURE of about 85 parts of hydrated high-calcium lime, containing about 5% of quicklime, with 10 to 15 parts of fused "low-calcium lime," slow setting calcium aluminate, and a few per cent. of sodium bisulphate, is crushed and intimately incorporated to reduce the volume of the mass to less than 85% of the original volume and to increase its plasticity and reliability in use.

—W. C. H.

Ceramic masses; Process for manufacturing —. T. Moses, Berlin. Eng. Pat. 24,304, Oct. 27, 1913. SEE Fr. Pat. 463,899 of 1913; this J., 1914, 354.

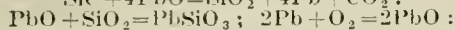
Treatment of silicate glasses and production of useful products [water-glass, etc.] therefrom. Eng. Pat. 11,959. See VII.

Regenerative furnace for use in the manufacture of steel, glass, or the like. Eng. Pat. 21,327. See X.

IX.—BUILDING MATERIALS.

Silundum; Preparation, properties, and composition of —. [Determination of combined carbon in carborundum-like substances.] S. A. Tucker and A. Lowy. J. Ind. Eng. Chem., 1915, 7, 565—571.

SILUNDUM is an electric furnace product obtained by the action of silicon vapour or a mixture of silicon vapour and carbon monoxide on carbon (see Bölling, this J., 1909, 27). Experiments in an Arsem electric vacuum furnace showed that the temperature of formation is above 1300° C. Up to about 1800° C. a greenish slate-coloured variety of silundum, of the composition, $\text{Si}_2\text{C}_2\text{O}$, is formed. Above 1800° C. the product is a steel-grey substance of the composition, SiC , which appears to be a form of carborundum. On continued heating above 2200° C. silundum is decomposed with formation of graphite. Conversion of carbon into silundum is more complete when the carbon is embedded in the charge of carbon and silica than when it is merely exposed to the vapours from the charge. Silundum is a good conductor of electricity and has a negative temperature coefficient of resistance: at 25° C. its specific resistance is 0.1543 ohm per c.c. for the slate-green variety and 0.2374 ohm for the steel-grey variety. The hardness is about 9 on Mohs' scale and the sp. gr. 2.9—3. Silundum is not attacked by acids, nor by hydrogen, oxygen, or nitrogen even at 1100° C. It is decomposed by fused alkali carbonates and hydroxides in presence of air, and by sodium peroxide and lead oxide, but not by fused sodium silicate, borax, potassium bisulphate, cryolite, potassium bichromate, or a mixture of potassium chlorate and nitrate. For the determination of combined carbon in silundum and other carborundum-like substances, the following process was devised, Fitzgerald's method of fusing with sodium peroxide and magnesia (this J., 1903, 1367), having proved to be subject to considerable errors. It is based on fusion of the substance with litharge, when the following reactions take place:—



0.2—0.25 grm. of the sample is well mixed with 5 grms. of litharge and placed in a combustion boat of vitrified clay. The boat is placed in the silica tube of an electric combustion furnace, the air displaced by dry oxygen, and the current turned on. The temperature and current of oxygen are regulated to avoid too rapid decomposition. After about 45 mins. at 600° C. the temperature is raised gradually to 1000° C. Any carbon monoxide evolved is oxidised by heated cupric oxide, and the total carbon dioxide is absorbed in potassium hydroxide. A blank test is made with the litharge.

—A. S.

PATENTS.

Brick; Pure-kieselguhr — and process for making the same. A. C. Hesselmeier, Chicago. U.S. Pat. 1,143,826, June 22, 1915. Date of appl., Nov. 6, 1914.

RAW kieselguhr is ground under water to the degree of fineness just short of destroying the cell walls, and formed into articles in suitable moulds. The articles are subjected to pressure and fired to a temperature above that of dehydration, but below that of sintering, the bonding being due to the cementitious properties of the finely ground material.—W. C. H.

Tiles and the like; Manufacture of cement-asbestos —. R. E. Golightly, Wotton-under-Edge, Glos. Eng. Pat. 18,005, July 30, 1914.

To prevent the production of an efflorescence on cement-asbestos tiles, by the water expelled from them by pressure during manufacture, or

condensed upon them when in the autoclave, the edges of the tiles while in the press, and after most of the excess water has been expelled, are dusted with Portland cement or any suitable material that will produce an equivalent result.

—W. C. H.

Tiles, conduit-pipes, bricks, and like products; Process for making —. C. Westergaard, Assignor to G. McKenzie, Everett, Wash. U.S. Pat. 1,143,004, June 15, 1915. Date of appl., Feb. 24, 1914.

A MIXTURE of sand, cement, powdered sulphur, and soapy water is moulded into the desired shapes, which are placed in a kiln for about 12 hours and sprayed with liquid to prevent abrupt induration. The articles are then subjected for three hours to steam at 108° F. (42° C.) and finally for one hour at 212° F. (100° C.) to complete the induration.—W. C. H.

Cement; Manufacture of ichile —. B. Hannen, London. Eng. Pat. 14,865, June 20, 1914.

MIXTURES of argillaceous and calcareous materials, containing a small proportion of iron compounds, are burned in the presence of an alkali or alkaline-earth chloride at a temperature below that at which the mixtures clinker, but at which the masses cake together and then require reduction to powder to yield white hydraulic cement (e.g., 1000°—1250° C.).—W. C. H.

Gypsum cement. Sir A. Denny, Dumbarton, and D. G. Anderson, Glasgow. Eng. Pat. 16,560, July 11, 1914.

NATURAL rock gypsum is calcined at a dull red heat in an oxidising atmosphere, and during grinding is mixed with from 2 to 10% by weight of ferrous sulphate or other salt containing iron in the form of sulphate, with or without filling materials. The hot calcined gypsum may also be sprayed with a solution of ferrous sulphate. To render the cement neutral or alkaline, from 1 to 4% of slaked lime or Portland cement may be added.

—W. C. H.

Mortar materials; Process and apparatus for slaking —. A. Anker, Paris. Eng. Pat. 7061, Mar. 20, 1914. Under Int. Conv., Mar. 20, 1913.

PARTIALLY slaked and disintegrated material is fed into the top of a vertical container provided with trickling plates, sieves, or pipes, and having lateral openings. This container is enclosed in an outer vessel into which steam is blown. The steam penetrates the material in the inner container, and means are provided for withdrawing the condensed water from the outer vessel without permitting it to come in contact with the material. Sluice chambers are attached to the top and bottom of the inner container, and means are provided for removing the slaked material from the bottom. Steam in the upper sluice chamber can pass by a pipe to a coil in the hopper above, where it preheats the material to be slaked.

—W. C. H.

Heat-resisting bodies [furnace linings]; Method of producing —. P. R. Hershman, Assignor to Armour Fertiliser Works, Chicago, Ill. U.S. Pat. 1,135,182, April 13, 1915. Date of appl., Oct. 12, 1914.

A PLASTIC mass is formed by mixing a heated body of aluminium particles with a heated carbonaceous binder, such as melted tar, and then moulded into the required shape to form the furnace lining, aluminium reinforcing rods, suitably fastened, being embedded in the mixture. The mass is first heated to a moderate temperature by means of a charcoal fire, and then to a higher temperature electrically, in the presence of a gas incapable of

combining with carbon, so as to form aluminium carbide and cause the consumption of the reinforcing rods.—B. N.

Heat-insulating material; Process of making —. F. J. Maywald, Brooklyn, N.Y. U.S. Pat. 1,142,829, June 15, 1915. Date of appl., July 30, 1910.

THE insulating material, consisting essentially of a soluble silicate in liquid form, is introduced gradually by means of an atomizer into a mould rotating at high speed, and heat is applied to the mould to bake, expand, and harden the material and prevent the formation of large bubbles. The product can be obtained of any desired size or thickness, and has a fine-grained, cellular structure.

—W. N. B.

Artificial stone; Process of manufacturing —. W. Weiler, Assignor to J. Sklarek, Munich, Germany. U.S. Pat. 1,143,670, June 22, 1915. Date of appl., Feb. 25, 1913.

SEE Eng. Pat. 3720 of 1913; this J., 1913, 829.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Silicon in iron, steel, ferrosilicon, etc.; Determination of —. R. Namias, L'Ind. Chim., Min., e Met., 1915, 2, 281—284.

IN the case of ferrosilicon, etc., containing 10% or more Si, 0.2 gm. of the finely powdered sample is fused with 3 grms. of sodium peroxide and 5 grms. of potassium carbonate, the mass is dissolved in water, treated with hydrochloric acid, evaporated to dryness in a porcelain crucible, and heated on an asbestos board directly over a flame for some time to decompose the ferric chloride. In this way the silica is obtained in a pulverulent condition, and can be readily washed free from iron and alkali salts. It is transferred to a filter, washed alternately with boiling water and hydrochloric acid, then dried and weighed. In the case of iron and steel, the best results are obtained by dissolving in hydrochloric acid and evaporating to dryness without the addition of an oxidising agent; most of the silicon separates in the elementary form, but is converted into silica during the subsequent calcination. In the case of white cast iron with a high content of combined carbon, the silica is frequently contaminated with iron (present as iron silicide) which cannot be removed by washing; the silica must then be purified by fusion with alkali. In the rapid determination of graphitic carbon in grey cast iron by treatment with hydrochloric acid, weighing the residue, which is regarded as a mixture of silica and carbon, and then oxidising the carbon by ignition, appreciable errors may arise, since the greater part of the silicon separates in the elementary form, and is weighed as such in the first weighing; errors due to this cause may be avoided by adding excess of potassium chlorate to the hydrochloric acid solution.—A. S.

Electrolytes: Relative migration velocities of the ions in complex —. A. Mutscheller, Met. and Chem. Eng., 1915, 13, 439—442. (See also this J., 1915, 751.)

BY investigating the behaviour of various commercial plating solutions under working conditions, results were obtained supporting the views already advanced by the author (*loc. cit.*). Smooth, adherent metallic deposits were produced when the concentration of metal ions at the cathode remained constant—a condition prevailing only when all ions ordinarily migrating towards the anode were prevented from transporting electricity,

and the cations thus caused to migrate towards the cathode as fast as they were deposited. This effect on the relative migration velocities of the ions was produced by the addition of a positively charged colloid to the electrolyte, so that the anions were absorbed and electrically neutralised; or by composing the electrolyte of complex ions (or adding to the solution, during electrolysis, salts capable of forming complex ions), the dissociation products of which formed non-ionised or little ionised salts with the anions.—W. E. F. P.

Cyaniding; Thiocyanates in —. H. R. Layng. J. Chem., Met., and Min. Soc., S. Africa, 1915, 15, 307—309.

THIOCYANATES are formed during cyaniding by the action of cyanide on thiosulphates resulting from the action of caustic alkali on sulphur. The formation of thiocyanates of copper and silver, soluble in excess of cyanide, was observed in cyaniding sulphide ores containing these metals. Thiocyanates do not, as a rule, interfere with the extraction, but correspondingly less cyanide is regenerated by zinc precipitation, the metallic thiocyanates present being converted into alkali thiocyanates.—W. R. S.

Study of the quality of platinum ware, with special reference to losses on heating. Burgess and Sale. See XXIII.

PATENTS.

Iron; Method of producing practically pure —. A. P. Scott, Brackenridge, Assignor to Allegheny Steel Co., Pittsburgh, Pa. U.S. Pat. 1,144,256, June 22, 1915. Date of appl., Oct. 6, 1910.

IRON is melted with fluxes to separate the impurities, transferred to a ladle, and agitated for about four minutes (e.g., by rotating the ladle) before teeming.—W. R. S.

Iron or steel; Method of coating —. R. Skemp, Scottsdale, and W. Gibson, Assignors to American Sheet and Tin Plate Co., Pittsburgh, Pa. U.S. Pat. 1,143,922, June 22, 1915. Date of appl., Sept. 1, 1910.

IRON or steel articles are dipped into a bath of molten metal and withdrawn through an atmosphere of dry, non-oxidising gas (e.g., carbon dioxide), in which the articles are kept while the coating is solidifying.—W. R. S.

Sheet metal and method for its production. C. F. Burgess, Assignor to C. F. Burgess Laboratories, Madison, Wis. U. S. Pat. 1,144,106, June 22, 1915. Date of appl., March 21, 1913.

SHEET iron is stated to be rendered more resistant to corrosion by embedding in it thin layers of a more electro-negative metal, such as nickel-iron alloy, which resists the inward growth of rust pits.—W. R. S.

Metal; Combined apparatus for melting and casting —. I. Hall, Birmingham. Eng. Pat. 2220, Feb. 11, 1915. (See also Eng. Pat. 15,323 of 1913; this J., 1914, 835.)

IS an apparatus for melting and casting type-metal, the body of the furnace is provided with handles at the sides and is mounted so that it can be rotated on a fixed, hollow base, ball bearings being interposed between the two parts.

—W. E. F. P.

Defining old tinware and like operations and furnaces therefor. A. W. Calvert, Leeds. Eng. Pat. 18,460, Aug. 8, 1914.

THE material is caused to pass, in succession, along two or more conveyors of the endless-band type contained in a closed chamber heated internally

by gas. The bands of the conveyors are inclined upwards and actuated by means of pentagonal sprocket wheels and ratchet mechanism, so that the charge is subjected to repeated shocks in addition to those caused by the falling of the material from the top of one conveyor to the bottom of the next. These facilitate the detachment of the molten tin, which falls into receptacles beneath the conveyors.—W. E. F. P.

Zinc-smelting furnace. J. M. Hyde, Berkeley, Cal. U.S. Pat. 1,144,036, June 22, 1915. Date of appl., March 10, 1915.

THE furnace contains upright retorts each of which is provided with a feed pipe, an outlet connected with an external condenser for collecting the metal, and a taphole for the removal of molten material, which discharges into a chamber inside the furnace and makes a gas-tight connection.

—W. R. S.

Zinc ores; Method of smelting —. J. M. Hyde, Berkeley, Cal. U.S. Pat. 1,144,037, June 22, 1915. Date of appl., March 10, 1915.

THE roasted ore mixed with a reducing agent is fed continuously into inclined retorts through a gas-tight charging device, and the zinc vapour collected in an external condenser. The hot residue from the smelting is mixed with fluxes, and smelted for the recovery of other values, the residual zinc being reduced, vaporised, and oxidised by the furnace gases, from which it is recovered as oxide.—W. R. S.

Roasting ores containing sulphur existing in the free state, or as a metallic sulphide. H. Wade, London. From A. D. Carmichael and H. S. Montgomery, Norwich, Conn., U.S.A. Eng. Pat. 14,295, June 13, 1914.

SULPHIDE ores of low sulphur content are roasted so as to sulphatise one or more of the metals present and at the same time produce a furnace gas rich in sulphur dioxide. The ore is heated to the required temperature in a muffled hearth, and then discharged into an oxidising hearth of a furnace of the superposed chamber type.

—W. E. F. P.

Aluminium and other metals; Cooling metal plates and other metal objects with —. E. Fritsch, Dresden, Germany. Eng. Pat. 21,807, Sept. 27, 1913.

THE process is illustrated by the following example:—A mixture of aluminium (85 parts) with tin (15), or of aluminium (83) with tin (11), lead (3) and bismuth (1), all the metals being in finely divided form, is made into a paste with a medium composed of Manila copal and turpentine, and applied to the iron sheets, etc., to be coated; when dry, the latter are heated to about 220°C. in a non-oxidising or reducing atmosphere for 50—60 minutes.—W. E. F. P.

Open-hearth furnace. J. C. Davis, Hinsdale, Ill., Assignor to American Steel Foundries, New York. U.S. Pat. 1,113,690, June 22, 1915. Date of appl., March 25, 1914.

THE furnace has straight, parallel inside walls and outwardly diverging end walls, thereby providing flues of greater cross-section than the cross-sectional area of the furnace at the point of discharge into the flues.—W. R. S.

Furnace; Regenerative — for use in the manufacture of steel, glass or the like. J. S. Atkinson, Thames Ditton, and The Coke Oven Machinery Co. Ltd., and K. Huessener, Twickenham. Eng. Pat. 21,327, Sept. 22, 1913.

ONE or more burners, to which gas and primary and secondary air are supplied, are arranged at

each end of a reversible regenerative furnace. Each burner has two passages for air, one for gas, and one for gas mixed with a portion of the primary air, the construction being such that the latter mixture is not inflamed until it meets the secondary air; each burner is provided with a swivel joint so that the flame may be directed as required.—W. E. F. P.

Annealing furnaces. Gibbons Bros., Ltd., R. Masters, and M. Van Marle, Lower Gornal, Staffs. Eng. Pat. 18,346, Aug. 7, 1914.

A GAS-HEATED furnace adapted for close or for open annealing, is provided, immediately beneath the annealing chamber, with combustion chambers to which gas and secondary air are supplied. Heating passages controlled by dampers are so arranged that the gases in combustion pass either through the annealing chamber or through the hollow arch above it, into waste heat flues below fortuous secondary air passages, the latter being immediately beneath the combustion chambers.

—W. R. S.

Ore; Method and apparatus for treating roasted —. A. Ramen, Halsingborg, Sweden. Eng. Pat. 15,254, June 25, 1914. Under Int. Conv., March 17, 1914.

THE roasted ore is fed in a thin layer on to a movable table or belt and sprinkled uniformly with liquid so as to prevent the formation of lumps and agglomerates in the subsequent lixiviation. The feed-hopper is adjustable and controls the thickness of the layer on the table or belt. The device is enclosed in a casing from which the dust and vapours are removed by suction and collected.—W. R. S.

Oxides [e.g. zinc oxide]; Reduction of metallic —. F. W. Highfield, Caversham. Eng. Pat. 6865, March 18, 1914.

A FURNACE having a grate supporting a bed of electrically heated carbon above a cooling chamber is used; a neutral or reducing atmosphere is maintained in the cooling chamber. Zinc oxide or blue powder is fed through a clay pipe, permeable to carbon monoxide, on to the upper surface of the carbon, which is maintained at about 1050° C., and the molten zinc produced percolates through the carbon by gravity.—W. R. S.

Ores; Electrical treatment of —. F. W. Highfield, Caversham. Eng. Pat. 6866, March 18, 1914.

COMPLEX sulphide ores are roasted, and then subjected to a reducing atmosphere, in an electrically heated furnace. The lead is run off into an electrically heated cupelling hearth and the resulting litharge reduced. The liquid copper-iron matte in the furnace is decomposed by a direct current. Zinc oxide fumes are precipitated by an electrical discharge in a condensation tower and reduced in an electric furnace.—W. R. S.

Metals; Process for the recovery of — from ores and the like. C. S. Vadner, Salt Lake City, Utah. U.S. Pat. 1,144,402, June 29, 1915. Date of appl., June 16, 1914.

THE ore is treated with sulphur dioxide in the presence of moisture and leached. After the removal of excess sulphur dioxide, the solution is partly neutralised and then blown with air to precipitate ferric hydroxide.—W. E. F. P.

Sulphide ores; Process for treating complex —. G. E. Kingsley, Spokane, Wash. U.S. Pat. 1,144,480, June 29, 1915. Date of appl., Jan. 22, 1915.

A MIXTURE of the ore with dilute nitric acid (maximum strength, 5%) is heated to 176° F. (80° C.) to produce a metal nitrate and free sulphur.—W. E. F. P.

(A) *Metal-coating, and (B) Alloy-coating, process.* J. C. Beneker, Cincinnati, Ohio. U.S. Pats. 1,144,523 and 1,144,524, June 29, 1915. Dates of appl., Aug. 18, 1911, and Jan. 9, 1913.

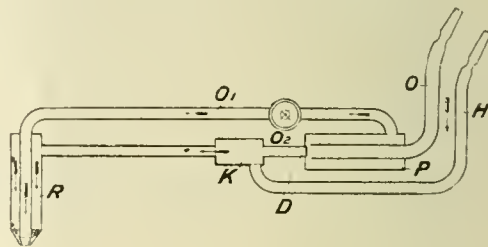
TO coat iron with a lead alloy, the cleaned surface is brought into contact with molten lead containing either (A) small proportions of cadmium or of zinc and cadmium, or (B) a considerable quantity of antimony and a small amount of cadmium, in the presence of a suitable flux.—W. E. F. P.

Magnetic [ore] separators. S. Brück, Charlottenburg, Germany. Eng. Pat. 20,552, Oct. 5, 1914. Under Int. Conv., Oct. 3, 1913. Addition to Eng. Pat. 11,898 of 1911, dated May 17, 1910.

THE efficiency of the separator described in the chief patent (this J., 1911, 1457) is increased by arranging several magnetic fields, in parallel, helically around the external surface of the cylindrical separating chamber; the entire surface of the separator may thus be utilised. The slime is fed on to the inner surface of the separator through volute channels, which cause it to take a helical path corresponding to the surrounding magnetic fields.—W. R. S.

Blow pipes [for cutting metals with oxygen]. Chem. Fabr. Griesheim-Elektron, Frankfurt, Germany. Eng. Pat. 15,763, July 1, 1914. Under Int. Conv., July 7, 1913.

OXYGEN passes from the pipe, O, into the chamber, P, whence a portion passes through the perforated disc, D, to the chamber, K, where it mixes with



hydrogen from the pipe, H, the mixed gases being led to the burner, R. The oxygen to be used for cutting passes from the chamber, P, by the pipe, O₁, at a point where variations in the amount taken do not affect the pressure of the gas in front of the disc, D. In another form, the end of the pipe, O, is connected directly to the pipe, O₂, and openings are provided near the end to admit oxygen to the chamber, P.—W. F. F.

Electroplating process. C. B. Mills, Baltimore, Md. U.S. Pat. 1,144,226, June 22, 1915. Date of appl., March 16, 1915.

NON-METALLIC articles are treated with a "moisture- and acid-proof filling and coating solution" of asphaltum, methylated spirits, stearic acid, and glycerol, then with a sizing solution, and an adhesive ground coating of litharge, asphaltum, methylated spirits, and a suitable gum resin is afterwards applied. On this is applied a dry powdered conducting substance, first alone and then mixed with a volatile liquid, the prepared surface being finally electroplated.—B. N.

Welding; Electric — and fusion deposition of metals. A. P. Strohmer, Assignor to Slaughter and Co., Ltd., London. U.S. Pat. 1,144,390, June 29, 1915. Date of appl., Dec. 23, 1914.

AN electrode for use in electric welding comprises a metallic core, of a composition selected according to the nature of the metal to be deposited, and a

relatively thin wire of another metal, such as aluminium, having a greater affinity for oxygen, so that it exerts a strong reducing action at the fusion temperature, laid alongside the metallic core. The core and wire are surrounded by a refractory fibrous material, which will melt and form a slag at the fusion temperature of the core.—B. N.

Steel ; Process for the treatment of —. F. Giolitti, Turin. Assignor to Soc. Anon. Italiana Gio. Ansaldo & Co., Genoa, Italy. U.S. Pat. 1,144,034, June 22, 1915. Date of appl., Apr. 8, 1913. SEE Fr. Pat. 453,712 of 1913 ; this J., 1913, 795.

Copper and nickel in copper nickel matte and other products ; Process of separating —. N. V. Hybinette, Christiania. Eng. Pat. 13,355, May 30, 1914.

SEE U.S. Pats. 1,128,313, 1,128,314, and 1,128,315 of 1915 ; this J., 1915, 364.

Zinciferous ores ; Method of treating — with sulphurous acid. Erzverwertungs-Ges. m. b. H., Berlin. Eng. Pat. 8479, April 3, 1914. Under Int. Conv., April 24, 1913.

SEE Fr. Pat. 474,306 of 1914 ; this J., 1915, 803.

Ores or other materials ; Process and apparatus for treating — in roasting and drying furnaces. O. Spinzig and W. Hommel, Clausthal, Germany. Eng. Pat. 8766, April 7, 1914. Under Int. Conv., April 9, 1913. Addition to Eng. Pat. 15,778, July 5, 1912.

SEE Addition of April 7, 1914, to Fr. Pat. 460,127 of 1913 ; this J., 1915, 183.

Metallic vapours ; Production and condensation of —. Helfenstein-Elektro-Ofen Ges. m. b. H., Vienna. Eng. Pat. 4101, Feb. 17, 1914. Under Int. Conv., Feb. 18, 1913.

SEE Fr. Pat. 468,445 of 1914 ; this J., 1914, 969. Reference is directed, in pursuance of Sect. 7, Sub-sect. 4, of the Patents and Designs Act, 1907, to Eng. Pats. 19,712 of 1906, 25,979 of 1909, 29,839 of 1910, and 27,881 of 1912.

Aluminium or alloys of aluminium ; Treatment of surfaces of — to prepare them for receiving a metallic deposit. F. A. Roux, Assignor to Soc. l'Aluminium Français, Paris. U.S. Pat. 1,144,000, June 22, 1915. Date of appl., Jan. 19, 1914.

SEE Fr. Pat. 464,720 of 1913 ; this J., 1914, 599.

Solder for aluminium and aluminium alloys. G. Bendel, Budapest. Eng. Pat. 7928, March 28, 1914. Under Int. Conv., April 3, 1913.

SEE Fr. Pat. 471,641 of 1914 ; this J., 1915, 431.

Sulphide ores ; Process of treating mixed —. E. Langguth, Neerpelt, Belgium. U.S. Pat. 1,144,181, June 29, 1915. Date of appl., Sept. 11, 1913.

SEE Fr. Pat. 456,500 of 1913 ; this J., 1913, 1018.

Generating heat [in fusion furnaces] ; Process for —. B. Stoughton, New York. Eng. Pat. 18,499, Aug. 10, 1914.

SEE U.S. Pat. 1,117,274 of 1914 ; this J., 1915, 35.

Reduction-furnace. H. Pape, Oker, Germany. U.S. Pat. 1,144,054, June 22, 1915. Date of appl., Nov. 28, 1913.

SEE Addition of Sept. 23, 1913, to Fr. Pat. 449,480 of 1912 ; this J., 1914, 321.

Furnace for working up ores. H. Pape, Oker, Germany. U.S. Pat. 1,144,053, June 22, 1915. Date of appl., Oct. 15, 1912.

SEE Eng. Pat. 22,715 of 1912 ; this J., 1913, 1073.

Ore roasting or drying furnace. H. M. Ridge, London. U.S. Pat. 1,143,438, June 15, 1915. Date of appl., Oct. 6, 1913.

SEE Eng. Pat. 23,763 of 1912 ; this J., 1913, 1115.

Separating the constituents of rocks ; Process of —. G. S. A. Appelqvist and E. O. E. Tydén, Stockholm. U. S. Pat. 1,143,797, June 22, 1915. Date of appl., Jan. 25, 1911.

SEE Eng. Pat. 1211 of 1911 ; this J., 1911, 810.

Making pure zinc oxide and recovering substances from liquors [of the wet copper extraction process]. U.S. Pat. 1,135,981. See VII.

Manufacture of [nickel] catalysts. U.S. Pat. 1,143,339. See VII.

Measuring temperature and resistivity. U.S. Pat. 1,144,776. See XXIII.

XI.—ELECTRO-CHEMISTRY.

PATENTS.

Electrolytic apparatus. W. E. Greenawalt, Denver, Colo. U.S. Pat. 1,144,538, June 29, 1915. Date of appl., Jan. 11, 1912.

THE electrolytic tank is divided into anode and cathode compartments by a straight diaphragm, and contains a straight reciprocating cathode and composite anodes on both sides of the cathode. Each anode consists of a series of suspended cylindrical rods arranged in line, and each rod is revolved about its vertical axis by a common driver.—B. N.

Anodes ; Process for manufacturing —. P. C. C. Isherwood, Bushey Heath. U.S. Pat. 1,143,828, June 22, 1915. Date of appl., May 17, 1913.

DENSE, hard, coherent electrodes of pure manganese dioxide are prepared by treating finely-powdered manganese ore with sulphuric acid, so as to remove metallic impurities such as iron, nickel, and cobalt compounds. The treated ore is made into a paste with a solution of manganese nitrate, moulded, dried, heated, and repeatedly soaked in manganese nitrate solution, dried, and heated to convert the nitrate into oxide, until the pores become filled.—B. N.

Storage-battery element and method of making the same. J. Redding, Malden, Mass., Assignor to E. Parker, Boston. U.S. Pat. 1,144,311, June 22, 1915. Date of appl., July 10, 1914.

A HOT, strongly-alkaline caustic solution containing a lead salt is electrolysed, using a lead anode, so as to deposit lead and the alkali metal on the cathode, and a portion of the current is shunted through an anode of another material than lead to prevent over-oxidation of the lead salt formed in the electrolyte. The cathode is washed to remove the alkali metal, leaving a porous, spongy mass of lead, which is dried in an atmosphere free from oxygen, the exposed portions of the lead deposit being afterwards converted into suboxide.—B. N.

Electro-osmotic processes; Apparatus for —. H. Illig and B. Schwerin. Assignors to Ges. für Elektro-osmose m. b. H., Frankfurt, Germany. U.S. Pat. 1,133,967, March 30, 1915. Date of appl., Feb. 26, 1914.

THE apparatus comprises a cylindrical anode, and comparatively wide laminae mounted, in a plane perpendicular to the axis of the anode, on rods parallel to the surface of the anode, so as to form a cathode with slots of greater length and width than thickness. An agitator forces the liquid and material in suspension in a stream from the container through the slots towards the anode.

—B. N.

Electrolytic apparatus. Maschinenfabr. Sürth Ges. m. b. H., Sürth, Germany. Eng. Pat. 8367, April 2, 1914. Under Int. Conv., Sept. 3, 1913.

SEE Fr. Pat. 462,394 of 1913; this J., 1914, 322.

[Electrolytic] production of chlorates of alkalis and alkaline-earths. U.S. Pat. 1,143,586. See VII.

Thermo-electric pyrometer system. U.S. Pat. 1,144,688. See XXIII.

Measuring temperature and resistivity. U.S. Pat. 1,144,776. See XXIII.

XII.—FATS; OILS; WAXES.

Oils extracted with carbon bisulphide and technical oils in general; Methods of purifying —. F. Canzoneri. *Annali Chim. Appl.*, 1915, 3, 344—349.

OLIVE oils which have been extracted with carbon bisulphide are not bleached by sulphur dioxide, hydrogen peroxide, ozone, or hydrosulphite, the difficulty of decolorisation being increased by the amount of iron invariably present. The use of ultra-violet rays has been successful for the purpose. By shaking the oil with 0.5 % of potassium chromate dissolved in a little water, and 5 to 6 % of hydrochloric acid, keeping the mixture for some hours at 90° to 100° C., filtering, and washing the filtrate, a pale yellow oil is obtained without material alteration or loss. The origin, quality, degree of oxidation, and especially the acidity of the oil affect the decolorisation. Neutral oils are more readily bleached than acid oils. In neutralising oils with an acidity of more than 50 %, emulsification may be prevented by mixing the oil with a neutral oil and treating the mixture with potassium or sodium hydroxide. When the acidity is over 50 % the oil may be heated to 120°—150° C. with 7 % of calcium hydroxide and afterwards extracted with petroleum spirit or acetone. Simultaneous neutralisation and decolorisation is effected by treating the hot oil with the calculated amount of lime and 2 to 3 % of fullers' earth, and extracting the mixture with petroleum spirit. A method of neutralising such oils by converting the free fatty acids (chiefly oleic acid) into ethyl esters has given good results in practice. The decolorised product (sp. gr. about 0.9) has a pleasant odour, burns steadily, is completely saponifiable although with some difficulty, is soluble in alcohol, and is very oxidisable, becoming thick in time. An esterified oil thus prepared from a "sulphur" oil with an acidity of 22 % had the following characters:—Sp. gr., 0.9055; refractometer reading (Zeiss) 51.3; iodine value, 75.2; and viscosity 5.8. Another sample with sp. gr. 0.901, iodine value 73, and viscosity 4.5, had the following approximate composition:—Esters of fixed acids (oleic) 51; esters of volatile fatty acids 2; glycerides 37; free fatty acids (as oleic) 5.0; hydroxystearic acid 3; and stearylactone 2 %. Details of the process of

esterification are reserved pending the issue of the patent. (See also this J., 1914, 1017.)—C. A. M.

Osage orange; Some important constituents in the fruit of the —. J. S. McHargue. *J. Ind. Eng. Chem.*, 1915, 7, 612—613.

THE Osage orange (*Machura pomiferum*) occurs abundantly in various parts of the United States. The fruit weighs on the average 1—1½ lb., and when ripe contains 80 % of water. The dried pulp contained 17.56 % of protein (N×6.25) and yielded to acetone 29.3 % of a brownish semi-solid resin. The seeds yielded to ether 42 % of a light yellow, semi-drying oil, somewhat less viscous than refined cottonseed and linseed oils; sp. gr. 0.929, iodine value 134—136, saponification value 192. The oil is insipid and has a pleasant odour. The residual meal, after extraction of the oil, contained 67.5 % of protein. (See also this J., 1914, 544.)—A. S.

Kambara earth and its bleaching action on oils. S. Ueno. *J. Ind. Eng. Chem.*, 1915, 7, 596—600.

THE bleaching action of Kambara earth (see this J., 1913, 12) on fatty oils increases with the temperature up to a certain point (about 140° C. for soya bean oil) and then gradually decreases; soya bean oil requires a higher temperature than drying oils, fish oils, etc. Below 130° C. the bleaching effect increases with the duration of treatment, but above about 150° C. the most satisfactory results are obtained by a short treatment. The bleaching action is diminished when the oil is agitated by a current of air during the treatment; a current of carbon dioxide has practically no effect, and hydrogen appears to have a favourable influence: in presence of inert or reducing gases, the bleaching is not much affected by variations of time and temperature. In the case of oils, such as chrysalis, rice, and soya bean oils, containing a considerable proportion of nitrogenous or mucilaginous impurities, treatment with chemicals previous to bleaching with the earth is advantageous. The bleaching action of the earth is diminished by the presence of free water, by treatment of the earth with strong inorganic acids or alkalis, and by heating the earth to a high temperature; treatment with weak acids, such as phosphoric acid and organic acids, has no effect. The spent residual earth has no bleaching power, but may be revived to a considerable extent by extraction with an oil solvent. When shaken with cod-liver oil the earth acquires a bluish green colour, the production of which may be applied to the detection of cod-liver oil. The chemical characters of oils bleached with Kambara earth differ but little from those of the original oils. The bleached oils have no injurious action on a nickel catalyst such as is used in oil-hardening processes, and the earth itself may be used as a carrier for such catalysts.—A. S.

Mineral oil in dégras and in mixtures with fatty substances; Detection and determination of —. K. Biazzo. *Annali Lab. Chim. Centr. delle Gabelle*, 1914, 7, 349. *Annali Chim. Appl.*, 1915, 3, 374—375.

AFTER saponifying as usual, the aqueous soap solution is treated with phenol before extracting with ether to remove the unsaponifiable matter. The phenol combines with the excess of alkali, and a sharp and rapid separation of the ethereal and aqueous layers is obtained. The ethereal layer is treated with potassium carbonate, washed with water, dehydrated, and distilled. A. S.

Emulsions; Experiments on —. H. T. R. Briggs and H. F. Schmidt. *J. Phys. Chem.*, 1915, 19, 478—499. (See also this J., 1915, 560.)

EXPERIMENTS were made upon the emulsification of benzene and water under comparable conditions

and in continuation of Newman's work (this J., 1914, 207). Two types of emulsions of benzene and water are possible, according to the nature of the emulsifying agent and the properties of the films in the dimeric interface. With mixtures of water containing 1% sodium oleate with 90 to 70% benzene, there was only partial emulsification after shaking for 5 mins., and three layers were visible, whereas with proportions of 60 to 10% of benzene there was complete emulsification. With higher proportions of benzene prolonged shaking was required for emulsification, but the best method was to add the benzene gradually and to complete the emulsification before each fresh addition. The optimum concentration for the soap solution is about 1%, which is in accordance with Brigg's qualitative test (this J., 1915, 434). A small amount of free alkali hydroxide stimulates emulsification, but a large amount has a strong restrictive action. The production of an emulsion when a pure oil is shaken with a liquid indicates the presence of a substance suspended in the aqueous phase, but non-emulsification does not necessarily prove the absence of a suspended colloid. Gelatin is not as efficient as alkali soap and is little better than ferric acetate as an emulsifying agent. Given the presence of a suitable benzene-soluble emulsifying agent, emulsions of water in benzene may be obtained, and the relative quantities of the two phases and the wetting of the walls of the bottle have then only a secondary influence on the type of emulsion produced. Donnan's "drop method" (Z. physik. Chem., 1899, 31, 42) does not afford a direct measure of the probable efficiency of a substance for the emulsification of a given liquid. —C. A. M.

Oxidation of cholesteryl acetate with chromic acid. Windaus and Resau. See XX.

Coprosterol. Windaus and Ubrig. See XX.

Cane wax. By-products of the cane sugar industry. II. Cross. See XVII.

PATENTS.

Refining oil; Apparatus for —. W. C. McElheny, Pittsburgh, Pa. U.S. Pat. 1,142,826, June 15, 1915. Date of appl., Nov. 25, 1912.

SEVERAL helical pipe coils are arranged concentrically inside a tank having an inverted conical bottom with a central outlet. Underneath the tank are two manifolds connected with the upper and lower ends of the several coils, each connection passing through the tank bottom and being fitted with a separate regulating valve. The upper ends of the several coils are at about the same level, and the lower ends rest closely against the bottom of the tank. —W. N. B.

Lubricants; Preparation of —. S. H. Blichfeldt, Southall. Eng. Pat. 15,463, June 27, 1914.

LIQUIDS of low internal friction (water or aqueous soap solutions) are emulsified with relatively insoluble liquids (oil), so that the suspended particles of the emulsion have a diameter not exceeding 1μ . Such mixtures can be retained in bearings against high pressure. The emulsions may be prepared in the apparatus described in Eng. Pats. 7498 of 1912, 23,653 of 1913, and 18,048 of 1914 (this J., 1913, 763; 1914, 1218). —C. A. M.

Catalysers [for hardening oils and fats]; Method of preparing —. A. J. Spieler, Celina, Ohio. U.S. Pat. 1,139,592, May 18, 1915. Date of appl., March 22, 1913.

GELATINOUS aluminium hydroxide or gelatinous silica, or a mixture of the two, is incorporated with nickel formate and carbonate suspended in water, and the mass is suspended in an oleaginous

medium, and heated to 235°—250° C. to decompose the nickel salts. —W. F. F.

Emulsions; Manufacture of — and of substances for use therein. C. Büchel, Frankfurt, Germany. U.S. Pat. 1,143,199, June 15, 1915. Date of appl., May 26, 1914.

SEE Fr. Pat. 472,655 of 1911; this J., 1915, 560.

Catalysts [for hydrogenating fats]; Production of —. C. und G. Müller Speisefettfabr. A.-G., Berlin. Eng. Pat. 7670, March 26, 1914. Under Int. Conv., June 20, 1913.

SEE Fr. Pat. 470,361 of 1914; this J., 1915, 186.

Treatment of silicate glasses and preparation of useful products [water-glass, etc.] therefrom. Eng. Pat. 11,959. See VII.

Catalytic reactions and catalytic agents for use therein. Eng. Pat. 8462. See I.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Camphor oil in oil of turpentine; Detection of —. E. Coen. Annali Lab. Chim. Centr. delle Gabelle, 1914, 7, 99. Annali Chim. Appl., 1915, 3, 372.

To detect light camphor oil in oil of turpentine and to distinguish it from pine oil, the author proposes testing for safrol, which is a constituent of camphor oil. 100 c.c. of the sample is distilled, and the last 5 c.c. of distillate is treated with an equal volume of concentrated sulphuric acid, added drop by drop, and cooling after each addition. The liquid is then added to 20 c.c. of water and extracted with 10 c.c. of amyl alcohol. On treating the amyl alcohol layer with 5 c.c. of a 20% solution of potassium carbonate, a green or bluish coloration, changing to red on addition of sulphuric acid, is produced in presence of safrol. —A. S.

PATENTS.

Oil varnishes and the like; Manufacture of —. Reichhold, Flügger, und Boecking, Hamburg, Germany. Eng. Pat. 15,595, June 29, 1914. Under Int. Conv., July 7, 1913.

SEE Ger. Pat. 282,959 of 1913; this J., 1915, 724.

Process of making pure zinc oxide. U. S. Pat. 1,135,981. See VII.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Rubber gum; Specification of vulcanised — by volume and its determination by a new solution method. F. Gottsch. J. Ind. Eng. Chem., 1915, 7, 582—586.

THE following methods for the chemical analysis of rubber goods are those in use at the Mt. Prospect laboratory, Dept. of Water Supply, Gas, and Electricity, New York. *Acetone extract.* 2 grms. of the sample is extracted continuously for 7 hours with 50 c.c. of acetone; the extraction is continued for 4 hours longer if the liquid in the siphon cup is still coloured after 7 hours. The acetone extract is evaporated with live steam, dried at 95°—100° C., and weighed. *Free sulphur.* The acetone extract is fused with potassium carbonate and sodium peroxide and the sulphur determined as barium sulphate. *Organic acetone extract* is the difference between the total acetone extract and the free sulphur. *Mineral fillers.* 1 gm. of the sample is extracted with acetone for 4 hours, then

dried at 95°—100° C., transferred to a beaker, the extraction thimble incinerated, and the ash added to the residue in the beaker. 50 c.c. of clear, molten salol is then introduced into the beaker, which is heated at 120°—150° C. until the rubber appears to be dissolved. The liquid is poured off, and if particles of undissolved rubber are perceptible in the residue, the latter is treated with a further quantity of salol. The united solutions are treated with 2 c.c. of a 1% solution of "soluble cotton" in amyl acetate, to act as a coagulant for finely-divided, suspended mineral matter, and after cooling, at least 75 c.c. of redistilled oil of turpentine is added. The flocculent precipitate is allowed to settle, the rubber solution decanted and filtered through an alundum crucible, and the residue washed by decantation with oil of turpentine and transferred to the crucible. The contents of the crucible are treated with a few c.c. of acetone to dissolve the "soluble cotton," and then washed with acetone, as is also the main residue of mineral matter. The mineral matter is dried to constant weight at 105°—110° C. All filtrates and washings are evaporated, the residue incinerated, and the weight of ash added to the weight found previously. It is stated that molten salol will dissolve soft rubber in less than 1 hour and vulcanite in 2—3 hours. *Total sulphur* is determined as barium sulphate after fusion with potassium carbonate and sodium peroxide. "*Foreign*" *chloroform extract*. If the material has a dark colour the residue from the acetone extraction, without removing the acetone, is extracted with chloroform for 4 hours. If the chloroform extract is very dark in colour or yields a tarry residue, 3% of the weight of vulcanised rubber gum (see below) is deducted from its weight. "*Foreign*" *alcoholic potash extract*. The residue from the chloroform extraction, or, if the material is light coloured (absence of tar, pitch, and asphaltum), the residue from the acetone extraction is dried at 95°—100° C., and heated in a pressure flask with 50 c.c. of N/1 alcoholic potash for 4 hours at 105°—110° C. The mixture is filtered, the residue washed with hot absolute alcohol, the filtrate made strongly acid with concentrated hydrochloric acid to precipitate potassium chloride, filtered, and the filter washed with hot chloroform. The filtrate is evaporated until the odour of hydrochloric acid just disappears, then treated with chloroform, filtered, and the chloroform solution evaporated. If the residue is not oily or greasy to the touch, it consists of rubber dissolved by the alcohol and is not reported; otherwise it is washed with small portions of naphtha (88° B., sp. gr. about 0.65), the naphtha evaporated, and the residue dried at 95°—100° C. *Carbonaceous foreign matter*. 1 gm. of the sample is heated with 30 c.c. of concentrated nitric acid and 15 c.c. of water; a black insoluble residue indicates the presence of lampblack, graphite, etc. If fibres or carbon can be perceived when the ground rubber or residue of mineral matter (see above) is examined microscopically, the mineral matter is washed with hot dilute hydrochloric acid and water, dried to constant weight at 105°—110° C., ignited, again weighed, and the difference recorded as carbonaceous foreign matter. *Specific gravity* is determined by weighing a strip of not less than 5 grms., thoroughly wetting it in water, with pressing and squeezing, to remove bubbles or films of air, and then weighing in water at 20° C. (taken as sp. gr. = 1.0). The percentage of vulcanised rubber gum by weight is obtained by subtracting from 100 the sum of the percentages of free sulphur, organic acetone extract, mineral fillers, and corrected foreign matter; the correction for the foreign chloroform extract is based on the vulcanised rubber gum calculated as above, except that the uncorrected value for foreign matter is used. The percentage of vulcanised rubber gum by weight when multi-

plied by the specific gravity gives the percentage of vulcanised rubber gum by volume, and the author strongly advocates the use of this latter value in specifications in preference to the percentage by weight. Free sulphur, total sulphur, and organic acetone extract are calculated separately and recorded as percentages by weight of the vulcanised rubber gum.—A. S.

Variability [of plantation rubber]. P. Schidrowitz. Rubber Industry, London, 1914, 212—229.

FROM an investigation of the variability of plantation rubber of various types, with a view to working out a systematic method of testing, the author, in conjunction with others, has arrived at the following conclusions:—Vulcanisation is physically and mechanically a progressive process; its progress can be accurately expressed by a series of stress-strain curves, and the state of cure of a given mixing at a given time is expressed by the corresponding curve. The curves representing progressive cures are related mathematically; and the series of curves for any one rubber are related mathematically to those of any other rubber. If x represent load (ordinate) and y elongation (abscissa), as curing proceeds the curves come regularly lower down in the diagram and do not cut one another at any point. Near the point of inflection the curves become parallel. The rate of stretch therefore decreases with increasing load and is independent of the state of cure. The curves correspond to $y = a - b \cdot \sin a x$; $x = n(a \cdot \cot a - b \cdot \cos a)$; a and b depend on the state of cure, and n is a constant independent of the state of cure. The relationship between the two series of curves for two different rubbers is represented by the value of the expression $a \cdot n$, which corresponds to slope or type. In every series there is a curve in which $a = b$, although $a \cdot n$ may vary. Physically, a represents the inverse of stretch capacity, and b the limit of extension; thus the curve in which $a = b$ corresponds to a theoretically ideal balance of properties. Experiment shows that the cure represented by this curve actually gives the best results for tensile properties, etc. In practice it is possible from the curve of a single preliminary cure to deduce the exact form of the curve for the "perfect" cure, and so find the time of cure. Comparison between the tensile properties of different rubbers is made by examining "perfectly" cured samples. In the author's system marks are allotted for tensile strength and elongation at break (i.e. work done in taking the test-piece to breaking-point); "type," which includes the chief mechanical properties; and curing capacity, which also involves physical condition and stability. Many results are quoted, from which the great variability of the rubbers examined is evident.

—E. W. L.

Caoutchouc from isoprene; Nature of synthetic —. C. Harries. Ber., 1915, 48, 863—868.

STEIMMIG (this J., 1914, 267, 430) expresses the view that artificial caoutchouc from isoprene is a mixture of two polymers of (1.5)-dimethyl-cyclo-octadiene-(1.5) and (1.6)-dimethyl-cyclo-octadiene-(1.5) and that caoutchouc identical with the natural product cannot be prepared from isoprene. The author, however, contends that the formation of the polymer of (1.6)-dimethyl-cyclo-octadiene-(1.5) is due to catalytic impurities which vary in isoprene obtained from different sources (see also this J., 1914, 325, 766). An appreciably different product is obtained when the isoprene is purified beforehand, and it is suggested that exhaustive purification would completely eliminate the formation of the (1.6)-isomer.—J. R.

PATENT.

Rubber latex; Coagulation of —. Dunlop Rubber Co., Ltd., London, and E. Mosinger, Hanau, Germany. Eng. Pat. 16,096, July 6, 1914.

LATEX is coagulated by the addition of a solution of aluminium, bismuth, or zinc chloride, or of a mixture of these salts, in the proportion of about 1 grm. of chloride in 10 c.c. of water to 100 c.c. of latex. In the case of bismuth chloride an appropriate quantity of acid must be used to form the solution.—E. W. L.

XV.—LEATHER; BONE; HORN; GLUE.

Hide; Absorbent power of plumped — towards vegetable tannins. E. Kudlacek. Collegium, 1915, 1—25, 59—80, 117—129, 163—179. J. Amer. Leather Chem. Assoc., 1915, 10, 387—390.

IN these experiments the author used dehydrated and neutralised calf pelt, which was carefully washed with water. For tanning, liquors varying from 0.2% to 3% tannin were used. Adsorption was practically complete in 4 to 5 weeks. At first tannin is rapidly taken up, then the absorption of non-tannins increases until it exceeds that of the tannins. Finally, the tannin begins to decompose and the products leave the hide, giving an apparently negative result for non-tannin absorption. Loss of hide substance is greatest with weak liquors and is best prevented by supplying tannin rapidly with more concentrated liquors. The specific gravity, tensile strength, elasticity, etc., of the leathers obtained was also determined.—F. C. T.

Water-soluble matter; Determination of — in leather. C. C. Smoot and L. E. Stacey. J. Amer. Leather Chem. Assoc., 1915, 10, 363—365.

A NEW apparatus for the control of temperature during extraction is described.—F. C. T.

Sludge; Recovery of — from the sulphide process of depilating skins. J. Helfrich. J. Amer. Leather Chem. Assoc., 1915, 10, 367—369.

THE dried sludge contains 4% available nitrogen, and is a valuable fertiliser. The original sludge cannot be directly filtered either mechanically or through sand filter beds, but needs the addition of aluminium sulphate as precipitant. Sulphuric acid may also be used, in which case less sulphate is needed and the process becomes profitable. The final product should not contain more than 15% of moisture.—F. C. T.

Osage orange, a substitute for fustic. Kressmann. See IV.

Detection and determination of mineral oil in dégras and in mixtures with fatty substances. Biazzo. See XII.

Experiments on emulsions. Briggs and Schmidt. See XII.

PATENTS.

Leather; Manufacture of decolorised or bleached —. J. Y. Johnson, London. From Badische Anilin und Soda Fabr., Ludwigshafen, Germany. Eng. Pat. 8028, Mar. 30, 1914.

LEATHER which has been more or less strongly stained or discoloured by the use of strong tanning extracts, may be decolorised or bleached by soaking it in a solution of one or other of the synthetic tanning agents described in Eng. Pats. 8511 and 24,216 of 1912, and 7137, 7138, and 18,253 of 1913 (this J., 1913, 246, 919; 1914, 269, 366, 841).

—E. W. L.

Semiplastic material [artificial horn, etc.] from the soya bean; Preparation of —. R. Dodd and H. B. P. Humphries, London. U.S. Pat. 1,143,893, June 22, 1915. Date of appl., June 26, 1914.

SEE Eng. Pat. 15,316 of 1913; this J., 1914, 841.

Treatment [proofing] of fibrous and felled substances [e.g., hide]. Eng. Pat. 12,079. See V.

XVI.—SOILS; FERTILISERS.

Humic acid; Nature of —. S. Odén. Arkiv. Kemi, Mineral., och Geologi, 1914, 5, No. 15, 1—13. Bull. Agric. Intell., 1915, 6, 660—661.

THE electric conductivity of various humus extracts mixed with very dilute ammonia was determined, and also that of the ammonia solutions separately. The extracts were prepared from "black" peat (well humified *Sphagnum* and *Eriophorum* peat), from well humified dry leaves, and from dried *Sphagnum* moss. Adsorption of ammonia was noted in all three cases, and the formation of salts in the first two cases was inferred from the observed increases in conductivity. It is concluded that humus contains one or more acids.—E. H. T.

Denitrifying thiosulphate bacteria; Physiology and distribution of —. A. Gehring. Centr. Bakt., 1914, 42, 402—433. Bull. Agric. Intell., 1915, 6, 660—661.

THE form of anærobic denitrifying thiosulphate bacterium discovered by Lieske in the mud of the Leipzig Botanical Gardens is very widely distributed and of great importance in nature. The number in arable soil, compost, beechwood mould, and peat was found to be very different; it increased with the carbon content of the soil, but did not vary with the depth of the soil in arable land and in peat. Different soils appear to contain different forms, the denitrifying power of these bacteria present in compost, beechwood mould, and peat being four times greater than that of those present in arable soil. The decomposition of nitrate varies directly with the thiosulphate and nitrate content of the medium: the former can be replaced by other sulphur compounds, but no substitute was found for nitrate as a source of oxygen. The addition of thiosulphate to the soil causes active denitrification, which is greatest when organic substances are added also. The denitrification is greatly increased by addition of bicarbonate to the soil.—E. H. T.

Soil solution; Electrolytic determination of biological —. E. Pantanelli. Centr. Bakt., 1914, 42, 439—443. Bull. Agric. Intell., 1915, 6, 663.

THE determination of the effects of microbial activity in promoting the availability of soil constituents was studied by measuring the electrical conductivity of the solutions obtained by percolation through various soils. These were treated with: sterilised water, sterilised water saturated with chloroform or containing 0.5% dextrose, or with water containing both chloroform and dextrose (three percolations), and it was found that the electrical conductivity was a good criterion of the solution of the soil particles by microbiological action, particularly if comparative determinations were made with and without the addition of chloroform and dextrose. The solubility of the soil constituents was increased in presence of chloroform, but usually decreased when dextrose was present; it also usually varied with the number of bacteria.—E. H. T.

Fermented molasses, as a source of nitrogenous and potash fertilisers. A. Aita. *Italia Agricola*, 1915, 52, 54—57. *Bull. Agric. Intell.*, 1915, 6, 663.

TAKING the last Italian sugar beet crop at 2.65 million tons, the yield of molasses would be about 100,000 tons, which would contain 1500 tons of nitrogen and 5000 tons of potash (K_2O). The residues obtained from the fermentation and distillation of molasses, known as "salin," contain 45—50% of potash but do not sell well: hence an attempt has been made to convert the carbonate content into sulphate by treatment with sulphuric acid. The treated product contains: total potash 38.92%, sulphuric acid 29.91%, and carbonic acid 4.20%. By this process the unit price of potash is increased and the potash content is lowered, yet potassium sulphate, presumably from this source, was put on the market in Italy last autumn. A sample examined consisted of minute pale yellow crystals, and contained 72.40% potassium sulphate; if the carbonate had been completely converted there should have been 79.24%.
—E. H. T.

Cyanamide; Ammonification of—. E. Lehnis. *Z. Gährungsphysiol.*, 1914, 5, 16—25. *Bull. Agric. Intell.*, 1915, 6, 673—675.

LABORATORY tests to determine the amount of ammonia formed in nutritive solutions containing calcium cyanamide, with and without soil, asparagin, and dextrose, showed that the presence of soil and an acid reaction (produced with lactic acid) were favourable, but that an alkaline reaction was inimical to the production of ammonia. Further, the intensity of the decomposition of the cyanamide solution was independent of the presence of asparagin and dextrose. Bacteria only were present in the alkaline solutions; they predominated in the neutral liquids, and were always present in the slightly acid solutions but were accompanied by *Eumyces*. In almost pure cultures prepared from the above samples, ammonification took place in the acid solutions only, and with increased intensity, but completely stopped in the neutral solutions; when the latter were inoculated with acid solution of the same composition, ammonia was produced. *Eumyces* developed vigorously in presence of acid, but were not present in neutral and alkaline solutions. Neutral cyanamide was always more decomposed than the alkaline solution of calcium cyanamide. In the latter solution acidification stimulated the ammonia production but it was without influence on the former. The active micro-organisms were isolated from all the soils, and of the 14 mycelles obtained, 7 seemed to belong to the *Penicillium* group. It is considered improbable that their action is of great importance under field conditions; the cyanamide is probably converted by the soil colloids, etc., into urea, and this is then ammonified by various bacteria and finally nitrified.—E. H. T.

Tricalcium phosphate; Formation of—on mixing ground limestone with acid phosphate [superphosphate]. R. N. Brackett and B. Freeman. *J. Ind. Eng. Chem.*, 1915, 7, 620.

GROUND limestone is sometimes used as a filling material in preparing lower-grade superphosphate from a higher-grade product. Tests made by the authors showed that when the two substances are mixed, formation of tricalcium phosphate begins immediately; the amount formed increases slightly on keeping. For example, in a mixture containing 85% of superphosphate (13.55% water-soluble phosphoric acid) and 15% of ground limestone, the content of water-soluble phosphoric acid was 10.50% on April 21, immediately after mixing, 8.66% on May 10, 8.15% on June 12, and 8.05% on Sept. 13th.—A. S.

Calcium cyanamide; Storage of—. A. H. Burgess and D. R. Edwardes-Ker. *J. S. E. Agric. Coll., Wye, Kent*, No. 22, 363—367. *Bull. Agric. Intell.*, 1915, 6, 675—676.

A SAMPLE of calcium cyanamide lost nitrogen at the rate of 0.07% per day when exposed to the open air. It lost very much less when exposed in a closed bottle to moist air, to carbon dioxide, or to both of these at the same time. No nitrogen was lost when the fertiliser was kept in a closed bottle; hence some atmospheric agent, other than carbon dioxide or moisture, is responsible for the loss on normal exposure.—E. H. T.

Recovery of sludge from the sulphide process of depilating skins. Helfrich. See XV.

PATENT.

Fertiliser, and process of manufacturing same. L. Kern, Hamburg, Germany. U.S. Pat. 1,144,905, June 29, 1915. Date of appl., March 27, 1915. See Ger. Pat. 278,492 of 1914; this J., 1915, 240.

XVII.—SUGARS; STARCHES; GUMS.

Sugar beet; Cultivation of—in the West of England. C. S. Orwin and J. Orr. *J. Board Agric.*, 1915, 22, 210—216.

THE authors have continued their enquiry into the prospects of establishing beet cultivation in England (this J., 1915, 294), and state that in Gloucester, Somerset, Devon, Berkshire, Wiltshire, and North and South Wales, though satisfactory yields on a small scale have been obtained, the attitude of the farmers at the present time is one of indifference because the prevailing high prices for live stock (oxen and sheep) and feeding stuffs (corn and mangolds) offer more certain and more lucrative profits. In Cornwall, especially in the south and west parts, the situation is different. The small holdings there are chiefly devoted to growing market garden crops (early potatoes and broccoli), in the cultivation of which competition from abroad is becoming keener, and the possibility of the introduction of beet is regarded with some favour; moreover labour conditions are better than in the counties above mentioned. Already in Cornwall landowners, farmers, and others privately subscribed half the cost of a factory, but the scheme did not materialise owing to the balance of the necessary capital not being obtained. A mistake would seem to have been made in proposing to stipulate that farmers should supply the roots for a period of 5 years at a fixed price without considering possible sugar market fluctuations. Moreover before recommending steps towards the erection of a factory the transport of the roots should be organised, the price offered being preferably for the beet at the farm-gate or the roadside. It is believed that capitalists might with advantage co-operate with farmers in Cornwall (where the situation is in several respects more promising than in Norfolk and Suffolk), for the authors consider there is little doubt that ultimately British agriculture will obtain a footing in the sugar market.—J. P. O.

Bagasse; Determination of sugar in—. H. Pellet. *Intern. Sugar J.*, 1915, 17, 327—328.

IN order to obtain the exact average amount of sugar in the bagasse of the cane sugar factory, the following conditions must be observed: (1) the bagasse must be uniformly sampled to the entire depth of the layer, and at the centre, as well as at both sides; (2) the sample must be well mixed, and passed through a suitable cutting machine to obtain a fine and uniform material; (3) this

divided sample must also be well mixed, and the sugar determined in it, using preferably the Norris-Pellet extracting apparatus (this J., 1913, 155), with which accurate results are rapidly obtained; and (4) the sugar determinations must be carried out frequently, at least every half-hour.

—J. P. O.

Saccharimetric analysis: Limits of accuracy in— C. A. Browne. Intern. Sugar J., 1915, 17, 320—326.

In the determination of sucrose in raw sugars by direct polarisation, errors may arise from (1) inaccuracy of the normal weight; (2) inaccuracy of the calibration of the flasks; (3) inaccuracy of the length of the observation tubes; (4) inaccuracy of the saccharimetric scale; (5) loss of moisture during mixing the sample; (6) loss of moisture during weighing the sample; (7) volume of precipitate during clarification by basic lead acetate; (8) precipitation of levulose in clarification; (9) imperfect mixing after clarification; (10) evaporation of the liquid during filtration after clarification; (11) omission of the bichromate cell in making the polarimetric observation; and (12) variation in the temperature between making up to volume and polarising. Errors from the first four causes are mutually compensating, and with careful management do not appear in the final average; while those resulting from the remaining eight causes all tend in one direction, the combination of influences being that of a plus error, which may amount to 0.48° V. It is, however, shown that with careful operating the errors arising from causes 5, 6, 7, and 8 may be reduced, and those from 9, 10, 11, and 12 wholly prevented.—J. P. O.

Reducing sugars: Constant presence of— in the freshly pulled beetroot. H. Pellet. Bull. Assoc. Chim. Sucr., 1915, 32, 59—92.

EXAMINATION of a large number of beets grown in France, Germany, Austria, Holland, Belgium, Spain, Egypt, and England shows that the freshly pulled beetroot always contains a certain amount of reducing sugars (see also this J., 1913, 38), which may vary from 0.04 to 0.50 per 100 parts of juice, and is usually about 0.08 to 0.15. There is no relation between the quantity of sucrose in the beet and its content of reducing sugars, though in general the glucose ratio (reducing sugars per 100 of sucrose) diminishes as the sucrose content increases; nor is there any relation between the content of the juice in reducing sugars and the maturity of the root. Beetroots exposed to the open air for several days after being pulled do not show an increased glucose ratio. Fodder beets or semi-fodder beets do not appear to contain a greater amount of reducing sugars than sugar beets, though the glucose ratio of the juice is high (about 42) on account of the comparatively small sucrose content. Sugar beets after being preserved under favourable conditions for 5 or 6 months only contain a small quantity of reducing sugars, namely, 0.13 to 0.18 per 100 c.c. of juice for a sucrose content of 13 to 15%.—J. P. O.

Sugar solutions; Hydrolysis of— under pressure. W. S. Hubbard and W. L. Mitchel. J. Ind. Eng. Chem., 1915, 7, 609—610.

SUGAR solutions were heated with water at varying pressures and temperatures, and the amount of inversion was determined. With a solution of 25 grms. of cane sugar to 25 c.c. of water, 94% of the sugar was inverted in 3 hours at 127° C. and a pressure of 1.5 kilos. per sq. cm. It is important to use pure sugar and distilled water: with slightly alkaline tap-water hydrolysis was retarded appreciably and considerable caramelisation occurred. For the preparation of non-crystallisable syrups

for preserving, etc., the authors recommend heating a solution of 1 part of sugar to 5 parts of water at 124° C. and a pressure of 1.375 kilos. per sq. cm.

—A. S.

Carbohydrates; Acetolysis [acetylation] of— S. Born and J. M. Nelson. J. Amer. Chem. Soc., 1915, 37, 1763—1769.

SUCROSE treated with acetyl chloride or acetyl bromide yields acetochloroglucose or acetobromoglucose, whilst maltose yields acetochloromaltose or acetobromomaltose. Maltose treated with acetic anhydride and a trace of sulphuric acid in the cold yields octa-acetylmaltose. Lactose treated with acetyl chloride at ordinary temperature gives a white, non-crystallisable glistening powder which is probably acetochlorolactose. α -Methylglucoside treated at ordinary temperatures with acetic anhydride and a trace of sulphuric acid yields α -penta-acetylglucose, whilst with acetyl bromide it yields a non-crystallisable syrup. Inulin treated with ice-cold acetyl bromide gives an unidentified syrup.—T. C.

Cane war. By-products of the cane sugar industry. II. W. E. Cross. Intern. Sugar J., 1915, 17, 311—313.

It has been proposed by Wijnberg to recover the wax occurring on the outer surface of the sugar cane by subjecting the stalks to a vibratory action and blowing the wax to a suitable collector. Extraction with organic solvents from the filter-press cakes is too costly, principally because fats and oils are also withdrawn, but experiments made by the author indicate that successful results are likely to be obtained by submitting to centrifugal action the raw mill juice, in which the wax is suspended. In this way a product containing over 50% of wax was obtained, and this on being once crystallised from alcohol gave a pure, hard product melting at 82° C.—J. P. O.

Reduction of copper oxide in alcohol vapour in reducing sugar determinations and in copper analysis. Wedderburn. See XXIII.

Fermented molasses as a source of nitrogenous and potash fertilisers. Aita. See XVI.

XVIII.—FERMENTATION INDUSTRIES.

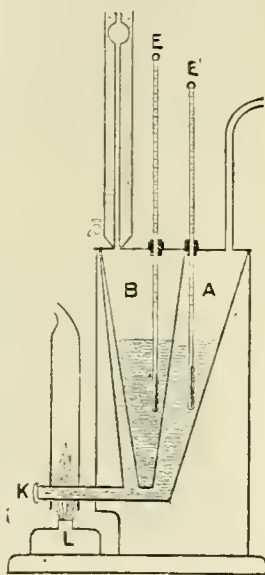
Proteases of must; Studies on the— E. Pantanelli. Centr. Bakt., 1914, 42, 480—502. Bull. Agric. Intell., 0915, 6, 741—743.

MUSTS from various kinds of grapes from Modena and near Rome were examined, and it was found that an autolytic protease could only be detected with certainty in the must from perfectly ripe fruit, and that the effect of its activity was either to increase the protein content, owing to synthetic enzymic action, or to leave it unchanged, the synthetic action being balanced by proteolysis. A slightly alkaline medium favours synthesis; the addition of water, proteolysis. In the must from unripe grapes, after fermentation and exposure to air, proteolytic action is retarded by a zymogen; only those grapes are physiologically ripe in which the decomposition of their own proteins exceeds the formation of new ones. No proteolytic enzymes are present in clear must free from proteins. Must protease is normally insoluble, but a little can be dissolved from the lees by adding salt or alkalis; it coagulates albumin very slowly in acid solution, rather more rapidly in alkaline solution. Trypsin and, particularly, pepsin inhibit the action of must proteases; tannin, colouring matter, and acetic acid are antiproteolytic; the invert sugar and tartaric acid present in the ripening fruit-cells

are without action; gypsum and bisulphite favour proteolysis and cause an increase in the content of soluble organic nitrogen compounds in the must; alcohol and monopotassium phosphate reduce the soluble nitrogenous constituents. The optimum temperature of the reaction is about 35° C.; at 45° C. it ceases. Must protease disappears during fermentation; its function is to promote the decomposition of proteins which are unattacked by the cells of the ferment.—E. H. T.

Ebullioscope; A new — for the determination of alcohol in wine. P. Malvezin. Bull. Assoc. Chim. Sucr., 1915, 32, 104—108.

In the apparatus illustrated, which is claimed to obviate sources of error, notably those arising from the presence of a high percentage of dry extract, the wine is contained in the vessel, B, which is surrounded by the water-bath, A, the latter being heated by the lamp, L, at the elbow, K. By observing the thermometers, E and E', and referring to a table compiled from actual determinations made with wines of average composition, the content of alcohol is ascertained.—J. P. O.



Hydrocyanic acid and benzaldehyde; Determination of — in Kirsch liqueur. J. Golse. J. Pharm. Chim., 1915, 12, 44—56.

THE French official method for the determination of hydrocyanic acid and benzaldehyde in liqueurs is stated to be untrustworthy, the chief objections being the insufficient quantity of alkali used to fix the hydrocyanic acid during the distillation of the aldehyde and the wrong conditions under which the latter is precipitated as its phenylhydrazone. The following procedure is recommended: 200 c.c. of the liqueur is treated with 1 c.c. of sodium hydroxide solution (sp. gr. 1.32—1.36) in a 600 c.c. flask, and the mixture is distilled until 175 c.c. of distillate has been collected (A). The residual liquid in the flask is then cooled, 50 c.c. of 10% sulphuric acid is added slowly through a tapered funnel, and the mixture again distilled, 50 c.c. of distillate being collected in a receiver containing 5 c.c. of ammonia (B). The distillate (A) is now transferred to a distillation flask, 5 c.c. of phenylhydrazine reagent (see below) is added, the mixture is diluted to 200 c.c., and 75 c.c. is distilled over; this distillate contains traces of hydrocyanic acid and is added to the distillate (B). The lower end of the condenser is then closed and the flask is heated by a water-bath until the hydrazone has precipitated; two hours' heating is usually sufficient. The precipitate is collected on a filter, washed with water, and then dissolved by treatment with 10 c.c. of alcohol, followed by 20 c.c. of ether; the alcohol-ether solution is evaporated, the residue dried under reduced pressure, and weighed (see also this Journal, 1906, 139). The weight of the hydrazone multiplied by 2.7 gives the weight

of the benzaldehyde in 1 litre of the liqueur. The distillate (B) is treated with 1 c.c. of 10% potassium iodide solution and then titrated with N/20 silver nitrate solution until a distinct opalescence is obtained; the number of c.c. of silver nitrate solution required, multiplied by 13.5, gives the weight, in mgrms., of the hydrocyanic acid present in 1 litre of the liqueur. Three samples of genuine Kirsch liqueur examined contained from 17.8 to 35.8 mgrms. of hydrocyanic acid and from 29.7 to 37.3 mgrms. of benzaldehyde per litre. The phenylhydrazine reagent is prepared by dissolving 1 gm. of phenylhydrazine in a mixture of 4 c.c. of glacial acetic acid, 2 grms. of sodium acetate, and 20 c.c. of water, heating and shaking vigorously, adding 1 c.c. of sodium bisulphite solution, and filtering. The presence of the bisulphite prevents the oxidation of the phenylhydrazone during precipitation.—W. P. S.

Yeast; Influence of radio-activity on the — used in the beetroot distillery. R. Pique. Bull. Assoc. Chim. Sucr., 1915, 32, 55—57.

YEAST which has been submitted to the influence of salts of radium and actinium has been found to give yields in the beetroot distillery approaching the theoretical value (1 hectolitre of 100% spirit from 160.64 kilos. of sugar). Moreover, the initial acidity of the wort may be lowered, and fermentation is comparatively rapid.—J. P. O.

Brandy; Detection and determination of higher alcohols in —. L. Settimj. Annali Lab. Chim. Centr. delle Gabelle. 1914, 7, 163. Annali Chim. Appl., 1915, 3, 373.

THE following method is simpler and quicker than that of Rocques (this J., 1897, 1048) and gives slightly higher results: 10 c.c. of the alcohol to be examined, previously distilled and adjusted to 50% strength, is treated with 0.5 c.c. of a 1% solution of benzaldehyde in pure 50% alcohol and then with 10 c.c. of concentrated sulphuric acid, the latter being added gradually down the sides of the tube and finally mixed rapidly with the alcohol. After a quarter of an hour the colour of the solution is observed: this is cherry red if higher alcohols are present. The coloration may be compared with that yielded by a solution of 0.5 gm. of isobutyl alcohol in 1 litre of pure 50% alcohol.—A. S.

Fermented molasses as a source of nitrogenous and potash fertilisers. Aita. See XVI.

Fermentation of tea, cacao, coffee, and tobacco. Schulte im Hofe. See XIX.

PATENTS.

Beers; Process of making alcohol-free or practically alcohol-free —. C. Reiter, Brimsdown, Middlesex. Eng. Pat. 23,003, Oct. 11, 1913.

WORT or mash is acidulated to the required degree, preferably by the activity of acid-forming bacteria, particularly the *B. bulgaricus*; the wort is then hopped, whereby the action of the bacteria is inhibited, and heated at 55°—60° C. to produce coagulation. Alcoholic fermentation may be prevented or allowed to proceed to a limited extent, when it is checked preferably by pasteurisation in a closed vessel. Afterwards, the beer is chilled to facilitate clarification, then racked and filtered before bottling, being again pasteurised in bottle.—J. F. B.

Enzymes and toxins; Methods and apparatus for manufacturing — by aerobic bacteria. A. Boidin Seclin, France, and J. Effront, Brussels. Eng. Pat. 16,198, July 7, 1914. Under Int. Conv., July 11, 1913.

SEE Fr. Pat. 471,546 of 1913; this J., 1915, 444

XIXA.—FOODS.

Sugar; Preservation of meat and fish by ——. A. Vasseux. Bull. Assoc. Chim. Sucr., 1915, 32, 33–35.

THE author's process of preserving meat (this J., 1914, 38) has the disadvantages that owing to the absorption of water, syrup is formed, which must be replaced by a further amount of sugar; and that a sweet taste is imparted to the food. These inconveniences may be obviated by submitting the product to a preliminary desiccation *in vacuo* before covering it with the powdered sugar; it is stated that meat and fish thus treated may be preserved indefinitely without their properties being impaired.—J. P. O.

Flour; Modifications undergone by — during baking, and the chemical composition of bread. H. Kalning and A. Schleimer. Z. gesamt. Getreidewesen, 1914, 6, 137–143. Bull. Agric. Intell., 1915, 6, 745–747.

ROUND loaves of about 3.3 lb. weight, made from wheat or rye flour, with fresh yeast or sour dough, were baked in two sets, one set being removed from the oven when the crust had a pale yellow colour, the other when the crust was dark brown. There were no marked differences in the ash, protein, crude fibre, or nitrogen-free extract in the various loaves, but the percentage of carbohydrates decreased and that of ash, fat, and protein increased during baking. Determinations of the carbohydrate and dextrin contents in the total water extracts from flour, crust, and crumb, were not conclusive, but the baking of wheat flour caused a loss of sugar and that of rye flour a gain. Except in the case of rye loaf made with yeast, the dextrin and total extract were higher in the crust than in the crumb. The flours and loaves were digested for 2 hours with water and with alcohol (70 vol. %), and the two sets analysed for proteins. The proteins in the crumb were usually more soluble than those in the crust, and those in the flour more soluble than those in the loaves. The phosphorus content of the crust and crumb was practically the same as that of the flour.—E. H. T.

Gelatinising agents, pasty material, and thickeners, used in food products; Concise group method for the detection of ——. L. A. Congdon. J. Ind. Eng. Chem., 1915, 7, 606–607.

THE tests are applied to the aqueous extract of the sample: (1) *Starch* and *amyllo*, *erythro*, and *achroo-dextrin* are detected by means of iodine solution. (2) The solution is shaken with Millon's or Stokes' reagent (acid mercury nitrate): a cloudy appearance and the formation of a yellow precipitate with picric acid solution indicate *gelatin*. Another portion of the solution is treated with a drop of the acid mercury nitrate reagent: a gelatinous precipitate soluble in excess of the reagent, indicates *gum acacia*; a slight white cloudy precipitate may indicate either *agar-agar* or *gum tragacanth*. (3) A white gelatinous precipitate with a concentrated solution of sodium borate indicates *agar-agar* or *gum acacia*: the latter gives an opaque white precipitate with basic lead acetate, and a bluish black coloration with tannin solution. (4) A brown colour on heating with sodium hydroxide solution indicates *gum tragacanth*; a white cloudy precipitate indicates *gum acacia*. (5) A slight turbidity with mercuric chloride solution may indicate *dextrin*: a white precipitate may indicate *albumin* or *gelatin*. (6) A concentrated aqueous solution of the sample is treated with Schweitzer's cuprammonium reagent and examined under the microscope: the presence of *pectin* is indicated by the characteristic appearance of cupric pectate.—A. S.

Cottonseed meal; Determination of lint in ——. R. N. Brackett. J. Ind. Eng. Chem., 1915, 7, 611–612.

A MIXTURE of crude fibre and lint is prepared from a sample of the meal by the American official method for crude fibre, using alkali and acid of 1.25% strength, and 0.2 gm. of it is stirred vigorously with 25 c.c. of zinc chloride solution for 3 mins. on a boiling water bath; the lint is dissolved completely and the crude fibre partially. The residue is collected on asbestos in a Gooch crucible, washed with 25 c.c. of the zinc chloride solution, then with water and with a little 95% alcohol, dried, and weighed. The amount of crude fibre dissolved, and hence the correction to be applied, is determined by control determinations on crude fibre obtained from the hulls and the meal respectively of cottonseed from which the lint has been removed by hand picking and singeing; the mean of the two results is taken. The zinc chloride solution is prepared by dissolving metallic zinc in concentrated hydrochloric acid, evaporating until the solution solidifies on cooling, and then adding twice the weight of 40% hydrochloric acid.—A. S.

Tea, cacao, coffee, and tobacco; Fermentation of ——. A. Schulte im Hofe. Z. Unters. Nahr. Genussm., 1914, 27, 209–225. Bull. Agric. Intell., 1915, 6, 712–715.

Tea. Tannin is present in all stages of development of the tea leaf and in all qualities of tea: the tannin content is higher in the young leaves and in the best qualities of tea. Teas grown at the highest elevations are best and richest in tannin. During rolling, both the acid content and the soluble tannin increase, but the latter decreases during fermentation. Green leaves treated with lactic or acetic acid to inhibit bacterial development, still turned colour, showing that the tannins are not transformed during fermentation by bacterial action but by enzymes.

Cacao. In cacao fermentation—for which the optimum temperature is 35°–40° C.—alcoholic fermentation is succeeded on the second or third day by acetic fermentation; during the subsequent drying, oxidation of the astringent constituents takes place. The market value of the seeds varies inversely as their tannin content. A sample of seeds treated in the ordinary way contained 4.64%, and this figure was much reduced by omitting the cooling process during fermentation; fermentation in a vessel containing oxygen reduced it to 1.4%. When the seeds contain over 20% of moisture, butyric fermentation often occurs and causes mouldiness. Oxidation is most rapid at 50°–60° C., but must not be allowed to proceed too far, or loss of aroma occurs. Strong West African cacaos are improved by encouraging oxidation and by slow drying after the moisture content has been reduced to 20%.

Coffee. Coffee beans, from which most of the pulp had been removed, were subjected to alcoholic fermentation, warmed to 45° C., exposed to air, and then thoroughly dried. They remained green and gave an aromatic beverage. Beans treated similarly but also subjected to acetic fermentation became yellowish-white and gave a tasteless coffee. Besides killing the seeds, fermentation softens the pulp remaining on them and so facilitates washing and drying.

Tobacco. Fermentation of tobacco leaves is accompanied by a diminution in tannin content, and during the prolonged fermentation of finer tobaccos, nitrogenous substances probably undergo change. These substances greatly influence the quality of the final product, and, by the prolonged action of the acids during fermentation, are probably transformed into amino-derivatives, and eventually into ammonia, nitric acid, and organic acids.—E. H. T.

Amino-acids of feeding stuffs; Quantitative determination of the —. H. S. Grindley, W. E. Joseph, and M. E. Slater. *J. Amer. Chem. Soc.*, 1915, 37, 1778—1781.

THE amino-acids of three feeding stuffs. (I.) cottonseed meal. (II.) tankage, and (III.) alfalfa hay, were determined directly by Van Slyke's method (this J., 1911, 771, 1135) without first isolating and purifying the proteins. The following average results were thus obtained, expressed in per cent. of the feeding stuff:—

	Ammonia N.	Melanine N.	Arginine N.	Cystine N.	Histidine N.	Lysine N.	Amino N in filtrate from bases.	Non-amino N in filtrate from bases.
I.	0.702	0.522	1.311	0.043	0.367	0.321	2.876	0.365
II.	0.659	0.440	1.416	0.128	0.495	0.749	5.238	0.729
III.	0.222	0.415	0.202	0.019	0.196	0.108	1.157	0.257

—T. C.

Pepsin; Determination of —. L. J. Geselschap. *Z. physiol. Chem.*, 1915, 94, 193—226.

THE author investigated various methods for the determination of pepsin in gastric juice. Those of Volhard, and Fuld and Levison were found least satisfactory. Sufficiently accurate results can be obtained by Mett's method, which is based on the measurement of the decrease in length of threads of coagulated egg-albumin enclosed in short lengths of glass tubing during 24 hours' digestion, and also by Grützner's method (Pflüger's Arch., 144, 545), in which fibrin stained with carmine is digested for a short time and the amount dissolved estimated from the colour of the liquid. The latter method is preferable where a rapid estimation is desired or where the peptic activity of the juice investigated is small. Pepsin preparations obtained from the mucous membrane of pigs' stomachs by Pekelharing's method (*Z. physiol. Chem.*, 1896, 22, 233; 35, 8) can be used as a standard in these determinations, as they are very uniform in activity and can be kept for a long time without deteriorating.—J. H. L.

Some important constituents in the fruit of the Osage orange. McHargue. See XII.

PATENTS.

Milk; Manufacture of artificial — [from soya beans]. F. Gössel. Frankfurt, Germany. Eng. Pat. 8027, March 30, 1914. (See also Fr. Pat. 451,447; this J., 1913, 621.)

SOYA beans are washed, decorticated, ground to a flour which will pass a 100-mesh sieve, and rubbed to a thin paste with soft water at 90°—95° C. The ratio of flour to water is 1:10, and 5 grms. of sodium phosphate is added to each 100 litres of water. The mixture is centrifuged to remove insoluble matter, and the liquid is cooled and again centrifuged to remove fat. The extract is now analysed, and according to the analysis sufficient fat or oil, sugar, and salts are added to make the composition similar to that of milk. These substances are added in an emulsifier and the mixture is emulsified in a partial vacuum at 35°—40° C. The liquid leaving the emulsifier is cooled and made up to the proper volume. Pure cultures of organisms such as *B. lactis acidii* or *B. Massol* may be added to the product.—J. H. J.

Whole-milk product; Method of making a —. B. E. Dunn, Assignor to Dunn's Whole Milk Buttermilk Co., Muncie, Ind. U.S. Pat. 1,143,516, June 15, 1915. Date of appl. Aug. 11, 1914.

A NUTRITIVE beverage, containing all the fat of

the original milk, is made by keeping milk at about 90° F., for 10—12 hours, until its acidity is equivalent to 0.6% lactic acid, cooling to about 45° F., and thoroughly agitating.—E. H. T.

Food products and the like; Concentrated —. T. Boberg, O. Söderlund, F. Aslund, and Technochemical Laboratories, Ltd., London. Eng. Pat. 14,671, June 18, 1914.

A LIQUID food product, e.g., meat extract, coffee-extract, etc., is concentrated to form a solid

material containing from 5 to 10% of water, and then broken up into fragments of any desired size. These fragments are heated to 90° C. in a rotary chamber, from which the air is exhausted rapidly; rapid drying with coincident swelling of the semi-fused material is thus brought about. The heater is rotated and the reduced pressure maintained until the granular product is thoroughly dry.—W. P. S.

Grain or other agricultural products; Apparatus for drying —. E. von Chrzanowski, Grätz, Germany. Eng. Pat. 22,143, Oct. 1, 1915.

A RECTANGULAR chamber situated above a furnace is divided into narrow vertical chambers by partitions of porous material. The grain is delivered into the top of these chambers and is dried by the furnace gases passing upwards through the spaces between the chambers. The latter have inclined floors, and the dried grain falls automatically from the chambers into a collecting device or conveyor. The size of the openings through which the grain is discharged may be regulated by means of slides or shutters.—W. P. S.

Nitrogenous substances from liquid wastes; Process and apparatus for the recovery of —. G. Ebrill, Dublin. Eng. Pat. 15,799, July 1, 1914.

CASEIN or other nitrogenous substance may be recovered from creamery and similar wastes by treating the latter with lime or any suitable precipitant and passing the mixture through a centrifugal filter. The aerated liquid is discharged into a tank, where the precipitated matter is floated by the escaping bubbles of air and forms a scum on the surface of the liquid which is separated.—W. P. S.

Dough; Treatment of —. G. Lunt, Farnby. U.S. Pat. 1,143,413, June 15, 1915. Date of appl., March 13, 1913.

SEE Eng. Pat. 14,291 of 1912; this J., 1913, 671.

XIXE.—WATER PURIFICATION; SANITATION.

Magnesium carbonate; Solubility of — in natural waters. R. C. Wells. *J. Amer. Chem. Soc.*, 1915, 37, 1704—1707.

AIR filtered through cotton and washed with distilled water, was bubbled through the solutions over long intervals in order to attain equilibrium with the small amount of carbon dioxide in the

atmosphere. In determining the solubility of $\text{MgCO}_3 \cdot 3\text{H}_2\text{O}$, practically the same results were obtained whether a solution containing an excess of magnesium bicarbonate or one containing pure $\text{MgCO}_3 \cdot 3\text{H}_2\text{O}$ was used, but equilibrium was attained only very slowly. The saturated solution contained 0.36 gm. Mg and 1.01 gm. CO_2 per litre at 20°C . With amorphous magnesite as solid phase, the saturated solution contained only 0.02 gm. Mg and 0.07 gm. CO_2 per litre at 20°C . Certain natural waters were found to be supersaturated with respect to magnesite, but none approached very closely the point of saturation of $\text{MgCO}_3 \cdot 3\text{H}_2\text{O}$.—A. S.

Sulphates in water; Determination of—by benzidine hydrochloride. F. W. Bruckmiller. J. Ind. Eng. Chem., 1915, 7, 600—602.

SULPHATES in water may be determined rapidly and with sufficient accuracy for practical purposes by the benzidine hydrochloride method (Baschig, this J., 1903, 883, 1066); it is preferable to use a stronger solution of benzidine hydrochloride than that usually employed. 250 c.c. of the water (less if the SO_4 -content is greater than 500 parts per million) is treated with 10 c.c. or more of a 1% solution of hydroxylamine hydrochloride to reduce any ferric iron present, and 20 c.c. of benzidine hydrochloride solution (8 grms. of benzidine and 10 c.c. of concentrated hydrochloric acid per litre) is added. The precipitate is collected in a Gooch crucible with the aid of suction, washed twice with cold distilled water, transferred to the original beaker, heated with water to boiling, and titrated with $N/20$ sodium hydroxide, using phenolphthalein as indicator. The number of c.c. used, multiplied by 9.6, gives the SO_4 -content in parts per million.—A. S.

Indole; Reaction for—[Detection of cholera bacilli.] O. Baudisch. Z. physiol. Chem., 1915, 94, 132—135.

IN testing for cholera bacilli a surface culture of the suspected organisms is made on agar, and after 8—16 hours a group of colonies is transferred with the supporting agar to a test-tube and heated to boiling with dilute potassium hydroxide solution containing a small quantity of nitromethane. After the solution has cooled somewhat it is shaken with 1 c.c. of amyl alcohol and again after addition of an excess of strong hydrochloric acid. The alcoholic layer, which separates best if the liquid is warmed nearly to boiling, is coloured red or pink if the colonies have produced the slightest trace of indole. The nitromethane, instead of being added with the alkali, may be mixed with the agar before the latter has set, a few drops sufficing for a large quantity of the medium.

—J. H. L.

PATENTS.

Softening and purification of water. W. E. Evans. London. From J. D. Reidel A.-G., Berlin-Brandenburg. Eng. Pat. 24,387, Oct. 28, 1913.

THE water is mixed with lime, caustic soda, or sodium carbonate, and then passed through a filter containing stones or minerals such as trass, phonolite, porphyry, leucite, trachyte, nepheline, sodalite, and mica, which although not zeolites, possess to a small extent the property of exchanging their bases for those in water. Single or double filtration may be used, and the filtering material may be stirred continuously during the process.

—J. H. J.

Lifts for sewage and other liquids; Pneumatic—W. Jones, and Jones and Attwood, Ltd., Stourbridge. Eng. Pat. 14,830, June 20, 1914.

THE lift is arranged in a dry pit below the level of the sewage or other liquid to be lifted. It

consists of several lift legs or rising mains connected together at the bottom, where each leg has an air chamber to which compressed air is supplied through a nozzle provided with a number of fine openings. The supply of air is proportional to the flow of sewage, the pressure of the sewage in the lift leg being transmitted to a diaphragm carrying a series of weights which are lifted successively and admit air to a series of valves on the air-supply pipe. The other lift legs are brought into operation in turn by a similar device actuated by the pressure of the sewage in the down-pipe. In a modified form of apparatus, the supply of air is regulated by a float apparatus actuated by the changes in the flow of sewage. Each up-lift leg has a valve at the top, which when closed causes the air pressure to drive the sewage backwards out of the leg, which is then closed by a valve at the bottom; in this way the legs can be thrown out of action for repairs without emptying the sewage into the lift pit. The down-legs can be closed similarly.—J. H. J.

Sewage and other residual waters; Treatment of—and apparatus therefor. Puech, Chabal, et Cie., Paris. Eng. Pat. 1146, Jan. 23, 1915. Under Int. Conv., Feb. 6, 1914.

SEE Fr. Pat. 468,134 of 1914; this J., 1914, 981.

Water; Process and apparatus for sterilising—and rendering it antiseptic. G. Ornstein, New York. Eng. Pat. 3666, Feb. 12, 1914. Under Int. Conv., Feb. 14, 1913.

SEE Fr. Pat. 471,627 of 1914; this J., 1915, 448.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Morphine; Contribution to the chemistry of—M. Freund and E. Speyer. Ber., 1915, 48, 197—502.

MORPHINE oxide, $\text{C}_{17}\text{H}_{19}\text{O}_3\text{N}$:O (this J., 1910, 1471), on treatment with acetic anhydride and sulphuric acid, gives a compound, $\text{C}_{34}\text{H}_{40}\text{N}_2\text{S}_2\text{O}_{15}$, which is regarded as a sulphonic acid inner salt

of the constitution $(\text{C}_{17}\text{H}_{20}\text{O}_4\text{N} \begin{smallmatrix} \text{SO}_2 \\ \diagup \quad \diagdown \\ \text{O} \end{smallmatrix})_2\text{O}$. It

crystallises in needles, which decompose at about 280°C . This substance was converted by the action of concentrated sulphuric acid into an anhydro-derivative, $\text{C}_{34}\text{H}_{33}\text{N}_2\text{S}_2\text{O}_{14}$, which, like the original sulphonic acid, was reduced by sulphur dioxide giving a yellowish green substance, which after recrystallisation from dilute acetic acid formed needles of the composition, $\text{C}_{17}\text{H}_{19}\text{NSO}_6$, to which the constitution of a morphinesulphonic acid is assigned.—G. F. M.

Mercuric acetate solution; Use of a saturated, aqueous—in the separation of terpenes. L. Balbiano. Ber., 1915, 48, 394—400.

WHEN a mixture of pinene, camphene, pinane, cymene, and aromatic hydrocarbons is boiled for 2 to 4 hours with a saturated aqueous solution of mercuric acetate, the pinene is completely oxidised to dioxypinene and resinous products; the pinane, cymene, and aromatic hydrocarbons are not attacked and can be recovered by distilling with steam, the aqueous liquid being then extracted with ether to remove dioxypinene, whilst the camphene is converted into an insoluble mercuric acetate compound of an oxycamphene, $\text{C}_{10}\text{H}_{16}\text{O}(\text{HgO}_2\text{C}_2\text{H}_3)_2$, from which camphene can be regenerated by prolonged boiling with zinc and hydrochloric acid.—T. C.

Phenols with unsaturated side-chains; Behaviour of — towards ozone. O. N. Witt. Ber., 1915, 48, 231—233.

The ozone method of Otto and Verley (Eng. Pat. 5696 of 1895; this J., 1896, 374) for the oxidation of phenols with unsaturated side-chains represents no advance on the older bichromate method. Ozonised air, containing 3% of ozone, as specified in the patent, gives under the most favourable conditions extremely small yields of aldehyde, viz., 1.4% of anisaldehyde from anethol, 0.35% of vanillin from eugenol, and 2% from isoeugenol, compared with 30% yields by the bichromate method. The use of ozonised oxygen might probably improve these results somewhat, but even then the ozone process could not possibly compete with the older bichromate method. (See also Harries and Haarmann, this J., 1915, 573.)

—G. F. M.

Cholesterol acetate; Oxidation of — with chromic acid. A. Windaus and C. Resau. Ber., 1915, 48, 851—857.

β -OXYCHOLESTENOL, $C_{27}H_{44}O_2$, obtained by oxidising cholesteryl acetate, $C_{27}H_{45}O.CO.CH_3$, with chromic acid and subsequently hydrolysing, is readily converted into an unsaturated ketone, $C_{27}H_{42}O$, known as oxysterole. The ketone is reduced by hydrogen in presence of platinum to the saturated hydrocarbon β -cholestane, and by sodium and alcohol to pseudocholesterol, $C_{27}H_{46}O$. The last-named substance is an alcohol of m.pt. $116^\circ C.$; it is isomeric with cholesterol, which it resembles in many respects. Pseudocholesterol is, however, dextro-rotatory and it yields no addition products with saponins.—J. R.

Coprosterol. A. Windaus and C. Ubrig. Ber., 1915, 48, 857—863.

UPON reduction coprosterol yields a saturated hydrocarbon, coprostane, which is identical not with β -cholestane, but with pseudocholestane (see Mauthner, Monats. Chem., 1909, 30, 639). The authors refer the difference existing between the molecules of the last two compounds to a particular asymmetric carbon atom, and a similar difference consequently exists between β -cholestanol and coprosterol. An equilibrium exists between coprosterol (10%) and pseudocoprosterol (90%) in presence of sodium amylate and boiling amyl alcohol, corresponding to the equilibrium between β - and ϵ -cholestanol. (Ber., 1914, 47, 2387). Coprosterol yields a complex compound with digitonin, whilst pseudocoprosterol does not: the two substances are thus quantitatively separable. β -Cholestanol and pseudocoprosterol form a partial racemate having a higher m.pt. than either component; the same substance is obtained by reducing cholesterol with hydrogen in presence of nickel at $200^\circ C.$ β -Cholestanol may be obtained from the partial racemate by means of its reaction with digitonin.—J. R.

Homo-vanillin. C. Harries. Ber., 1915, 48, 868—869.

HOMO-VANILLIN (this J., 1915, 573) when distilled under 0.25 mm. pressure yielded a fraction of b.pt. 105° — $106^\circ C.$, which solidified to a hard, white crystalline mass at winter temperature: less pure fractions deposited crystalline material upon inoculation. A preparation from eugenol-ozone after two distillations *in vacuo* solidified completely when inoculated. The substance was further purified by successive crystallisation from carbon bisulphide and carbon tetrachloride; it forms thick glistening prisms, m.pt. 50° — $50.5^\circ C.$, b.pt. 116° — $118^\circ C.$ at 0.4 mm. pressure. HOMO-vanillin sublimes less readily than vanillin; it is readily soluble in the usual organic solvents with the exception of petroleum spirit, and is also soluble

in hot water. Traces of acid or alkali cause resinification. The smell is more pleasant but fainter than that of vanillin. HOMO-vanillin *p*-nitrophenylhydrazone melts at $154.5^\circ C.$ —J. R.,

Arseno-benzoic acids. A. Michaelis. Ber., 1915, 48, 870—873.

p-BENZARSINIC acid, $HOOC.C_6H_4.AsO(OH)_2$ (3 grms.), prepared by heating *p*-tolylarsinic acid with dilute nitric acid to $150^\circ C.$ in a sealed tube, is dissolved in hot water (70 c.c.) and to the boiling solution is added red phosphorus (2 grms.) and then, gradually, hydriodic acid of sp. gr. 1.96 (13 c.c.). After heating until the supernatant liquid is colourless the crystalline mass of *p*-benzarsenious iodide, $HOOC.C_6H_4.AsI_2$, is collected by filtration: it crystallises from hot chloroform in yellowish-red needles, m.pt. $133^\circ C.$ Upon dissolving the iodide in aqueous sodium carbonate and adding dilute hydrochloric acid, *p*-benzarsenious acid is precipitated: it is dissolved in hot water and the solution boiled with an excess of solid phosphorous acid, whereupon *p*-arseno-benzoic acid, $HOOC.C_6H_4.As : As.C_6H_4.COOH$, separates as a yellowish-white voluminous precipitate. The acid is amorphous and insoluble, and when heated it decomposes without melting. The sodium salt, $C_{11}H_9Na_2As_2O_7$, is obtained as a brownish amorphous powder by dissolving the acid in the requisite amount of dilute sodium hydroxide and evaporating to dryness: it is precipitated by excess of sodium hydroxide. *o*-Arseno-benzoic acid is prepared similarly, starting from *o*-tolylarsinic acid. *o*-Benzarsinic acid is much more soluble in water than the corresponding *p*-acid; its aniline salt is also soluble, whilst that of the *p*-acid readily crystallises from solution. *o*-Benzarsenious iodide is also readily soluble in water, and the solution may be rendered alkaline directly with sodium hydroxide and then boiled with excess of solid phosphorous acid, whereupon *o*-arseno-benzoic acid separates as a heavy yellow powder. *o*-Arseno-benzoic acid is very sparingly soluble in all ordinary solvents; it dissolves in aqueous alkalis and alkali carbonates. The sodium salt does not crystallise readily, and it is not precipitated from solution by excess of alkali. Both acids are strongly poisonous, *o*-arseno-benzoic acid more so than the *p*-compound: in each case harmful action is exerted upon the kidneys and liver.—J. R.

Iodine; Use of — as a dehydrating and condensing agent. H. Hibbert. J. Amer. Chem. Soc., 1915, 37, 1748—1763.

TERTIARY alcohols lose water readily when distilled with very small amounts of iodine, and are converted into unsaturated hydrocarbons. Secondary alcohols react similarly but much more slowly. Thus tertiary amyl alcohol yields trimethylethylene, pinacol yields dimethylbutadiene, and cyclohexanol yields tetrahydrobenzene. Ketone-alcohols distilled with small amounts of iodine yield unsaturated ketones, whilst aldols yield unsaturated aldehydes: diacetone-alcohol for example yields mesityl oxide, and acetaldo and paracetaldo yield crotonaldehyde. Polyglycols and polyglycerols are obtained by heating glycols and glycerol respectively with traces of iodine, whilst glycols condense with aldehydes under the same conditions, butyleneglycol for example condensing with acetaldehyde to give 1-methylpropanediolethylal. It is suggested that the catalytic action of iodine is due to the primary formation of an alkyl iodide and alkyl hypoiodite from the iodine and hydroxy compound, which either react directly together to give free iodine, water, and the unsaturated or condensation product, or which dissociate into hydriodic and hypoiodous acids, which then react liberating iodine, and this again takes part in the cycle of reactions.—T. C.

Brauneria angustifolia; Constituents of the root of —. F. W. Heyl and M. C. Hart. J. Amer. Chem. Soc., 1915, 37, 1769—1778.

THE air-dried root of *Brauneria angustifolia* (*Echinacea*) was extracted with alcohol, the solution concentrated under reduced pressure, and excess of water added. The resin thus precipitated, amounting to 1.9% of the air-dried drug, together with the aqueous solution, were separately examined and the following substances isolated: a phenolic acid, $C_9H_{11}O_5$, m. pt. 207° C.; betaine; sucrose; levulose; oleic, linolic, cerotic, and palmitic acids; two isomeric phytosterols, $C_{27}H_{46}O$, m. pt. 154.5°—156.5° C. and 136°—137° C. respectively; a phytosterolin, $C_{33}H_{56}O_6$, m. pt. 280°—290° C. No physiologically active substance could be identified.—T. C.

Ethylene; Hydrogenation of — by means of colloidal platinum. C. Paal and A. Schwarz. Ber., 1915, 48, 994—1001.

ETHYLENE when mixed with an equal volume of hydrogen is slowly reduced quantitatively to ethane at the ordinary temperature on the addition of a solution of colloidal platinum. The velocity of the reaction within certain limits is only slightly dependent on the concentration and amount of colloidal platinum present. A colloidal solution of platinum requires about twice as long to bring about complete hydrogenation as a colloidal solution of palladium of equal strength, whilst with colloidal solutions containing atomic proportions of palladium and platinum, the former is slightly more active.—T. C.

Cynarin, the active principle of *Apocynum cannabinum*. A. Windaus and L. Hermanns. Ber., 1915, 48, 979—990.

CYMARIN, $C_{26}H_{44}O_9$, obtained from *Apocynum cannabinum*, crystallises from aqueous methyl alcohol in stout, colourless prisms, m. pt. 130°—138° C., $[\alpha]_D^{20} = +23.5^\circ$ in chloroform. It is soluble with difficulty in water and in ether but more readily soluble in other organic solvents. Cynarin crystallises with various amounts of water of crystallisation. It is a lactone and a glucoside, and on hydrolysis with cold hydrochloric acid gives cymarigenin, $C_{23}H_{36}O_5 + H_2O$ (identical with the apocynamarin obtained by Moore from *Apocynum androsaemifolium*, Chem. Soc. Trans., 1909, 95, 734), and a sugar, cymarose, $C_7H_{14}O_4$, which crystallises in colourless prisms, m. pt. 88° C., and is the methyl ether of digitoxose, giving all the characteristic reactions of this latter sugar. Cymarigenin crystallises from dilute methyl alcohol in stout, pearly, rhombic plates, m. pt. 171° C., and gives a well-defined mono-benzoyl derivative, m. pt. 230° C. Hydrochloric acid gas in chloroform solution converts it into anhydrocymarigenin, $C_{23}H_{32}O_4$, m. pt. 246° C. Cymarigenin is a lactone and dissolves in warm, dilute sodium hydroxide solution, the solution on acidifying yielding an isomeric lactone, isocymarigenin, crystallising in pearly leaflets, m. pt. 239° C. When cynarin is warmed with alkalis it is converted into the corresponding hydroxy-acid, cymarinic acid, m. pt. 168° C., which is hydrolysed by acids into cymarose and isocymarigenin.—T. C.

Cynarin; The relationship between — and other vegetable cardiac poisons. A. Windaus and L. Hermanns. Ber., 1915, 48, 991—994. (See also preceding abstract and this J., 1915, 680.)

CYMARIGENIN, obtained by the acid hydrolysis of cynarin, is chemically identical with strophanthidin, obtained by the acid hydrolysis of the glucoside Kombé strophanthin. Cynarin and Kombé strophanthin differ only in the nature of the sugar obtained on hydrolysis, the former

yielding digitoxose methyl ether and the latter strophanthobiose methyl ether. Digitoxose is also obtained by the acid hydrolysis of the cardiac poisons from *Digitalis purpurea* (digitoxin) and *Adonis toxicaria* (antiarin), the residual hydrolytic product in these cases being digitoxigenin and antiarigenin respectively, which are hydroxylactones similar to cymarigenin, with closely related formulae. Bufotalin, the poison of the toad, is also a hydroxylactone related to cymarigenin.—T. C.

Bergamot oil; A new adulterant of —. E. Coen. Annali Lab. Chim. Centr. delle Gabelle, 1914, 7, 89. Annali Chim. Appl., 1915, 3, 372.

A MIXTURE of 70% of triacetin, 20% of bergamot oil, and 10% of orange oil or terpenes is now being used to adulterate bergamot oil. For its detection a modification of the test proposed by Schimmel und Co. for the detection of ethyl glycerate is recommended: 10 c.c. of the oil is treated with 40 c.c. of alcohol diluted to 10%, the mixture is concentrated to a small volume, neutralised, saponified with alcoholic potash, and evaporated to dryness. The residue is extracted with a mixture of alcohol and ether, and the extract is treated with potassium bisulphate; if triacetin was present in the original sample, acetic acid is liberated and acrolein vapour is evolved on heating.—A. S.

Thiosaccharin. A. Mannessier. Gaz. Chim. Ital., 1915, 45, I., 540—552.

A FINELY ground intimate mixture of equimolecular proportions of saccharin and phosphorus pentasulphide was heated gradually to 220° C., then at once cooled, and extracted repeatedly with boiling benzene. On distilling off the benzene, a good yield of thiosaccharin, $C_6H_5 \begin{matrix} \text{CS} \\ \text{SO}_2 \end{matrix} \text{NH}$, yellow needles, m. pt. 180° C., was obtained. It has a bitter taste and is hydrolysed by water and alkali carbonates and hydroxides with production of hydrogen sulphide and saccharin. Ammonia dissolves it to a yellow solution from which it is reprecipitated unaltered by acid. When heated with dilute hydrochloric acid it yields ammonium o-sulphobenzoate.—A. S.

3,6-Diaminoselenopyronine (3,6-diaminoxanthoselenonium). Ehrlich and Bauer. See IV.

Determination of pepsin. Gesellschaft. See XIXA.

Determination of indican in urine. Jolles. See XXIII.

PATENTS.

Formaldehyde solution. G. P. Fuller, Assignor to National Electrolytic Co., Niagara Falls, N.Y. U.S. Pat. 1,143,114, June 15, 1915. Date of appl., June 1, 1914.

A SOLUTION of formaldehyde is produced by treating polymerization products of formaldehyde with less than an equivalent quantity of a base or of certain salts in the presence of water. Sulphites of the alkali metals can be used or any salt which has a basic reaction, or which on solution in water is hydrolysed with formation of a base.—W. N. B.

[Hydroxyquinoline compounds. H. J. Hahl, Elberfeld, Germany, Assignor to Synthetic Patents Co., New York. U.S. Pat. 1,129,865, March 2, 1915. Date of appl., July 17, 1914.

SEE Ger. Pat. 282,455 of 1913; this J., 1915, 686. The compounds may also be obtained by treating hydroxyquinoline compounds of bismuth with

hydrogen iodide, or bismuth compounds with the hydriodic acid salts of hydroxyquinolines.

Tobacco: Method of removing nicotine from —. W. Kraus, Berlin-Charlottenburg, Germany. Eng. Pat. 2394, Feb. 15, 1915. Under Int. Conv., Jan. 9, 1915.

TOBACCO is heated in a vacuum chamber at 25°–30° C. for about half an hour, then treated with a saturated solution of lime containing 1% of calcium nitrate for the same length of time, at the same temperature under vacuum. The liquid is run off and replaced by a 0.5% solution of formaldehyde, which is allowed to act for about 5 mins., also under vacuum, the treated material being then removed and dried at 40° C. About 40–50% of the nicotine is thus removed from the tobacco without loss of aroma.—J. F. B.

Esters of the tertiary alcohols: Production of the —. Dr. Neumann und Co. Chem. Fabr. Ges. m. b. H., and J. Zeltner, Berlin. Eng. Pat. 25,262, Nov. 5, 1913.

SEE Fr. Pat. 466,804 of 1913; this J., 1914, 845.

Acetylsalicylic acid: Process for preparing salts of —. O. Gerngross, Berlin, and H. Kast, Charlottenburg, Germany. Eng. Pat. 25,080, Nov. 3, 1913. Under Int. Conv., Nov. 7, 1912.

SEE Fr. Pat. 464,081 of 1913; this J., 1914, 439.

Lecithin: Manufacture of compounds containing free —. H. Martin, Vienna. Eng. Pat. 8589, April 4, 1914. Under Int. Conv., April 8, 1913.

SEE Fr. Pat. 470,527 of 1914; this J., 1915, 198.

Antiseptically-acting bodies: Process for the production of —. R. von Walther, Dresden. Assignor to J. D. Riedel A.-G., Berlin. U.S. Pat. 1,144,270, June 22, 1915. Date of appl., March 16, 1914.

SEE Ger. Pat. 275,093 of 1913; this J., 1914, 807.

Halogen derivatives of organic compounds: Manufacture of —. W. H. Perkin, C. Weizmann, and H. Davies, Manchester. U.S. Pat. 1,144,237, June 22, 1915. Date of appl., Dec. 30, 1912.

SEE Eng. Pat. 277 of 1912; this J., 1913, 212.

Dimethyl-p-aminophenol and p-(hydroxyphenyl)trimethylammonium: Production of stable salts of —. J. Lagutt, Assignor to Chem. Fabr. vorm. Sandoz, Basle, Switzerland. U.S. Pat. 1,144,141, June 22, 1915. Date of appl., Aug. 31, 1914.

SEE Fr. Pat. 467,085 of 1914; this J., 1914, 845.

Lecithin-containing substances: Method of removing acetone from —. G. Fendler, Schöneberg, Germany. U.S. Pat. 1,144,829, June 29, 1915. Date of appl., Feb. 9, 1914.

SEE Ger. Pat. 272,057 of 1913; this J., 1914, 568.

Unsaturated hydrocarbons and intermediate compounds: Manufacture of —. F. E. Matthews and H. J. W. Bliss, London. U.S. Pat. 1,144,558, June 29, 1915. Date of appl., June 7, 1913.

SEE Eng. Pat. 13,923 of 1912; this J., 1913, 841.

Papaverine or its derivatives: Manufacture of condensation products of hydro-derivatives of — with aldehydes. A. Pictet, Geneva, Switzerland. Eng. Pat. 17,578, July 24, 1914. Under Int. Conv., Aug. 6, 1913.

SEE Ger. Pat. 281,047 of 1913; this J., 1915, 636.

Mercury compounds of amino-aryl-sulphonic acids: Manufacture of —. Chem. Fabr. von Heyden A.-G., Radebeul, Germany. Eng. Pat. 8153, March 31, 1914. Under Int. Conv., April 23, 1913.

SEE Ger. Pat. 281,009 of 1914; this J., 1915, 452.

Catalytic reactions and catalytic agents for use therein. Eng. Pat. 8462. See I.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

PATENTS.

Multi-colour films and apparatus for their production. J. E. Thornton, London. Eng. Pat. 14,145, June 11, 1914.

IN producing multi-colour films by successive printings of the different colours, uniformity of effect is obtained by the use of intaglio-engraved rollers or plates under definite conditions as to temperature, action of the "doctor," composition of the inks, etc. A coating of gelatin or celluloid may be applied after each colour printing to prevent running of the colours into one another or into the sensitive film which is subsequently applied. A yellow, colour-correcting screen may also be applied either by staining of the celluloid base or by a separate coating. To obtain accuracy of registration in printing a cinematograph film, it is preferable to cement this to a rigid metal surface, thus preventing variation in size during the process. To prevent the appearance of a screen effect with cinematograph films in the lantern, a small displacement or "stagger" is given to the colour printings on successive pictures.—B. V. S.

Colour photography. G. S. Whitfield, Watford. U.S. Pat. 1,144,575, June 29, 1915. Date of appl., Nov. 18, 1914.

SEE Eng. Pat. 24,566 of 1913; this J., 1915, 199.

XXII.—EXPLOSIVES; MATCHES.

Hydrazine: Contribution to the knowledge of —. Schlenk and Weichselfelder. See VII.

Solubility in the solid state of some nitro derivatives of toluene and benzene. Guia. See III.

PATENTS.

Explosive. C. M. Stine, Chester, Pa., Assignor to E. I. du Pont de Nemours Powder Co., Wilmington, Del. U.S. Pat. 1,143,330, June 15, 1915. Date of appl., Dec. 13, 1913.

NITRATED ivory nut is incorporated with nitroglycerin explosives, which may also contain nitro-cotton, an organic nitro-compound, a combustible absorbent, and an inorganic oxidising agent.

—W. N. B.

Explosives known as gelatin: Machine for packing — into paper shells. F. Lavan, Assignor to C. A. Blank, Miller, Ind. U.S. Pat. 1,144,216, June 22, 1915. Date of appl., Feb. 21, 1913.

THE shells to be filled are mounted on a shuttle carrier, which carries them into position beneath the feed hopper. When in this position, tubes projecting downwards from the hopper extend into the shells. The carrier moves automatically from the hopper as the shells are being filled. The feed of gelatin from the hopper can be cut off at any time and, by means of slotted wheels adapted to engage the carrier, the latter can be lowered sufficiently to allow the filled shells to be removed.

—W. N. B.

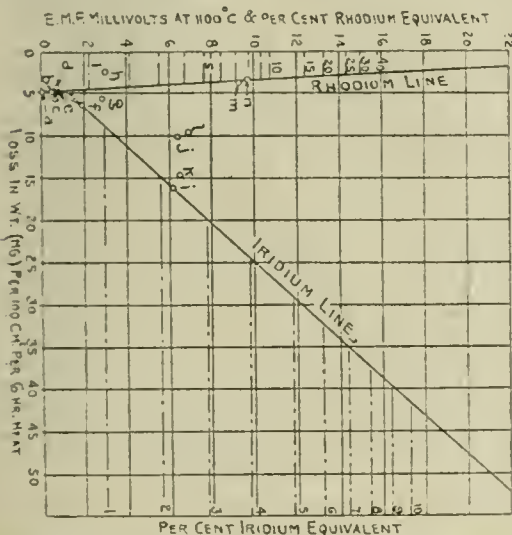
Smokeless gunpowder: Manufacture of —. C. Claessen, Berlin. Eng. Pat. 24,713, Oct. 30, 1913.

SEE Addition of Oct. 17, 1913, to Fr. Pat. 410,239 of 1909; this J., 1914, 614.

XXIII.—ANALYTICAL PROCESSES.

Platinum ware; Study of the quality of— with special reference to losses on heating. G. K. Burgess and P. D. Sale. U.S. Bureau of Standards. J. Ind. Eng. Chem., 1915, 7, 561—564.

OF 164 pieces of platinum were submitted to the thermo-electric purity test (this J., 1914, 769). 26% contained impurities equivalent to 0—0.5% Ir; 20%, 0.5—1.0% Ir; 31%, 1—2% Ir; 17%, 2—4% Ir; and 6%, impurities equivalent to 4—25% Ir. Of the 84 crucibles tested, 65% contained impurities equivalent to more than 0.5% Ir. In the case of 14 crucibles determinations were also made of the loss on heating for 2 hours at 1200° C. in an electric furnace in which there were no heated metal parts; of the loss on treatment with boiling 25% hydrochloric acid for 5 mins. after the heat treatment; of the amount of iron removed by the acid treatment; and of the magnetic susceptibility of the platinum. With crucibles practically free from iron the loss on heating at 1200° C. ranged from 0.71 to 2.69 mgrms. per 100 sq. cm. of crucible surface per hour; the losses were less for crucibles containing rhodium than for those containing iridium. The nature of the alloy metal, whether iridium or rhodium, can be ascertained by microscopic examination: with the former definite smooth crystals with heavy boundaries are observed, whilst with the latter the crystals are more irregular and not so well-defined; new platinum ware containing a considerable quantity of rhodium usually exhibits a characteristic bluish colour after heating to dull redness. For highest grade crucibles it is recommended that platinum containing 3—5% Rh, practically free from iron and iridium, and containing no other detectable impurities, should be used. Such platinum would exhibit the characteristic crystal structure due to rhodium; would yield no iron on treatment with acid after heating for 2 hours over a strong blast flame; and would give an E.M.F. greater than 5 and less than 8 millivolts against pure platinum at 1100° C. For pure platinum ware or ware containing other stiffening ingredients than rhodium, the E.M.F. at 1100° C. against pure platinum should be less than 1 millivolt. From the results of a thermo-electric and microscopic examination and with the aid of the accompanying



graphs (see fig.), it is possible to predict, within limits close enough for analytical purposes, the

probable loss of weight of a platinum crucible when heated for 6 hours at 1200° C.—A. S.

Gas analysis; Specific absorption of reagents for —. R. P. Anderson. J. Ind. Eng. Chem., 1915, 7, 587.

THE author proposes to describe the efficiency of a reagent for gas analysis in terms of its specific absorbing power or specific absorption, that is, the volume of gas absorbed by unit volume of the reagent up to the point at which the gas is not completely absorbed from a mixture by the reagent in a given time. For example a certain solution of alkaline pyrogallol was used to determine the oxygen in successive samples of a mixture containing 21% of oxygen by shaking with the reagent for 3 mins. in a Hempel double pipette. The total volume of oxygen absorbed up to the point when the reagent was no longer capable of absorbing all the oxygen in the sample in 3 mins., was five times the volume of the reagent used, i.e., the specific absorption of the reagent under the prescribed conditions was five.—A. S.

Gas analysis; Reagents for use in —. I. Alkaline pyrogallol. R. P. Anderson. J. Ind. Eng. Chem., 1915, 7, 587—596.

THE most satisfactory alkaline pyrogallol reagent for absorbing oxygen is one containing 13.6 grms. of pyrogallol and 71.5 grms. of potassium hydroxide per 100 c.c., prepared by dissolving 15 grms. of pyrogallol in 100 c.c. of potassium hydroxide solution of sp. gr. 1.55; carbon monoxide is formed only in negligible traces, if at all, by this reagent. Using 100 c.c. of gas sample in a Hempel double pipette, with 25 c.c. of the reagent in the first pipette and 185 c.c. in the second, and working at 20°—24° C., the following values were obtained for the specific absorption of the reagent (see preceding abstract):—

In Hempel pipette for use with mercury.

No. of minutes samples were shaken	1	2	3	4	5
Samples containing 20.9% O	27	30	31	—	—
Samples containing 90% O	21	24	24	—	—

In Hempel pipette for liquid reagents.

Samples containing 20.9% O	25	29	31	—	—
Samples containing 90% O	0	27	30	31	32

The values for the samples mentioned are applicable to all samples containing less oxygen, and the values for samples containing 90% of oxygen could be applied, for practical purposes, to the analysis of nearly pure oxygen. Hempel's objection to the use of potassium hydroxide purified by alcohol could not be confirmed.—A. S.

Alkalinity and acidity; New method of determining —. J. Traube. Ber., 1915, 48, 947—949. (See also this J., 1915, 511.)

MINUTE quantities of alkali may be determined by measuring the diminution in the surface tension when the alkali is added to aqueous solutions of salts of alkaloids with strong acids, which have essentially the same surface tension as water. The method is extraordinarily delicate and requires from 3 minutes, with the viscostagonometer, to 5 minutes, with the stalagmometer. To determine acidity, the acid liquid is similarly added to a solution of a capillary-inactive salt, e.g., sodium isovalerate, and the diminution in surface tension measured as before.—J. R.

Potassium and sodium: Separation of— by means of aniline perchlorate and the subsequent determination of the sodium. D. U. Hill. Amer. J. Sci., 1915, 40, 75—77.

ABOUT 1 gram. of the mixed chlorides is dissolved in 1.5 c.c. of water, the solution treated with an excess of aniline perchlorate (about 0.5 gram.) dissolved in 48.5 c.c. of absolute alcohol, and the precipitated potassium perchlorate filtered off with the aid of suction, washed with about 20 c.c. of 97% alcohol, dried at 110° C., and weighed. The filtrate is saturated with gaseous hydrogen chloride and the precipitated sodium chloride collected in a Gooch crucible, washed with a saturated solution of hydrogen chloride in 97% alcohol, dried at 110° C., and weighed; or the sodium in the alcoholic filtrate may be precipitated with sulphuric acid, and the precipitation completed by saturating the liquid with hydrogen chloride.—C. A. M.

Copper oxide: Reduction of— in alcohol vapour in reducing sugar determinations and copper analysis. A. Wedderburn. J. Ind. Eng. Chem., 1915, 7, 610—611.

CUPROUS oxide obtained in the determination of reducing sugars, or cupric oxide obtained in copper analyses may be readily and quantitatively reduced to metallic copper as follows:—The cuprous or cupric oxide is collected in an alundum or Gooch crucible, washed with hot water and alcohol, and heated to redness to destroy organic matter. In the meantime a layer of strong alcohol, about 1 cm. deep, is placed on the bottom of a 400 c.c. metal beaker, the beaker is covered with a watch-glass, and the alcohol boiled until it begins to condense on the cover-glass. The crucible containing the copper oxide, which has cooled until the redness just begins to disappear, is then placed on a small tripod in the beaker, above the boiling alcohol, and the cover-glass replaced. The alcohol is allowed to boil for a moment and the source of heat is then removed. Reduction of the oxide to metallic copper is almost instantaneous, and after 3 or 4 mins., when the crucible has cooled to a temperature slightly above that of the alcohol vapour, it is removed, cooled in a desiccator, and weighed. Should the crucible be cold when removed from the beaker, a small quantity of pure alcohol is burned in it, before weighing.—A. S.

Antimony: Detection of— by oxidation of an alkali antimonite. E. Gastaldi and C. Pertusi. Annali Lab. Chim. Centr. delle Gabelle, 1914, 7, 371. Annali Chim. Appl., 1915, 3, 375.

A HYDROCHLORIC acid solution of the antimony is treated with a small quantity of mercuric chloride and excess of caustic soda. The sodium antimonite formed is oxidised to antimonate, and a black turbidity, due to reduction of mercuric oxide, is produced. The reaction is not given by stannic salts.—A. S.

Stannic sulphide: Identification of— in qualitative analysis. C. Pertusi and E. Gastaldi. Annali Lab. Chim. Centr. delle Gabelle, 1914, 7, 367. Annali Chim. Appl., 1915, 3, 375.

STANNIC sulphide when treated with magnesium powder in presence of water is converted into stannous sulphide or metallic tin, which dissolves in hydrochloric acid and may be easily identified with mercuric chloride.—A. S.

Selenium: Determination of— in organic compounds. H. Bauer. Ber., 1915, 48, 507—508.

FROM 0.2 to 0.3 gram. of the substance is heated with 1.5 c.c. of fuming nitric acid in a sealed tube for 5 hours at 250° C. The contents are then washed into a flask with 100 c.c. of fuming hydrochloric acid and boiled under a reflux condenser ground

into the neck of the flask, until nitrous fumes have disappeared (1—3 hours). After filtration the selenium is precipitated by addition of 3 grms. of anhydrous sodium sulphite, collected in a Gooch crucible and weighed after washing and drying at 110°—120° C.—G. F. M.

Uranium and phosphorus: Determination of—. H. D. Newton and J. L. Hughes. J. Amer. Chem. Soc., 1915, 37, 1711—1715.

THE methods depend upon the reduction of uranyl compounds to the uranous condition by means of titanous sulphate, oxidation of the excess of titanous salt with bismuth trioxide, and titration with permanganate after filtering. In determining uranium, a known quantity of uranyl sulphate solution is treated with a slight excess of titanous sulphate solution (stored under a constant pressure of hydrogen), and enough sulphuric acid is added to make the solution about 16% acid by volume. After cooling, a small quantity of bismuth trioxide, sufficient to oxidise the excess of titanous sulphate, is added, and the solution filtered quickly through a pad of asbestos in a platinum cone. The filter is washed three or four times with 16% sulphuric acid, and the filtrate titrated with permanganate: 1 c.c. of N/10 permanganate = 0.0135 gram. UO_2 . Phosphorus is determined by precipitating as ammonium uranyl phosphate, $\text{UO}_2\text{NH}_4\text{PO}_4$ (see this J., 1903, 1209), dissolving the washed precipitate in 16% sulphuric acid, and proceeding as described above. There is no difficulty in filtering the ammonium uranyl phosphate if a perforated platinum cone lined with an asbestos felt is used.—A. S.

Indican in urine: Determination of—. A. Jolles. Z. physiol. Chem., 1915, 94, 79—103.

INDOXYL condenses with thymol in presence of ferric chloride and hydrochloric acid to form a compound, $\text{C}_{18}\text{H}_{17}\text{O}_2\text{N}$, probably 4-cymene-2-indolindolignone (Friedländer's nomenclature), which forms red crystals melting with decomposition at 218°—220° C. and yields an intensely violet monohydrochloride which is very readily hydrolysed. This reaction can be applied to the detection or determination of indican in urine. 10 c.c. of the urine is mixed with 1 c.c. of a 5% solution of thymol in alcohol, and 10 c.c. of fuming hydrochloric acid containing 5 grms. of ferric chloride per litre, and after 15 mins. the mixture is extracted with 4 c.c. of chloroform, which is coloured violet if the urine contained as little as 0.0032 mgm. of indican. For quantitative purposes, the urine is treated with 1/10 of its volume of basic lead acetate solution and filtered; 5—10 c.c. of the filtrate is mixed with the thymol and ferric chloride solutions in the same proportions as—or the qualitative test, and after standing for 2 hours the liquid is extracted with portions of 5 c.c. of chloroform so long as the extracts are coloured. The united extracts are washed once with water, whereupon the colour changes to reddish brown owing to hydrolysis of the hydrochloride, once with very dilute alkali (N/500—N/1000) and once again with water. Any colouring matter in the first water washing is extracted by a few c.c. of chloroform which is then washed with alkali with the rest. The total extract is made up to 25 or 50 c.c. with chloroform and compared colorimetrically with a suitably diluted standard solution containing 0.01 gram. of the colouring matter (corresponding to 0.009 gram. of indican) in 100 c.c. of chloroform.—J. H. L.

Detection of methane. Hauser and Herzfeld. See IIa.

Process for toughening ordinary filter paper. Rankin. See V.

Factor to be used for calculating the phosphoric acid in Neumann's method. Jodidi. See VII.

Volumetric determination of ferrocyanides. Campbell. See VII.

Preparation, properties, and composition of silundum. [Determination of combined carbon in carborundum-like substances.] Tucker and Lowry. See IX.

Determination of silicon in iron, steel, ferrosilicon, etc. Namias. See X.

Detection and determination of mineral oil in dégras and in mixtures with fatty substances. Biazzo. See XII.

Detection of camphor oil in oil of turpentine. Coen. See XIII.

Specifications of vulcanised rubber gum by volume, and its determination by a new solution method. Gottsch. See XIV.

Determination of water-soluble matter in leather. Smoot and Stacey. See XV.

Determination of sugar in bagasse. Pellet. See XVII.

Limits of accuracy in saccharimetric analysis. Browne. See XVII.

A new ebullioscope for the determination of alcohol in wine. Malvezin. See XVIII.

Detection and determination of higher alcohols in brandy. Settimj. See XVIII.

Determination of hydrocyanic acid and benzaldehyde in kirsch liqueur. Golse. See XVIII.

Concise group method for the detection of gelatinising agents, pasty material, and thickeners, used in food products. Congdon. See XIX.

Determination of lint in cottonseed meal. Brackett. See XIX.

Determination of pepsin. Geselschap. See XIX.

Determination of sulphates in water by benzidine hydrochloride. Bruckmiller. See XIX.

Reaction for indole. [Detection of cholera bacilli.] Baudisch. See XIX.

Use of a saturated aqueous mercuric acetate solution in the separation of terpenes. Balbiano. See XX.

A new adulterant of bergamot oil. Coen. See XX.

PATENTS.

[Combustible] gases and vapours [in the atmosphere]; Contrivance for automatically detecting the presence of certain —. A. and L. D. Williams, London. U.S. Pat. 1,143,473, June 15, 1915. Date of appl., March 16, 1915.

THE apparatus consists of a casing having an open compartment containing a pair of thermo-electric elements, and a closed compartment containing a voltmeter and relay, all being arranged in the same circuit. The thermo-electric elements, one of which contains a catalytic element, are connected by a platinum wire in circuit with a resistance coil, and maintained at an even temperature by means of a battery, the arrangement being such that a third circuit, including an electric bell and battery, is closed by the relay when in operation.—W. E. F. P.

Thermo-electric pyrometer system. R. P. Brown, Philadelphia. U.S. Pat. 1,144,688, June 29, 1915. Date of appl., Oct. 9, 1914.

THE apparatus consists of a closed chamber containing an indicating instrument, the cold junction

of the thermo-couple, the hot junction of an auxiliary thermo-couple, an electric lamp, and a thermostat. The last forms part of one of the live wires of the lamp, and consists of a thermostatic coil having an arm which engages with an adjustable stop; and leads are provided for connecting the binding posts of the indicating instrument with the cold junction of the main thermo-couple or with the auxiliary thermo-couple.—W. E. F. P.

Temperature and resistivity: Method of and means for measuring —. E. F. Northrup, Princeton, N.J. U.S. Pat. 1,144,776, June 29, 1915. Date of appl., Oct. 3, 1914.

A METHOD for measuring temperatures higher than the vaporising point of mercury, which depends on the fact that the changes in temperature and electrical resistance of molten tin are directly proportional.—W. E. F. P.

Calorimeter. J. F. Simmance and J. Abady, London. U.S. Pat. 1,113,790, June 22, 1915. Date of appl., Nov. 28, 1913.

SEE Eng. Pat. 27,920 of 1912; this J., 1914, 45.

XXIV.—MISCELLANEOUS ABSTRACTS.

Alpha-ray effect; A new —. F. H. Glew, J. Röntgen Soc., 1915, 11, 77—80.

A LOCAL increase in volume occurs when mica is exposed to the action of α -rays, resulting, with thin plates, in curvature, but if the mica is too thick a strain only is produced. The convex side is nearest to the region of maximum ionisation. These mechanical effects are cumulative, and do not appear to be reversible, persisting through a great range of temperature.—B. N.

Prizes.

A PRIZE competition has been instituted by the Società d'Incoraggiamento d'Arti e Mestieri, of Milan, for memoirs dealing with the solution of the following technical problems:—(1) Utilisation of pyrites cinder. (2) Prevention of the corrosion of boilers due to salts contained in the feed water. (3) Treatment of phosphorites to obtain superphosphate of maximum solubility and in such a physical condition that it can be readily applied to the soil. The prizes range from Lire 500 to Lire 1000, and will be awarded in January 1916. Competing memoirs must be delivered not later than Dec. 31, 1915. For further particulars apply to the Secretary of the Soc. d'Incoragg. d'Arti e Mestieri, Via S. Marta, 18, Milan, Italy.

* New Books.

[The Roman numerals in thick type refer to the similar classification of abstracts under "Journal and Patent Literature" and in the "List of Patent Applications."]

I. *Derr, L., Ed.: Cyclopedica of engineering; a general reference work on steam boilers and pumps, steam engines, steam turbines, gas and oil engines, producers, elevators, heating and ventilation, compressed air, refrigeration, dynamo-electric machinery, power stations, etc.; il. with over 2000 engravings. 7 v. Chic. Am. Technical Soc. c. (Bibls). pls. tabs. diagrs. 8vo. 1915. \$19.80.*

Peebles, J. C.: Furnace efficiency, combustion and flue gases. Chic. J. G. Branch Pub. c. '14. 156 p. 12mo. 1915. \$1.

IIA. *Fieldner, A. C., Smith, H. I., Fay, A. H., and Sanford, S.*: Analysis of mine and ear samples of coal collected in the fiscal years 1911—1913. (Bureau of Mines Bull.) Svo. pp. 444. Wesley. 1915. Net 5s.

IV. *Green, A. G.*: Analysis of dyestuffs, and their identification in dyed and coloured materials, lake-pigments, foodstuffs, etc., etc. pp. 154. C. Griffin. 1915. Net 8s. 6d.

VII. *Dale, T. N.*: The calcite, marble, and dolomite of eastern Vermont. Wash., D.C. Gov. Pr. Off. 66 p. maps O (Geol. Survey. bull. 598).

VIII. *Stull, R. T., and Hursh, R. K.*: Designs of seven test kilns. Urbana, Ill., Univ. of Ill. '11. 16 p. il. Svo. (Ceramics bull.) 1915. 10 c.

X. *Brerley, H.*: Case-hardening of steel; an illustrated exposition of the changes in structure and properties induced in mild steels by cementation and allied processes. N.Y., Van Nostrand. 1914. 8+164 p. il. figs. tabs. O. 1915. \$ 2.50 n.

Granjon, R., and Rosenberg, P.: Practical manual of autogenous welding (Oxy-acetylene). 3rd ed. Svo. pp. 256. C. Griffin. 1915. Net 5s.

Swingle, C. F.: Oxy-acetylene welding and cutting. Cr. Svo. Spon. 1915. Net 4s. 6d.

Thomson, F. A.: Stamp milling and cyaniding. N.Y., McGraw-Hill. 285 p. il. Svo. 1915. \$3 n.

Treptow, Prof. E.: Grundzüge der Bergbaukunde einschliesslich Aufbereitung u. Brikettieren. 5., verm. u. vollständig umgearb. Aufl. (In 2 Bdn.) 1. Bd. Bergbaukunde. 1. Tl. (VIII., 262 S. m. 400 Abbildgn.) Lex 8o. Wien. Druckerei u. Verlags-Akt.-Ges. vorm. R. v. Waldheim. 1915. Price of the complete work. M. 14.

XIII. *Cravire, C.*: Le conifere da rimboscimento e l'industria resiniera: descrizione, coltivazione, malattie delle conifere adatte al rimboscimento in Italia e metodi di estrazione delle resine (gemmatura). 16mo. fig. p. xii. 322. Milano. 1915. L. 4.

XVI. *Ehrenberg, Prof. P.*: Die Bodenkolloide. (Der Kolloide in Land- u. Forstwirtschaft. 1 Tl.) Eine Ergänzung f. die übl. Lehrbücher der Bodenkunde, Düngerlehre u. Ackerbaulehre (XII, 563, S. m. Fig.) gr. 8o. Dresden. Th. Steinkopff. 1915. Cloth. M 14.50.

Hopkins, C. G., and Sachs, W. H.: Radium as a fertilizer. (Univ. of Ill.) 12 p. Svo. (Agric. Exper. Stat. bull.).

Manrilli, V.: I campi sperimentali di concimazione chimica (interpretazione dei loro risultati). 16mo. fig. p. 242. Catania. 1915. L. 3.

Quear, C. L.: Soils and fertilizers; a discussion upon the nature and treatment of soils and the value of fertilizers. ed. by O. L. Boor. (Clac. E. F. Harmon & Co. c. 10+202 p. il. Svo. 1915. \$1.

XIXB. *Daniels, F. E.*: The operation of sewage disposal plants; a manual for the practical management of sewage disposal works; with suggestions as to improvements in design and construction, il. from photographs by the author N.Y., Municipal Journal. c. '14. 136 p. Svo. 1915. \$1.50.

Swain, G. F.: Conservation of water by storage; addresses delivered in the Chester S. Lyman lecture series, 1914, before the senior class of the Sheffield Scientific School, Yale University. New Haven. Ct. Yale Univ. c. 84 p. (12 p. bibl.) il. pls. tabs. diags. O. 1915. \$3 n.

Craveri, C.: Insetti nocivi all'agricoltura e alla selvicoltura: descrizione, costumi e mezzi per combatterli. 16mo. fig. p.x. 481. Milano. 1915. L. 4.

XX. *Werner, C.*: A textbook on tobacco; an exhaustive technical treatise on the culture, the manufacture and the merchandising of tobacco and tobacco products. 11th ed. N.Y., Tobacco Leaf Pub. c. '14. 323 p. il. tabs. Svo. 1915. \$1.50.

XXI. *Jahrbuch f. Photographie u. Reproduktionstechnik f. d. Jahr 1914.* Unter Mitwirkg. hervorrag. Fachmänner hrsg. v. Dr. J. M. Eder. 28. Jahrg. Mit 207 Abbildgn. u. 4. Kunstdruckbeilagen. (VIII. 596 S.) Svo. Halle. W. Knapp. 1914. Cloth. M. 9.50.

XXII. *Arndt, Prof. K.*: Handbuch der physikalisch-chemischen Technik f. Forscher u. Techniker. (XVI. 830 s. m. 644 Abbildgn.) Lex 8o. Stuttgart. F. Enke. 1915. Cloth. M. 30.

Formenti, C.: Residui agricoli. Utilizzazioni, ricuperi. Cascami di fibre tessili—Residui vegetali—Residui animali. 16mo. fig. p. XXVII. 594. Milano. 1915. L. 5.

Gallotti, A.: Exercices numériques de physique et de chimie à l'usage des candidats au baccalauréat de philosophie. in-Svo Vuibert. Paris. 1915. 1 fr. 75.

Jones, H. C.: The electrical nature of matter and radioactivity. 3d ed. completely rev. N.Y., Van Nostrand. 8+212 p. O. 1915. \$2 n.

* Dissertations.

[Prices vary, ranging from three to four shillings.]

I. *Poensgen, R.*: Ueber die Wärmeübertragung von strömendem überhitztem Wasserdampf an Rohrwandungen und von Heizgasen an Wasserdampf. München (Techn. Hochsch.). 1914. 88 S. 4° (8°).

IIA. *Berneis, B.*: Bestimmungen der spezifischen Wärme unvollkommener Gase nach der Durchströmungsmethode. Heidelberg. 1914. 83 S. 1 Taf. 8°.

Fricke, H.: Ueber pyrogene Azetylenkondensationen. Braunschweig (Techn. H.). 1914. 30 S. 8°.

Philippide, St.: Ueber die Zersetzung von Mineralöl beim Erhitzen unter Druck. Karlsruhe (Techn. Hochsch.). 1914. 48 S. 8°.

III. *Balle, G.*: Zur Kenntnis der Pschorrschen Phenanthren-Synthese. Giessen. 1914. 62 S. 8°.

Bourath, W.: Zur Kenntnis des Acenaphtenchinons und der Naphtalaldehydsäure. Giessen. 1914. 45 S. 8°.

Breit, O.: Beiträge zur Kenntnis der Derivate des 1'- und 1'-Dibenzoylbenzols. Stuttgart (Techn. Hochsch.). 1914. 66 S. 8°.

Bräunig, W.: Optische Untersuchungen über die Konstitution der Nitrosoaniline und Nitrosophenole. Leipzig. 1914. 47 S. 8°.

Gruber, W.: Ueber die Reduktion des Dimethylpyrons. München. 1914. 50 S. 8°.

Jaroslawzew, A.: Jodierung aromatischer Kohlenwasserstoffe mittels Jod und Persulfat. Giessen. 1914. 30 S. 8°.

Wirsing, A.: Ueber *pp'*-Azophenyl-alkylsulfide und ihre Derivate. Giessen. 1914. 50 S. 8°.

IV. *Albert, A.*: Synthesen in der Indol- und Indigo-Gruppe. München (Techn. Hochsch.). 1914. 52 S. 8°.

Fick, R.: Synthetische Versuche im Gebiet der Carminsäurefarbstoffe. Greifswald. 1914. 61 S. 8°.

Goldstein, E.: Ueber das Tetra-Amido-Diphenyl-Para-Azophenyl. München. 1914. VIII, 64 S. 8°.

Official Notices.

NEW CLASSIFICATION OF THE MEMBERS OF THE SOCIETY.

(See this Journal, July 31st, 1915, 745).

Out of 2500 possible replies to the Council's Classification circular, already 2000 have been received. The information furnished will be of the greatest service. The President cordially thanks those members who have so promptly responded to his request, and asks those who have not yet sent in their cards, to post them without delay, so that the work of sorting and classification may be completed at an early date. A reply card will be found in the July 31st number.

THE DISPOSAL OF NITRE CAKE.

A SUBJECT FOR INDUSTRIAL RESEARCH.

The question of the disposal of nitre cake is engaging the attention of the Admiralty. More than 300 tons of it are being produced every week in Kent, and large stocks have accumulated, some of which it is proposed to dump into the sea. It contains about 17 per cent. of available sulphuric acid.

The Chemical Society and the Society of Chemical Industry have been asked to suggest some commercial use for this material, and the matter has been handed over to a Special Joint Committee.

There have been several proposals for dealing with it, some of which are in actual practice, but the amount is now so large that the committee would welcome further suggestions. Among the suggestions already made are the following:—

1. Heating the nitre cake with common salt, collecting the hydrochloric acid, and afterwards treating the sodium sulphate in the black ash furnace in the usual way. The demand for hydrochloric acid is limited and saltcake is very cheap.

2. Heating with magnesite to make Epsom salts. There is a great demand for this in the textile industries.

3. Using it to replace sulphuric acid in the manufacture of superphosphates.

4. Roasting with iron scale to get off the available acid in its most concentrated form. This requires a high temperature, and the action on the vessels employed is considerable.

5. Use in making and glazing slag bricks.

6. Use for sprinkling manure heaps to fix the ammonia.

7. Heating with mixed sulphide ores to extract the zinc.

The Committee invites further suggestions for dealing with nitre cake on industrial lines. Communications should be addressed to the undersigned at the Society's Office, Broadway Chambers, Westminster, S.W.

CHARLES G. CRESSWELL,
Secretary.

Obituary.

BRYAN CORCORAN.

Bryan Corcoran was born in London on April 27, 1843. In 1864 he went to the north of England, and assisted in the construction of the railway from Barnsley to Wakefield. In 1871 he joined the firm of engineers and millwrights, bearing his name, which has been carried on since 1780 in Mark Lane. An expert in the science of milling, he was constantly engaged as arbitrator and umpire in flour mill affairs. His connection with this Society dated from 1890; he was a regular attendant at the meetings of the London Section, and for some time served on the Committee. Since 1910 he had been a member of the Court of Common Council of the City of London.

He died on August 4th, at Bexhill, where he had gone to recuperate after a severe illness.

Journal and Patent Literature.

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I.—GENERAL; PLANT; MACHINERY.

Fusible tin boiler plugs; An investigation of—

G. K. Burgess and P. D. Merica. U.S. Bureau of Standards. J. Wash. Acad. Sci., 1915, 5, 461—462.

THE most frequent cause of failure in used tin boiler plugs was found to be the formation of tin oxide either at the fire end of the plug or as a network throughout the tin filling. Corrosion of the latter kind was traced to the presence of zinc in the tin employed; zinc does not form a solid solution with tin, but, even when present to the extent of only 0.3%, separates out as a network bounding the tin grains, on prolonged heating of the plug at about 180° C. Lead and

zinc were found to be the chief impurities in tin plug fillings, and since all the "failed" plugs contained these or other impurities, it is concluded that only the purest grades of tin (99.9%) should be employed for this purpose. The determination of the freezing point by a cooling curve method is a rapid and convenient means for ascertaining the purity of tin in tin plugs, since 0.1% of either lead or zinc can thus be detected.—W. E. F. P.

PATENTS.

Drying apparatus. J. W. Dale, Portland, Oreg. U.S. Pat. 1,144,817, June 29, 1915. Date of appl., Dec. 18, 1913.

HEATED moistened air is forced into the chamber containing the material to be dried. A portion of

the air is withdrawn from the chamber, subjected to a spray of water, and then returned to the drying chamber through a separate inlet to that by which fresh air is supplied.—W. H. C.

Evaporating process. T. F. Sanborn, Assignor to Sanborn Evaporator Co., New York. U.S. Pat. 1,143,074, June 15, 1915. Date of appl., Jan. 16, 1912.

A HEATING medium (steam) is passed through the tubes of an evaporating cell containing the liquid to be evaporated, and the uncondensed portion of the heating medium is withdrawn separately and passed through the heating tubes of a succeeding cell.—W. H. C.

Evaporating apparatus. L. P. Bauer, Pekin, Ill. U.S. Pat. 1,143,743, June 22, 1915. Date of appl., April 29, 1911.

A VACUUM or other evaporating apparatus is provided with a number of hollow discs, spaced apart, and mounted on a hollow shaft by means of which steam is introduced into and condensed water withdrawn from the discs. The shaft and discs are supported on a track, so that they can be withdrawn from the vessel. Flexible bodies are interposed between the discs, so that they rub against the surface of the discs as the latter are rotated.—W. H. C.

Evaporating apparatus. L. P. Bauer, Pekin, Ill. U.S. Pat. 1,143,744, June 22, 1915. Date of appl., April 29, 1911.

THE apparatus consists of a number of vacuum pans connected in two series to form two multiple effect evaporators. All the pans of both series are connected together so that they can intercommunicate.—W. H. C.

Filling liquids [water, etc.]; Apparatus for —. J. J. Lassen and V. F. Hjort, London. Eng. Pat. 16,185, July 7, 1914.

THE liquid to be filtered passes in succession, upwards through two or more filters, arranged side by side in a tank, and separated by baffles. Each filter has a gutter near its upper surface which communicates by means of a valve with a by-pass trough at the side of the tank, so that any filter compartment may be cut out for cleaning without interfering with the working of the others.—W. H. C.

Separating solids from liquids; Apparatus for —. J. J. Berrigan, Orange, N.F. U.S.A. Eng. Pat. 14,976, June 23, 1914. Under Int. Conv., June 30, 1913.

IN the pressing apparatus described in Eng. Pat. 18,584 of 1912 (this J., 1913, 933) a gradually increasing pressure is applied to the material in the bags by causing a gradual angular movement of the members of the press towards each other. The faces of the pressing members are provided with grooves to which liquid may be supplied. Two or more bags of material of differing degrees of fineness are used, one within the other, the inner bag being larger and made of coarser material than the outer bag. Valves are provided by means of which the bags can be filled and emptied while in the press.—W. H. C.

Kiln; Sectional —. G. R. Mumma, Assignor to The C. W. Raymond Co., Dayton, Ohio. U.S. Pat. 1,143,549, June 15, 1915. Date of appl., June 29, 1914.

THE division walls of the kiln are provided with gas flues (one for each section) which communicate with continuous water-smoking flues in the side walls.—W. H. C.

Cooling towers. F. Uhde, Breslau, Germany. Eng. Pat. 14,115, June 11, 1914. Under Int. Conv., July 12, 1913.

THE cooling water falls from a distributor on to concentric annular trays placed one below the other and diminishing in size downwards, each tray underlying only a part of the tray above it. The water overflowing from the trays is led by suitable conduits to a small, central reservoir below.—W. F. F.

Cooling slacks or towers. W. W. White, London. Eng. Pat. 19,646, Sept. 10, 1914.

THE liquid flows in a thin layer along a number of oppositely inclined shallow gutters formed of a series of planks arranged in a tower, and is cooled by air which passes between the gutters.—W. H. C.

Stirring, agitating, or mixing liquids; Method of and apparatus for —. B. Goldman, and Galvanische Metall-Papier Fabrik, Act.-Ges., Berlin. Eng. Pat. 24,588, Oct. 29, 1913.

THE mixing is effected by the combination of a rotating vane or inclined disc, mounted near the bottom of the containing vessel on a central vertical shaft, and stationary baffles at the surface of the liquid. The latter, which only just dip into the liquid, are adjustable vertically to suit different quantities of liquid, or the upper stirrers may consist of a series of hinged baffles attached at different levels to the sides of the tank and so arranged that they can be swung out or folded back as required.—W. H. C.

Mixing and agitating machines and appliances. D. W. R. Read, London. Eng. Pat. 2919, Feb. 23, 1915.

THE mixing pan is circular in section and concave inwards towards the base, which is arched. The stirrer has one edge following the contour of the side of the pan, and is mounted on an eccentric spindle carried by a bracket on a shaft which is concentric with the axis of the receptacle. The stirrer is revolved bodily about the axis of the pan, and at the same time rotated in the opposite direction about its own axis by chain and sprocket gear driven by change-speed pulleys. The pan is mounted on a support which slides vertically on the machine frame.—W. F. F.

Pulveriser. F. R. Cornwall, Assignor to Williams Patent Crusher and Pulverizer Co., St. Louis, Mo. U.S. Pat. 1,144,352, June 29, 1915. Date of appl., Nov. 30, 1910.

THE hammers of a rotary hammer mill are adjustably supported on discs mounted upon the shaft, and locking means are provided to hold the hammers rigidly in position.—W. H. C.

Pulverising and mixing soft inflammable materials; Process and apparatus for —. W. J. Strawson, London. Eng. Pat. 1000, Jan. 21, 1915.

A HOLLOW cylinder containing a cooling liquid, a roller and a number of spikes similar to a harrow are mounted in a frame and drawn to and fro over the materials, which are spread on a suitable floor. The spikes are loosely mounted in the frame, so that they have a jumping or chattering motion.—W. H. C.

Evaporating apparatus. W. Wiegand, Merseburg, Germany. U.S. Pat. 1,145,728, July 6, 1915. Date of appl., Mar. 25, 1912.

SEE Eng. Pat. 5944 of 1912; this J., 1912, 707.

Centrifugal machines for separating solid substances from liquids. H. Wade, London. From Jahn und Co., Arnswalde, Germany. Eng. Pat. 9583, Apr. 17, 1914.

SEE U.S. Pat. 1,124,907 and Fr. Pat. 471,531; this J., 1915, 264, 410.

Kneading and mixing machines. R. Herbst, and Hallesche Teigteil, Knet- u. Mischmaschinenfabr., Halle, Germany. Eng. Pat. 12,570, May 21, 1914.

SEE U.S. Pat. 1,138,651 of 1915; this J., 1915, 648.

Recovery of energy expended in compressing gases and vapours. Eng. Pat. 18,922 of 1914. See IIA.

Apparatus for supplying air to furnaces, especially to gas generators. Eng. Pat. 9154 of 1914. See IIA.

Apparatus for heating liquids and like purposes. Eng. Pat. 17,207 of 1914. See IIB.

Centrifugal strainers. U.S. Pat. 1,145,097. See V.

Drying cylinders [for textile fabrics]. Eng. Pat. 15,072 of 1914. See V.

Separating the constituents of air or other gaseous mixtures. Eng. Pat. 24,735 of 1914. See VII.

Means for removing the sintered together burnt material from kilns or the like. Eng. Pat. 4539 of 1914. See IX.

Heating furnaces. Eng. Pat. 20,929 of 1914. See X.

Apparatus for the filtration, aeration, and gasification of liquids. Eng. Pat. 19,901 of 1914. See XIXB.

IIA.—FUEL; GAS; MINERAL OILS AND WAXES.

Exportation of coal and coke.

IN virtue of an Order in Council of August 3rd, the exportation of coal and coke will no longer be permitted freely to Allied countries on and after August 13th and will be prohibited to all destinations abroad other than British Possessions and Protectorates.

Applications for licences to export these commodities to prohibited destinations should be addressed on a special form to the War Trade Department, at 4, Central Buildings, Westminster, London, S.W.

By an Order in Council of July 30th, the exportation of charcoal and peat is prohibited to all foreign countries in Europe and in the Mediterranean and Black Seas, other than France, Russia (except Baltic ports), Italy, Spain, and Portugal.

Petroleum; Nature and classification of the [solid] paraffins of — and methods for their extraction. M. A. Rakuzin. J. Russ. Phys. Chem. Soc., 1914, 46, 1544—1566. J. Chem. Soc., 1915, 108, i., 489.

PETROLEUM was centrifuged and filtered through a Chamberland candle and through various powdered, porous materials, and the various products separated were examined microscopically. All the higher, so-called solid paraffins, resin, and carbonaceous matter can be removed from petroleum by centrifuging (compare this J., 1909, 789). When boiled in a reflux apparatus with the finely powdered porcelain of a Chamberland candle, petroleum loses all its solid paraffins, but the resin is retained. The results indicate the presence in petroleum of soft, medium, and hard paraffins of crystalline structure and do not confirm Zoloziecki's theory (this J., 1888, 428), according to which crude petroleum contains only amorphous "proto-paraffins," which consist of isomerides of normal paraffins, and are converted into crystalline "pyro-paraffins" of the normal series on distillation.

Petroleum for medicinal purposes; Production of — in the United States. U.S. Commerce Rept. No. 179, Aug. 2, 1915.

THE cessation of imports of Russian medicinal petroleum has stimulated great interest among American refiners, with the result that at least ten sources of American oil are now available. Tests made by the American Medical Association have shown no appreciable difference in the therapeutic efficiency of Russian and American oils. That the foreign oil has not previously met with serious competition is attributed to the fact that the supply was ample and that American refiners confined their efforts rather to increasing the supply of the more easily refined products, such as gasoline and naphtha, for which the demand continues to increase.

Petroleum production of the world. J. D. Northrop. U.S. Geol. Survey, 1915.

THE accompanying table shows the marketed production of crude petroleum in the various producing countries during 1913 and 1914, expressed in barrels of 42 galls. :—

Country.	1913.	1914.
	brls.	brls.
United States	248,446,230	265,762,535†
Russia	62,834,356	67,020,522†
Mexico	25,902,439	21,188,427†
Roumania	13,554,768	12,826,579†
Dutch East Indies	11,966,857	12,705,208*
India	7,930,149	8,000,000†
Galicia	7,818,130	5,033,350†
Japan	7,942,009	2,738,378†
Peru	2,133,261	1,917,802†
Germany	995,764†	995,764†
Egypt	94,635	777,038
Trinidad	503,616	643,533
Canada	228,080	214,805
Italy	47,256	39,548
Other countries	270,000†	620,000§
Total	384,667,550	400,483,489

* Includes British Borneo. † Estimated. ‡ Includes Formosa. § Includes 600,000 barrels produced in Argentina.

Russian petroleum industry in 1914. Ch. of Comm. J., Aug., 1915.

THE war has had little or no effect either on the output of petroleum or on the market demand. The production has continued during the latter months of 1914 as strong as during the previous year. The decrease on the year's output was due to labour troubles in the summer when, in the space of two months, the production was reduced as a result of strikes by 700,000 tons. The total output in 1914 was 8,900,000 tons against 9,000,000 in 1913. The maximum output was in 1904—10·5 million tons, when it suddenly fell in 1905 to 7·3 million tons. Since then, with the opening of new oil fields, the production has steadily increased year by year. The petroleum yield from the oil fields on the Apsheron Peninsula, in Surakhany and Binagadi, on the Island of Svatoi, at Maikop, in the Urals, in the Ferghana Territory and Grozny, was estimated at 3·2 million tons, so that the output from the old Baku deposits in 1914 was but 5·7 million tons, against 9·9 millions in 1904.

The decrease in the output from the old Baku deposits is not only due to a diminution of the fountains, but also to smaller quantities of pumped oil; the actual decrease in output owing to the diminishing quantity of oil was 6·8%. In the Grozny region, which is the most important after Baku, about 1,600,000 tons of oil was extracted; in 1904 the quantity was but 640,000 tons. The Urals oil production was about 274,000 tons,

against 113,000 in 1913. Maikop yielded but 64,000 tons. Boring operations in the new regions of Surakhany, Grozny, and the Urals were greater last year than in 1913, but less boring was done on the old Baku fields.

Owing to the stoppage of export the operations of the oil works diminished as shown by the figures for 10 months in 1913 and 1914 :—

	Millions of tons.	
	1913.	1914.
Kerosene	1.09	0.96
Mazut fuel	2.56	2.35
Other products.....	0.51	0.42

Petroleum in Papua. Bull. Imp. Inst., 1915, 13, 185—189.

PETROLEUM has been discovered at various places in the neighbourhood of the Vailala river, and the geological features of the oil field have been examined (Wade, *Report on Petroleum in Papua* 1914), but extensive drilling operations have been postponed until more knowledge of the geological conditions has been gained. A sample of the crude petroleum consisted of a reddish-brown, mobile oil, showing a blue fluorescence; sp.gr. at 15° C., 0.802; bromine absorption, 3.27% by weight; flash point (Abel-Pensky closed test), below 20° C.; paraffin wax, about 2%. On fractional distillation the oil yielded 32.5% by vol. of water-white light petroleum, b.pt. below 150° C., sp.gr. 0.758, flash point below 20° C., and 58.7% of pale yellow kerosene, b.pt. 150°—300° C., sp. gr. 0.822, flash point 57° C. In regard to yields of distillation products the oil resembles Sumatra crude petroleum (Redwood, *Petroleum*, 1913, vol. i., p. 234).—A. S.

Thermal study of the carbonisation process. Hollings and Cobb. See IIB.

PATENTS.

Coal, coke or the like; Presses for briquetting —. E. C. R. Marks, London. From Maschinenbau-Anstalt Humboldt. Cologne-Kalk, Germany. Eng. Pat. 3985, Feb. 16, 1914.

SMALL briquettes are made by passing the material on a travelling band under a plunger which presses it into an undivided flat cake, and then immediately, and in the same mould, under a second plunger which cuts it into the required blocks.

—W. F. F.

Fuel for internal combustion engines; Process for producing —. T. Franke, London. Eng. Pat. 28,072, Dec. 5, 1913.

THE fuel consists of a mixture of unrefined aliphatic "carbinols" produced from raw peat (i.e., fusel oil and lower alcohols), and about 50% of aliphatic hydrocarbons of high calorific value, such as peat oil, kerosene, or their distillates, the substances being preferably mixed as gases during distillation.—W. F. F.

Retorts or ovens for carbonising coal. F. L. Slocum, Pittsburg, Pa., U.S.A. Eng. Pat. 18,215, Aug. 1, 1914.

IN a retort for the continuous carbonisation of coal under pressure produced by forcing fresh coal into the retort, a constriction is formed just below the feed opening, to prevent the expansion of the plastic coal when the pressure is relieved during the introduction of a fresh charge.—W. F. F.

Vertical retorts for continuous carbonisation of coal or the like; Discharging —. A. McD. Duckham, Ashted, Surrey. Eng. Pat. 21,191, Oct. 19, 1914.

THE lower end of the retort has a water seal consisting of a suspended, oscillating trough, and a fixed, vertical scraper by means of which the contents of the trough are divided into two approximately equal parts and discharged over opposite edges, alternately, during oscillation. Alternatively, one side of the retort is made longer than the other and extends nearly to the flat bottom of a water trough having a vertical and an oblique side; the trough is oscillated by horizontal movement upon a roller, so that the contents are continuously pushed up the sloping side and discharged over the edge, by the scraping action of the longer side of the retort.—W. E. F. P.

Gas generators; Apparatus for supplying air to furnaces, especially to —. Poetter G. m. b. H., Düsseldorf. Eng. Pat. 9154, Apr. 11, 1914. Under Int. Conv., Oct. 14, 1913.

MEANS are provided whereby a steam-jet air injector is brought into operation automatically in the event of the failure of the usual power-driven blowing device, and made inoperative when the latter is re-started.—W. E. F. P.

Gas-generating furnace. W. C. London, St. Louis, Mo. U.S. Pat. 1,145,327, July 6, 1915. Date of appl., Sept. 28, 1912.

THE furnace consists of a vertical casing containing a number of horizontal gas-retorts arranged in tiers above a fire-box, at each side of which is a vertical series of horizontal flues. Air, admitted at the base of the structure and preheated by traversing spaces around the horizontal flues, is mixed with the gases from the fire-box and the mixture discharged into combustion chambers which communicate with the horizontal flues.—W. E. F. P.

Furnaces for the destructive distillation of carbonaceous substances. W. W. Crawford, London. Eng. Pat. 18,437, Aug. 8, 1914.

THE furnace consists of a number of radial retort chambers with alternate heating chambers, the whole being mounted on a framework, which is power-driven through a rack ring and pinion, and rotates on a circular rail. Radial gas burners are mounted by a swivel joint on a central supply pipe, so that distillation takes place continuously during rotation. The doors at the top and bottom of the retorts are opened automatically by a trip device, the lower door closing after the contents are discharged, and the upper door remaining open while a fresh charge is introduced.—W. F. F.

Gas retorts; Means for charging and discharging —. H. J. Toogood, and R. Dempster and Sons, Ltd., Elland, Yorks. Eng. Pat. 17,117, July 20, 1914.

IN a machine having a ram or pusher for discharging the retorts, and a charger of the projector type, the discharging ram is entirely withdrawn before the fresh charge is introduced. The projector is arranged between the side cheeks of the ram, and forces the coal through an aperture in the ram head into the retort.—W. F. F.

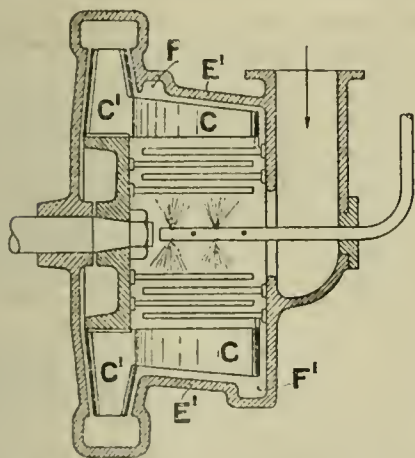
Peat gasification. T. Rigby, Dumfries, and Wet-carbonizing, Ltd., London. Eng. Pat. 16,918, July 16, 1914.

PRESS cakes of peat, obtained as described in Eng. Pat. 17,610 of 1911 (this J., 1912, 1171) and containing about 65—70% of water, are conveyed to a rotary screen, from which the fine material passes

to disintegrators and is then briquetted. The larger lumps pass from a hopper provided with an adjustable door to a jig conveyor operated by an electric motor, and thence to a second rotary screen. The larger lumps are conveyed to a mixing hopper where they are mixed with peat briquettes containing about 5% of water, which have been subjected to similar treatment. The moisture content of the mixture which passes to the producer is adjusted by the openings of the two hopper doors, and kept constant by the interconnection of the switches controlling the jig conveyor motors.—W. F. F.

Gas washers; Centrifugal —. H. E. Theisen, Munich, Germany. Eng. Pat. 9618, Apr. 18, 1914. Addition to Eng. Pat. 22,433, Sept. 27, 1910, as improved upon or modified by Eng. Pat. 27,606, Dec. 9, 1911 (this J., 1911, 1045; 1912, 1020).

APPARATUS of the kind described in the earlier patents is modified for the purification of small quantities of gas very rich in tar. A disintegrator



of the fixed and revolving bar type is combined with a fan having an axial prolongation, *c*, an additional washing surface, *E¹* and a tar gutter as at *F* or *F¹*. The pure gas is withdrawn by the fan blades, *c¹*. In a modification, the parts *c*, *c¹*, of the fan are separated by an annular disc projecting inwards from the casing, and additional peripheral vanes are provided on the fan in the space between the blades, *c*, and the disc.
—W. F. F.

Gases and vapours; Method of and means for the recovery of energy expended in compressing —. L. de Florez, and Hall Motor Fuel, Ltd., London. Eng. Pat. 18,922, Aug. 21, 1914.

THE compressed mixture (*e.g.*, natural gas or gases from the cracking of oil) is passed through a surface condenser to a water-cooled condenser and a receiver for the condensate. The uncondensed gas passes back from the second condenser to the first, where it receives heat from the compressed mixture, and is then employed in a working cylinder to assist in the compressing operation.—W. F. F.

Powdered fuel; Process for burning —. *Method of conducting combustion. Process of combustion.* H. L. Doherty, New York. U.S. Pats. (A) 1,145,356, (B) 1,145,357, and (C) 1,145,358, July 6, 1915. Dates of appl., Dec. 31, 1909, Jan. 17, 1911, and Jan. 17, 1911.

(A) THE fuel is suspended in a current of combustion gases containing less oxygen than is neces-

sary to form a combustible mixture, and discharged into a combustion chamber into which it induces air in the form of a conical annulus so as to give a prolonged flame. (B) A mixture of gas and excess of air is ignited and the flame maintained continuously at approximately uniform temperature by adding alternate portions of gas and air, each in excess. (C) Gas and air are introduced alternately at opposite ends of alternate heating flues of a coke oven, at such pressures as to maintain, in conjunction with the draught, a pressure equal to or slightly above that in the oven.—W. F. F.

Carbon monoxide; Effecting the removal of — from gas mixtures. J. V. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen, Germany. Eng. Pat. 9271, April 14, 1914.

To prevent injury to metal (*e.g.* iron) vessels which are used in the absorption of carbon monoxide from gas mixtures at or above atmospheric pressure, ammoniacal solutions of cuprous oxide containing little or no halogen are used. In preparing the solutions, no acid or only a weak acid such as carbonic or an organic acid is used.—W. F. F.

Carbon monoxide; Separation of — from gas mixtures. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Eng. Pat. 20,616, Oct. 6, 1914.

IN separating carbon monoxide from gas mixtures by treating at or above atmospheric pressure with an ammoniacal solution of a cuprous compound, oxygen, or air or other gas containing oxygen is introduced to prevent the separation of metallic copper and partially to oxidise the absorbed carbon monoxide to dioxide.—W. F. F.

Light hydrocarbons; Process for obtaining — from heavy hydrocarbons. E. Graefe and R. von Walther, Dresden. Eng. Pat. 25,510, Nov. 7, 1913.

PETROLEUM oil is heated to a high temperature under a pressure of 20 to 50 atmos., produced by its own vapour, until decomposed, and then distilled under the same pressure. Both operations may be carried out in the same apparatus, and the distillation may be made fractional by the use of a connected series of apparatus.—C. A. M.

Hydrocarbons; Treatment of —. L. Hirschberg, and Potential Developments, Ltd., London. Eng. Pat. 4573, Feb. 21, 1914.

FINELY divided liquid or vaporised heavy hydrocarbons are brought into contact with a heated catalyst consisting of light, bulky chromium oxide obtained by calcining chromium salts which have volatile bases (*e.g.*, ammonium chromate or bichromate) with or without other catalysts, and the resulting lighter hydrocarbons are distilled.
—C. A. M.

Peat; Process for utilising the liquid associated with —. N. Testrup and M. A. Adam, London, and T. Rigby and G. W. Andrews, Dumfries. Assignors to Wetcarbonizing Ltd., London. U.S. Pat. 1,145,095, July 6, 1915. Date of appl., Jan. 27, 1914.

SEE Eng. Pat. 2283 of 1913; this J., 1914, 543.

Producer gas from bituminous fuels; Production of —. Dellwik-Fleischer Wassergas Ges., Frankfurt, Germany. Eng. Pats. 303, Jan. 5, 1914 (under Int. Conv., Mar. 12, 1913), and 884, Jan. 12, 1914.

SEE Fr. Pat. 466,422 of 1913; this J., 1914, 585.

Gas; Apparatus for generating or producing —. W. R. Degenhardt, London. Eng. Pat. 19,652, Sept. 10, 1914.

SEE U.S. Pat. 1,128,858 of 1915; this J., 1915, 346. Provision is made for introducing superheated steam and air to the top of the generator chamber.

Gas liquor; Method of treating the — in small gas works. Berlin-Anhaltische Maschinenbau-A.-G., Berlin. Eng. Pat. 4243, Feb. 18, 1914. Under Int. Conv., Oct. 21, 1913. Addition to Eng. Pat. 4242 of 1914, dated May 9, 1913.

SEE Ger. Pat. 272,985 of 1913; this J., 1914, 685.

Fractional distillation of mixtures of liquids having different boiling points [e.g., petroleum]; Continuous —. E. Barbet et Fils et Cie., Paris. Eng. Pat. 9088, Apr. 9, 1914. Under Int. Conv., Apr. 12, 1913.

SEE Fr. Pat. 468,068 of 1913; this J., 1914, 954.

Light hydrocarbons from heavy hydrocarbons; Manufacture of —. F. Bergius, Hanover, Germany. Eng. Pat. 4574, Feb. 21, 1914. Under Int. Conv., May 5, 1913.

SEE Fr. Pat. 470,551 of 1914; this J., 1915, 167.

Manufacture of hydrogen. Eng. Pat. 25,710 of 1913. See VII.

Producing dry pulverulent compounds of mineral oils or wax and malt extract or malto-dextrin. Eng. Pat. 26,390 of 1913. See XVIII.

Apparatus for detecting the presence of fire damp and other gases. Eng. Pat. 18,280 of 1914. See XXIII.

Apparatus for testing [flue] gases. Eng. Pat. 3885 of 1914. See XXIII.

Means for detecting the presence of injurious gases in mines and like places. Eng. Pat. 25,412 of 1913. See XXIII.

IIB.—DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Carbonisation process; Thermal study of the —. H. Hollings and J. W. Cobb. Chem. Soc. Trans., 1915, 107, 1106—1115.

A FURTHER discussion of results already presented (this J., 1914, 685). Thermal phenomena at low temperatures are only marked in the case of cellulose and coals in which the degradation of cellulose is incomplete and the oxygen content high, whilst phenomena at high temperatures are most pronounced with anthracite and coals of low oxygen content. The following correlation of chemical and thermal stages is suggested: (1) *Below 400° C.* cellulose shows a strong exothermic reaction, commencing at 345° C., but this is very much weakened in dehydrated cellulose and lignite and is absent in coals. It is presumably connected with the loss of hydroxyl groups, and consequent molecular condensation in the residue. (2) *Between 400° and 600° C.* the characteristic differences of the types of coal are manifested. Oils, unsaturated hydrocarbons, higher paraffins, and oxygenated compounds are produced, in quantity and nature dependent on the kind of coal, and thermal phenomena are varied in a corresponding degree. (3) *Between 600° and 800° C.* methane is evolved and the process is decidedly exothermic, the production of methane appearing to be the main exothermic reaction during the carbonisation process. (4) *Above 800° C.* the process is thermally neutral or slightly endothermic, the main product being hydrogen. A "heating curve" and ultimate

analysis are given for each material examined. A comparison of the heating curves of coal with those of the soluble and insoluble fractions obtained by extracting the same coal with pyridine, supports the view that prolonged extraction with this solvent effects partial decomposition. (See also Vignon, this J., 1913, 76; Bantlin, 1914, 129.)

—F. SODN.

PATENTS.

Charcoal; Process for producing and revivifying decolorising —. J. Wunsch, Skrivan, Bohemia. Eng. Pat. 10,126, April 24, 1914. Under Int. Conv., May 2, 1913.

CARBONACEOUS material, such as wood, cellulose, starch, coal, offal, etc., or a mixture of spent decolorising charcoal with cellulose, is heated in an open vessel with excess of anhydrous zinc chloride until the latter commences to volatilise. The fused mass is then cooled, crushed, and lixiviated in a filter press with hot water containing hydrochloric acid, the resulting solution being utilised for the treatment of a further charge of raw material.—W. E. F. P.

Heating liquids and like purposes; Apparatus for —. A. Kay and F. Lomax, Manchester. Eng. Pat. 17,207, July 21, 1914.

THE apparatus consists of a series of vertical metal trays provided with ribs on one side to guide the liquid in a zig-zag channel over the face of the plate, and baffles on the opposite side to distribute the heating medium. Between each pair of trays is a metal plate which separates the liquid from the heating medium, and suitable ports are provided in the trays and plates so that the liquid finds a continuous passage through the apparatus. Hot gases from a burner underneath pass through the alternate chambers, which do not communicate with one another.—W. F. F.

Filaments; Supports for electric incandescence lamp —. G. Lüdecke, and The Brimsdown Lamp Works, Ltd., Brimsdown, Middlesex. Eng. Pat. 27,157, Nov. 25, 1913.

THE support comprises a wire of an alloy of nickel and tungsten containing up to 50% of the latter. —B. N.

Furnaces for the destructive distillation of carbonaceous substances. Eng. Pat. 18,437 of 1914. See IIA.

Metals [tungsten] and method of manufacturing them. Eng. Pat. 15,961 of 1914. See X.

Heating furnaces. Eng. Pat. 20,929 of 1914. See X.

Apparatus for the destructive distillation of sewage sludge. Eng. Pat. 10,071 of 1914. See XIXb.

Destructor furnaces or stores. Eng. Pat. 19,334 of 1914. See XIXb.

Destructor apparatus for treating faecal or other sewage matter. Eng. Pat. 19,561 of 1914. See XIXa.

III.—TAR AND TAR PRODUCTS.

Acenaphthylene and its derivatives. B. Campbell. Chem. Soc. Trans., 1915, 107, 918—921.

ACENAPHTHYLENE, $C_{12}H_8$, obtained by passing the vapour of acenaphthene through a red-hot silica tube, crystallises from alcohol in square yellow plates, m.pt. 93° C. In carbon tetrachloride solution it is converted by chlorine into 1,2-dichloroacenaphthene, m.pt. 115° C., crystallising

from petroleum spirit in glistening white plates and from alcohol in needles, and yielding naphthalic acid on oxidation with potassium permanganate. Dichloroacenaphthene when boiled with alcoholic sodium ethoxide yields monochloroacenaphthene as a yellow oil. Acenaphthylene is converted by iodine at the ordinary temperature into polyacenaphthylene.—T. C.

Absorption spectra of monosubstituted benzene compounds, and the benzene substitution law. E. C. C. Baly and F. G. Tryhorn. Chem. Soc. Trans., 1915, 107, 1058—1070.

WHERE the two groups of disubstituted derivatives of benzene are electro-positive, the *para*-isomeride shows the most pronounced absorption band; on the authors' hypothesis that this indicates the most open force field, the reactivity will be most pronounced in the *para*-position, and hence, if a mono-substituted benzene compound shows a pronounced absorption band, it will give *para*-disubstituted derivatives. Conversely if a mono-substituted benzene derivative shows a feeble absorption band, such a compound will tend to give *meta*-disubstituted derivatives. Bearing in mind that it is the absorption powers of the pure homogeneous substances and not of their dilute solutions which are in question, since the reactions involving the entry of a second substituted group are carried out with the pure compound or with a very concentrated solution, observations of the absorption curves of numerous benzene derivatives showed that, with but one or two exceptions, the above deductions from the force field theory are substantially in accord with the facts.—G. F. M.

Chlorinated amines; Formation of — by the reduction of nitro-compounds. W. G. Hurst and J. F. Thorpe. Chem. Soc. Trans., 1915, 107, 934—941.

3-CHLORO-*p*-PHENETIDINE was obtained in 90% yield by the reduction of *p*-nitrophenetole with tin and concentrated hydrochloric acid, whilst the reaction proceeded normally, with production of *p*-phenetidine, when dilute hydrochloric acid was used. The chlorinated amine was separated from traces of the unchlorinated base by extracting the aqueous solution of its acetate with ether. It forms a colourless liquid, b.pt. 161.5°C. at 33 mm. Cooled in ice it forms colourless needles which melt at 24°C. On acetylation with acetic anhydride it gives 3-chlorophenacetin, m.pt. 90°C. The compound described by Orton and Jones (Chem. Soc. Trans., 1909, 95, 1456) under this name is actually 2-chlorophenacetin. 3-Chlorophenacetin when treated with aluminium chloride in benzene solution is hydrolysed to 3-chloro-4-acetaminophenol, forming prisms of m.pt. 121°C. The corresponding derivatives of anisidine were also prepared. 3-Chloro-*p*-anisidine is a feeble base, boiling at 156° at 31 mm. pressure. Its acetyl-derivative melts at 114°C. The action of aceto-acetic ester on these chlorinated bases resulted in the formation of derivatives of the type, RNH.CO.NHR, where R is a chloroethoxyphenyl-group.—G. F. M.

Pyridine nucleus; New reaction of compounds containing the —. A. E. Tschitschibabin and O. A. Zeide. J. Russ. Phys. Chem. Soc., 1914, 46, 1216—1236. J. Chem. Soc., 1915, 108, i., 590—591.

THE action of sodamide on pyridine at a temperature not exceeding 120°C. and subsequent decomposition of the product with water yields 2-aminopyridine in 70% yield. With methyl iodide and 2-methylpyridine, sodamide yields principally 6-dimethylamino-2-methylpyridine. The action of sodamide on pyridine may proceed still further, both α -hydrogen atoms being replaced with formation of 2,6-diaminopyridine, m.pt.

122°C., which is obtained in good yield and serves as the initial product for the preparation of a series of new derivatives of pyridine. It may be combined with diazo-compounds, such as that of *m*-phenylenediamine, giving true azo-dyes. The reaction of pyridine derivatives with sodamide proceeds best in presence of a solvent neutral to sodamide, such as toluene, xylene, or, in cases where a higher temperature is required, dried vaseline oil. The latter and certain other solvents, particularly dimethylaniline, facilitate the reaction, owing to the fact that the sodium derivatives of amines are soluble in them, the reaction thus proceeding in a homogeneous medium. Access of atmospheric oxygen must be prevented during the reaction. Water is subsequently added gradually to the cooled products, which are kept well mixed and cooled.

2-Aminopyridine; Nitration of —. A. E. Tschitschibabin. J. Russ. Phys. Chem. Soc., 1914, 46, 1236—1244. J. Chem. Soc., 1915, 108, i., 591—592.

2-AMINOPYRIDINE (see preceding abstract) can be nitrated with approximately the same ease as aniline. The principal product is 5-nitro-2-aminopyridine, together with a considerably lower proportion of an isomeride which is regarded as 3-nitro-2-aminopyridine. The nitroaminopyridines bear a certain resemblance to the nitroanilines, being yellow compounds and exhibiting the properties of feeble bases, the salts of which are readily decomposed by water. 5-Nitro-2-aminopyridine is distilled only with difficulty in a current of steam, whereas 3-nitro-2-aminopyridine is readily volatile under these conditions. 5-Nitro-2-aminopyridine, $C_5H_5O_2N_3$, forms yellow plates, m.pt. 188°C., and dissolves in mineral acids, giving colourless salts, but these solutions turn yellow on dilution with water owing to the liberation of the base. 5-Nitro-2-hydroxypyridine, $C_5H_4O_3N_2$, obtained by the action of concentrated sulphuric acid on 5-nitro-2-aminopyridine, and also when the mixed products from the nitration of 2-aminopyridine are left over-night, forms faintly yellow needles, m.pt. 184°C. and exhibits feeble basic, but marked phenolic properties. With concentrated alkali hydroxide it yields yellow needles of the alkyl phenoxide, which is readily soluble in cold water. 2-Chloro-5-nitropyridine, obtained by diazotisation of 5-nitro-2-aminopyridine in concentrated hydrochloric acid solution, forms coarse needles, m.pt. 108°—110°C. 3-Nitro-2-aminopyridine, forms yellow needles, m.pt. 162°C.

Ketones; Chlorination of cyclic — with antimony pentachloride. A. Eckert and K. Steiner. Monatsh. Chem., 1915, 36, 175—189. J. Chem. Soc., 1915, 108, i., 564—565.

THE general procedure was to mix the ketone with fifteen to twenty times its weight of antimony pentachloride and a trace of iodine; after the first vigorous reaction, the mixture was boiled for six to eight hours. The crude chlorination product was in each case at least twice the weight of the ketone taken. Anthraquinone gave a product consisting mainly of heptachloroanthraquinone, yellowish-green needles, m.pt. 380°C., and perchlorobenzoylbenzoic acid, hexagonal tablets, m.pt. 266°C., together with smaller quantities of tetrachlorophthalic acid and hexachlorobenzene. When heated with sulphuric acid at 200°—250°C., perchlorobenzoylbenzoic acid is decomposed into tetrachlorophthalic acid and pentachlorobenzene; a similar decomposition takes place when the acid is heated with antimony pentachloride, the products being tetrachlorophthalic acid and hexachlorobenzene. Fluorenone gave almost entirely *o*-pentachlorophenyltetrachlorobenzoic acid (per-

chlorophenylbenzoic acid), $C_6Cl_5 \cdot C_6Cl_4 \cdot CO_2H$, leaflets, m.pt. $264^\circ C.$, together with a little perchlorodiphenyl. With phenanthraquinone it was found advisable to add the antimony pentachloride in two instalments, the reaction product under these conditions being less complex, consisting chiefly of perchlorophenylbenzoic acid. The main product from xanthone was octachloroxanthone, pale yellow needles, m.pt. $321^\circ C.$, accompanied by pentachlorobenzoic acid and hexachlorobenzene. Acridone yielded octachloroacridone, pale yellowish-green needles, m.pt. $340^\circ C.$

Anthraquinone; Exhaustive halogenation of —. A. Eckert and K. Steiner. *Monatsh. Chem.*, 1915, **36**, 269—280. *J. Chem. Soc.*, 1915, **108**, i., 565—566. (Compare preceding abstract.)

THE heptachloroanthraquinone obtained by the action of antimony pentachloride on anthraquinone is the 1.2.3.5.6.7.8-compound, and the apparent difficulty of the occurrence of 1.4.5.8-tetrachloroanthraquinone as an intermediate product is removed by the discovery that treatment of the tetrachloro-compound with antimony pentachloride gives largely the 1.2.3.5.6.7.8-heptachloroanthraquinone instead of the 1.2.4.5.6.7.8-isomeride. Tetrachlorophthalic anhydride was condensed with 1.2.4-trichlorobenzene in the presence of aluminium chloride, the resulting mixture of isomeric heptachlorobenzoylbenzoic acids, m.pt. 226° — $230^\circ C.$, being accompanied by a neutral substance, needles, m.pt. $312^\circ C.$ When heated with fuming sulphuric acid at $200^\circ C.$ the mixture of heptachlorobenzoylbenzoic acids was converted into 1.2.4.5.6.7.8-heptachloroanthraquinone, pale yellow needles, m.pt. $302^\circ C.$ Under the influence of antimony pentachloride this compound undergoes partial isomerisation into the 1.2.3.5.6.7.8-compound, and its formation probably precedes that of the latter substance in the exhaustive chlorination of anthraquinone. By the gradual and cautious addition of bromine to a solution of anthraquinone in fuming sulphuric acid, the mixture being subsequently warmed for three hours at $50^\circ C.$, heptabromoanthraquinone, yellow needles, m.pt. above $400^\circ C.$ is obtained. If an excess of bromine is used at a higher temperature, the reaction product contains heptabromobenzoylbenzoic acid, needles, m.pt. $278^\circ C.$, and its decomposition products, tetrabromophthalic acid and hexabromobenzene, the m.pt. of which was found to be 306° instead of above $315^\circ C.$ as generally stated in the literature. When heated with concentrated sulphuric acid, heptabromobenzoylbenzoic acid yields tetrabromophthalic acid and pentabromobenzene; the latter substance, silky needles, m.pt. $293^\circ C.$, appears not to have been obtained pure by previous investigators.

Carbolic acid production in Japan. Oil, Paint, and Drug Rep., Aug. 2, 1915.

THE experimental production of benzol, naphthalene, carbolic acid, and aniline by the Tokyo Gas Company has been attended with satisfactory results. The company is producing about 24 cwt. of carbolic acid monthly, an amount which will be increased immediately to 6 tons monthly. When the plant is working at its full capacity, an annual production of 190 tons is expected. It is reported that a "semi-official" factory is to be started in Japan for the production of carbolic acid.

PATENTS.

[Hydr]oxynaphthoyl derivatives of aminonaphthols; Manufacture of —. A. G. Bloxam, London. From Chem. Fabr. Griesheim-Elektron, Frankfurt, Germany. Eng. Pat. 5446, Apr. 10, 1915.

AMINONAPHTHOLS are condensed with O-acyl

derivatives of halogenides of 2.3-hydroxynaphthoic acid and the products saponified to give substances of value in the production of azo-dyestuffs. —F. W. A.

[Hydr]oxynaphthoyl derivatives of aminonaphtholsulphonic acids; Manufacture of —. A. G. Bloxam, London. From Chem. Fabr. Griesheim-Elektron, Frankfurt, Germany. Eng. Pat. 5445, Apr. 10, 1915.

THE condensation products obtained from aminonaphtholsulphonic acids and halogenides of 2:3-hydroxynaphthoic acid or of its O-acyl derivatives, subsequently saponified in the latter case, possess great affinity for cotton and silk. —F. W. A.

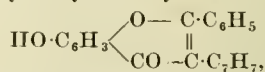
Manufacture of carboxylic acids of the arylides of hydroxyarylecarboxylic acids. Eng. Pat. 5444 of 1915. See XX.

Medicinal and pharmaceutical preparation [from beechwood creosote]. Eng. Pat. 9745 of 1914. See XX.

IV.—COLOURING MATTERS AND DYES.

Benzo- γ -pyrones and flavones; Syntheses of —. II. S. Jacobson and B. Ghosh. *Chem. Soc. Trans.*, 1915, **107**, 959—966. (See also this J., 1915, 544.)

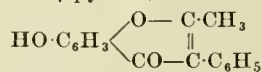
THE condensation of substituted benzoylacetate esters with phenols gives rise to substituted flavones, a reaction analogous to the formation of substituted benzo- γ -pyrones from substituted acetoacetic esters. Thus benzyl-benzoylacetate ester and resorcinol in presence of dry hydrogen chloride yield 7-hydroxy-3-benzyl-flavone,



which forms colourless leaflets, m.pt. $186^\circ C.$ It dissolves in sodium hydroxide to a yellow solution, and in sulphuric acid with the production of an intense bluish-violet fluorescence. Its constitution is proved by its decomposition on boiling with alkalis into benzylacetophenone and β -resorcylic acid. Similar condensation products were obtained from benzyl-benzoylacetate ester and other phenols. The condensation takes place readily with *m*-dihydroxy compounds, excepting those in which the 5-position is occupied (*e.g.*, orcinol). Pyrogallol gives 7.8-dihydroxy-3-benzylflavone, m.pt. $136^\circ C.$, which produces a greenish fluorescence in sulphuric acid. α -Naphthol condenses to 3-benzyl-1.4-naphthoflavone m.pt. $71.5^\circ C.$, phloroglucinol to 5.7-dihydroxy-3-benzylflavone, pale brown prisms, m.pt. $119^\circ C.$, and orcinol to 7-hydroxy-3-benzyl-5-methylflavone, lemon yellow needles, m.pt. $108^\circ C.$ —G. F. M.

Benzo- γ -pyrones and flavones; Syntheses of —. III. S. Jacobson and B. Ghosh. *Chem. Soc. Trans.*, 1915, **107**, 1051—1058. (Compare preceding abstract.)

ETHYL- α -PIENYLACETOACETATE condenses with resorcinol, pyrogallol, and α -naphthol in presence of sulphuric acid, and with phloroglucinol in presence of zinc chloride, to give respectively the substituted benzo- γ -pyrones, 7-hydroxy-3-phenyl-2-methylbenzo- γ -pyrone,



colourless needles, m.pt. $226^\circ C.$, dissolving in sulphuric acid to a colourless, bluish violet fluorescent solution; 7.8-dihydroxyl-3-phenyl-2-

methylbenzo- γ -pyrone, pale yellow [prisms, m.pt. 268° C.; 3-phenyl-2-methyl-1,4- α -naphthopyrone, lemon yellow needles, m. pt. 209° C., which develop a dark green fluorescence in sulphuric acid, and 5,7-dihydroxy-3-phenyl-2-methylbenzo- γ -pyrone, lemon yellow needles, m.pt. 178° C. Resorcinol and ethyl- α -phenyl formylacetate condense when heated with zinc chloride to give a small yield of 7-hydroxy-3-phenylbenzo- γ -pyrone, which forms yellow needles, m.pt. 131° C., and gives a green fluorescence in alcohol and in sulphuric acid.

—G. F. M.

Anthrimides [dianthraquinonylamines]. A. Eckert and K. Steiner. *Monatsh. Chem.*, 1914, **35**, 1129—1151. *J. Chem. Soc.*, 1915, **108**, i., 567—568.

THE preparation and properties of the three isomeric dianthraquinonylamines and their nitro-derivatives are described. On reduction with stannous chloride in alkaline solution the nitro-derivatives are converted into the corresponding hydroxy-compounds. Reduction in acid solution results in the formation of the corresponding amino-compounds or of indanthrene derivatives. 1,1'-Dianthraquinonylamine, prepared by heating 1-aminoanthraquinone and 1-chloroanthraquinone with sodium acetate and metallic copper in nitrobenzene solution at 200° C. (compare Ger. Pat. 162,824; this J., 1906, 175), crystallises in dark red needles, and gives an olive-green coloration with sulphuric acid. 1,2'-Dianthraquinonylamine, obtained from 1-chloroanthraquinone and 2-aminoanthraquinone or from 2-chloroanthraquinone and 1-aminoanthraquinone in a similar manner, crystallises in coppery-red needles. 2,2'-Dianthraquinonylamine, prepared by heating 2-chloroanthraquinone and 2-aminoanthraquinone with potassium carbonate at 280° C., forms pale coppery-red needles (compare Ger. Pat. 257,811; this J., 1913, 481). When mixed with sodium bicarbonate and exposed for two or three days to the action of bromine vapour at the ordinary temperature, 1,1'-dianthraquinonylamine yields 4,4'-dibromo-1,1'-dianthraquinonylamine, which forms dark red needles, sublimes undecomposed, and reacts with boiling aniline in the presence of sodium carbonate and a trace of cuprous chloride to form 4,4'-dianilino-1,1'-dianthraquinonylamine, dark bluish-green needles. 4,4'-Dinitro-1,1'-dianthraquinonylamine, prepared by nitrating 1,1'-dianthraquinonylamine with the calculated amount of acid in a sulphuric acid solution of boric acid, forms small, brownish-red scales, and reacts with aniline in the presence of sodium carbonate, yielding the dianilino-derivative mentioned above. The constitution of the dinitro-compound has been established by its formation from 1-amino-4-nitroanthraquinone and 1-chloro-1-nitroanthraquinone. 1-Chloro-1-nitroanthraquinone, prepared by nitrating 1-chloroanthraquinone, forms large, yellow crystals, m.pt. 259° C., and when heated with *p*-toluidine in the presence of stannous chloride, sodium carbonate, and boric acid is converted into 1,4-di-*p*-toluidinoanthraquinone, long, blue needles, m.pt. 213° C. (Ger. Pat. 91,149). When heated with nitric acid (sp.gr. 1.5) on the water-bath, 1,1'-dianthraquinonylamine yields 2,2',4,4'-tetranitro-1,1'-dianthraquinonylamine, which crystallises in reddish-orange needles and is probably identified with the nitro-derivative described in Ger. Pat. 213,501 (this J., 1909, 1082). 1,4-Dinitro-1,2'-dianthraquinonylamine, orange leaflets, and 2,4,1'-trinitro-1,2'-dianthraquinonylamine, yellow needles, are also described. On reduction with alkaline stannous chloride, 4,4'-dinitro-1,1'-dianthraquinonylamine yields 4,4'-dihydroxy-1,1'-dianthraquinonylamine, crystallising in violet needles. The constitution of the di-

hydroxy-compound has been confirmed by its formation from 1-chloro-1-hydroxyanthraquinone and 1-amino-1-hydroxyanthraquinone in hot nitrobenzene solution in the presence of a copper salt. 1-Nitro-1-hydroxyanthraquinone, prepared by nitrating 1-hydroxyanthraquinone in a sulphuric acid solution of boric acid, crystallises in golden-yellow needles, m.pt. 267° C., and is reduced by sodium sulphide to 1-amino-1-hydroxyanthraquinone. 1-Chloro-1-hydroxyanthraquinone is obtained in orange-yellow needles, m.pt. 186° C., by the addition of hydrochloric acid to a suspension of 1-hydroxyanthraquinone in a dilute acetic acid solution of sodium chlorate; when heated with methyl alcohol and potassium hydroxide at 100° C. it yields 4-methoxy-1-hydroxyanthraquinone (quinizarin mono-methyl ether), which forms yellow needles, m.pt. 189° C., and is hydrolysed by sulphuric acid in the presence of boric acid at 140° C. to quinizarin. 2,2'-Diamino-4,4'-dihydroxy-1,1'-dianthraquinonylamine, prepared by reducing 2,4,2',4'-tetranitro-1,1'-dianthraquinonylamine with alkaline stannous chloride or sodium sulphide, crystallises in microscopic, dark green needles; reduction with stannous chloride and hydrochloric acid in acetic acid solution yields 4,4'-diaminoindanthrene, small green needles. 1',4'-Dihydroxy-1,2'-dianthraquinonylamine, prepared from the corresponding dinitro-derivative by reducing with alkaline stannous chloride, forms brownish-red crystals; reduction in acid solution yields 1',4'-diamino-1,2'-dianthraquinonylamine, lustrous brown crystals. Alkaline reduction of 2,4,1'-trinitro-1,2'-dianthraquinonylamine gives 2-amino-1',4'-dihydroxy-1,2'-dianthraquinonylamine, as an amorphous, brown powder.

Phenazine; New synthesis of —. A. Eckert and K. Steiner. *Monatsh. Chem.*, 1914, **35**, 1153—1155. *J. Chem. Soc.*, 1915, **108**, i., 596.

THE authors have shown previously (see preceding abstract) that the reduction of nitrodianthraquinonylamines in acid solution gives rise to indanthrene derivatives. A similar internal condensation, resulting in the formation of phenazine, is now shown to occur during the reduction of 2,2'-dinitrodiphenylamine. The latter compound is readily prepared by heating a mixture of *o*-nitroaniline, *o*-bromoaniline, and sodium carbonate in nitrobenzene solution in the presence of a trace of cuprous chloride. Its conversion into phenazine is effected by reduction with stannous chloride and hydrochloric acid in acetic acid solution, and subsequent oxidation of the resulting quinhydron, by hydrogen peroxide, potassium permanganate or ferric chloride.

Magenta solutions; Decolorisation of — by amorphous carbon. A. B. Drogglever Fortuyn. *Proc. K. Akad. Wetensch. Amsterdam*, 1915, **17**, 1322—1325. *J. Chem. Soc.*, 1915, **108**, i., 596.

AN aqueous solution containing 0.01% of New Magenta, from which the colour has been almost completely discharged by the action of charcoal, shows a return of the red colour when the filtered solution has been kept for some time. The phenomenon cannot be attributed to impurities in the charcoal, for the effect was observed with charcoal which had been boiled with 25% hydrochloric acid and subsequently treated with ammonia and washed thoroughly with distilled water. The addition of a little acetic acid accelerates the return of the colour. A similar effect has been observed with solutions of Acid Magenta. The phenomenon depends to some extent on the nature of the carbon, and was not observed with certain impure varieties of animal charcoal.

Thiazine dyes; Spectra of the simplest—. *Quinoneimide dyes. IV.* F. Kehrmann. J. Speitel, E. Grandmougin, and G. Diserens. Ber., 1914, 47, 2976—2983. J. Chem. Soc. 1915, 108, i., 586—587.

PHENAZOTHIONIUM, like the azoniums, forms two series of salts; the ordinary salts are *meri*-quinonoid 3.6-Dimethylphenazothionium also gives two series of salts, and the reason why 3-aminophenazothionium was said to form only two series of salts, instead of three, is that the colour of the tri-acid salts is hardly distinguishable to the eye from that of the di-acid salts. The existence of three series of salts in the case of the 1-amine is not proved, however, for only the chloride is known in the solid state, and this, despite all precaution, becomes *meri*-quinonoid in concentrated sulphuric acid. When a few drops of concentrated sulphuric acid containing hydrogen peroxide are added to the greenish-orange solutions obtained by the oxidation of thiodiphenylamine by concentrated sulphuric acid, the colour changes to the green exhibited by a solution of pure thiodiphenylamine sulphoxide in the same acid. The phenazothionium sulphate is, therefore, a *meri*-quinonoid salt. 3.6-Dimethyl thiodiphenylamine behaves differently; it dissolves in cold, concentrated sulphuric acid to give the magenta-coloured *meri*-quinonoid salt, but this is soon oxidised further, by the air, to the brownish-red *hoto*-quinonoid salt. On diluting these *hoto*-quinonoid di-acid salt solutions, the *meri*-quinonoid monacid salts are developed, but the *hoto*-quinonoid salts are stable in glacial acetic acid. The changes were followed by the spectrographic method. The 3-amino-derivative gives violet monacid salts in dilute acids, pure green di-acid salts in 60% sulphuric acid, both series being *para*-quinonoid, and somewhat yellowish-green tri-acid, *ortho*-quinonoid salts in the concentrated acid. The di-acid salts show absorption bands at $\lambda = 454, 435$, and $300 \mu\mu$, and the tri-acid salts at the extreme red and $460 \mu\mu$, that is, the same as the *hoto*-quinonoid phenazothionium disulphate.

Bixin. J. Herzig, F. Faltis, and E. Mizzan. Monatsh. Chem., 1914, 35, 997—1020. J. Chem. Soc., 1915, 108, i., 572—573.

BIXIN and its derivatives are difficultly combustible, so that special precautions are necessary in order to obtain correct analytical values. The results of numerous analyses show that bixin and its methyl ether have the formulæ, $C_{25}H_{27}O_3 \cdot OCH_3$ and $C_{25}H_{26}O_2(OCH_3)_2$, respectively (compare Hasselt, this J., 1914, 677). The methyl ether, prepared by the action of diazomethane on bixin or of methyl sulphate on its potassium salt, melts at $158^\circ C$. Dihydrobixin, prepared by reduction with zinc dust and acetic acid, forms reddish-yellow crystals, m.pt. 178° — $179^\circ C$. Different preparations of the dihydro-derivative show a marked difference in their behaviour on exposure to light and air. Some specimens become almost colourless during the course of twelve to fourteen days, and increase in weight by 30—32%, whilst others remain practically unchanged even after several months' exposure. In solution, however, all preparations undergo oxidation in the course of three to four days, the increase in weight being 38—40%. Determination of the methoxyl content in the oxidation product, after methylation with diazomethane, shows that one, or at most two, new carboxyl or hydroxyl groups are formed, although the increase in weight corresponds with the addition of eight or ten atoms of oxygen. According to Hasselt, bixin decomposes quantitatively at 190° — $200^\circ C$. into *m*-xylene and an amorphous product, $C_{21}H_{24}O_5$. The authors find, however, that the decomposition is much more complicated. The distillate has no constant b.pt., although

m-xylene may be readily isolated from it. Further, the residue, after heating, contains a smaller percentage of methoxyl than bixin itself, whilst substances containing methoxy-groups occur in the volatile products. Determinations of the iodine value of bixin, its methyl ether, and dihydro-derivative by the methods of Hübl and Wijs show that all three compounds combine with eight atoms of iodine, but in the case of the two first-named substances the addition of the last two iodine atoms proceeds with difficulty.

PATENTS.

Azo dyestuffs; Manufacture of yellow—and intermediate compounds for use therein. P. A. Newton. London. From Farbenfabr. vorm. F. Bayer und Co., Leverkusen, Germany. Eng. Pat. 9252, Apr. 14, 1914.

THE azo dyestuffs prepared from diazo-compounds and acetoacetic esters are converted after saponification into acid chlorides by means of thionyl chloride, phosphorus pentachloride, etc., and the products treated with aliphatic or aromatic mono- or diamines. The dyestuffs obtained are intended to be used as lake colours.—F. W. A.

Azo dyestuffs; Production of new—and sulphonic acids of aromatic aminothiazoles for use therein. P. A. Newton. London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 6644, Mar. 6, 1914.

AROMATIC aminothiazoledisulphonic acids having a sulphonic group in the *ortho*-position to the amino-group, are obtained by the "baking process," e.g., by heating monosulphonic acids of dehydrothiitoluidine, its homologues and substitution products, and of the corresponding primulines, with one mol. or more of sulphuric acid to high temperatures, preferably *in vacuo*. On combining the diazo-compounds of these acids with acetoacetic arylides, dyestuffs are obtained which give pure yellow shades on cotton of excellent fastness to light.—F. W. A.

Arylaminoanthraquinones; Manufacture of heterocyclic derivatives of—and sulphonic acids thereof. Farb. vorm. Meister, Lucius, and Brüning, Höchst, Germany. Eng. Pat. 12,239, May 18, 1914. Under Int. Conv., May 22, 1913.

SEE Fr. Pat. 472,100 of 1914; this J., 1915, 417.

[Azo] colouring matters capable of being further developed; Manufacture of—. P. A. Newton. London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 26,236, Nov. 15, 1913.

SEE Fr. Pat. 465,794 of 1913; this J., 1914, 639.

Azo dyestuffs; Manufacture of—. P. A. Newton. London. From Farbenfabr. vorm. F. Bayer und Co., Elberfeld. Eng. Pat. 21,932, Sept. 29, 1913.

SEE Ger. Pat. 274,081 of 1913; this J., 1914, 784.

Azo dyestuffs insoluble in water and process of making them. A. L. Laska and A. Zitscher, Offenbach. Assignors to Chem. Fabr. Griesheim-Elektron, Frankfurt, Germany. U.S. Pat. 1,145,072, July 6, 1915. Date of appl., June 16, 1914.

SEE Fr. Pat. 472,889 of 1914; this J., 1915, 486.

Colouring matters of the naphthalene series; Manufacture of—. J. Y. Johnson. London. From Badische Anilin und Soda Fabrik, Ludwigshafen, Germany. Eng. Pat. 26,690, Nov. 20, 1913.

SEE Ger. Pats. 276,357 and 276,956 of 1913; this J., 1914, 1045, 1084.

Blue colouring matters for dyeing wool; Manufacture of —. S. Sokal, London. From Kalle und Co. A.-G., Biebrich, Germany. Eng. Pat. 9433, Apr. 16, 1914.

SEE Fr. Pat. 471,230 of 1914; this J., 1915, 171.

Manufacture of [hydr]oxynaphthoyl derivatives of aminonaphthols and aminonaphtholsulphonic acids. Eng. Pats. 5445 and 5446 of 1915. See 111.

Manufacture of preparations of indigo white. Eng. Pat. 8689 of 1914. See VI.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Pulp wood in Canada. U.S. Commerce Rept. No. 181, Aug. 4, 1915.

THE consumption of pulp-wood in Canada has more than doubled since 1910, and the consumption in 1914 was 10% more than in 1913. In 1914 the 66 active pulp mills in Canada consumed 1,224,376 cords of pulp-wood (value £1,600,000), whilst 972,508 cords (value £1,300,000) was exported in an unmanufactured state. In 1914, 55.7% of the pulp-wood produced in Canada was made into pulp in the Dominions, and the remainder was exported, chiefly to the United States. The proportion of pulp made by chemical processes is increasing.

Wood pulp in Argentina; Production of —. U.S. Commerce Report, No. 169.

ARGENTINA produces in abundance a tree, the *Araucaria imbricata*, which provides excellent raw material for making paper pulp. In the Territory of Neuquen this tree is found over an area of more than 1,000,000 hectares (2,470,000 acres). Three and one-half average trees suffice to produce 1 ton of pulp. For news print paper, two and one-half trees will provide one ton of pulp. It might be possible to utilise the waters of the Neuquen River to produce energy required to develop the industry locally; cost of erecting and equipping an up-to-date paper factory in the Territory is estimated at about £990,000.

PATENTS.

Fibrous material [from Papyrus] suitable as a substitute for flax, hemp, and jute; Manufacture of a —. P. Hoering, Berlin, Germany. Eng. Pat. 6971, Mar. 19, 1914.

PAPYRUS stems, preferably in a fresh condition, are cut into suitable lengths and broken in machines similar to the rag engines used in paper mills; the material is then digested three or four times with hot water; if necessary, e.g. in the case of hard stems, it may be digested with boiling water under pressure. The fibres are finally impregnated with fat or other substance by heating with water to which an emulsion of castor oil or palm kernel oil has been added. During the washing, the longer fibres are separated from the shorter ones and collected on strainers. The long fibres, after drying, are broken, combed, and heckled in the usual manner.—J. F. B.

Drying cylinders [for textile fabrics]. C. Whitehead, and G. Whitehead and Sons, Ltd., Todmorden. Eng. Pat. 15,072, June 23, 1914.

A SPIRAL steam pipe is fitted inside rotary drying cylinders used for textile fabrics, paper, etc., even distribution of the heat being ensured by embedding the steam-pipe in a layer of heat-conducting material in contact with the shell of the cylinder; the whole is coated with an inner lining of non-conducting material.—F. W. A.

Airiation and like apparatus; Material for the construction of invisible —. British Emaillite Co., Ltd., London. From Ledüc, Heitz et Cie, Levallois-Perret, France. Eng. Pat. 1049, Jan. 14, 1914.

TRANSPARENT plates of cellulose compounds for aeroplanes, etc., are provided with a reinforcement which has as nearly as possible the same index of refraction as the mass of the plate. Silk, tulle, etc., may be treated with a solution of 110 grms. of cellulose acetate or hydroacetate and 35 grms. of a mixture of equal parts of β -naphthol, β -naphthyl ethyl ether, and benzenesulphonamide, in 880 grms. of tetrachloroethane and 120 grms. of alcohol.—F. W. A.

Products resembling celluloid; Manufacture of —. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen, Germany. Eng. Pat. 9270, April 11, 1914.

PRODUCTS resembling celluloid are made by treating nitrocellulose, acetylcellulose, or other suitable cellulose derivatives with an acyl derivative of a completely hydrogenised aromatic base. *Example*.—70 parts of nitrocellulose, 30 parts of *p*-toluenesulphodicyclohexylamine, and sufficient alcohol are kneaded together to form a flexible material like celluloid.—F. Sr.

Wood pulp and cellulose; Centrifugal strainer for —. H. Thorensen and J. C. Falch, Assignor to N. R. Heyerdahl, Christiania. U.S. Pat. 1,145,097, July 6, 1915. Date of appl., July 29, 1913.

IN a centrifugal strainer having a stationary perforated member and a rotary member on a horizontal shaft and surrounding the perforated member, liquid pulp is supplied to the rotary member in an axial direction at a constant head near its periphery. Blades are fitted to the rotary member opposite the supply opening, having their initial portion inclined to the axis at an angle determined by the speed of rotation and the head, to receive the material and increase its velocity with harmonic acceleration in the direction of the axis; the blades also have portions designed to rotate the material and to throw it against the screen and expel the unstrained portion.—J. F. B.

Paper-making pulp from esparto and the like; Manufacture of —. S. Milne, Edinburgh. Eng. Pat. 14,070, June 11, 1914.

THE digested material is reduced to a pulp, washed, and then refined, previous to bleaching, by passing the diluted pulp through a coarse strainer to remove unusable impurities, such as roots, etc., and then through a fine strainer to remove the coarser particles of useful pulp. The rejections from the fine strainer are concentrated by the removal of water and treated in a refiner until they are sufficiently reduced to pass with the fine pulp through the fine strainer.—J. F. B.

Paper pulp from flax-straw, flax-tow, and other ligneous materials; Process of making —. J. L. Merrill, Washington, D.C. U.S. Pat. 1,145,498, July 6, 1915. Date of appl., Mar. 3, 1915. Dedicated to the public.

THE material is digested with 15–25% of milk of lime under a steam pressure of 75–100 lb. per sq. in.; it is then finely cut up and washed to remove the woody elements.—J. F. B.

Filaments or threads from crude viscose; Manufacture of —. Verein. Glanzstoff-Fabriken A.-G., Elberfeld. Eng. Pats. 826 and 834, Jan. 12, 1914. Under Int. Conv., Jan. 10, 1913.

SEE Fr. Pats. 467,164 and 467,165 of 1914; this J., 1914, 858.

Cellulose acetates; Manufacture of infusible——. Verein f. Chem. Ind. in Mainz, Frankfurt. Eng. Pat. 9266, Apr. 14, 1914. Under Int. Conv., Apr. 14, 1913.

SEE Fr. Pat. 470,963 of 1914; this J., 1915, 173.

Process of treating resinous woods. U.S. Pat. 1,142,922. See XIII.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

PATENTS.

Dyeing yarn in cops; Machines for——. K. Callebaut and J. de Blicquy, Brussels. Eng. Pat. 3826, Mar. 10, 1915. Under Int. Conv., Dec. 24, 1913.

THE cops are placed on spindles projecting from the periphery of a drum built up of a number of annuli, each clamped to a support by means of which it is rotated. The spindles are arranged in quincunx, there being preferably only four rows on the circumference of each annulus.—F. W. A.

Dyed yarns, hosiery, and weavings; Process of producing melange-like——. G. R. Pester, Wittgensdorf, Germany. U.S. Pat. 1,145,846, July 6, 1915. Date of appl., Jan. 9, 1915.

“JASPE-MELANGE” textiles are produced by twisting together yarns of different undyed materials of different dye-absorbing properties (e.g., cotton and wool), to form twined thread of at least four-fold, and dyeing in a bath of a dyestuff (e.g., a wool dye) having different actions on the various components of the thread.—F. W. A.

Indigo white; Manufacture of preparations of——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen, Germany. Eng. Pat. 8689, Apr. 6, 1914.

INDIGO white is mixed with a medium such as molasses or glycerin and a solid organic substance which assists the fermentation, e.g., bran, flour, dextrin, wood, or sugar. An inorganic reducing agent, e.g., zinc dust, may be added. Even though these preparations contain a low percentage of indigo white, they are of a thick pasty consistency, are of excellent stability, and can be added to a fermentation vat.—F. W. A.

Fireproofing of fabrics and other articles. T. J. I. Craig, and Whipp Bros. and Tod, Ltd., Manchester. Eng. Pats. 16,153, 18,310, 19,041, and 23,421, July 7, Aug. 7 and 25, and Dec. 2, 1914.

TEXTILE fabrics, etc., are rendered less inflammable by precipitating therein a double carbonate of aluminium and an alkali by treatment with a solution of an alkali aluminate and subsequently with a solution of an alkali bicarbonate. The fabric impregnated with aluminate may be dried at above 100° C. and treated with carbon dioxide before treatment with the alkali bicarbonate, and the treatments may be carried out under pressure.—F. W. A.

Dyeing and like machinery; Compact——. J., T., and E. Brandwood, Bury. U.S. Pat. 1,145,858, July 6, 1915. Date of appl., Oct. 27, 1914.

SEE Eng. Pat. 17,219 of 1914; this J., 1915, 25.

Dyeing of hanks or skeins. H. Krantz, Aix-la-Chapelle, Germany. Eng. Pat. 8919, Apr. 8, 1914. Under Int. Conv., Apr. 10, 1913.

SEE Fr. Pat. 470,734 of 1914; this J., 1915, 174.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Sodium thiosulphate; Action of chlorine on—— [in respirators]. P. A. W. Self. Pharm. J., 1915, 95, 133—134.

IN order to prevent the formation of sulphur dioxide, the amount of sodium carbonate or bicarbonate added to sodium thiosulphate solutions for respirators should be sufficient to neutralise the whole of the acid resulting from the interaction of chlorine and thiosulphate. The solutions should be as strong as possible—hence sodium carbonate is preferable to sodium bicarbonate—and the thiosulphate and alkali should be used up at approximately equal rates, a slight excess of alkali remaining at the end. The proportions recommended as the result of trial experiments are: crystallised sodium thiosulphate, 52 parts; crystallised sodium carbonate, 60 parts; and water, 100 parts, together with a considerable proportion of glycerin to keep the respirators moist. Upon passing chlorine through a solution said to have been recommended by the Paris Academy of Medicine (sodium thiosulphate, 1000 grms.; crystallised sodium carbonate, 200 grms.; water, 800 grms.; glycerin, 150 grms.) acidity was developed when only 35% of the thiosulphate had been decomposed; after this point sulphur was deposited and sulphur dioxide produced in large quantities. Consequently, respirators containing this solution would become useless after the decomposition of about one-third of the thiosulphate contained in them.—J. R.

Cobalt and nickel; Metallo-compounds of——. S. U. Pickering. Chem. Soc. Trans., 1915, 107, 942—951.

COBALT and nickel form compounds which are closely analogous to the cupri-compounds (this J., 1910, 348, 1202; 1912, 281), being characterised by great depth of colour and solubility and by containing the metal as anion, as proved by electrolysis. Solutions of the double carbonates and citrates, and the single tartrates, racemates, malates, citrates, and glycerates are considered to contain cobalto- or nickelo-compounds, these being precipitated, as a rule, by alcohol, in the form of emulsions. In some cases scale preparations are obtained by evaporating the solutions, and the dried emulsion or scale (except with the tartrates) is stable; but the solutions change gradually into the less soluble normal salts, which crystallise. The residue of metallo-compound also is converted entirely into the normal salt by repeated moistening and evaporation; the change is reversible, but slow in either direction. The colour-intensity of solutions of the organic salts of cobalt and nickel, like those of copper, decreases on dilution, and the organic salts dissolve in alkali hydroxide to form compounds which, as far as investigated, resemble the corresponding copper compounds. In several cases, as with copper, jellies are obtained, potassium hydroxide, for example, converting potassium nickelocitrate solution into a permanent dark green jelly. A metallo-compound is precipitated as an emulsion when a concentrated solution of potassium racemate is added to one of cobalt chloride, in equivalent proportions, and two metameric forms of normal cobalt racemate have been obtained.—F. SODN.

Metallo-compounds in solution. S. U. Pickering. Chem. Soc. Trans., 1915, 107, 955—959.

A COMPARISON of the residues obtained by evaporating solutions of various organic salts containing copper showed that scale or vitreous residues or crystals are produced, according as the colour intensity of the solution indicates richness in cupri-

compound or in the normal salt. Thus potassium cuprimucate, cuprimalate, and cupritartrate, sodium cupritartrate, sulphate-cuprimalate, and copper quinate gave a scale or vitreous residue, and copper glycerate, citrate, and malate gave a mixture of scale and crystals, but other copper salts gave only crystals. Scale residues were obtained with cobalt citrate and glycerate, cobalt mono-potassium citrate, and nickel citrate, malate, and glycerate, whilst crystals were obtained with cobalt tartrate and malate and with tetrapotassium citrates of nickel and cobalt (the colour intensity of the cobalt compound being only 2.3, as compared with 18.9 for the corresponding copper compound, which yields a vitreous residue on evaporation).—F. SÖDN.

Supersaturated solutions; Experiments on—
M. Jones and J. R. Partington. Chem. Soc. Trans., 1915, 107, 1019—1025.

THE existence of supersaturated solutions of the "second type," i.e., those in which deposition of solid is produced by rise of temperature, as described by Jones and Partington (Phil. Mag., 1915, 29, 35), has been proved directly in the cases of calcium butyrate and acetate, and indirectly with calcium sulphate (gypsum). The existence of equilibria between finely powdered gypsum and solutions in contact with it, with concentrations different from those in normally saturated solutions, has been established. The solubility curve of finely powdered gypsum has been shown to agree with that calculated from Gibb's theory.—B. N.

Hydrogen peroxide; Catalysis of—*in presence of acids and alkalis.* G. Lemoine. Comptes. rend., 1915, 161, 47—51.

THE retarding effect of acids on the decomposition of hydrogen peroxide is attributed to their affinity for water, which counteracts the catalytic action of the latter. The acceleration of the decomposition of hydrogen peroxide by caustic alkalis is attributed to the formation and decomposition of alkali peroxide. The effect of the acids or alkalis is not directly proportional to their concentration. —W. R. S.

Uranium and radium; The relation between—
VI. *The life-period of ionium.* F. Soddy and A. F. R. Hitchins. Phil. Mag. 1915, 30, 209—219.

MEASUREMENTS of the quantity of radium in solutions of a carefully purified uranium preparation showed an unmistakable increase in the growth of radium. This appears to be proportional to the square of the time, as theory requires if ionium is the only long-lived intermediate member of the series. The period of average life of ionium is calculated to be about 100,000 years. This experiment also furnishes direct experimental evidence that uranium is the ultimate parent of radium.—W. R. S.

Potash production in California. T. H. Norton. U.S. Commerce Rept., No. 137.

THE difficulties in exploiting the mineral deposits of California are chiefly connected with transport, the demand being mainly from the eastern half of the United States. For this reason it is doubtful whether the deposits in south-eastern California could be utilised profitably. Deposits in the Imperial Valley, east of San Diego, are reported as promising, when the projected rail connection is established. It is hoped that in a few months the American Trona Company will put potash on the market, obtained from the Searles Lake deposits. There seems to be no possibility of securing a supply of potash from Nevada. A certain amount of kelp is being utilised as a source of potash, but the extension of the industry is hindered by the diffi-

culty at present experienced in separating the alkali chlorides from the organic residue; filtration and diffusion methods have not been successful, but experiments on the coagulation of the organic matter appear to offer a solution of the problem.

Potash from kelp. F. K. Cameron. U.S. Commerce Rept., No. 143, June 19, 1915.

AN exhaustive examination of the kelps found on the coast of the United States has given the following average figures for the various kinds:—*Macrocystis pyrifera*, K_2O , 12.59%; N, 1.57%; I, 0.23%; *Nereocystis luelkeana*, K_2O , 20.1%; N, 1.9%; I, 0.13%. *Alaria fistulosa*, K_2O , 9.1%; N, 2.6%; I, trace. The available beds of the Pacific coast and the annual harvest of kelp, with the resultant quantities of potassium chloride, are estimated as follows:—

Region.	Area sq. m.	Fresh kelp.	KCl.
		tons.	tons.
Cedros Island to San Diego	91.4	16,979,800	649,000
San Diego to Point Conception	97.9	18,195,300	696,000
Point Conception to Cape Flattery	36.2	4,377,400	167,000
Puget Sound	5.0	520,000	20,000
South-East Alaska	141.6	15,666,000	598,000
Western Alaska	17.9	3,367,000	136,000
Total	390.0	59,105,500	2,266,000

The amount of potassium chloride that it is possible to produce thus is five times the total import of potash salts (calculated to chloride) from Germany. It is thought that the cost of handling, drying, grinding, storing, and loading, at San Diego and neighbourhood, should not much exceed \$1 per ton of dried kelp; cutting and collecting is estimated at \$1.83 and general expenses at \$1, giving a total cost of \$3.83. The total fertiliser value of dry kelp is calculated to be \$15.75 per ton, of which \$9 represents the potash value. The margin of profit thus shown should stimulate the utilisation of the large local resources. It is suggested that it may be possible later to replace the plants in some of the beds with varieties, such as *Pelagophycus porra* (egg kelp), which contain higher percentages of potash; this variety is found in scattered groups along the coast of Lower California.

Potash deposits of Spain. U.S. Cons. Rept., July, 1915.

NUMEROUS borings have been made in the region where the potash salts abound in the provinces of Barcelona and Lerida. The results have been particularly favourable, but it will require the employment of capital and enterprise to make the potash from these deposits a profitable product. In the various borings near the town of Sarria, potash salts were found at depths between 121 and 197 feet and others at 420 ft. At 886 ft., the greatest depth attained, important quantities of potassium compounds were found to rest on a stratum of salt not yet pierced. In the area tested by borings, comprising some 2,690,000 sq. ft., there is approximately 2,550,000 tons of carnallite and 1,150,000 tons of sylvite.

From the general characteristics of the region it is considered probable that there are further deposits in the neighbourhood of those already tested. In a stream running by the salt works of Cardona there is a large percentage of potash in solution, and vast quantities of potash have already been allowed to go to waste in the salt mines that might have been profitably used. On account of the exceptionally irregular geological

formation of this particular part of the country near Barcelona, it is difficult to make exact valuations of the amount of potash salt that can be mined.

Sodium nitrate industry in Chile. Min. and Eng. World, 1915, 43, 137—138.

IN view of the continually increasing cost of labour special efforts are being directed towards reducing the cost of mining sodium nitrate, which at present represents about 60% of the cost of the raw product. One of the heaviest items of expense is the removal of the overburden, consisting generally of a hard mixture of sand and clay. In some cases this overburden is 20 ft. deep, making the cost of mining prohibitive. A large drag-line excavator has been installed at one field, and has given very satisfactory results in replacing hand labour. In the subsequent purification of the caliche, the present evaporating process requires one pound of fuel to produce 6 lb. of nitrate. A process has been patented by S. A. Orchard, by which it is claimed that 16 to 19 lb. of nitrate can be produced per lb. of fuel; in this process, the solution is passed through five or six evaporators, the first three or four of these working under vacuum and the remainder under a slight steam pressure.

Radium production by the U.S. Bureau of Mines. U.S. Comm. Rept., July 27, 1915.

THE production of radium from Colorado carnotite ores by the Bureau of Mines, in connection with the National Radium Institute, has passed the experimental stage in its new process and is now on a successful manufacturing basis, and the Bureau of Mines is able to produce radium at a much lower cost than by other processes. The cost of one grm. of radium metal produced in the form of bromide during March, April, and May of the present year was \$36,050. The cost of producing radium in the small experimental plant during the first few months of the Bureau's activities was somewhat higher, but not enough to affect seriously the final average. This low cost of production does not necessarily mean an immediate fall in the selling price of radium. The National Radium Institute was fortunate in securing through the Crucible Steel Co. the right to mine on 10 claims of carnotite ores belonging to it, and this was practically the only ore available at the time. Since then new deposits have been opened, but these are closely held; and according to the experts employed by the Bureau of Mines, the Colorado and Utah fields, which are much richer in radium ores than any others known, will supply ore for a few years only at the rate of production that obtained when the European war closed foreign mines. The demand for radium will also increase rapidly.

The 10 carnotite claims being operated at Long Park, Colo., by the National Radium Institute have already produced more than 796 tons of ore averaging over 2% U_3O_8 . The cost of ore delivered at the radium plant in Denver has averaged \$81.30 per ton. This included 15% royalty, salary of the Bureau of Mines employees, amortisation of camp and equipment, and all expenses incidental to the mining, transportation, grinding, and sampling of the ore.

A concentrating plant for low-grade ores has been erected at the mines and is successfully recovering material formerly wasted. The radium plant at Denver has now a capacity of three tons of ore per day, having been more than doubled in size since last February. To July 1, 1915, slightly over 3 grms. of radium metal was obtained in the form of radium-barium sulphate containing over 1 mgrm. Ra per kilo. of sulphates. The conversion of the sulphates into chlorides and the

purification of the radium therefrom are easily accomplished, and with small loss of material. Unfortunately acid-proof enamel ware, obtainable only in France, has not been delivered of sufficient capacity to handle the crystallization of the full plant production, so that only 1304 mgrms. of radium has been delivered to the two hospitals connected with the National Radium Institute. The average radium extraction of all ore mined by the National Radium Institute has been more than 85% of the amount present in the ore, and for the last five carloads of carnotite treated, above 90%.

Sodium nitrate industry in Chile. U.S. Commerce Rept. No. 176, July 29, 1915.

THE shipments of nitrate from Chile have increased during the last few months, though production has remained at the same level; the exports from January to March, 1915, amounted to about 320,000 tons and the production to 260,000 tons, reducing the stock on the coast to about one million tons. Only 36 plants were in operation, as compared with 134 in May, 1914, when the production was 265,000 tons. An increasing percentage of refined (96%) nitrate is now being shipped, for use in making explosives.

Magnesite deposits in British Columbia. U.S. Commerce Rept. No. 177, July 30, 1915.

LARGE deposits of magnesite of exceptional purity have been found along the shore of Lake Atlin, in the north-eastern part of British Columbia. Arrangements are being made for working the deposits, and it is expected that a supply will be available shortly.

Asbestos deposits in China. U.S. Commerce Report No. 171, July 23, 1915.

THE U.S. Consul at Chungking reports that valuable asbestos deposits have been found near Pachow, Western China. The mineral appears to be of good quality and is cheap, the mining expenses and carriage to Chungking amounting to about 3s. per 100 lb.

a-Particles; The passage of — through hydrogen. E. Marsden and W. C. Lantsberry. Phil. Mag., 1915, 30, 240—243.

EXPERIMENTS on the passage through hydrogen of α -particles from radium emanation and radium indicate that H-particles are emitted from the radioactive atoms themselves, apparently with unequal velocity.—W. R. S.

Action of nitric acid on aluminium. Trillat. See X.

Detection of hydrocyanic acid. Lavialle and Varenne. See XXIII.

PATENTS.

Ammonia from its elements; Synthetic process for the production of —. H. Wade, London. From M. Pier, Zehlendorf, Germany. Eng. Pat. 213, Jan. 3, 1914.

THE catalyst is composed of iridium or rhodium, or their compounds, in conjunction with an alkaline or basic contact-carrier, the quantity of which is a multiple of that of the catalyst. For example, it is made by precipitating a solution containing 1 grm. of iridium chloride by means of alkali, mixing the washed precipitate with 10 grms. of potassium carbonate, and drying the mass in a current of nitrogen or hydrogen or a mixture of these gases.—F. SODN.

Ammonia from its elements; Production of —. H. Wade, London. From M. Pier, Zehlendorf, Germany. Eng. Pat. 214, Jan. 3, 1914.

A CONTACT-CARRIER composed of, or containing,

magnesium oxide or carbonate is coated or impregnated with a catalyst (metals of the Pt group or Fe, Co, Ni, Mo, W, or U, or their compounds), so that the quantity of magnesium compound is a multiple of that of the catalyst. For example, 1 gm. of ruthenium chloride (alone or mixed with rhodium or iridium chloride) or 0.1 gm. of potassium ruthenate may be spread over 20 grms. of magnesium oxide, or a solution of ruthenium chloride may be precipitated with magnesia, the washed precipitate mixed with ten times its weight of magnesium oxide, and the mixture dried in a current of nitrogen or hydrogen, or a mixture of nitrogen and hydrogen. (See also Eng. Pat. 213 of 1914; preceding.)—F. SODN.

Ammonia from atmospheric nitrogen; Manufacture of—F. W. Dafert and R. Miklauz, Vienna. Eng. Pat. 16,597, July 11, 1914. Under Int. Conv., July 12, 1913.

BARIUM nitride is converted into the hydride and ammonia, with intermediate formation of unstable products, by heating in a current of hydrogen at a moderate temperature (about 400° C., for example), and when a suitable proportion (say 75%) of the nitrogen has been converted into ammonia, the hydride is re-converted into nitride by heating at a higher temperature (about 600° C.) in a current of nitrogen. Instead of using the gases alternately, a mixture of nitrogen and hydrogen may be employed, and the temperature, or temperature and pressure, varied periodically.

—F. SODN.

Sulphur dioxide [from gases]; Recovery of—J. B. Garner, Pittsburgh, Pa., Assignor to Metals Research Co., New York. U.S. Pat. 1,145,579, July 6, 1915. Date of appl., Dec. 3, 1914.

DRY gases containing sulphur dioxide are passed through absorbent carbonaceous material, such as charcoal, from which volatile constituents which would cause part of the sulphur to be deposited in elementary form have been previously expelled, preferably by heating under reduced pressure. The absorbed sulphur dioxide is subsequently recovered.—F. SODN.

Electrolysis of "halogen alkalies"; Process and apparatus for the—Siemens und Halske A.-G., Berlin. Eng. Pat. 17,089, July 18, 1914. Under Int. Conv., July 26, 1913. Addition to Eng. Pat. 18,102 of 1913 (this J., 1914, 23).

THE chlorine is exhausted from the anode space by an apparatus provided with an adjustable regulator, so that the pressure, which is variable, is below that of the atmosphere. The hydrostatic pressure of the electrolyte standing over the horizontal diaphragm is thus partially counterbalanced, and the speed of filtration of the lye can be regulated.—B. N.

Alumina; Process for the production of pure—M. Buchner, Heidelberg, Germany. Eng. Pat. 15,851, July 2, 1914.

CLAY, bauxite, aluminium nitride, or alumina waste is decomposed with acids and the filtered and concentrated solution treated with aqueous or gaseous ammonia, preferably in excess, whereby iron and aluminium hydroxides are precipitated. The latter is separated by dissolving in caustic alkali lye and is recovered by known methods, including self-precipitation. The alkali lye is used continuously. Ammonium ferrocyanide may be used instead of ammonia for the precipitation, in which case the iron is precipitated and the aluminium remains in solution. Alternatively, the aluminous material is converted into aluminium nitride by known methods, and the nitride decomposed by acid, the ammonia evolved being used to precipitate the hydroxides as before.—J. R.

Fluorine compounds of the rare-earth metals; Process for the manufacture of—Gehr. Siemens und Co., Berlin-Lichtenberg, Germany. Eng. Pat. 9087, April 9, 1914. Under Int. Conv., May 17, 1913. Addition to Eng. Pat. 8015 of 1914 (see this J., 1914, 830).

WHEN ground fluorspar is added to slightly acid solutions of rare-earth metals the liquid gradually clears, owing to the precipitation of double fluorides. These may be separated by filtration; further contact with the liquid results in their decomposition. Solutions of the rare earths act upon the double compounds with the formation of fluorides of the rare earths. As an example, a solution of 11 kilos. of residual oxides from thorium manufacture in a slight excess of hydrochloric acid was diluted to 100 kilos., and 13 kilos. of powdered fluorspar was added to the boiling solution, which was kept boiling for half-an-hour. The precipitated double fluorides weighed 18.2 kilos. (calculated amount, 18.4 kilos.).—J. R.

Peroxides and perborates; Manufacture of—H. Wade, London. From Henkel und Co., Düsseldorf, Germany. Eng. Pat. 1687, Feb. 2, 1915.

CATHODIC hydrogen peroxide may be produced economically under ordinary pressure at 0° C., for use in the preparation of peroxides and perborates, if its accumulation within the electrolyte is prevented by precipitation as a solid peroxide compound. This is effected by the addition of a suitable soluble compound, e.g., calcium hydroxide, unless the electrolyte yields an insoluble compound without such addition. The output is raised by the further addition of starch, gelatin, boric or phosphoric acid, or other stabilising agent, such as sodium silicate or other inorganic colloids.—J. R.

Hydrogen; Manufacture of—K. Schaefer, Charlottenburg, Germany. Eng. Pat. 25,710, Nov. 10, 1913. Under Int. Conv., May 21, 1913.

IN the production of hydrogen by the alternate action of steam and reducing gases on iron, the latter is heated at the beginning of the process by burning gas of high calorific power, preferably water-gas. The iron is only partially oxidised by the action of steam, and by passing in air, after the steam, to complete the oxidation, sufficient heat is developed to maintain the requisite working temperature without using further quantities of reducing gas for heating purposes.—F. SODN.

Air or other gaseous mixtures; Process for separating the constituents of—Ges. für Linde's Eismaschinen A.-G., Hölriegelskreuth, Germany. Eng. Pat. 24,735, Dec. 29, 1914. Under Int. Conv., Jan. 29, 1914.

AIR is first separated by liquefaction and rectification in known manner into two parts, rich in oxygen and nitrogen respectively. The crude oxygen without previous warming enters a vertical rectifying column near the middle, the column having a heating coil at its lower end and a cooling device at its upper end. Liquid oxygen separates at the lower end, and nitrogen and argon at the upper end. The latter mixture may be treated with a reducing agent, e.g., hydrogen, and then further treated in a similar apparatus to separate the nitrogen and argon. The two columns may have a common cooling bath, which may consist of a mixture rich in nitrogen or a mixture rich in oxygen and boiling at a lower pressure than that in the rectifying column.—W. F. F.

Sulphuric acid chambers or the like; Means for fastening or holding the leaden walls of—M. Seeck, Schoppinitz, Germany. Eng. Pat. 16,187, July 7, 1914.

SEE FR. Pat. 474,302 of 1914; this J., 1915, 715.

Nitric acid of high concentration; Process of preparing —. M. Moest, Bodio, Switzerland, and M. Eckardt. Assignors to Farb. vorm. Meister, Lucius, und Brüning, Höchst, Germany. U.S. Pat. 1,145,162, July 6, 1915. Date of appl., June 10, 1914.

SEE Fr. Pat. 472,775 of 1914; this J., 1915, 491.

Ammonium sulphate; Manufacture of —. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen, Germany. Eng. Pat. 27,962, Dec. 4, 1913.

SEE Fr. Pat. 466,302 of 1913; this J., 1914, 645.

Atomino-silicates; Manufacture of —. Permutit A.-G., Berlin. Eng. Pat. 353, Jan. 6, 1914. Under Int. Conv., Jan. 6, 1913.

SEE Fr. Pat. 467,038 of 1914; this J., 1914, 865.

Aluminium nitride; Process for the manufacture of —. Electric furnace. P. Bunet, Whitney, N.C., Assignor to Soc. Générale des Nitrures, Paris. U.S. Pats. 1,145,747 and 1,145,748, July 6, 1915. Dates of appl., May 9, 1913, and Nov. 24, 1914.

SEE Fr. Pat. 457,723 of 1913; this J., 1913, 1010.

Zinc oxide; Manufacture of —. W. Asef, Philadelphia. Eng. Pat. 23,826, Dec. 9, 1914.

SEE U.S. Pat. 1,135,981 of 1915; this J., 1915, 833.

Rare-earth metals; Manufacture of compounds of the —. Gebr. Siemens und Co., Berlin-Lichtenberg, Germany. Eng. Pat. 9534, Apr. 17, 1914. Under Int. Conv., July 16, 1913. Addition to Eng. Pat. 8015 of 1914.

SEE Fr. Pat. 470,633 of 1914; this J., 1915, 283.

Salts of the complex hydrofluoric acids; Process for the manufacture of —. Gebr. Siemens und Co., Lichtenberg, Germany. Eng. Pat. 10,175, Apr. 24, 1914. Under Int. Conv., Apr. 30, 1913.

SEE Ger. Pat. 279,011 of 1913; this J., 1915, 230.

Colloidal solutions of metals; Manufacture of stable —. Ges. f. Elektro-Osmose m.b.H., Frankfurt. Eng. Pat. 9261, Apr. 14, 1914. Under Int. Conv., Apr. 14, 1913.

SEE Fr. Pat. 471,679 of 1914; this J., 1915, 431.

Ions adsorbed by colloids; Process for the exchange of —. Ges. f. Elektro-Osmose m. b. H., Frankfurt, Germany. Eng. Pat. 10,083, Apr. 23, 1914. Under Int. Conv., Apr. 23, 1913.

SEE U.S. Pat. 1,120,551 of 1914; this J., 1915, 228.

Graphite; Process of purifying —. E. N. Lainé, Paris. U.S. Pat. 1,145,024, July 6, 1915. Date of appl., Jan. 15, 1914.

SEE Fr. Pat. 464,642 of 1913; this J., 1914, 550.

Nitrogen; Process of obtaining — simultaneously with oxides of nitrogen. Farb. vorm. Meister, Lucius, und Brüning, Höchst, Germany. Eng. Pat. 9974, Apr. 22, 1914. Under Int. Conv., Apr. 22, 1913. Addition to Eng. Pat. 3662 of 1913, dated Feb. 19, 1912.

SEE Addition of Apr. 17, 1914, to Fr. Pat. 453,845; this J., 1915, 552.

Nitrogen and oxygen compounds; Process for the production of —. C. Krauss, Köln-Braunsfeld, and P. Stähelin, Knapsack, Germany. Eng. Pat. 26,499, Nov. 18, 1913. Under Int. Conv., July 26, 1913.

SEE Fr. Pat. 465,045 of 1913; this J., 1914, 549.

Hydrogen; Manufacture of —. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen. Eng. Pats. 27, 963, Dec. 4, 1913, and 8029, Mar. 30, 1914.

SEE Ger. Pat. 279,583 of 1913; this J., 1915, 355. Reference is directed in pursuance of Sect. 7, Sub-sect. 4 of the Patents and Designs Act, 1907, to Eng. Pat. 27,955 of 1912, and in pursuance of Sect. 8, Sub-sect. 2, to Eng. Pat. 8864 of 1913.

Separation of carbon monoxide from gas mixtures. Eng. Pats. 9271 and 20,616 of 1914. See IIA.

Lime, cement, or like kilns. Eng. Pat. 16,030 of 1914. See IX.

Apparatus for making white lead. U.S. Pat. 1,144,701. See XIII.

Utilising beet-molasses waste. [Recovering ammonia and hydrogen cyanide]. U.S. Pat. 1,145,484. See XVII.

Manufacture of base interchanging substances. Eng. Pat. 20,144 of 1914. See XIXB.

VIII.—GLASS; CERAMICS.

The International Plate Glass Syndicate. Engineering, July 23, 1915.

To an international concern like the Plate-Glass Syndicate, in which French, Belgian, and German capital is interested, the war naturally brings about somewhat awkward conditions. Prior to the Reisholz Plate-Glass Works joining the syndicate, it comprised seven companies. Of these, one was entirely French, whilst French and Belgian capital was invested in some of the other works; the French influence then had an allotment figure of 49.1%, whilst the share of the French capital in the syndicate amounted to $\frac{2}{3}$, the corresponding figures for Belgium being 12.3% and $\frac{3}{14}$. By the addition of the Reisholz Works, this proportion has been materially altered, which will appear from the appended table:—

	Share of capital.	Share of allotment.
French	12 $\frac{2}{14}$	31.0
Belgian	2 $\frac{3}{14}$	12.3
German	2 $\frac{3}{14}$	56.7

Germany has thus secured the majority, both as regards capital and share of turnover, and the chairman is now also a German. The State control is still in force, but the compulsory or State management has been abandoned, except in the ease of the purely French concern. In some of the undertakings belonging to the syndicate, German and non-German capital is equal, and it has been urged in Germany that German capital ought to step in so as to obtain the absolute majority.

PATENTS.

Glass products; Manufacture of crystalline —. H. Becker, Berlin-Niederschöneweide. Eng. Pat. 10,161, Apr. 24, 1914. Under Int. Conv., Apr. 24, 1913.

A MIXTURE of glass-forming raw materials is heated just to fusion and withdrawn from the melting zone of the furnace before the separate constituents (more particularly the silica) have dissolved completely in the melt; the product is then worked in the same manner as ordinary glass.—W. E. F. P.

[Refractory] material for use in the construction of wheels for grinding and like purposes; Manufacture of —. J. Pettigrew and E. Gerbel-Strover, London. Eng. Pat. 8483, Apr. 3, 1914.

"GRIT," obtained by melting bauxite or the like in an electric furnace and breaking up the resulting mass, is heated under oxidising conditions, at a temperature (about 800° C.) insufficient to cause fusion, in order to oxidise iron compounds. The product is then mixed with binding material.

—F. SODN.

Magnetic materials; Devices for separating — from materials in which they may be present as impurities or foreign matter [e.g., potters' slip or glazes]. H. H. Thompson, Aldridge, Staffs., and A. E. Davies, Hockley Heath, Warwick. Eng. Pat. 19,254, Aug. 31, 1914.

A DEVICE for wet magnetic separation in which the electro-magnet is provided with pole-pieces projecting downwards and furnished with plate-like shoes having projecting bars or teeth. One shoe may be in a higher plane and has projections on its upper and lower surface, while the other has projections on the upper surface only.—W. R. S.

Bricks, tiles, and the like; Manufacture of —. G. Hidoux and J. Bernheim, Paris. Eng. Pat. 17,876, July 28, 1914. Under Int. Conv., July 28, 1913.

SEE Fr. Pat. 400,803 of 1913; this J., 1914, 25.

Reversible regenerative furnaces for use in making steel, glass, etc. Eng. Pat. 27,678 of 1913. See X.

Process and apparatus for applying coatings to various surfaces or materials. Eng. Pat. 15,960 of 1914. See X.

IX.—BUILDING MATERIALS.

Cement trade of Australia. U.S. Commerce Rept. No. 178, July 31, 1915.

THE demand for cement in Australia continues to increase, and is not satisfied by the production. During 1913 the production amounted to 200,000 tons and the imports to 125,000 tons, of which Germany, Austria, and Belgium contributed 81,000 tons and the United Kingdom 31,000 tons. Two factories in New South Wales produce 145,000 tons, whilst there are two smaller factories in Victoria and one in South Australia. The high local freights are responsible for the fact that little cement is shipped from State to State, so that Queensland, Tasmania, and Western Australia seem to offer promising markets for cement.

PATENTS.

Cement; Means for removing the sintered together burnt material, for instance —, from kilns or the like with horizontal kiln chambers. M. Lorenz, Rodaun, Lower Austria. Eng. Pat. 4539, Feb. 21, 1914.

THE horizontal kiln chamber is connected with a delivery tunnel beneath by a number of armoured, inverted conical openings, each provided with a beater grate upon which the larger masses of clinker are broken before discharge. In the heating zone of the kiln, these openings are closed at the bottom by sliding plates and the conical hollows filled with added clinker; in the cooling zone, they are opened to admit air or steam from the delivery tunnel into the incandescent charge, to facilitate its disintegration and removal.

—W. E. F. P.

Lime, cement, or like kits. W. Renner, Misburg, Hanover, J. Schmarje and C. Hoche, Hamburg. Eng. Pat. 16,030, July 1, 1914. Under Int. Conv., July 5, 1913.

THE material under calcination is prevented from clinging to the sides of the kiln chamber by the employment, at the discharge end of the kiln, of a pair of oppositely rotating parallel breaking rollers with spiral ribs of varying pitch.—J. R.

Mortar materials; Apparatus for treating — with steam or moist hot air. A. Anker, Paris. Eng. Pat. 8645, April 6, 1914. Under Int. Conv., Nov. 14, 1913. Addition to Eng. Pat. 7061 of 1914, dated March 20, 1913 (this J., 1915, 836).

AN inner and an outer container, mounted to revolve together about a horizontal axis, are arranged so that steam can be admitted to the inner container from the outer (through perforations, for example), whilst the outer can be filled with steam and has means for letting off condensed water. An orifice extending outwards from the inner container serves as a feeding aperture or as outlet, according to the upright or inverted position of the vessel.—F. SODN.

Wood; Art of preserving —. A. V. St. Armande, Nitshill, and T. Reid, Glasgow. Eng. Pat. 20,260, Sept. 28, 1914.

THE wood is treated with dichlorobenzene and/or one or more of its homologues, with or without the addition of other compatible materials, such as paraffin wax and naphthalene.—W. E. F. P.

Silicious material; Processes of treating — to produce hydraulic cement and alkali therefrom. H. E. Brown, Kingston, N.Y., U.S.A. Eng. Pat. 13,448, June 2, 1914.

SEE Fr. Pat. 473,279 of 1914; this J., 1915, 553.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Metals consumed in shell manufacture. Min. and Eng. World, 1915, 43, 146.

THE demands of manufacturers of shrapnel and other shells and rifle cartridges constitute an important item of consumption in copper, spelter, and other metals. The metals needed to fill the war orders already placed are estimated at over 10% of last year's copper production of the United States, about 7% of the spelter production, and nearly 20% of the lead production.

A British 18-pounder, or 3.3-in. shrapnel, requires 5 lb. 9½ oz. of brass, containing 66 to 70% Cu, or nearly 3½ lb. A small copper band around the shell adds 4½ oz., making the total copper 4.04 lb. Spelter consumption per shell of this size is about 1.87 lb. Lead bullets weighing 7.92 lb., and composed of 7 parts Pb to 1 Sb, constitute the metal load of the projectile. Estimating the total orders for shrapnel and other shells placed in the United States by Europe at 25,000,000 shells, these orders would call for a total of 101,000,000 lb. of copper, 46,750,000 lb. of spelter, and 173,250,000 lb. of lead.

Actually the metal consumption is larger, as a fair proportion of the shells are 4.7-in. howitzer shells, using more brass; some 6-in., 7½-in., and probably 9-in. shells are also being made. Rifle cartridges are composed mainly of copper, there being 1 lb. of the red metal used in making 24 Lebel cartridges, a type widely used by the French army. Every 125 of these cartridges consume 1 lb. of spelter and a small amount of nickel. Steel consumption per shell varies more widely with the different types. A finished 3.3-in. shell

contains 6 lb. 15½ oz. of steel, the steel shell weighing 6 lb., 5½ oz., and the diaphragm 9½ oz. If the shell is made from a steel bar, the weight of this is about 17 lb., while a forging for the same purpose weighs approximately 14½ lb., and a "bottle" made by the seamless tube process somewhat less.

Cold-worked metals; The properties of —. Part I. The density of metallic fittings. T. M. Lowry and R. G. Parker. Chem. Soc. Trans., 1915, 107, 1005–1018.

THE complete annealing of cold-worked metals is accompanied by a contraction in volume, which is attributed to the recrystallisation of amorphous material produced by working. The contraction is preceded by an expansion, which appears to be universal and independent of the nature of the metal. With Au, Ag, Cu, Co, Ni, and Sb, this expansion is again preceded by a preliminary contraction, which appears to be a specific property of a limited group of metals. In the case of gold, this preliminary contraction and intermediate expansion can be observed to take place consecutively when the metal is heated to 100°C. Observations on filings of sixteen metals showed a slight decrease of density produced by filing, excepting with Mg and Pt: the observations were not conclusive since the filings possibly enclosed air. On annealing the filings at 100°C., expansion was observed with Al, Zn, Cd, Sn, Pb, and Bi, contraction with Co, Ni, Cu, Ag, and Sb, and no change with Mg, Fe, Pd, Pt, and Au.—B. N.

Aluminium; Action of nitric acid on —. A. Trillat. Bull. Soc. d'Encour., 1915, 132, 547–554.

PLATES of commercial aluminium of 99.7% purity, measuring 100×28×1 mm. and weighing 7–8 grms., were kept in closed glass bottles containing nitric acid of various concentrations and at various temperatures. About 9/10 of each plate was immersed in the acid, the rest being exposed to the fumes. After 15 days the plates were carefully brushed, washed, and weighed, and immersed for a second period of 90 days. The accompanying table shows the loss in weight of the plates under

Sp. gr. of acid.	Temp. °C.	Percent. loss of weight		Loss of wt. in 15 days. grms. per sq. m. surface.
		in 15 days.	in 105 days.	
1.52	0°	0.54	1.03	15
1.52	5°	0.92	1.57	25
1.52	18°	1.42	2.58	38
1.52	28°	4.27	6.54	116
1.39	8°	8.76	16.70	237
1.39	28°	31.10	58.50	845
1.13	18°	11.78	22.40	320
1.13	28°	46.10	82.60	1250

different conditions. In a second series of experiments the bottles were left open, exposed to the air; the corrosion was considerably greater than in the first series, partly on account of absorption of moisture by the acid. The plates were most deeply corroded at the surface of the liquid. Attempts to protect the metal by coating it with celluloid varnish, cellulose acetate, caoutchouc, and paraffin were unsuccessful; but by heating it for about an hour at 400°–500°C. its resistance to attack by nitric acid was much increased, though this treatment is not recommended for thin aluminium vessels as it impairs the mechanical strength of the metal (see Heyn and Bauer, this J., 1911, 218; Bleisch, 1912, 199). Welded aluminium was found to be as resistant to nitric acid as the untreated metal. The rate at which aluminium is attacked by nitric acid is increased by the

presence of copper, sodium, or magnesium in the metal, or chlorine or hydrochloric acid in the acid. The author concludes that nitric acid can be safely transported in aluminium vessels provided that the metal is of high purity and the acid is at its maximum concentration (cp. Fr. Pat. 451,812 of 1912; this J., 1913, 699), but great care is necessary in using aluminium vessels for the preparation of nitrocellulose, as the rate at which they are attacked is much accelerated by hydration of the acid and rise of temperature.—J. H. L.

German South-West Africa; Economic [mineral] resources of —. Bull. Imp. Inst., 1915, 13, 233–260.

THE chief economic minerals are the diamonds of the south-western coastal district and the copper and lead ores of the Otavi district. The most important copper mine is at Tsumeb, where the ore-body occurs in grey compact dolomite. The chief ore minerals are galena, chalcocite, enargite, famatinite, and zinc blende, but at and near the surface there is a large variety of minerals arising from oxidation. In the year ended March 31, 1913, the output of copper ore by the Otavi mines was 54,100 tons, of which 44,500 tons was exported, containing, on the average, Cu 13, and Pb 25%, and Ag 230 grms. (7 oz. 8 dwt.) per ton. During the same period there was exported 665 tons of copper matte containing Cu 48, and Pb 25%, and Ag 440 grms. (14 oz. 3 dwt.) per ton, and 400 tons of crude lead containing 98% Pb and 910 grms. (29 oz. 5 dwt.) Ag per ton. In the 6 months ended Sept. 30, 1913, the exports amounted to 25,560 tons of copper ore, 507 tons of copper matte, and 45 tons of crude lead. Other deposits of copper ores occur in various parts of the colony. Important deposits of calcareous, brown iron oxide ore, containing 60% Fe₂O₃, occur north-west of Kalkfeld; the ore has been used as a flux in the smelting of lead-copper ores. Galena is found, as stated above, associated with the Otavi copper ores and also in other parts. Marble suitable for statuary occurs in the Karibb district, about 250 tons, valued at about £1000, being exported in 1912. Tin ore occurs in various parts of the colony, partly in pegmatites and partly in the surface alluvium from the disintegration of the pegmatites. During the first half of 1913 the exports of tin concentrates, obtained almost entirely from the surface gravel, amounted to 101 tons, valued at £16,340. Other economic minerals which have been found are auriferous copper ore, wolframite, molybdenite, mottamite (vanadium ore), tantalite, monazite, salt, and beryl.—A. S.

Investigation of fusible tin boiler plugs. Burgess and Merica. See I.

Use of aluminium in industries concerned with foods. Trillat. See XIXA.

Volumetric estimation of lead. Miles. See XXIII.

PATENTS.

Iron; Manufacture of wrought —. G. A. Jarvis, Wellington, Salop. Eng. Pat. 20,163, Sept. 25, 1914.

A PUDDLING process in which non-phosphoric iron is worked with an acid silicate of iron in an acid-lined furnace to produce a malleable and fibrous metal.—W. E. F. P.

Steel; Manufacture of — by the basic open-hearth process. A. E. Davies, Bilston, Staffs. Eng. Pat. 20,582, Oct. 6, 1914.

THE slag is retained in the furnace after tapping the steel, thickened by adding lime and metallic

oxides, and made to adhere to the sides and bottom of the lining by tilting the furnace repeatedly backwards and forwards. The hot oxidising coating thus formed is ready to react with the next charge of molten metal.—W. R. S.

Iron and steel ingots; Treating —. B. Talbot, Middlesbrough. Eng. Pat. 2639, Feb. 18, 1915.

THE molten metal is poured into a composite mould to retard the cooling of the upper part of the ingot by at least 100° C., so that this portion of the metal may remain fluid or plastic in the interior after the lower part has solidified. The ingot is then removed from the mould and squeezed, with or without previous re-heating.—W. E. F. P.

Furnaces; Reversible regenerative — for use in the manufacture of steel, glass, etc. J. S. Atkinson, Thames Ditton, The Coke Oven Machinery Co., Ltd., and K. Huessener, Twickenham. Eng. Pat. 27,678, Sept. 22, 1913.

OUTLET passages for the products of combustion are provided at each end of the furnace hearth, separate from, and with their entrances in advance of, the gas and air inlet passages, so as to prevent the rapid burning back of the latter.—W. R. S.

Copper carbonate; Process for leaching ores or minerals containing —. J. Erdős, Kolozsvár, Hungary. Eng. Pat. 4658, Feb. 23, 1914. Under Int. Conv., Feb. 27, 1913.

LOW-GRADE malachite and azurite ores are leached with a solution of aluminium sulphate or alum, whereby the copper passes into solution as the sulphate and the aluminium is precipitated as hydroxide, which is separated with the gangue. By using an amount of the aluminium salt just equivalent to the copper present, no associated iron passes into solution, and a fairly pure solution of copper sulphate is obtained.—T. St.

Zinc oxide; Reduction of —. W. Buddeus, Charlottenburg, Germany. Eng. Pat. 26,379, Nov. 17, 1913.

A MIXTURE of nearly pure zinc oxide of low density with coke dust or other carbonaceous material is blown by a current of an inert or reducing gas, preferably carbon monoxide, into a rotary cylindrical chamber previously heated to a white heat. The temperature of the chamber is maintained by passing furnace gases through passages in the walls. The products consist almost entirely of zinc vapour and carbon monoxide, which escape at the exit end of the chamber. The zinc is condensed and the carbon monoxide collected.—T. St.

Zinc and lead vapours; Condenser for —. E. A. Johansson Trollhättan, Sweden. U.S. Pat. 1,145,685, July 6, 1915. Date of appl., April 21, 1915.

THE condenser is provided with a loose bottom, supported by a collecting chamber which is sealed against the atmosphere. Both the chamber and the condenser bottom can be rotated.—W. R. S.

Receivers for zinc furnaces and the like; Process for the manufacture of —. "Tellus Aktienges." Bergbau und Hüttenindustrie, Frankfurt, Germany. Eng. Pat. 17,557, July 24, 1914. Under Int. Conv., July 25, 1913.

THE apparatus consists of a punch having a continuous oscillating movement, and a die (containing the material to be moulded) which moves towards, and away from, the punch alternately. The die is mounted on trunnions to facilitate discharge at the point of greatest distance from the punch.—W. E. F. P.

Ore [e.g., zinc and lead]; Process of recovering metal from — and apparatus therefor. H. Wade, London. From New Metals-Process Co., Chicago. Eng. Pat. 17,325, July 21, 1914.

THE ore is mixed with several times its volume of lump fuel and subjected to a limited down-draught air supply in a deoxidising chamber at a temperature sufficient to vaporise the reduced metals without producing slag; portions of unconsumed fuel and solid gangue are removed at the bottom of the chamber at intervals, and the fuel is again mixed with fresh ore and fuel. The furnace gases and metallic vapour are drawn through a condenser by means of a pump.—W. R. S.

Aluminium solder. J. F. Gross, Allentown, Pa. U.S. Pat. 1,145,307, July 6, 1915. Date of appl., Jan. 15, 1915.

THE solder consists of tin 80, lead 16, aluminium 8, zinc 16, and phosphorus 8 parts.—W. R. S.

[Tungsten.] *Metals and methods of manufacturing the same.* The British Thomson-Houston Co., Ltd., London. From A. Pacz, Cleveland, Ohio, U.S.A. Eng. Pat. 15,961, July 3, 1914.

IN the manufacture of tungsten filaments for incandescence lamps, greatly superior results are stated to be obtained by forming the slug from two or more varieties of substantially pure tungsten, differing in respect of the compounds from which they are derived. In carrying out the process, commercial tungstic oxide is treated with compounds of lithium, ammonium, sodium, and potassium, respectively, and tungstic oxide again obtained from the filtered solution of the tungstates. The tungsten then obtained by reduction is agglomerated and formed into filaments. Such tungsten, containing 99.7 to 99.95% pure metal, yields filaments which are extremely pliable and, even after prolonged use, retain their shape and show no off-setting. The ultimate metals obtained from the different tungstates have the same composition but differ as regards colour, density, and electrical conductivity. These differences do not depend on the size or shape of the particles, but are attributed to the molecular structure of the metal.—T. St.

Metals [e.g., tungsten]; Process for producing chemically pure —. O. Voigtländer and H. Lohmann, Essen-Ruhr, Germany. Eng. Pat. 27,369, Nov. 27, 1913. Under Int. Conv., Dec. 2, 1912.

A MIXTURE of tungstic oxide and aluminium powder is introduced pneumatically into an electrically heated rotary furnace, and the pure tungsten separated from the other products by centrifuging the heated mixture. Metals other than tungsten can be obtained in a pure state from ores or oxides by combined electrical smelting and centrifuging. (See also Fr. Pat. 455,313; this J., 1913, 949.)—W. R. S.

Sintering fine oxide ores and metallurgical products; Apparatus for —. W. K. Bartsch, Hessen, Germany. Eng. Pat. 8384, Apr. 2, 1914. Under Int. Conv., July 17, 1913.

SEPARATE and continuous streams of fuel and ore are fed in succession upon an endless-band conveyor. The layer of fuel is ignited before arriving beneath the ore-feed, from which point the charge is subjected to an upward blast of air from a pressure chamber below. The sintered product is removed from the conveyor by means of scrapers.—W. E. F. P.

Ore-roasting furnace. I. R. Margetts and E. R. Pembroke, Salt Lake City, Utah. U.S. Pat. 1,145,329 July 6, 1915. Date of appl., Oct. 23, 1914.

THE apparatus consists of a number of box-like, travelling members, each having a perforated bottom, containing a separate charge of ore, and adapted to pass in turn over the top of an open fire-box.—W. E. F. P.

Cupola-furnace. M. Zippler, jun., Pittsburgh. U.S. Pat. 1,145,648, July 6, 1915. Date of appl., Dec. 11, 1913.

Is a cupola having tuyères arranged at two different levels, an air-cooled bosh element is interposed between the upper and the lower tuyère constructions and forms the top of the latter.

—W. E. F. P.

Ores; Method of treating roasted —. A. Ramen, Helsingborg, Sweden. Eng. Pat. 15,378, June 26, 1914. Addition to Eng. Pat. 15,254 of 1911 (this J., 1915, 838).

Is the process described in the chief patent, the extraction may be performed in several stages by using different quantities of solvent, or different solvents, in order to obtain separate solutions of different metals. The speed of the rotating device can be altered so as to regulate the relation between the quantity of ore and solvent.—W. R. S.

Ores; Concentration of —. H. W. C. Annable, Egham, Surrey, and A. E. Roberts, London. Eng. Pats. 15,692, 19,411, and 20,194, July 3, Sept. 3 and 25, 1914.

SULPHIDE ores containing alkaline-earth carbonates are crushed, suspended in water, and subjected to the action of sulphur dioxide at a temperature not exceeding 40° C., air being excluded. The alkaline-earths are dissolved as bisulphites, while the sulphide minerals remain practically unaffected.—W. R. S.

Ores; Apparatus for the water-concentration of —. W. M. Martin, Redruth. Eng. Pat. 2845, Feb. 22, 1915.

A MIXTURE of ore and water is fed into a revolving drum the inner surface of which is frosted or fluted (see Eng. Pat. 2844 of 1915; this J., 1915, 803), so that the values are raised while the gangue and water flow away. The values are detached at the upper portion of the drum by sprays of water and collected by means of a launder.—W. R. S.

Aluminium; Method of coating articles with —. W. Krumbhaar, Cöln-Ehrenfeld, Germany. Eng. Pat. 3713, Feb. 12, 1914. Under Int. Conv., Nov. 24, 1913.

To produce an aluminium coating having a brightly polished surface, the article is lacquered, allowed to dry completely, rubbed vigorously with finely divided aluminium, and finally washed in water.—W. E. F. P.

Electrodeposition of metal upon metal by means of high current density, specially applicable for coating printing rollers, hydraulic rams, and other like purposes. T. R. Harris, Harlington, Middlesex. Eng. Pat. 17,133, July 20, 1914.

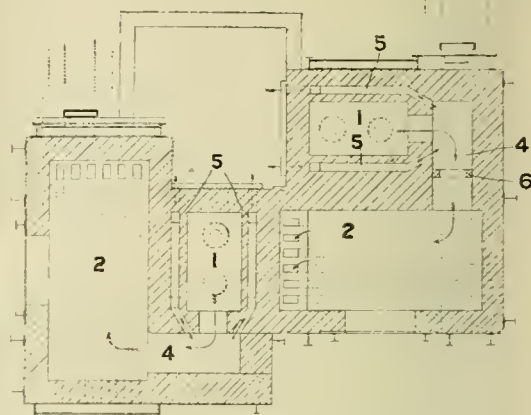
THE article to be coated forms the cathode, which is revolved at the rate of 200 ft. per minute between the limbs of a horizontal, U-shaped tube through which electrolyte is sprayed, and a current density of 250 amps. per sq. ft. is employed.

—B. N.

[Heating] furnaces. R. F. Hislop and G. R. Hislop, jun., Paisley. Eng. Pat. 20,929, Oct. 13, 1914.

Is an installation comprising a furnace (for heating

metal plates prior to rolling) and a gas producer for supplying fuel—or a pair of furnaces and a



pair of producers, as shown in plan in the figure—the producer, 1, adjoins the furnace, 2, and communicates with it through a combustion chamber, 4, to which pre-heated air is supplied from ducts, 5, around the producer, the arrangement being such that the heating gases are twice deflected at right angles, and baffled in the combustion chamber by the arch, 6, before passing over the charge and beneath the hearth to the stack.—W. E. F. P.

Coatings; Process of and apparatus for applying — to various surfaces or materials. R. K. Moreom, Westminster. Eng. Pat. 15,960, July 3, 1914.

Is applying coatings of fusible materials to surfaces by spraying, smaller blow-pipes are attached to the main sprayer blow-pipe by means of a yoke, so that as the sprayer is moved along the surface, the latter receives a preliminary heating or drying by a "leading" jet, and the coating receives a finishing heating by a "following" jet. The leading jet may also be used to apply a flux, if desired. The several jets are fed through a common union, so that they may be regulated in common or independently, and by providing an excess of the fuel in the gas-mixture the flames may be made deoxidising (see also this J., 1914, 968, 1013).—T. St.

Pig-iron; Process for dephosphorising —. A. F. Pasquier, Dijon, France. U.S. Pat. 1,145,506, July 6, 1915. Date of appl., Nov. 20, 1912.

SEE Ger. Pat. 252,504 of 1911; this J., 1913, 29.

Steel and slag rich in soluble phosphates; Production of high-grade —. Deutsch-Luxemburgische Bergwerks- u. Hütten-A.-G., Bochum, and A. Vögler, Dortmund, Germany. Eng. Pat. 27,868, Dec. 3, 1913.

SEE Fr. Pat. 466,016 of 1913; this J., 1914, 600.

Metallie zinc or zinc oxide; Manufacture of —. H. W. de Stucklé, Dieuze, Alsace. Eng. Pat. 28,188, Dec. 6, 1913. Under Int. Conv., Dec. 7, 1912.

SEE Fr. Pat. 465,816 of 1913; this J., 1914, 599.

Nickel-iron alloys; Production of —. W. Borchers and E. Thilges, Aachen, Germany. Eng. Pat. 9535, Apr. 17, 1914. Under Int. Conv., July 31, 1913.

SEE Ger. Pat. 271,595 of 1913; this J., 1914, 488.

Metallic [tungsten and other] bodies and process and apparatus for obtaining them. J. Pintsch A.-G., Berlin. Eng. Pat. 16,620, July 11, 1914. Under Int. Conv., Oct. 15, 1913.

SEE Fr. Pat. 469,212 of 1914; this J., 1915, 36.

Roasting furnaces: Mechanical—. J. Claude, Frankfurt, Germany. Eng. Pat. 10,058, Apr. 23, 1914. Under Int. Conv., May 7, 1913.

SEE Fr. Pat. 468,968 of 1913; this J., 1914, 970.

Ore roasting furnaces. P. Piketty, Paris. Eng. Pat. 149, Jan. 1, 1915. Under Int. Conv., Jan. 5, 1914.

SEE Fr. Pat. 466,991 of 1914; this J., 1914, 835.

Devices for separating magnetic materials from materials in which they may be present as impurities or foreign matter. Eng. Pat. 19,254 of 1914. See VIII.

XI. ELECTRO-CHEMISTRY.

PATENTS.

Electrolytic cell and method of maintaining the efficiency thereof. W. M. Jewell, Assignor to Chloride Process Co., Chicago, Ill. U.S. Pat. 1,145,593, July 6, 1915. Date of appl., Mar. 2, 1914.

ANODE and cathode chambers are disposed side by side, and the heavier liquor from the lower portion of the anode chamber is caused to flow towards the cathode chamber, across the lower portion of the latter and below the level of the cathode. It then passes out of the cell independently of the outflow of the lighter cathode liquor, and is again introduced into the anode chamber.—B. N.

Electrolytic apparatus. G. Planeq, London. Eng. Pat. 21,727, Oct. 29, 1914.

THE cell is composed of alternate plates and porous diaphragms of cement or ebonite, the diaphragms having integral insulating borders of the same or different material, which act wholly or partly as distance pieces. The diaphragms may be made by coating a wire mesh with cement, and tapping to remove the cement from the interstices, so that the strands remain coated, with capillary passages between.—B. N.

Electrodes for galvanic cells: Carbon—. V. Scholz, Berlin. Eng. Pat. 10,171, April 24, 1914. Under Int. Conv., May 17, 1913.

COLLOIDAL graphite is employed for the carbon electrode in cells containing manganese dioxide as depolariser.—B. N.

Electrolytic purification of liquids; Apparatus for—. J. L. Goucher, Assignor to The New York Conveyancers Co., New York. U.S. Pat. 1,145,862, July 6, 1915. Date of appl., March 10, 1909.

A CONTINUOUS stream of the liquid to be purified is caused to pass through a perforated insulator, placed between a pair of electrodes, each having a concave surface towards the opening in the insulator, and the liquid makes contact with the faces through the opening, thus closing the circuit. The insulators and vessel-shaped electrodes are arranged in series, with means for varying the space intervals.—B. N.

Suspension colloids, emulsion colloids, true colloids, ions or dissolved bodies or members of two or more of these classes; Separating from a mixture one or more—. Ges. f. Elektro-Osmose m. b. H., Frankfurt, Germany. Eng. Pat. 11,823, May 13, 1914. Under Int. Conv., March 2, 1914.

THE mixture is subjected to electro-osmosis with

diaphragms interposed in the circuit, the potentials of these being such that certain constituents migrate through the diaphragms whilst others cannot pass. Electrolytes which hinder the migration may be removed by the interposition in front of the electrodes of positive or negative diaphragms, for obtaining the required concentration of acid or base in the mixture, and, in the fractional separation of colloids, diaphragms are selected of a charge capacity such that their charges correspond with those of the colloids. Ions of different migration velocities may be fractionally separated by the use of suitable diaphragms, and bodies which are neither electrolytes nor colloids may be removed from a mixture of dissolved substances by causing them to pass with the water through the diaphragms which retain the electrolytes and colloids. For example, with a viscose diaphragm at the anode and parchment paper at the cathode, a mixture of sulphuric and lactic acids can be fractionated, the sulphuric acid alone passing through the viscose. Again, using an animal diaphragm at the cathode and viscose at the anode, the non-sugars can be separated from a solution of crude sugar, and a solution of glue can be separated into several fractions by using calcined alumina as positive diaphragm and calcined pure silicic acid as negative diaphragm.—B. N.

Furnaces; Electrode— which have an arrangement for automatically mixing up the charge. F. Krupp A.-G., Essen, Germany. Eng. Pat. 742, Jan. 10, 1914. Under Int. Conv., Jan. 17, 1913.

THE furnace is worked by means of alternating current supplied by one electrode placed over the centre of the charge and a number of base electrodes arranged at the edge, so that the current is spread out substantially in a radial direction. The current circuit contains a single or several exciting windings, which serve to produce a magnetic field directed substantially at right angles to the upper surface of the bath, and hence to impart a circulating movement to the charge. The exciting winding consists of two coils connected electrically to each other, and a point in the conductor joining the coils is connected to the charge by a conductor containing a switch. An alternating polyphase current may be employed, each of the exciting windings being connected up in series with a phase winding of the system. With three-phase current, the phase winding, in series with the exciting winding, is connected up in the well-known way opposite to the two other phase windings, or one of the phase windings is thus connected opposite to the two other phase windings, and is linked up thereto in star connection, while the ends of one exciting winding are connected to the zero point of the star connection and to the charge. The charge may be heated mainly by means of continuous current, upon which an alternating current is superposed.—B. N.

Anode of hard lead for electrolytical purposes. E. C. R. Marks, London. From Siemens and Halske A.-G., Berlin. Eng. Pat. 284, Jan. 5, 1914. SEE Ger. Pat. 270,191 of 1912; this J., 1914, 322.

Electrodes for electrolytic purposes; Manufacture of [manganese dioxide]—. Siemens and Halske A.-G., Berlin. Eng. Pat. 2767, Feb. 20, 1915. Under Int. Conv., Feb. 21, 1914. Addition to Eng. Pat. 605, Jan. 9, 1909.

SEE Ger. Pat. 282,225 of 1911; this J., 1915, 622.

Separating dust-particles from gases or air by means of high-tension current; Method and apparatus for—. G. A. Krause, Munich, Germany. Eng. Pat. 27,059, Nov. 24, 1913. Under Int. Conv., Nov. 25, 1912.

SEE Fr. Pat. 465,277 of 1913; this J., 1914, 491.

Separating suspended particles from gases by means of high tension electricity: Method of —. G. A. Krause, Munich, Germany. Eng. Pat. 27,060, Nov. 24, 1913. Under Int. Conv., Nov. 25, 1912.

SEE Fr. Pat. 465,276 of 1913; this J., 1914, 191.

Process and apparatus for the electrolysis of "halogen alkalis." Eng. Pat. 17,089. See VII.

Treatment of wheat and other cereals or cereal products. Eng. Pat. 16,664. See XIXA.

Purification of liquids. Eng. Pat. 21,513. See XIXB.

XII. FATS; OILS; WAXES.

Edible and oil-producing nuts and seeds. Appointment of Committee on Promotion of West African Trade.

THE Secretary of State for the Colonies has appointed a Committee to consider and report upon the present condition and the prospects of the West African trade in palm kernels and other edible and oil-producing nuts and seeds and to make recommendations for the promotion, in the United Kingdom, of the industries dependent thereon. The Committee is composed of Mr. A. D. Steel-Maitland (Chairman); Sir G. Fiddes; Sir F. Lugard, Governor-General of Nigeria; Sir Hugh Clifford, Governor of the Gold Coast; Sir Owen Philipps, Mr. G. A. Moore, and Mr. T. Walkden (representing respectively the London, Liverpool, and Manchester Chambers of Commerce); Sir W. G. Watson; Mr. L. Couper, Manager of the Bank of British West Africa; Professor W. R. Dunstan; Mr. T. Middleton, Board of Agriculture; Mr. T. Worthington, Commercial Intelligence Branch of the Board of Trade, and Mr. T. Wiles, M.P. Communications may be addressed to the Secretary, Mr. J. E. W. Flood, of the Colonial Office.

Animal fats; Constituents of —. J. Klimont and K. Mayer. Monatsh. Chem., 1915, 36, 281—287. J. Chem. Soc., 1915, 108, i., 621.

THE acid mixture isolated from goose-fat (Klimont and Meisels, this J., 1909, 662) is not a eutectic of stearic and palmitic acids, as at first believed. The solid constituents were separated from the crude fat and purified by recrystallisation until the mixture had m.pt. 59°—60° C. The product was then hydrolysed with alcoholic potassium hydroxide, and the component acids were separated by the method used by Meyer and Beer (this J., 1912, 501). The main constituents of the acid mixture were margaric and palmitic acids, with a little stearic acid and heptadecic acid; oleic and linolic acids could also be detected. It appears probable that the fatty compound, m.pt. 60.5° C., present in goose-fat is a mixed glyceride, most likely dipalmitomargarin.

Fat of fish; Content and biological significance of the — and its variations with the age of the individual. O. Polimanti. Biochem. Zeits., 1915, 69, 145—154. J. Chem. Soc., 1915, 108, i., 621.

THE bodies of fish which live at the surface of water contain a larger amount of fat than the bodies of those living in deep water or in the sand. A change in fat-content is also found in the same individual at different stages of its existence which corresponds with a change in the habitat; thus, in the cases of *Crenilabrus* and *Magil*, the young individual lives mostly at the surface, and the bodies contain a larger amount of fat than is found

in the older individuals which live more in the depths. The reverse of this is the case with other species of fish, and in other cases, again, when there is no difference of habitat as regards the depth of the sea inhabited, there is no marked difference in the fat-content of the bodies of the young and older individuals.

Field and forest resources of British Guiana. Harrison and Bancroft. See XVII.

PATENTS.

Oils and fats; Process for treating —. W. P. M. Grelek, Elgin, Ill. U.S. Pat. 1,144,539, June 29, 1915. Date of appl., Feb. 19, 1914.

FATTY compounds are prepared by intimately mixing the components, forming the resulting compound into fine spray, and congealing the spray by contact with air or other gas at a relatively low temperature.—C. A. M.

Oil from the coconut and other nuts; Process for the extraction of — and apparatus employed in connection therewith. J. A. Frolich, London. From R. T. H. Werlemann, Sourabaya, Java. Eng. Pat. 10,601, Apr. 29, 1914.

THE kernels are reduced to small pieces and mixed with water, the mixture grated, pressed, and allowed to stand for about 24 hours. The "cream" is then skimmed off, boiled for about an hour, and the oil expressed. The apparatus comprises a casing having an opening at the bottom and containing a rotating cylindrical grater, a series of blades near the periphery of the grater, a cylinder with a serrated periphery below the grater, and a scraper or rotating brush for removing adhering material from the grater.—C. A. M.

Soap [for detergent and therapeutic purposes]. I. Leiser, Berlin. Eng. Pat. 17,461, July 23, 1914. Under Int. Conv., July 2, 1914.

POWDERED amber or a solution of amber is incorporated with the soap to obtain a product with detergent and therapeutic properties (e.g., for nervous and rheumatic ailments).—C. A. M.

Unsaturated oleic and fatty acids and their esters; Process for converting — into saturated compounds. C. H. Hausmann, Hamburg, Assignor to De Nordiske Fabrikker De-No-Fa Aktieselskap, Christiania. U.S. Pat. 1,145,480, July 6, 1915. Date of appl., Oct. 7, 1913.

SEE Fr. Pat. 462,905 of 1913; this J., 1914, 321.

Slimy materials, fats, and the like; Treatment of —. Richter and Richter, Frankfurt, Germany. Eng. Pat. 26,084, Nov. 13, 1913. Under Int. Conv., Nov. 15, 1912. Addition to Eng. Pat. 11,614 of 1912, dated June 6, 1911.

SEE Addition of Nov. 11, 1913, to Fr. Pat. 443,789 of 1912; this J., 1914, 663.

XIII. PAINTS; PIGMENTS; VARNISHES; RESINS.

Abietic acid of Spanish colophony. J. Sureda Blanes. Anal. Fis. Quim., 1915, 13, 176—179. J. Chem. Soc., 1915, 108, i., 493.

THE abietic acid, $C_{19}H_{26}O_2$, present in Spanish colophony, forms white crystals, m.pt. 153°—154° C., $[\alpha]_D^{20} = -57.8^\circ$. It is identical with the acid present in American colophony, and can be isolated by the method of Easterfield and Bagley (this J., 1904, 989). It contains two double linkings, being converted by the hydrogenation method of Willstätter and Matt into hydroabietic acid

$C_{15}H_{23}O_2$, m.pt. 176° — 170° C., $[\alpha]_D^{25}$ — -16.85° , identical with the acid obtained by Maly in 1866, by reduction with sodium amalgam and alcohol.

PATENTS.

White lead; Apparatus for making —. C. Ellis, Montclair, N.J., Assignor to Ellis-Foster Co., U.S. Pat. 1,144,701, June 29, 1915. Date of appl., Aug. 25, 1911.

MOLTEN lead is finely divided in an "atomiser" and propelled through a long conveyor, where it is hydrated by contact with air and moisture. After removal of metallic particles by means of a separator, the hydrated product is passed through a second conveyor, where it is carbonated with carbon dioxide.—C. A. M.

Paint-binding medium termed "painter's size"; Process for the manufacture of neutral —, in the form of powder, for house and decorative painting. F. Beckmann, Warsaw. Eng. Pat. 4567, Feb. 21, 1914.

LIME (about 100 parts) is mixed with powdered sugar (50 parts), with the addition of potato flour (30 parts) and dextrin (20 parts), to promote solution and prevent the formation of lumps.

—C. A. M.

Resinous wood; Method of terating — to remove the soluble constituents therefrom. I. S. Clope, Macon, Assignor to Empire Chemical Co., Atlanta, Ga. U.S. Pat. 1,144,174, June 22, 1915. Date of appl., Dec. 4, 1914.

CHIPS of the wood are digested with that portion of the distillate from coniferous woods distilling between 170° and 185° C. (sp. gr. 0.875 to 0.880), or with other extractive agent consisting mainly of limonene, dipentene, terpinene, and cineol; or the wood may be treated with the vapours of the solvent in an evacuated vessel. The extracted substances are separated by distillation, and the vapourised solvent returned to the digester.

—C. A. M.

Resinous woods; Process of treating —. M. C. Whitaker, New York, and J. S. Bates, Boston, Mass., Assignor to A. D. Little, Boston. U.S. Pat. 1,142,922, June 15, 1915. Date of appl., Oct. 20, 1913.

THE resinous constituents are extracted by means of an alkaline (dilute caustic soda) solution, and separated from dissolved humus by precipitation with alkali (caustic soda). The alkaline solution is used for pulping the residual wood.—C. A. M.

Resin oils; Process of producing pure —. M. Melamid, Freiburg, Germany. U.S. Pat. 1,133,991, Mar. 30, 1915. Date of appl., Aug. 4, 1914.

MELTED rosin or rosin distillates are heated with phosphorus pentoxide or other oxygen compounds of phosphorus, other than phosphoric acid, to about 150° to 200° C. Rosin thus treated yields about 80% of clear, odourless rosin oil and 20% of a substitute for oil of turpentine.—C. A. M.

Condensation products from phenol or cresols and formaldehyde and the like; Manufacture of —.

(A) A. Heinemann, London, H. C. Harvey, Birmingham, and H. W. Robinson, Sedgely. (B) A. Heinemann. Eng. Pats. 28,187, Dec. 6, 1913, and 9390, Apr. 15, 1914.

(A) PHENOL or cresol and formaldehyde or the like are heated together without a catalyst, and the resulting liquid hydroxybenzyl alcohol transformed into a solid condensation product by heating it in an open vessel with an aqueous solution of sulphur dioxide. (B) Gaseous sulphur dioxide is passed through an open vessel containing a cold mixture

of phenol and formaldehyde, or the like, or the hydroxybenzyl alcohol resulting from their interaction, and the mixture is allowed to stand until condensation is complete.—C. A. M.

Floor coverings; Process for the manufacture of —. De Vogel van Cateur and Co., Zwolle, Holland. Eng. Pat. 1190, Jan. 25, 1915. Under Int. Conv., Jan. 23, 1914.

FLOOR coverings resembling granite or other mineral substances are prepared by spraying two consecutive layers of pigment on to the surface of a fabric base which has been coated on both sides with the usual protective layers. The ground-work pigment may consist of a coloured pigment mixed with kaolin, coal tar oil, a separating agent (e.g. a mixture of zinc oxide, copal varnish, and drying oil), and oil of turpentine, while the second pigment, which is intended to combine with the first in such a way as to imitate the markings of the mineral, may contain, in addition to the pigment, kaolin, coal tar oil, and a separating agent.—C. A. M.

Transparent [lacquer] coatings; Process of producing —. E. N. Todd, Millburn, N.J. U.S. Pat. 1,143,464, June 15, 1915. Date of appl., Nov. 14, 1914.

THE article is coated with a hygroscopic lacquer and subjected to a temperature above the "dew point" of the surrounding atmosphere until the solvent of the lacquer has evaporated.—C. A. M.

Solvent for dried-in coats of oil colour, lacquer, or varnish; Non-inflammable and non-exploding —. S. Schwimmer, Budapest. Eng. Pat. 10,497, Apr. 28, 1914.

TETRACHLOROETHANE is mixed with other halogenated aliphatic or aromatic hydrocarbons (trichloroethane, carbon tetrachloride, and especially those of the benzene series), with or without the addition of aniline, paraffin wax, colophony, tar oils, etc., which may prevent evaporation or re-drying of the dissolved coats of paint, etc.—C. A. M.

Anticorrosive paints and the like; Process of making —. R. Eberhard, Munich, Germany. U.S. Pat. 1,145,186, July 6, 1915. Date of appl., Nov. 26, 1912.

SEE FR. Pat. 451,719 of 1912; this J., 1913, 666.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Rubbered balloon fabrics, G. Barr. Rubber Industry, London, 1914, 259—272.

ALTHOUGH rubber is not a perfect substance for the purpose, it is, on the whole, the most satisfactory material available for balloon envelopes. Various mechanical tests are discussed, including tensile strength of the rubbered fabric, and its dependence upon the humidity of the air; compound stress tests, bursting and tearing tests. Attempts to lessen gas-permeability by addition of wax to the rubber mixing have been partially successful. Of the two methods for measuring permeability, the static method, in which diminution of volume at constant pressure is measured, is open to objection on account of the progressively increasing impurity of the gas; diffusion of air into the envelope; leakage, uncertain and unknown, at the junction between the fabric and the rest of the apparatus; and of the fact that variations in outside temperature and pressure cause changes in the volume of the gas, which necessitate corrections of the same order of magnitude as the actual leakage. The dynamic

method in which a current of hydrogen at constant pressure is maintained past the inner surface of the envelope, and the leakage to the outside swept away, burnt, and weighed as water, is therefore to be preferred. Since the permeability varies about 7% for each 1° C. change of temperature, the latter should be regulated to within $\pm \frac{1}{2}^{\circ}$ C. The presence of moisture in the gas does not affect the observed permeability. The change in permeability due to "weathering" is discontinuous. At first there is a reduction in the rate (from 10 litres per day per sq. metre to $\frac{1}{2}$ litre per day or less), but after this the rate rises very rapidly. At the same time the acetone extract of the rubber rises (from 5% to 77%) and then falls (to 50%), whilst the soda extract increases (from 2½% to 13 or 14%). Deterioration is also due in part to oxidation of free sulphur, and the action of the sulphuric acid formed upon the fabric. Protection of the fabric from actinic rays by means of a coloured layer is effective, but there are drawbacks to the use of both lead chromate and yellow dyes for this purpose; the former may weaken the fabric, whilst the latter are usually not permanent.—E. W. L.

Plantation rubber; Advantages and defects of—W. A. Williams. Rubber Industry, London, 1914, 284—293.

MEDIUM grades of rubber, such as Africans, have been largely displaced by plantation rubber, because it gives less trouble in manufacture and better products. Where low resin content is a desideratum, as in certain work to specification, plantation rubber can be used where medium grades could not. Comparison with fine hard Para shows that the plantation product is inferior in uniformity and, generally speaking, in strength. In the author's opinion, if a more uniform product could be supplied in a damp condition than dry, the presence of moisture would not constitute a serious disadvantage. As examples of the variation which occurs in curing capacity, instances are quoted in which the time of cure had to be increased by 16·6, 40, and 100% respectively. Stress and strain tests do not give a sufficient indication of the value of plantation rubber as compared with Para, for although in this respect the two rubbers may be equal, the plantation product fails under fatigue, as when used for catapult cord.

Comparing the different forms in which plantation rubber is marketed, the author has found the best all-round manufacturing results to be given by unsmoked sheet. Crêping should be left entirely to the factory. Plantations should turn out the strongest possible product. Smoked sheet shows no advantage in working over unsmoked, and has the drawbacks of a higher loss on washing and higher resin content.

The effect of adding sodium bisulphite to the rubber mixing has been studied: 0·125% increases the time of cure 18%; 0·25% increases it 27% and reduces breaking stress 20% and strain 15%; 3% entirely prevents complete vulcanisation. In view of the marked effect upon cure of the presence of small quantities of certain impurities, chemicals should not be added to the latex or rubber without the most careful consideration.

—E. W. L.

Field and forest resources of British Guiana. Harrison and Baneroff. See XVII.

PATENTS.

Automobile tyres and like articles of vulcanised indiarubber; Removal of the fabric or like support from — and recovering indiarubber therefrom. H. Debaugé, Paris. Eng. Pat. 16,116, July 6, 1914. Under Int. Conv., July 12, 1913.

THE tyres are soaked in xylol or other solvent

for from two to three days, when the fabric can be easily stripped away from the rubber. The rubber cement, used for uniting the layers of fabric to each other and to the rubber layer, remains on the fabric, and can be removed from it by carrying the fabric, by means of a spiked cylinder, into contact with a revolving wire-brush. The friable rubber cement is brushed off into a casing below the brush, whilst the fabric is carried round to an exit opening where it is removed by means of springs pressing on the surface of the spiked cylinder. The rubber may be ground whilst still in the brittle, swollen condition, produced by the solvent, and the solvent recovered from it, and also from the fabric, by distillation either with steam or dry. In the latter case the distillation may be carried out under reduced pressure. The solvent may also be removed by washing with acetone or alcohol.—E. W. L.

Latex; Treatment of — and extraction of indiarubber therefrom. S. C. Davidson, Belfast. U.S. Pat. 1,145,351, July 6, 1915. Date of appl., Nov. 9, 1912.

SEE Eng. Pat. 25,256 of 1911; this J., 1913, 98.

Indiarubber; Extraction or coagulation of — from the latex. S. C. Davidson, Belfast. U.S. Pat. 1,145,352, July 6, 1915. Date of appl., Jan. 28, 1913.

SEE Eng. Pat. 11,470 of 1912; this J., 1913, 799.

XV. LEATHER; BONE; HORN; GLUE.

Gas tubing made of glue. See XXIII.

PATENTS.

Leather board; Waterproof — and process of preparing the same. F. B. Gallivan, Assignor to The Newton Co., Newton, Mass. U.S. Pat. 1,142,953, June 15, 1915. Date of appl., Apr. 3, 1911.

A PULP containing fibres of tanned leather is mixed with a gelatinous basic compound of aluminium or other metal or metals of the third group and made into the desired product.—C. A. M.

Leather; Manufacture or treatment of —. [Egg-yolk substitute.] O. Röhm, Darmstadt, Germany. Eng. Pat. 8877, Apr. 8, 1914. Under Int. Conv., Apr. 8, 1913.

SEE Fr. Pat. 470,594 of 1914; this J., 1915, 190.

Separating colloids from mixtures. Eng. Pat. 11,823 of 1914. See XI.

XVI. SOILS; FERTILISERS.

Soil protozoa and soil bacteria. E. J. Russell. Roy. Soc. Proc., 1915, B 89, 76—82.

THE soil may be regarded as a mineral framework covered with a complex mixture of soluble oxides, nutrient salts, organic substances, etc., and showing the physical properties of a colloid. In addition to air and water, it contains active bacteria, eel-worms, vermes, etc., and, according to Rothamsted experiments, a protozoan fauna (ciliates and amoebæ) of which some members at least are in a trophic state. The phenomena induced by the partial sterilisation of soils indicate that the activity of these protozoa is one of the factors limiting the number of bacteria in the soil; the only negative evidence is that the inoculation of protozoa into partially sterilised soils does not depress the bacterial numbers. The first experiments of Goodey indicated that soil protozoa were inactive, but the researches of Martin and Lewin

negated this view by showing that the organism introduced in hay infusions in cultural experiments are not identical with the protozoa native in the soil. Cunningham (this J., 1915, 561) estimates the number of trophic protozoa as at least many thousands per grm. of soil and has found that the introduction, under suitable conditions, of protozoa into partially sterilised soil causes a marked diminution in the numbers of bacteria. Goodey (this J., 1915, 438) concludes that the ciliates, amebæ, and flagellates in soil do not exercise any inhibitive function, but his inferences are vitiated by the objections that there is no evidence that the protozoa he used for inoculation were normal soil protozoa, and that, except in one case, there is nothing to show that they continued to exist after inoculation. Further, he probably failed to overcome the difficulty of securing an adequate control, for soil partially sterilised by heat, antiseptics, or prolonged storage is changed in other respects besides in that of the destruction of the limiting factor; ammonia is formed, the soluble matter is increased, and abnormal quantities of bacteria and of their products are accumulated. Cunningham has shown that the presence of unusually large numbers of bacteria hinders the development of protozoa in a cultural medium. Also the protozoa used by Goodey were introduced together with hay infusion and bacteria.—E. H. T.

Denitrification in arable soil. C. Lumia. *Annali Chim. Appl.*, 1915, 4, 1—55.

THE results of laboratory experiments performed, in part, in graduated burettes (see this J., 1914, 759) and, in part, in flasks fitted with gas outlet tubes, led to the following conclusions:—There are two kinds of denitrification, sharply distinguished one from the other, namely, rapid denitrification, in which a very short induction period is followed by a period of vigorous evolution of nitrogen, the added nitrate and that present in the soil being decomposed in a relatively short time; and slow denitrification, in which the induction period is longer and there is no vigorous evolution of nitrogen, the decomposition of the nitrate being slow and incomplete. In addition to the presence of nitrate and denitrifying organisms, and the absence of air in continuous circulation, the following conditions are necessary for rapid denitrification, viz., a temperature not below 22° C.; the presence of easily decomposable organic compounds, such as citrates, malates, etc., or of more complex organic substances, e.g., green stalks of leguminous plants, farmyard manure, straw, etc., capable of acting as sources of carbon for the denitrifying organisms; and the presence of a certain quantity of water (not less than 18% of the dry soil in the author's experiments). Denitrification is slow and incomplete when any of the conditions mentioned are not fulfilled, or when a substance, such as calcium cyanamide, which hinders or prevents denitrification, is present. The loss of fertility of soils under certain conditions, characterised by the plants suffering from nitrogen starvation, is due to rapid denitrification, and it is recommended that: (1) the soil should not be worked after light rain; (2) organic manures should be applied in autumn when the temperature of the soil is below 20°—22° C.; (3) calcium cyanamide or ammonium salts should be applied in preference to, or mixed with, nitrate fertilisers.

—A. S.

Plant food accessories (auximones); Bacterial test for —. W. B. Bottomley. *Roy. Soc. Proc.*, 1915, B 89, 102—108.

FOR such plant foot accessories as that obtained from an alcoholic extract of bacterised peat (which stimulates the growth and nitrogen-fixing power of *Azotobacter chroococcum*), the name "auximone"

(promoting growth) is recommended. A fresh culture of the nitrifying organisms in garden soil was used for inoculating normal nitrifying culture solution, and for the same mixed with the phosphotungstic and silver fractions respectively from one grm. of bacterised peat (see this J., 1914, 975). After 48 hours' incubation at 26° C., only those liquids which contained the added auximone were covered with a thick scum. The scum formation was not due to organisms introduced with the auximone, but was caused by the joint activity of at least two specific organisms originally present in the garden soil. These organisms are apparently widely distributed in soils, but different soils gave somewhat different effects. The scum formation is thus a test for the presence of auximones. The amount of scum formed was found to increase with the amount of plant food accessory present, and the presence of sugars, asparagine, peptone, tyrosine, and other organic substances had no influence upon the scum formation. The scum-forming organisms require no organic carbon for their growth; they can assimilate nitrogen from ammonium salts but not from nitrates; and they are equally serviceable for indicating the presence of other food accessories, e.g., vitamins. Experiments with fresh and with two-year-old rotted stable manure showed that auximone was present in both, and more in the latter than in the former. With the aid of this bacterial test, auximones have been discovered in the root nodules of leguminous plants. Plant auximones differ from those concerned in animal nutrition by their stability towards heat: a phosphotungstic extract from bacterised peat gave a thick scum after being heated at 134° C. for one hour in an autoclave.

—E. H. T.

PATENTS.

Fertiliser composition and process of making it. T. L. Willson and M. M. Haff, Ottawa, Assignors to Southern Investment Co. of Canada, Ltd., Montreal, Canada. U.S. Pat. 1,145,107, July 6, 1915. Date of appl., Aug. 18, 1913.

A SUBSTANTIALLY dry fertiliser is made by adding phosphoric acid and "potash" to phosphate rock and then introducing ammonia gas in larger quantity than required to neutralise the free acid.

—F. SODN.

Manure; Method for producing —. L. Kern, Hamburg, Germany. U.S. Pat. 1,145,370, July 6, 1915. Date of appl., April 16, 1914.

KIESELGUHR, containing, for example, 70% silicic acid, 5% iron oxide, and 4% alkali, is mixed with a solution of a potassium salt, and the mixture is calcined, preferably at 100°—200° C. Lime and phosphate powder may be added to the product.

—F. SODN.

Superphosphate chambers; Means for emptying —. H. W. Hall, Zürich, Switzerland. Eng. Pat. 2077, Feb. 9, 1915. Addition to Eng. Pat. 22,645, Nov. 17, 1914 (this J., 1915, 439).

THE principle involved in the main patent is applied to existing stationary reaction chambers by erecting a tilting track, resting on bearing bolts, within the chamber. The track is tilted whilst filling the chamber, but, before discharging, it is restored to its level position, to allow boards covering the surface of the track to be removed and the scraping machine to be shunted on; it is then tilted again so that the machine may advance.

—F. SODN.

Phosphate rock; Process of treating — to render its phosphate content available as plant food. W. F. Downs, Chatham, N.J., U.S.A. Eng. Pat. 16,335, July 8, 1914.

SEE U.S. Pat. 1,120,917 of 1914; this J., 1915, 94.

Reference is directed in pursuance of Sect. 7, Sub-sect. 4, of the Patents and Designs Act, 1907, to Eng. Pat. 6632 of 1887.

Treatment of sewage [to produce fertiliser]. Eng. Pat. 13,235 of 1911. See XIXB.

VII. SUGARS; STARCHES; GUMS.

Field and forest resources of British Guiana. J. B. Harrison and C. K. Bancroft. Bull. Imp. Inst., 1915. 13, 203—233.

Sugar products. The most important agricultural resource of the colony is the sugar cane, with which about 72,000 acres is planted, *i.e.*, about the same as eighteen years ago. The yield of sugar products has increased in recent years. The annual exports amount to about 110,000 tons of sugar, 3600 casks of molasses, 2,500,000 galls. of rum, and 12,000 tons of cattle food prepared from waste products of the sugar cane. There is a large amount of land suitable for sugar cane cultivation in the eastern and north-western parts of the colony, and if it were not for the scarcity of labour, it is estimated that by applying modern scientific methods of cultivation and manufacture, the annual production of sugar could be increased to 2½ million tons. The Bourbon cane, which was the source of the well-known "Demerara Crystals," has suffered severely in recent years from fungoid disease, and although new varieties have been developed capable of giving higher yields of sugar, none of them has proved equal to the Bourbon as a source of "Demerara Crystals." The most promising new varieties of cane are 208 B. and 117 B., imported from Barbados, and D. 625, Diamond 185, D. 118, and D. 145, raised in Demerara. The sugar-manufacturing industry is almost entirely in the hands of large capitalists and companies. *Rum* is produced from a molasses wash of sp.gr. about 1.06, rendered slightly acid, and fermented rapidly (36—48 hours) with pure yeast; the yield of alcohol is nearly quantitative. In 1914, 27 distilleries used pot or vat stills and 9 used continuous rectifying stills. A cattle food named *molaseuit* is made by mixing vacuum pan molasses with the finer particles of the inferior spongy tissues of the sugar cane separated from the megass. It has the following composition: moisture 17.3, fat 0.6, proteins 1.5, sucrose 36.1, dextrose 20.2, other soluble carbohydrates 7.3, digestible fibre 7.6, woody fibre 2.9, mineral matter (ash) 6.3%.

Coconuts. In the year 1914-1915 there was an area of 15,260 acres under coconut palms, of which a large proportion has not yet come into bearing. Imported coconut and other kinds of oil are being gradually replaced by coconut oil prepared locally. In the three years 1912—1914, the average annual exports of coconuts amounted to 1,427,644 tons; 1690 cwt. of copra was also exported in 1914.

Rubber. "Orinoco scrap" rubber is obtained from wild indigenous species of *Sapium*, and the cultivation of the Para rubber tree is being extended. In 1914 there was about 4040 acres under Para rubber, and tapping on an appreciable scale will be carried on within a year. There should be a reasonable profit with rubber at 2s. per lb.

Limes. At present there is about 1000 acres under limes, but there are large areas of suitable land, and British Guiana should become one of the most important producers of limes and their products in the world.

Other agricultural products are rice, coffee, cacao, cotton and other fibres, including *Hedycheum coronarium*, balata, timber, and small quantities of gums, oils, resins, etc. In cacao cultivation mixtures of potassium sulphate and superphosphate have proved to be the best artificial fertilisers. In

1913, 1,323,609 lb. of balata was exported. There is a small charcoal-burning industry; the exports amount to 80,000 bags of charcoal per annum. —A. S.

PATENTS.

Beet-molasses waste; Utilising — [recovering ammonia and hydrogen cyanide]. F. W. Huber and R. W. Poindexter, jun., Los Angeles, Cal. U.S. Pat. 1,145,484, July 6, 1915. Date of appl. July 21, 1914.

Waste liquors, such as those from the Steffen process, are concentrated and subjected to destructive distillation. The gases are heated beyond a red heat, to produce hydrogen cyanide, and, after being cooled sufficiently to deposit tarry matters, they are washed with acid to recover ammonia and finally cooled to condense moisture and hydrogen cyanide or washed with water to recover the latter. —J. H. L.

Dextrin and the like: Manufacture of —. F. E. Rudman, Radcliffe, Lancs. Eng. Pat. 16,362. July 9, 1914.

A SPRAY or shower of the finely powdered starchy material, entering an enclosed casing, is moistened by a spray of the hydrolytic agent, preferably hydrochloric acid. The starch and acid may enter the casing by separate inlets, or the acid may be injected into a pipe through which the starch is blown to the casing by hot compressed air. The moistened charge is heated in air-tight drums. —J. H. L.

Sugar masses; Process for colouring —, more particularly sweetmeat masses. Ungemach A.-G., Els Conserven-Fabr. u. Import-Ges., Schiltigheim, Alsace. Eng. Pat. 288, Jan. 5, 1914. Under Int. Conv., Feb. 25, 1913.

SEE Fr. Pat. 466,925 of 1913; this J., 1914, 879.

Process for producing and revivifying decolorising charcoal. Eng. Pat. 10,126 of 1914. See IIB.

Separating colloids from mixtures of colloids. Eng. Pat. 11,823 of 1914. See XI.

XVIII.—FERMENTATION INDUSTRIES.

Electrical effects accompanying the decomposition of organic compounds. 11. Ionisation of the gases produced during fermentation. M. C. Potter, Roy. Soc. Proc., 1915. A 91, 465—480. (See this J., 1911, 1188.)

A METAL plate suspended above a fermenting solution of commercial glucose and charged to a potential of 110 or 220 volts, was found to be slowly discharged by the fermentation gases, whether its original charge was positive or negative. It is concluded that the carbon dioxide evolved during the fermentation of glucose by yeast carries both positive and negative ions. It is suggested also that the gases produced during the putrefaction of organic matter are ionised, and the ionisation of the atmosphere may be due in part to the presence of such gases escaping from the soil and water. —J. H. L.

Alcoholic fermentation. G. Paris. Boll. Ministero Agric., Ind. e Comm., 1915. 1, B., 30. Annali Chim. Appl., 1915. 4, 70.

THE use of musts sterilised by means of sulphurous acid and of pure cultures of yeasts habituated to sulphurous acid, is advocated. By using pure cultures of yeasts from different varieties of grapes, and a sterilised solution containing 20% of sugar, the author prepared wines of an alcoholic strength

0.8–0.9% higher than that of wine prepared in the usual way.—A. S.

Fermentation; Inhibitory action of hydrogen ions on —. E. Hagglund. *Biochem. Zeits.*, 1915, **69**, 181–191. *J. Chem. Soc.*, 1915, **108**, i., 629.

THE rate of fermentation with a yeast R.XII was measured in the usual manner in the presence of varying concentrations of lactic acid. The inhibition by the acid of the rate (calculated as relative rates after two days) was found to be directly proportional to the hydron concentration. Above 35° (and up to 40° C.), the inhibitory action of the acid increased.

Yeast; Protein changes in —. II. Influence of the medium on protein degradation. W. Zaleski and W. Schataloff. *Biochem. Zeits.*, 1915, **69**, 294–304. *J. Chem. Soc.*, 1915, **108**, i., 620–630.

ALCOHOLS inhibit the proteolysis of hefanol. Hydrochloric acid in low concentrations (N/920—N/60) exerts no influence, but in higher concentration (N/23) its action is inhibitory. Other acids (phosphoric, oxalic, lactic, pyruvic, acetic, and citric acids) accelerate proteolysis up to a certain concentration, above which they exert an inhibitory action. Alkalis and sodium pyruvate have an inhibitory action.

Field and forest resources of British Guiana. Harrison and Bancroft. See XVII.

Use of aluminium in industries concerned with foods. Trillat. See XIXA.

PATENTS.

Compounds of mineral oils and solids or wax and malt extract or malto-dextrin; Process of producing dry pulverulent or pulverisable —. M. Hamburg. Bishop's Stortford, Herts. Eng. Pat. 26,390, Nov. 17, 1913. Addition to Eng. Pat. 29,481 of 1912 (this J., 1913, 672).

A MINERAL oil, or a mineral solid or wax which when melted has the character of an oil, is emulsified with a highly concentrated malt extract or malto-dextrin syrup, without the addition of an emulsifying agent, and the emulsion is dried. The proportions used are 25% of oil or wax and 75% of malt extract or syrup.—J. H. J.

Distillation and rectification; Process for separating the first and last runnings in —. F. Pampe. Halle, Germany. U.S. Pat. 1,145,332, July 6, 1915. Date of appl., Apr. 18, 1905; renewed May 28, 1915.

SEE Eng. Pat. 8176 of 1905; this J., 1906, 230.

Sparkling wines and the like; Manufacture of — and apparatus for use therein. A. Chaussepied, Saumur, France. Eng. Pat. 14,459, June 16, 1914. Under Int. Conv., June 17, 1913.

SEE Fr. Pat. 470,539 of 1913; this J., 1915, 191.

XIXA.—FOODS.

Aluminium; Use of — in industries concerned with foods. A. Trillat. Bull. Soc. d'Encour., 1915, **132**, 555–574.

THE author describes the properties of commercial aluminium and the influence of various conditions on its corrosion (see Heyn and Baner, Chapman, Bleisch, Schönfeld and Himmelfarb, Bailey, and Scala; this J., 1911, 218; 1912, 87, 199, 789; 1913, 293, 368). Copper and magnesium present as impurities in the metal accelerate corrosion, whereas iron and silicon have scarcely

any influence. The presence of arsenate of iron (e.g., 1.5%) in the metal, or traces of arsenates in the liquid with which it is in contact, retards corrosion. Hard-rolled aluminium corrodes more rapidly than softer kinds, but by heating the former at about 400° C. it is rendered more resistant, though at the expense of mechanical strength (cp. Bleisch, and Heyn and Bauer, *loc. cit.*). The loss of strength is usually not a serious matter if the metal is more than 2–3 mm. thick. By treating aluminium with a dilute solution of ammonia or sodium carbonate, a hard reddish-brown coating is formed which retards further corrosion. In some cases other protective coatings may be used, containing celluloid, cellulose acetate, caoutchouc, vaseline, or paraffin. Celluloid varnish will prevent corrosion in acid liquids for a long time, but eventually the celluloid swells and becomes detached. The tendency of different samples of aluminium to corrode may be compared by measuring the rates at which they evolve hydrogen when immersed in acid or alkaline liquids under similar conditions. There is little or no evidence that salts of aluminium are toxic; the amounts of the metal dissolved by most liquids in contact with aluminium are small compared with those present in some foodstuffs. The conclusions of the author respecting the use of aluminium in brewing confirm those of other investigators (see this J., 1912, 87, 109, 247, 789; 1913, 248). The vessels used should have as smooth a surface as possible, and be kept dry when not in use. Aluminium stills have been used successfully in distilleries (cp. Rüdiger and Karpinski, this J., 1913, 41), but they should not be provided with copper taps. In the milk and cheese industries aluminium is suitable for the construction of vessels for storing and skimming milk, moulds for curds, and vats for the manufacture of cheese; it is not recommended for milk cans for transport, as these are subject to rough usage. Wine may be fermented in aluminium vats, but not stored in them, as the metal leads to turbidity by precipitating the tannins.—J. H. L.

Phosphatides of milk. T. B. Osborne and A. J. Wakeman. *J. Biol. Chem.*, 1915, **21**, 539–550.

TWO phosphatides were separated from milk. One contained nitrogen and phosphorus in the ratio of 1:1, and yielded choline (containing one-half of the nitrogen), fatty acids, and glycerophosphoric acid in proportions corresponding approximately with a stearyl-oleyl-lecithin of the structure commonly assumed for this substance. The other phosphatide contained nitrogen and phosphorus in the ratio of 2:1, and belonged to the group of diaminophosphatides; it was apparently similar to, and possibly identical with, the diaminophosphatide obtained from egg-yolk, ox and horse kidneys, and other animal organs. Both these phosphatides were obtained from alcoholic extracts of the coagulum which forms when milk serum is boiled after the casein has been precipitated with dilute hydrochloric acid.

—W. P. S.

Banana meal from Jamaica. Bull. Imp. Inst., 1915, **13**, 200–201.

A SAMPLE of banana meal from Jamaica contained: moisture 12.0, crude protein 4.6, fat 0.6, starch, etc. (by diff.) 79.6, fibre 0.7, ash 2.5%; the nutrient ratio was 1:17.6; food units, 93. One-half of the crude protein consisted of nitrogenous substances, probably amides, inferior to true proteins in food value. Banana meal might be used locally as a partial substitute for wheat flour or maize meal, but is distinctly inferior in nutritive value.—A. S.

Peptones: Separation and determination of—by their solubility in methyl and ethyl alcohols. E. Vlahuta. *Bull. Acad. Române*, 1914/5, 3, 290—300. *J. Chem. Soc.*, 1915, 108, i, 602—603.

THE peptones resulting from the partial hydrolysis of a number of different proteins obtained from various sources, using Fischer's method, were separated into four fractions, varying in their solubilities in methyl alcohol. The protein material was added in small quantities to 70% sulphuric acid at 0° C. with constant stirring, and kept at this temperature for two hours. The mixture was kept for three days at the ordinary temperature, with frequent stirring, and then poured into twenty litres of distilled water at 0° C., and the sulphuric acid was just completely precipitated with barium hydroxide. The barium sulphate was filtered off and the filtrate evaporated to dryness at 35—40° C. under reduced pressure (15 mm.). The peptone residue was divided into four fractions as follows: the peptone was extracted with hot methyl alcohol and filtered, the insoluble portion being fraction I. The filtrate on standing for twenty-four hours gave a deposit, fraction II, which was filtered off. The filtrate on dilution with an equal volume of ethyl alcohol gave a further deposit, fraction III, and the filtrate from this on evaporation in a vacuum at 35—40° C. left a residue, fraction IV. These four fractions, of which all but the first were invariably easily soluble in water, were tested in aqueous solution by the biuret reaction, Millon's reagent, for cystine, for tryptophan, and for precipitation with the usual protein precipitants. In addition the ash content was determined and the optical rotation measured. This method was applied to the gluten of wheat, the protein of beef, the protein of fish, the albumin of eggs, the casein of milk, and keratin. The results obtained show that the peptones bear the mark of their origin. Thus, from proteins rich in cystine or tyrosine, peptones were obtained also rich in these substances, and *vice versa*.

Amino-acid content of certain commercial feeding-stuffs and other sources of protein. E. H. Nollau. *J. Biol. Chem.*, 1915, 21, 611—614.

THE following results were obtained in an investigation of the nitrogen distribution in various protein substances: the method employed was that described by Van Slyke (this J., 1911, 1135):

Field and forest resources of British Guiana. Harrison and Bancroft. *See* XVII.

PATENTS.

Wheat and other cereals or cereal products; Treatment of— C. W. Chitty, Dover, W. Jago, London, W. Watson, and Woodlands Ltd., Dover. Eng. Pat. 16,664, July 13, 1914.

A CEREAL or cereal product is mixed with water and subjected to electrolysis, and the mixture is then used as a flour improver, either directly or after concentration; the liquid portion may be separated from the electrolysed mixture, and used for the same purpose either in the liquid form or after evaporation to dryness. A small quantity of phosphoric acid is added in the preparation of the first mixture in order to render the liquid a conductor; in subsequent batches, the phosphoric acid may be replaced by a portion of the liquid from a previous batch.—W. P. S.

Flour; Process of treating— W. G. Andrews, Chicago, U.S.A. Eng. Pat. 2416, Feb. 16, 1915.

FLOUR is heated to 100°—125° F. (38°—52° C.) and passed between rollers heated to a similar temperature and held against each other with considerable pressure, the object being to rupture the starch cells and so improve the baking quality of the flour.—W. P. S.

[Flour] bleaching-gas generator. J. Neely, Lapeer, Mich. U.S. Pat. 1,145,609, July 6, 1915. Date of appl., Oct. 16, 1914.

A CHAMBER divided into a number of communicating compartments, is attached at one end to a closed tank containing a reagent, and galvanised wire is fed intermittently into the latter; the nitric oxide formed is drawn into the chamber by the action of a fan in one of the compartments and distributed to the place where it is required.—W. P. S.

Baking powder or self-raising flour; Acid basis to be used in baking or in the manufacture of— J. A. Jessop, Bradford, A. J. Walker and E. P. Hatschek, Needham Market, Suffolk. Eng. Pat. 24,286, Dec. 18, 1914.

A DRIED mixture of 1 part by weight of lactic acid (containing 75% of actual acid) with 1.25 parts

Nitrogen as:—

	Ammonia.	Melanine.	Cystine.	Arginine.	Histidine.	Lysine.	Mono-amino-acid.	Proline, oxyproline, tryptophane, etc.	Total.
	%	%	%	%	%	%	%	%	%
Soya bean	12.97	3.69	1.52	15.52	2.60	7.02	48.76	7.12	99.20
Distillers' dried grains...	13.06	8.21	3.02	11.27	0.00	4.79	50.68	10.66	101.70
Cottonseed meal	14.06	6.27	2.74	12.77	7.57	1.94	45.02	7.49	97.86
Cow pea	11.83	9.57	6.74	15.98	0.00	3.56	46.70	0.58	94.96
Wheat bran	9.67	13.75	5.96	12.53	3.84	4.04	49.95	0.00	99.74
Maize kernel	4.63	7.00	4.06	16.19	4.45	8.53	49.69	0.00	94.55
Hemp seed	9.93	4.15	2.05	21.38	3.01	6.71	44.20	5.28	96.73
Rice	10.23	9.98	6.97*	11.94	3.18	0.00*	38.83	15.90	97.03
Sunflower seed	15.42	5.73	2.98	16.80	4.56	4.86	45.32	5.27	100.92
Rolled oats	13.12	2.60	5.22*	12.12	10.54	0.00*	46.99	12.68	103.27
Oat grain	13.31	2.97	4.48*	11.42	9.58	0.00*	43.49	11.29	96.54
Sprouted oats	13.18	2.40	5.32*	11.26	9.61	0.70*	41.61	12.48	96.56
Barley grain	16.19	2.87	4.38*	8.65	6.70	0.00*	44.16	18.37	101.32
Rye grain	15.00	1.54	2.20	10.49	10.48	1.24	37.96	21.63	100.52
Swift's digester tankage ..	10.03	6.88	2.46	12.34	2.18	2.50	54.73	9.01	100.13
Armour's dried blood	6.19	5.69	2.02	7.72	8.37	9.97	51.53	3.94	95.44
Unroasted peanut	10.93	4.36	0.81	20.82	6.13	5.31	52.36	1.40	99.12
Black walnut	10.71	4.53	1.27	23.77	5.98	3.49	45.01	3.12	97.90
Shellbark hickory nut	9.47	6.59	1.58	24.24	6.66	3.37	43.25	7.48	103.61
Pecan	9.43	6.21	2.87	6.91	21.91	3.25	42.28	7.89	100.75
Gluten flour	22.99	1.31	2.12	8.86	5.18	0.40	49.19	7.67	97.72
Wheat gluten	22.53	1.01	1.91	7.61	5.57	0.51	49.05	9.76	97.95

* These results are possibly not quite correct, the cystine being too high and the lysine correspondingly low.

by weight of any farinaceous flour or meal, or absorbent substance.—W. P. S.

Process for treating oils and fats. U.S. Pat. 1,144,539. See XII.

XIXB. WATER PURIFICATION; SANITATION.

Air; Methods of bacterial analysis of —. G. L. A. Ruehle. J. Agric. Res., 1915, 4, 343—368.

THE bacterial content of air may be determined by finding the number of organisms present in a given volume, or the number precipitated on a known area in a given time. The former method has been tested by a rigorous investigation of three forms of apparatus: the standard sand-filter "aeroscope" recommended by the American Public Health Association, a modified form of it, and Rettger's apparatus in which the air is bubbled through pure water or physiological salt solution which retains the bacteria. The standard aeroscope consists of an upright cylindrical glass tube, 70 mm. long by 15 mm. wide, fitted at each end with a rubber stopper carrying a tube, 40 × 6 mm. The upper tube is bent at 45°; the lower one is straight and is attached to the aspirator. Immediately above the lower stopper is a layer of bolting cloth which supports a 10 mm. layer of sand, the particles of which will pass through a 100-mesh, but not through a 200-mesh sieve. In the modified form the small tube at the lower end is fused into the larger one and the sand (100—160 mesh sieve) is supported on a layer of cotton. The upper stopper is made of cork so that the apparatus can be sterilised by dry heat instead of by steam. The Rettger apparatus resembles a small gas wash-bottle, the bottle being replaced by a thick-walled test-tube, and the long inlet tube made to terminate in a bulb with 8—10 small perforations. Two of each kind of aeroscope, joined in tandem, were used for the tests, which showed that the modified standard instrument was much superior to the standard, retaining nearly 100% of the bacteria in the first tube. The efficiency of the standard aeroscope was very variable, probably owing to the caking of the sand during the sterilisation with steam. The modified apparatus is cheaper, less fragile, easier to operate, and better adapted for field-work than either the standard form or that of Rettger. The last-named can give excellent results to an experienced worker, but its manipulation needs much care, the rubber stopper tends to leak after sterilisation, the liquid may froth, and the bacteria are inclined to adhere to the inner surface of the moist inlet tube. The comparative results with all three forms of aeroscope were found to be reliable only when a large number of analyses were performed. The method of enumerating air bacteria by precipitation on exposed Petri plates is extremely unreliable, as it only measures the number of bacteria-laden dust particles which fall upon the plates. A much better method is to expose a given quantity of sterilised water in a sterilised pail for a definite time. The numbers of bacteria so found were from 2 to 32 times greater than those obtained by the plate method. Bacterial analyses of air are of especial importance in relation to the bacterial contamination of milk in the cow-shed.—E. H. T.

Action of chlorine on sodium thiosulphate [in respirators]. Self. See VII.

PATENTS.

Water; Purification and sterilisation of —. H. Kriegsheim, Berlin. Eng. Pat. 17,494, July 23, 1914. Under Int. Conv., Aug. 12, 1913.

THE water is sterilised by means of chlorine or

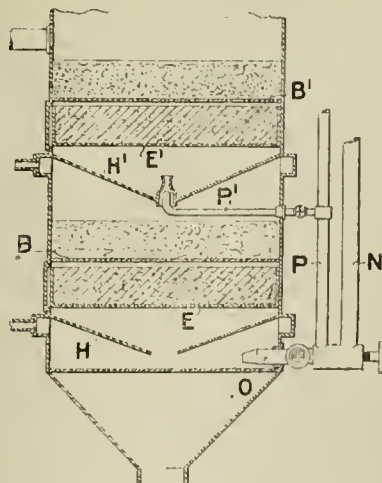
bleaching powder, and then filtered through bodies with microscopic pores, such as natural and artificial zeolites, coated or impregnated with a catalyst, such as freshly precipitated manganese dioxide or iron oxide, when the oxygen formed in the sterilisation reaction is converted into ozone. To prevent the formation of ozone, an oxide of lead, copper, cerium, nickel, or cobalt, should be used as catalyst. If the silicate used contains manganese and nickel oxides, permanganate is produced, which acts on oxidisable matter in the water, and the excess is removed by silicates containing reduced manganese compounds. No substance remains in the filter to cause obstruction.—J. H. J.

Water-still. J. A. Manahan, Assignor to T. Manahan, New York. U.S. Pat. 1,145,497, July 6, 1915. Date of appl. April 5, 1913.

WATER is evaporated in a chamber at the lower part of a cylindrical casing, and the steam passes upwards through tubes, constricted at their middle and widened at the ends, and enters a reflux condensing apparatus in the upper part of the casing. Air is injected into the steam as it passes through the tubes, the air nozzles projecting from below into the tubes near the constricted portion. The condensed water collects in the part of the casing between the evaporator and the condenser, and is drawn off and passed through a cooling coil.—W. P. S.

Filtration, aeration, and gasification of liquids [e.g. sewage]; Apparatus for the —. T. K. Irwin, London. Eng. Pat. 19,901, Sept. 17, 1914.

PERFORATED trays, B, B', carry layers of surface contact filtering material such as clinker or coke, and similar trays, E, E', carry layers of fine filtering



material such as sand. Sewage enters by the pipe, X, and inlet, O, and air under pressure by the pipes, P, P'. Cones, H, H', are provided to act as grease traps. Precipitants or other chemicals may be added at the various stages, and the air may be drawn off at the top and used over again.—W. E. F.

Liquids; Apparatus and process for the purification of —. B. B. Crombie and C. J. A. Dalziel, Westminster. Eng. Pat. 21,513, Oct. 26, 1914.

THE liquid is run from a supply tank to the bottom of a treatment box containing aluminium-alloy plates, so placed that each alternate plate is fixed to one side of the box and extends nearly across the box, the intermediate plates being fixed to the

opposite side. The plates contain 3 grains of platinum per lb. and are connected by wires to a source of electric supply so that they are alternately positive and negative. The liquid entering the box passes between the plates, the rate of flow being regulated according to the amount of treatment required. The dissolved solids are precipitated. From the treatment box the liquid passes to a sedimentation tank with a bottom sloping to a sump at the centre: the precipitated solids settle to the bottom and are run off from the sump. The clarified liquid leaves the tank by a pipe at the surface, protected by a strainer.

—J. H. J.

Sewage sludge; Apparatus for the destructive distillation of—, R. Nübling, Stuttgart-Gaisburg, and A. Krauss, Ludwigshafen, Germany. Eng. Pat. 10,071, April 23, 1914. Addition to Eng. Pat. 9341 of 1914 (see Fr. Pat. 470,848; this J., 1915, 197).

The invention relates to the distillation of sludge in retorts which are heated by waste gases from an illuminating gas plant. A double furnace contains a gas producer and the sludge distilling retorts in its lower portion and the gas retorts in its upper portion. The gases from the producer pass up into a combustion chamber surrounding the gas retorts, and the waste combustion gases pass downwards into the chamber in which the sludge retorts are situated, effecting the drying and distillation of the sludge. The gas given off in the sludge retorts is added to that produced in the coal retorts.—J. H. J.

Sewage; Treatment of— [to produce a fertiliser]. T. K. Irwin, Westminster. Eng. Pat. 13,235, May 29, 1914.

The sewage, to which a basic or an acid phosphate or other precipitant has been added, is passed through a long tank with sloping sides, from which the sludge is removed by a set of mechanical scrapers into a culvert in the centre or at each side, whence it gravitates into a receiving tank. Here it is mixed with 0.25–5% of yeast, starch waste, or other fermentable matter, and heated to 90° F. It is then run into a second long tank where it undergoes digestion, the solid matter rising to the surface. The liquid is drawn off through a pipe with $\frac{3}{4}$ -inch perforations, and the solids are dried and powdered for use as a fertiliser.—J. H. J.

Destructor furnaces or stores. J. Thomas, Kenilworth, Warwickshire. Eng. Pat. 19,334, Sept. 2, 1914.

To prevent escape of smoke during the charging of destructors for household use, the air door of the combustion chamber, which is moved in one direction by the action of gravity, a spring, or a weight, controls the action of the charging door of the fire chamber by means of connecting levers. The action is such that when the air door is opened the charging door is closed, and *vice versa*. Means are also provided for opening the air door to any extent independently of the charging door, when desired. The doors may have either a vertical or horizontal movement. (See also Eng. Pat. 24,923 of 1913; this J., 1914, 842.)—J. H. J.

Destructor apparatus for the treatment of faecal or other sewage matter. S. O. S. Ltd., and E. W. Janson, London. Eng. Pat. 19,561, Sept. 8, 1914.

The apparatus consists of a hopper with an air-tight cover and containing a pair of hollow rollers heated by gas produced in the process. The hopper opens into the top of a cylindrical iron vessel or mechanical retort, containing a series of hollow shelves communicating with each other at the side of the cylinder, and having one axial slit or opening

in each. A central rotating shaft carries arms which are fitted with scrapers. A small gas producer supplies the bottom shelf of the retort with hot gases, which are drawn upwards through the connecting passages and shelves by a fan at the top of the retort. The faecal matter is introduced into the hopper, passes through the heated rollers which evaporate the urine, and is discharged on to the top shelf of the retort. The scraping arms push the material round the shelf to the radial opening, through which it drops on to the next shelf, and so on. The coke finally produced is collected at the bottom and used to charge the gas producer. The oil, ammonia, and gas, given off during the passage of the material down the retort, pass out through side tubes into a pipe leading to a condenser, from which the uncondensable gas is led to the gas producer, while the ammonia liquor and oil are recovered, the oil being used in the gas producer and the ammonia liquor as a disinfectant.

—J. H. J.

Garbage; Process for treating—, T. C. Pardington, Cincinnati, and J. G. Ashby, Montgomery, Ohio. U.S. Pat. 1,145,845, July 6, 1915. Date of appl., Oct. 21, 1911.

GARBAGE is subjected to the action of highly heated steam in a closed tank; a stirrer agitates the garbage during the treatment and causes it to move upwards in the tank. Means are provided for drawing off and condensing the vapours evolved and for separating the volatile and fatty oils. The treated garbage is discharged from the bottom of the tank into a vessel fitted with an air-tight cover.

—W. P. S.

Base interchanging substances [water softeners]; Manufacture of—, Permutit Aktienges., Berlin. Eng. Pat. 20,144, Sept. 24, 1914. Under Int. Conv., Sept. 23, 1913.

GELATINOUS precipitates containing silicic acid, obtained, for example, as described in Ger. Pat. 174,097 of 1905 (this J. 1907, 771), are converted into granular filtering material by slowly drying the filtered and incompletely lixiviated material below 100° C. and "hydratising" the hard product by treating with water.—F. SOEX.

Water; Treatment of— [to remove dissolved oxygen]. R. von Walther, Dresden, Saxony. Eng. Pat. 9031, Apr. 9, 1914. Under Int. Conv., Apr. 10, 1913.

SEE FR. PAT. 473,092 OF 1914; THIS J., 1915, 509.

Water purifying apparatus. Maschinenbau-Anstalt Humboldt, Cologne-Kalk, Germany. Eng. Pat. 10,157, Apr. 24, 1914. Under Int. Conv., Sept. 25, 1913.

SEE FR. PAT. 171,079 OF 1914; THIS J., 1915, 197.

Sewage sludge; Treatment of—, R. Nübling, Stuttgart-Gaisburg, and A. Krauss, Ludwigshafen. Eng. Pat. 9341, Apr. 15, 1914. Under Int. Conv., Apr. 30, 1913.

SEE FR. PAT. 470,848 OF 1914; THIS J., 1915, 197.

Apparatus for filtering liquids [water]. Eng. Pat. 16,185 of 1914. See I.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Cinchona assay. P. J. Kruysse, Chem. and Drug., 1915, 87, 155.

SIX grms. of the coarsely powdered bark is moistened with 1.5 c.c. of ammonia solution and 1.5 c.c. of water; 6 grms. of sand is added, and the whole

rubbed in a mortar to fine powder; 3 grms. of slaked lime and, when a homogeneous mixture is obtained, 3 c.c. of water are then added, and the mixture is extracted with acetone (174 c.c.) by boiling for half an hour. After cooling, the loss by evaporation is made good by adding more acetone, the solution filtered, and 150 c.c., representing 5 grms. of cinchona-bark, collected. The acetone is removed by distillation, and the residue dried on the water-bath. To the alkaloids so obtained 1 or 2 c.c. of hydrochloric acid and 20 c.c. of water are added and the solution is filtered. In order to remove excess of fat, it is advisable to shake out with ether or chloroform in alkaline solution, the alkaloids being subsequently removed from the organic liquid by shaking out with acidulated water. (In the case of *C. succirubra* bark the removal of fat is absolutely necessary, but in the case of *Ledgeriana* bark it may be omitted.) The warm acid solution of the alkaloids is neutralised with ammonia, using litmus as indicator, and the quinine precipitated as oxalate by adding to the boiling neutral solution 0.5 gm. of ammonium oxalate. When a large quantity of quinine is present, as in *Ledgeriana* bark, the quinine oxalate is precipitated as the solution cools. If the precipitate does not appear in from five to ten minutes, as in the case of *Succirubra* bark, 220 mgrms. of quinine hydrochloride is dissolved in the solution, which is again brought to the boiling-point. (If this addition is necessary, 0.5% must be deducted from the amount of quinine sulphate found.) The crystals, which in the case of *Ledgeriana* bark consist of pure quinine oxalate, are collected on a filter, washed with water, dried at 100° C., and weighed. The weight multiplied by 1.2 plus 20 mgrms., which must be allowed for the solubility of the quinine oxalate, gives the quantity of quinine sulphate in 5 grms. of the bark.

In the analysis of *Succirubra* bark the precipitate obtained consists, on an average, of 72.5% of quinine oxalate, 23.6% of cinchonidine oxalate, and 4% of impurities. It is therefore necessary in such a case to convert the quinine into the nitroprusside compound as follows: To a neutral solution of the precipitate in 75 c.c. of water, 0.5 gm. of sodium nitroprusside is added; after cooling, the crystals of quinine nitroprusside are collected, dried, and weighed; the weight, multiplied by 1.04, gives the corresponding quantity of quinine sulphate, to which must be added 50 mgrms., representing loss owing to the solubility of the quinine oxalate and the quinine nitroprusside. The result is the quantity of quinine sulphate in 5 grms. of the bark.

If the quantity of cinchonidine and cinchonine in the bark is also required, the cinchonidine can be determined by precipitating it from the united filtrates as cinchonidine tartrate. The cinchonine can then easily be determined, as it is insoluble in ether.

Cinchona alkaloids; Compounds of — with metals and phosphoric acid. E. D. Watkins. *Biochem. Bull.*, 1915, 4, 91—95. *J. Chem. Soc.*, 1915, 108, i., 580.

COMPOUNDS of silver with quinine and orthophosphoric acid were obtained; these are stated to be of therapeutic value; all attempts to crystallise the compounds failed.

Erythrin; Structure of —. E. Zerner. *Monatsh. Chem.*, 1914, 35, 1021—1024. *J. Chem. Soc.*, 1915, 108, i., 551.

THE author criticises the formula of Laynes (*Annalen*, 1861, 132, 355) and of Hesse (*J. prakt. Chem.*, 1898 [ii.], 57, 232) for erythrin and shows that the behaviour of the compound is best represented on the assumption that the orsellinic acid residues are differently attached to the

erythritol molecule as shown in the formula: $(HO)_2(C_6H_3)_2C_6H_2CO_2C_6H_3(OH)_2O_2C_6H_3(OH)_2COOH$. This formula not only explains the acid character of erythrin, but also accounts for the fact that only one molecule of orsellinic acid is removed by hydrolysis. The picroerythrin resulting from the hydrolysis still possesses acid properties, gives a violet coloration with ferric chloride, and, therefore, must contain a free hydroxyl in the *ortho*-position to the carboxyl group.

Convallarin. J. Lindner. *Monatsh. Chem.*, 1915, 36, 257—267. *J. Chem. Soc.*, 1915, 108, i., 571—572.

A SAMPLE of commercial convallarin, a glucoside first isolated from the Lily of the Valley (*Convallaria majalis*) by Walz in 1858, was investigated, and the author was unable to verify Walz's statement that it can be made to assume a crystalline condition. Analysis indicated a formula, $C_{25}H_{46}O_{10}$, instead of $C_{24}H_{42}O_{11}$, as suggested by Walz. By heating with dilute sulphuric acid, convallarin is hydrolysed to a hexose and convallaretin, the latter forming crystals which decompose without melting on heating. The formula of convallaretin is probably $C_{19}H_{28}O_4$, this being confirmed by analysis and by molecular-weight determination in phenol. Convallaretin forms a stable monohydrate; it is free from ethylenic linkings, ketonic groups, and methoxyl groups, but contains a benzene ring and two hydroxyl radicals; the two remaining oxygen atoms appear to constitute part of a carboxy-ester group.

Tartaric acid; Polarimetric researches on the modifications that — undergoes during fusion. G. Bruhat. *Ann. Chim.*, 1915, [ix], 3, 121—140. *J. Chem. Soc.*, 1915, 108, i., 196.

THE author has followed the changes which take place in tartaric acid on fusion by frequent measurements of the rotation of an aqueous solution of the superfused acid over a long period of time. The chemical changes which take place are the same whether boric acid is present or not, the influence of the latter tending only to modify the rotatory power of the solutions. This change in the solution of the superfused acid takes place in two stages: (1) a rapid modification finished in a few hours, marked in both cases by a diminution in the rotation, slightly less rapid in the presence of boric acid; (2) a slow modification, lasting several months, which produces a diminution of the rotation for pure tartaric acid, and an increase in the presence of boric acid, there being an increase in the dispersion in the latter case. The author considers that the second phase is due to the transformation of ditartaric acid into tartaric acid, and this is borne out by measurements at frequent intervals of the acidity of the solution, which increases slowly with the time for several months. The first phase is apparently unaccompanied by any change in acidity, and is probably due to the conversion of metatartaric acid into tartaric acid.

Dichlorodinitromethane; Preparation of —. J. N. Rakshit. *Chem. Soc. Trans.*, 1915, 107, 1115—1117.

WHEN concentrated nitric acid is added to cooled acetone containing a considerable quantity of solid calcium chloride, simultaneous nitration and chlorination of the acetone takes place with evolution of chlorine, nitrosyl chloride, and nitrous fumes. The reaction is violent and may become explosive if large quantities of the reagents are employed. On pouring the acid layer, which floats on the calcium chloride solution, into water, dichlorodinitromethane separates as a pale yellow oil, b.p. 121°—122.5° C. If the reaction is pro-

longed for 24 hours, using excess of acid and calcium chloride, a colourless, more highly chlorinated product is obtained. Dichlorodinitromethane is moderately volatile and has an extremely pungent odour; its vapour powerfully affects the eyes. It is insoluble in water but soluble in most organic solvents.—T. C.

Sarcosine: Preparation of —. L. Baumann. J. Biol. Chem., 1915, 21, 563—566.

THE following method for the preparation of sarcosine yielded 25% of the quantity required by theory; 65 grms. of potassium cyanide dissolved in the least possible quantity of water at 10° C. was added gradually to 67.5 grms. of methylamine hydrochloride dissolved in 120 c.c. of 37% formaldehyde solution; when the temperature of the mixture reached 70° C., any further rise was prevented by external cooling. After 3 hours the mixture, consisting of an aqueous and an oily layer and a sediment of salts, was extracted with ether, the ethereal extract dried with anhydrous sodium sulphate, filtered, and evaporated. The residue was heated for 12 hours under a reflux apparatus with 400 c.c. of water and 125 grms. of barium hydroxide, then cooled, filtered, treated with a small quantity of ammonia, and the barium precipitated with carbon dioxide. After filtering off the barium carbonate, the solution was concentrated under reduced pressure to a syrup, and the sarcosine crystallised from alcohol.—W. P. S.

Will indigo (Baptisia tinctoria): Blackening of the leaves of the —, and the isolation of a new phenol, baptisol. E. D. Clark. J. Biol. Chem., 1915, 21, 645—660.

THE leaves of the plant *Baptisia tinctoria* change rapidly in colour from green to black when they are bruised or frost-bitten; the blackening seems to be produced by any agency that disturbs the normal relationships of the cells containing certain enzymes and those containing the substrate, and is probably due to enzymic hydrolysis and oxidation. A new phenol, baptisol, $C_{15}H_{11}O_5$, m.pt. 213° C., was isolated from the efflorescence on the dried leaves after these had been blackened by vapours of chloroform, etc. The formation of triacetylbaptisol, m.pt. 189° C., and tribenzoylbaptisol, m.pt. 183° C., indicates the presence of three hydroxyl groups; one methoxyl group is also present. Baptisol differs in its properties from two other phenols having the same empirical formula, namely butin from *Butea frondosa* and naringenin from *Citrus decumana*.—W. P. S.

Yohimbine (quebrachine). G. Barger and E. Field. Chem. Soc. Trans., 1915, 107, 1025—1030.

ANALYSES of yohimbine crystallised from benzene and dried at 100° C. agree with the formula, $C_{22}H_{28}O_3N_2$. It combines with methyl iodide to give a methiodide $C_{22}H_{30}O_4N_2 \cdot CH_3I$, and with one and two mols. of bromine in chloroform solution yielding the hydrobromides of monobromoyohimbine, m.pt. 296—298° C., and dibromoyohimbine, m.pt. 296° C. respectively. These compounds all contain one molecule of water more than yohimbine itself. Yohimbine dissolves in cold concentrated sulphuric acid yielding a sulphonic acid, m.pt. 292°—295° C., very sparingly soluble in water, and on treatment with 25—30% nitric acid it gives a crystalline nitro-compound, and a white, amorphous, unstable oxidation product with hydrogen peroxide. Yohimbine nitrate when fused with potassium hydroxide yields a nitrogenous dicarboxylic acid, m.pt. 200° C. Yohimbine distilled with soda-lime yields an ethyl- or dimethyl-indole, giving a red crystalline picrate, m.pt. 151—155° C.,

and a base which probably contains both a pyridine and a benzene ring.—T. C.

Extraction by immiscible solvents. P. A. W. Self. Pharm. J., 1915, 95, 164—165.

TO prevent formation of emulsions when extracting with an immiscible solvent, the simplest and best method, in most cases, is to use a large volume of the solvent. For example, when a mixture of 10 c.c. of malt extract and cod liver oil and 10 c.c. of concentrated hydrochloric acid was shaken for 2 mins. with 25 c.c. of light petroleum spirit, there was no separation of the solvent after 12 hours, whereas with 50 and 100 c.c. of the solvent, separation took place at once, and the volume of emulsion separated in 15 mins. was 6 and 3 c.c. respectively. The preliminary removal of fat in the B.P. method for the assay of liquid extract of belladonna may be dispensed with if a large volume of chloroform be used for the extraction. The same principle may be applied to the breaking of emulsions already formed, the emulsion being added, in small quantities at a time, to a further quantity of the solvent, with vigorous shaking after each addition. —A. S.

Alcoholysis: Dilatometric determination of the velocity of — in the presence of a large excess of alcohol. G. B. Kolhatkar. Chem. Soc. Trans., 1915, 107, 921—933.

THE velocity of interchange of radicals in mixtures of esters and alcohols in presence of hydrogen chloride as catalyst has been studied by the dilatometric method in the case of methyl, ethyl, propyl, *iso*-propyl, *iso*-butyl, and *iso*-amyl alcohols and the esters of acetic, propionic, butyric, benzoic, monochloroacetic, and trichloroacetic acids. The ester under examination was mixed with about 20 mols. of the alcohol containing a definite amount of catalyst; the temperature was kept constant at 30° C. and the very small changes in volume observed after definite time intervals by means of a reading microscope. The reaction in each case was found to approximate to a uni-molecular one, and the velocity constant for mixtures of various esters and alcohols was determined. The relative rates of esterification by the catalytic method and of alcoholysis of the corresponding esters by means of hydrogen chloride, follow the same order, except in the case of monochloroacetic acid. The relative activities of the various alkyl groups determined from the alcoholysis of the acetates are: methyl 100, ethyl 28, *n*-propyl 19, *iso*-propyl 3.4, *iso*-butyl 16, and *iso*-amyl 17.—T. C.

Production of petroleum for medicinal purposes in the United States. See II.A.

Metallo-compounds of cobalt and nickel. Metallo-compounds in solution. Pickering. See VII.

Phosphatides of milk. Osborne and Wakeman. See XIX.A.

Detection of hydrocyanic acid in toxicology. Lavielle and Varenne. See XXIII.

PATENTS.

Acetaldehyde from acetylene: Manufacture of —. W. P. Thompson, Liverpool. From Consortium f. Elektrochem. Ind. G. m. b. H., Nürnberg, Germany. Eng. Pat. 16,957, July 17, 1911.

IN preparing acetaldehyde by passing acetylene through an aqueous solution containing a mercury compound as catalyst, earthenware reaction vessels can be employed if the current of acetylene is adjusted so that the heat produced by the reaction is approximately equal to the heat absorbed by the evaporation of water in the

current of acetylene, and by the cold water added to replace the water consumed in the reaction and lost by evaporation. The best temperature is about 80° C., and the solution should contain 6 to 35% H_2SO_4 . *Example*.—Acetylene is passed at the rate of 11–13 cubic metres per hour through 350 litres of 15% acid at about 80° C. in an earthenware boiler. Mercuric oxide is added regularly, and the water lost is replaced by cold tap water. The boiler is surrounded by water also at 80° C. Acetylene is absorbed at the rate of 8–9 cubic metres per hour.—F. Sp.

[Hydr]oxyphenylquinolinedicarboxylic acid; *Manufacture of* —. O. Murray, London. From Farb. vorm. Meister, Lucius, u. Brüning, Hoechst, Germany. Eng. Pat. 22,828, Nov. 20, 1914.

HYDROXYPHENYLQUINOLINEDICARBOXYLIC acid, $\text{C}_9\text{H}_5\text{N}(\text{C}_6\text{H}_4\text{OH}(\text{COOH}))_2(\text{COOH})_2$ (X=1), and valuable for the treatment of arthritis and rheumatism, is prepared either by heating acetosalicylic acid (COCH_3 ; OH; COOH 5:2:1) with isatinic acid in caustic alkaline solution, or by heating *p*-aldehydsalicylic acid with aniline and pyruvic acid in alcohol. *Example*.—147 parts of isatin, 600 parts of caustic soda solution (33%), and 180 parts of acetosalicylic acid are heated on the water bath for 8 hours. The hydroxyphenylquinolinedicarboxylic acid is precipitated with hydrochloric acid, filtered, and washed with hot alcohol. It may be purified by recrystallising its disodium salt or its diethyl ester (m.pt. 103° C.). It is a yellowish powder, m.pt. 283–284° C. with decomposition, insoluble in water and light petroleum spirit, and soluble with difficulty in ethyl and methyl alcohol. The disodium salt has a sweet taste and becomes deep yellow when treated with caustic soda.—F. Sp.

Dihalogenobis(methylamino)tetraaminoarsenobenzenes; *Manufacture of* —. C. F. Boehringer und Soehne, Mannheim-Waldhof, Germany. Eng. Pat. 15,057, June 30, 1914. Under Int. Conv., July 2, 1913.

THESE compounds are obtained by the simultaneous oxidation and nitration of the 2-halogen-4-dimethylaminobenzenearsenoxides, or by nitration of the corresponding arsinic acid, and subsequent reduction of the nitroarsinic acids thus obtained by means of powerful reducing agents. Details are given of the preparation of dichlorobis(methylamino)-tetra-amino-arsenobenzene ($\text{CH}_3\text{NH} : \text{NH}_2 : \text{NH}_2 : \text{Cl} : \text{As} : 1:3:5:2:1$).

The products are more active therapeutically than the non-halogenated compounds described in Eng. Pat. 996 of 1913 (this J., 1914, 161).—B. V. S.

Carboxylic acids of the arylides of [hydr]oxyaryl-carboxylic acids; *Process for the manufacture of* —. A. G. Bloxam, London. From Chem. Fabr. Griesheim-Elektron, Frankfurt, Germany. Eng. Pat. 5144, Apr. 10, 1915.

THE carboxylic acids of hydroxyarylecarboxylic acid arylides are obtained by condensing hydroxy-arylecarboxylic acids with aminoarylecarboxylic acids in presence of dehydrating agents, which are added slowly to the mixed acids, preferably suspended in a suitable medium, the mixture being finally heated to boiling. As examples, details are given of the condensation of 2,3-hydroxynaphthoic acid with *m*- and *p*-amino-benzoic acid; of *m*-cresotinic acid with *p*-amino-benzoic acid, etc.—B. V. S.

Medicinal and pharmaceutical preparation from beechwood creosote. P. R. J. Willis, London. From B. L. Maltbie, Newark, U.S.A. Eng. Pat. 9745, Apr. 20, 1914.

BEECHWOOD creosote is treated with calcium

hydroxide to form a granular powder, which can be administered in larger doses than beechwood creosote alone.—F. Sp.

Ureas of the naphthalene series; *Manufacture of* —. Farbenfabr. vorm. F. Bayer und Co., Leverkusen. Eng. Pat. 13,866, June 8, 1914. Under Int. Conv., Oct. 16, 1913. Addition to Eng. Pat. 9172 of 1914.

SEE Fr. Pat. 471,933 of 1914; this J., 1915, 347.

4-Ketones of the quinoline series; *Process for producing* —. A. Kaufmann, Geneva. U.S. Pat. 1,145,187, July 6, 1915. Date of appl., May 1, 1913.

SEE Fr. Pat. 456,251 of 1913; this J., 1913, 959.

Pyrolidine derivatives; *Manufacture of* —. A. Zimmermann, London. From Chem. Fabr. auf. Actien, vorm. E. Schering, Berlin. Eng. Pat. 25,805, Nov. 11, 1913.

SEE Ger. Pat. 280,971 of 1913; this J., 1915, 636.

Heavy-metal compounds of thioprotein bodies; *Process for preparing soluble* —. R. Uhl, Munich, Germany. U.S. Pat. 1,145,631, July 6, 1915. Date of appl., Feb. 4, 1913.

SEE Ger. Pat. 264,926 of 1912; this J., 1913, 1032.

Soap with detergent and therapeutic properties. Eng. Pat. 17,461 of 1914. See XII.

Producing dry pulverulent compounds of mineral oils or wax and malt extract or malto-dextrin. Eng. Pat. 26,390 of 1913. See XV111.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Development; *The retarding action of sugar on* — and the permeability of gelatin to a metol-quinol developer, with and without sugar. J. Mالدینی. Comptes rend., 1915, 161, 73–76.

THE addition of sugar to a developer has a retarding effect similar to that of potassium bromide. For instance the addition of 10% of sugar to a metol-quinol developer reduces its speed of development to half, while 60% of sugar reduces the speed to about 1/45th. The effect appears to be chiefly due to increase of viscosity reducing the rate of penetration of the gelatin film by the developer. In examining the permeability the developer was placed over the jelly in a tube and the rate of penetration observed by means of a cathetometer; the jelly contained phenolphthalein to act as indicator. A table is given showing the rates of penetration for a normal metol-quinol developer, for the same with the addition of sugar in quantities varying from 10 to 50 grms. per 100 c.c. of developer, and for plain sugar solution containing 50 grms. per 100 c.c. There is a gradual decrease in the rate of penetration as the quantity of sugar in the developer is increased, and the plain sugar solution shows a much lower rate still; the figures given, for instance, for one hour's penetration are 3.96 for developer, 3.72, 3.5, 3.26, 3.14, and 3.12 for developer with 10, 20, 30, 40 and 50 grms. respectively of sugar per 100 c.c., and 1.78 for the plain sugar solution.—B. V. S.

PATENTS.

Photomechanical printing surfaces; *Production of* —. E. Rosenberg, Budapest, Hungary. Eng. Pat. 26,140, Nov. 14, 1913.

IN photomechanical printing, where the printing surface is a photographically prepared colloid film on a rigid support, this support is made of porous material such as a fireclay plate, which is

soaked in a mixture of glycerin and water, so that the colloid retains the necessary amount of moisture during use. To prolong the life of a gelatin printing surface, the inks are treated with a hardening agent such as alum or tannin. In producing the positive the printing through the negative and the screen may be done in one operation by first stripping the negative, reversing it, and transferring it to the front side of a gelatin film of suitable thickness on the back of which a screen has been printed.—B. V. S.

Screens for photomechanical and process printing.
H. C. Knudsen, Brooklyn, N.Y., U.S.A. Eng. Pat. 2817, Feb. 3, 1914.

A PHOTOMECHANICAL screen is made having on one surface of a transparent base a layer of irregularly arranged, hemispherical, coloured, translucent projections. This may be obtained, for example, by dusting one side of a sheet of glass with fine asphaltum powder, exposing the surface to the vapour of chloroform until it softens, and then allowing it to harden.—B. V. S.

Colour photography. F. E. Ives, Philadelphia, U.S. Pat. 1,145,143, July 6, 1915. Date of appl., Dec. 26, 1914.

SEE Fr. Pat. 161,078 of 1913; this J., 1914, 44.

XXII. EXPLOSIVES; MATCHES.

Explosives in coal mines.

THE Home Secretary has issued an Order under the Coal Mines Act, dated July 3, adding two new explosives to the permitted lists. The names and composition of these new additions, together with the names of the manufacturing firms, are as follows:—

Abbeile No. 2 (Messrs. Kynoch-Arklow, Ltd.):—

Ingredients.	Parts by weight.	
	Not more than	Not less than
Nitro-glycerin	9.5	7.5
Di-nitro-toluol	2.5	0.5
Nitrate of ammonium	59.5	55.5
Chloride of sodium	24.0	22.0
Woodmeal (dried at 100° C.) ..	9.0	7.0
Moisture	2.0	0.5

Mersey Powder (Cotton Powder Company, Ltd.):—

Nitro-glycerin	6.5	4.5
Tri-nitro-toluol	7.0	5.0
Nitrate of ammonium	52.5	49.0
Nitrate of sodium	12.0	10.0
Woodmeal (dried at 100° C.) ..	4.0	2.0
Chloride of ammonium	24.0	21.0
Moisture	1.5	—

PATENTS.

Explosives; Manufacture of——. H. H. Stockfeld, London. From Powerite Explosive Co., Ltd., Sydney, N.S.W. Eng. Pat. 19,267, Aug. 31, 1914.

THE explosive is a plastic mixture of the gelatinous type composed of nitroglycerin (40 parts), nitrocellulose (20), nitrated Australian grass tree gum (20), calcium picrate (2), potassium nitrate (10), wood meal (3 or more) and castor oil (1 part). The coarsely powdered gum (red or yellow) of the Australian grass tree is covered to a depth of six inches with a mixture of 1 part of acetone, 1 part of oil of turpentine, and 98 parts of petroleum, and fuming nitric acid (sp.gr. 1.5) is dropped through the liquid until the ensuing violent

reaction has ceased. After pouring off the liquid the nitrated gum remains as a viscous mass, which is repeatedly washed with a solution containing 2% borax and 1% each sugar and lime. The nitroglycerin and nitrocellulose are also washed with the alkaline solution. The nitrocellulose may be boiled with the alkaline solution and then thoroughly washed with water. This treatment renders them neutral and much more stable and safe to handle. In compounding the explosive the nitrocellulose is dissolved in the nitroglycerin with addition of some acetone, and then the calcium picrate is added. The previously mixed potassium nitrate and nitrated gum are added next, then the castor oil, and finally the wood meal, the whole being kneaded to a uniform consistence.—W. N. B.

Explosives; Waterproof cartridges for——. S. Laszczynski, Miedzianka, Russian Poland. Eng. Pat. 16,208, July 7, 1914.

WATERPROOF cartridge cases for explosives containing petroleum are made by rolling non-impregnated paper into a tube the longitudinal edges of which are united by compression between two seam-crimping wheels; the end is made in a similar manner, covered with a layer of chrome-glue solution, and dried. The whole case is then dipped in linseed oil varnish. These cases are specially suitable for use with explosives of the "Sprenzel" type requiring to be dipped in an inflammable liquid before use. For this purpose they are made with a diameter a few millimetres greater than that of an inner perforated wrapper containing the explosive. Before use this inner wrapper can be readily withdrawn, dipped, and re-inserted in the case.—W. N. B.

Fireworks; Manufacture of a new material for——. A. Jedel, New York. U.S. Pat. 1,145,121, July 6, 1915. Date of appl., July 3, 1914.

CHIPS of steel are uniformly coated with about 1% of linseed oil or other fatty oil by spraying at a temperature of about 150° F. (67° C.) and subsequently agitating the mass to ensure even distribution.—W. N. B.

XXIII.—ANALYTICAL PROCESSES.

Lead; Method for the volumetric estimation of——. F. D. Miles. Chem. Soc. Trans., 1915, 107, 988—1004.

THE mixture of lead sulphate and sulphuric acid, produced by evaporation till white fumes appear, is cooled and 50 c.c. of water added, filtered, washed with 5% sulphuric acid and then with alcohol and water. The washed sulphate, with the filter paper, is then mixed with a saturated aqueous solution of hydrogen sulphide, 10 c.c. for each 0.1 grm. of lead. The air in the flask is expanded by heating, and the flask corked, the contents being heated to 50° C. and well shaken for 20 minutes. When cool, the liquid is filtered through paper pulp, using a pump, the filtrate heated to remove hydrogen sulphide, and titrated with standard alkali, using methyl orange as indicator. The results are not so accurate when a Gooch crucible is employed, particularly with the use of asbestos. With a large amount of additional finely powdered insoluble matter, it is advantageous to omit the washing with alcohol. Calcium and copper introduce no appreciable error in the results, but barium, iron, and bismuth tend to inaccuracy. In the presence of barium, a double precipitation is necessary, after dissolving the lead sulphate in 10 c.c. of a boiling 30% solution of caustic soda, and in the case of iron, the original precipitate is dissolved in a mixture of

15 c.c. of concentrated hydrochloric acid and 10 c.c. of water, the evaporation with 5 c.c. of concentrated sulphuric acid being repeated. The method may be applied to the estimation of lead in ores.—B. N.

Hydrocyanic acid in toxicology; Detection of — by the ferric thiocyanate reaction. P. Laviolle and L. Varenne. J. Pharm. Chim., 1915, 12, 74—S1.

The solution containing hydrocyanic acid or an alkali cyanide is heated to boiling for 5 mins. with a slight excess of ammonium sulphide, and then evaporated to 1 c.c. The residue is dissolved in 9 c.c. of water, 10 drops of concentrated hydrochloric acid added, the mixture extracted several times with ether (20 c.c., 10 c.c., and 10 c.c.), the ethereal solution is evaporated at the ordinary temperature, and dilute ferric chloride solution added to the residue in small quantities at a time, by means of a glass rod, until the maximum coloration is produced; an excess of the reagent is to be avoided. The mixture is then shaken with 2 c.c. of ether; after separation has taken place, the ether will exhibit a red-violet coloration if hydrocyanic acid was present in the original solution. Formic and acetic acids do not give a coloration with ferric chloride under the conditions of the test; meconic acid, however, yields a reaction similar to that given by hydrocyanic acid, but the red coloration in this case is not soluble in ether. The red colour of ferric thiocyanate is also destroyed rapidly by the addition of 10% gold chloride solution, whilst the colour of ferric meconate is not affected. The test will detect the presence of 0.000054 grm. of hydrocyanic acid.—W. P. S.

Gas tubing made of glue. U.S. Commerce Rept., No. 171, July 23, 1915.

SUCCESSFUL attempts are reported in the use of glue in making a substitute for rubber tubing. These "Sonjatin" tubes are said to be more impervious to gases and more resistant to heat than rubber. They will withstand high pressures when encased in a suitable envelope. They are said to be especially suitable for use with petroleum products, but their use is limited since they will not withstand water. They cost about 6½d. per yard.

Bacterial test for plant food accessories (auximones) Bottomley. See XVI.

Methods of bacterial analysis of air. Ruehle. See XIXb.

Cinchona assay. Kruysse. See XX.

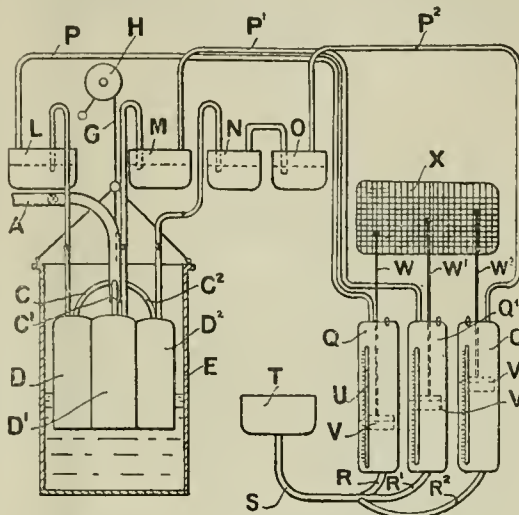
Extraction by immiscible solvents. Self. See XX.

PATENTS.

[Flue-] gases; Apparatus for testing —. E. Nies, Hamburg. Eng. Pat. 3885, Feb. 14, 1914. Under Int. Conv., Feb. 15, 1913.

IN an apparatus (see fig.) for determining automatically the composition of flue-gases, the gas supply pipe, A, is branched and communicates by pipes, C, with a number of equal receiving bells, D; the latter dip into a liquid (water covered with petroleum) contained in a tank, E which forms the weight of a clockwork device, H. The gas drawn into the bells by the fall of the tank is passed (by the reverse motion on re-winding the clock) through water and suitable reagents contained in the vessels, L, M, N, O—the contents of each bell being passed through a separate vessel or series—and thence by pipes, P, to vessels, Q, the latter containing a coloured liquid and connected

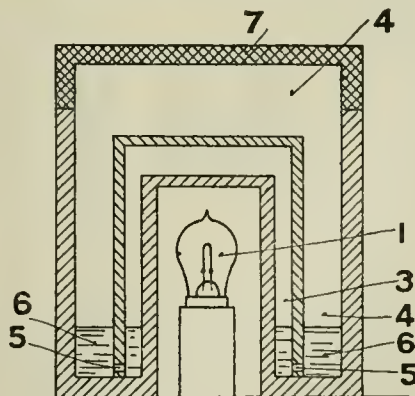
by flexible pipes, R, S, with an open vessel, T. The vessels, Q, are provided with graduated scales, U, or with a recording device, V, W, X, actuated by



means of floats, on which the percentage of the various constituents is indicated.—W. E. F. P.

Injurious gases in mines and like places; Means for detecting the presence of —. Schoeller und Co., Frankfort, Germany. Eng. Pat. 25,412, Nov. 6, 1913. Under Int. Conv., Nov. 6, 1912.

THE apparatus (see fig.) consists of a lamp, 1, surrounded by three concentric glass cylinders



the spaces, 3 and 4, between them communicating by means of holes, 5, at the base, and containing a coloured liquid, 6. The increase or decrease of pressure produced in the space, 4, by differential diffusion through the porous plate, 7, forming the top of the outer cylinder, causes a corresponding alteration in the level of the liquid and thus a change in the colour of the light. Instead of a coloured liquid, coloured or opaque floats may be used, the light in the latter case being cut off by a change of pressure.—W. E. F. P.

Firedamp and other gases; Apparatus for detecting the presence of —. W. Gaudie, Sunderland, and G. Wilkinson, Durham. Eng. Pat. 18,280, Aug. 7, 1914.

IN apparatus of the type in which the presence of firedamp is indicated by the movement of a diaphragm closing the mouth of a porous vessel

through which the gas diffuses, the small movement is magnified by a chain of long-and-short-arm levers connected in circuit with one white and one coloured electric lamp, so that the movement of the diaphragm extinguishes the white and lights the coloured lamp.—W. F. F.

Trade Report.

Chemical trade of Japan in 1914. Board of Trade J., July 29, 1915.

THE general question of chemicals has been occupying a great deal of attention in Japan, and a special commission has been sitting at the Department of Agriculture and Commerce to discuss it. It is believed that the Government will be asked to protect the industry by granting loans at low rates of interest and contracting to buy the products, while high import duties are to be imposed if necessary.

The following table (as given in the official returns) shows the quantities and values of the imports of chemicals into Japan during 1913 and 1914 :—

Articles.	Quantity.		Value.	
	1913.	1914.	1913.	1914.
	Tons.	Tons.	£	£
Drugs, chemicals and explosives—				
Dynamite and other explosives . . .	—	—	86,400	80,400
Glue	1,356	762	50,000	28,600
Glycerin	851	1,021	66,600	102,100
Phosphorus	374	309	66,000	56,800
Potassium chlorate	3,387	2,645	107,400	88,800
Potassium cyanide	496	318	33,500	21,500
Resin	7,041	4,800	98,800	52,000
Rubber, crude	1,197	1,029	352,300	219,100
Soda ash	30,834	32,699	148,100	159,000
Caustic soda	12,064	13,719	134,400	144,500
All other drugs, etc.	—	—	969,600	1,079,900
Total	—	—	2,113,100	2,032,700

Japanese chemical factories are now turning out certain chemicals of very fair quality and in considerable quantities. As examples may be mentioned zinc oxide, zinc chloride, precipitated chalk, magnesium carbonate, magnesium phosphate, acetic acid, bismuth salts, etc. These not only supply the domestic demand but are to some extent being exported to India and other Oriental countries. Hitherto there has been a regular export from Japan of tea sweepings, which were bought mostly in Germany, and it is thought that they were used for chemical purposes. A Japanese company at Shizuoka has now started the production of caffeine from tea sweepings and it is said that the monthly output at present is 300 lb.; another smaller company is also taking up the manufacture.

A large export business has been done in acetic acid, though the customs returns do not record it separately. Since the outbreak of war considerable orders have been received for shipment to rubber-growing districts. The exports of potassium iodide have doubled during 1914 and were over £63,000 in value. Sulphuric acid was shipped to some extent, the figures recorded showing £14,000, but it is understood that the business done in 1915 will be much larger.

Prohibited exports. Italy. Board of Trade J., July 22, 1915.

By an Order in Council dated July 19th, the following recommendation was approved :—

"That the exportation of the goods which, in virtue of the Proclamation of 3rd February and subsequent amending Orders of Council, are at present prohibited to be exported to all foreign ports in Europe and on the Mediterranean and Black Seas, other than those of France, Russia (except Baltic ports), Spain, and Portugal, should be prohibited to all foreign ports in Europe and on the Mediterranean and Black Seas, other than those of France, Italy, Russia (except Baltic Ports), Spain, and Portugal."

The Italian Ministry of Finance has issued to the Italian Customs authorities certain instructions in further explanation of the Royal Decree of the 10th June, which prohibited the exportation from Italy of all goods made wholly or in part from raw materials of which the exportation is prohibited, or made from the products of such materials. While the absolute prohibition of exportation of all products and manufactures which can serve for military equipment (established by Royal Decree of the 1st August, 1914) holds good, the Customs must on their own initiative apply the regulations contained in the Decree of the 10th June to the products or manufactures which come under the following categories :—Goods of all kinds manufactured with metals the export of which is prohibited (*e.g.*, copper, cast-iron, tin, zinc); articles made with gutta-percha and indiarubber; medicines and chemical products any of the ingredients of which are materials of which the export is prohibited, or such products as are in any way prepared by the use of prohibited materials; products made from mineral oils, fats, soaps, and fatty and lubricating materials; colouring materials containing aniline colours and salts.

Book Received.

ALCOHOLOMETRIC TABLES. By Sir EDWARD THORPE, C.B., F.R.S. Longmans, Green and Co., 39, Paternoster Row, London. XIV+91 pages. 7½×5 in. Price 3s. 6d.

THESE tables were compiled under Sir Edward Thorpe's direction by Messrs. T. J. Cheater and J. Holmes, and were originally published in an abbreviated form in connection with the article "Alcoholometry" in Thorpe's "Dictionary of Applied Chemistry." The results of the work of Blagden and Gilpin, Drinkwater, and Mendeléeff have been incorporated.

Table I. shows the percentage of ethyl alcohol (1) by weight and (2) by volume at 60° F. (15·6° C.), and the percentage of fiscal proof spirit in aqueous solutions of ethyl alcohol of different specific gravities at 60°/60° F.; the figures are given for specific gravities of 0·79359 (absolute alcohol), 0·7940, 0·7942, and so on with an addition of 2 to the fourth place of decimals.

Table II. shows the indications of Sikes' hydrometer and the corresponding percentages of British proof spirit, American proof spirit, ethyl alcohol by weight (Germany), and ethyl alcohol by volume at 15° C. (France), and at 60° F. (15·6° C.), according to Tralles.

Table III. shows the indications of Sikes' hydrometer and the percentage of British proof spirit, with the corresponding indications of the hydrometers of Russia, Holland, Spain (Cartier), and Switzerland (Beck).

The preface contains an interesting survey of the history of alcoholometry.

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SEPTEMBER 15, 1915.

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Obituary.

PAUL EHRLICH.

Professor Paul Ehrlich died at Homburg on August 20th, at the age of 51. Born at Strehlen, Silesia, he was educated at Breslau and Strasburg, where he graduated in medicine. After some years of clinical work, he went in 1890 to assist at the Koch Institute in Berlin. Here he discovered the so-called "tri-acid stain," which enables five varieties of white blood corpuscles to be differentiated, and he also introduced a method for standardising diphtheria antitoxins by the use of guinea-pigs. His most important work was in connection with the action of chemical compounds on the human body, and he formulated a theory by which he claimed that it was possible to forecast the action of a substance from its chemical consti-

tution. He found that certain dyes possessed a peculiar affinity for tubercle bacilli, and later, whilst working with Shiga, he discovered a dye, Trypan Red (tetrazotised benzidine-mono-sulphonic acid + 2 mols. of sodium naphthylamine-3,6-disulphonate) capable of curing trypanosome infection in mice. Extending his work to other organic compounds, especially those of arsenic, he was led to the discovery of one of the most important synthetic drugs, namely, Salvarsan (diamino-dihydroxyarsenobenzene, or "606"), which has the power of destroying the specific organism of syphilis. His latest researches have been in connection with compounds of Salvarsan with heavy metals, especially copper and gold; it is hoped that the copper compound will afford a remedy for sleeping sickness.

In 1908 Prof. Ehrlich was awarded the Nobel Prize and in 1914 the Cameron Prize of Edinburgh University.

Journal and Patent Literature.

PATENT SPECIFICATIONS may be obtained by post by remitting as follows:—

English.—6d. each, to the Comptroller of the Patent Office, Southampton Buildings, Chancery Lane, London, W.C.

United States.—1s. each, to the Secretary of the Society.

French.—1 fr. 05 c. each as follows: Patents dated 1902 to 1907 inclusive, Belin et Cie., Rue Ferou 8, Paris, (6e); Patents from 1908 to date, L'Imprimerie Nationale, 87, Rue Vieille du Temple, Paris.

I.—GENERAL; PLANT; MACHINERY.

Boiler scale; Use of aluminium in preventing formation of—. I. Pouget. Comptes rend., 1915, 161, 135—136.

Two similar constant-level iron water-baths were heated continuously under identical conditions for a fortnight. In the first, to which a small amount of aluminium powder had been added, the deposited scale weighed 7 grms., while in the second, which contained no aluminium, the weight of the deposit was 17 grms. A coat of aluminium paint effected a similar reduction.—J. R.

PATENTS.

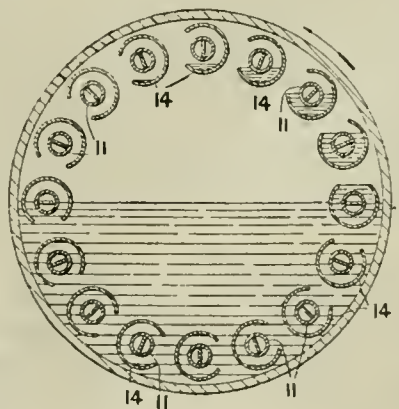
Tanks, vats, or containers made of cement and concrete; Process of obtaining a metallic lining for—. P. Zürn, Cassel, Germany. Eng. Pat. 11,001, May 4, 1914. Under Int. Conv., May 5, 1913.

A METAL, *e.g.*, iron, which is not attacked by the cement or concrete, is projected on the surface through a blow-pipe flame or electric arc, and then a second coating is applied, *e.g.*, of aluminium, which is unaffected by the contents of the vessel.—W. F. F.

Refrigeration plants; Machines and apparatus for—. H. Pollard, Manchester, and The Seay Syndicate, Ltd., Bradford. Eng. Pat. 11,495, May 9, 1914.

In rotary apparatus of the kind described in Eng. Pat. 25,806 of 1907 (this J., 1908, 740), for absorbing or generating ammonia, the rotary drum, 1, is provided with tubes, 11, through which the heating or cooling medium circulates. Each tube is provided with a trough, 14, so that it is maintained in contact with the liquid after it has

left the main body, and the liquid is tipped from the trough so as to present a large surface to the vapour. In a second form the tubes are arranged



in groups, each group being provided with a trough. In a third form the tubes are arranged in helical coils, each in its own trough. In a fourth form a single large helical pipe in the centre of the drum is surrounded by small revolving troughs which distribute the liquid upon it. In a fifth form, a large central helical pipe is combined with the first form.—W. F. F.

Feeding apparatus for liquids with solids in suspension. F. Shewring, Droitwich. Eng. Pat. 21,301, Oct. 21, 1914.

In a gravity feed apparatus for liquids containing

suspended solids (*c.g.*, for adding milk of lime to a sulphate still), the liquid is supplied in excess to one or more inverted conical receivers, from which the excess overflows into a larger surrounding receiver, and is returned to the mixing vessel. The outlet of the first receiver is enlarged to form a socket for a detachable glass discharge tube.—W. F. F.

Concentrating plant; Acid, alkali, neutral, syrup or like — J. Harris, Sheffield, and D. H. Thomas, Morriston, Glamorgan. Eng. Pat. 23,414, Dec. 2, 1914.

TUBULAR evaporating vessels are placed across a heating flue and through its walls, and are arranged in two or more rows to form horizontal baffles for the flue gases, with ports at alternate ends. The liquor is run separately into each of the topmost vessels, and flows through these into the row below until it reaches a common discharge channel at the base; the height of the liquor in each vessel is regulated by means of a transverse weir. The lowest row thus contains the most concentrated liquid and is exposed to the greatest heat. The vessels may be in contact or separated by asbestos rope or other refractory packing.—E. H. T.

Dehydrating or treating air or other gases; Apparatus for — Bryant and May, Ltd., London. From The Diamond Match Co., New York. Eng. Pat. 24,113, July 15, 1914.

NARROW zigzag receptacles having perforated or reticulated side walls, and filled with calcium chloride or other suitable dehydrating agent, are spaced apart in an outer chamber, so as to leave sinuous passages for the air between them. The air is drawn through the chamber by a fan and is deflected by suitable baffles on to and through the dehydrating agent. The receptacles are supported on rollers so that they can be easily withdrawn from the chamber.—W. H. C.

Cooling towers. F. Uhde, Breslau, Germany. Eng. Pat. 666, Jan. 15, 1915. Under Int. Conv., March 19, 1914. Addition to Eng. Pat. 14,115, of 1914, dated July 12, 1913.

IN the cooling tower described in the chief patent (this J., 1915, 858), the pump shaft in which the cooled water collects and from which it is drawn by the pump, to be delivered again to the top of the tower, is provided with a float device which allows fresh water to enter, to replace that lost by evaporation, so that a constant level is maintained and fluctuation in pumping avoided. The water-catching trays are arranged endwise to the walls of the pump shaft, and have holes or notches on the inner side for the discharge of the water.—W. H. C.

Furnaces; Reverberatory — Manchester Furnaces, Ltd., W. A. Russell, and J. Lord, Manchester. Eng. Pat. 6050, April 22, 1915.

THE secondary air is preheated by mixing it with a portion of the hot gases leaving the furnace, and is injected in such a way that the air blast follows the contour of the arched roof of the furnace, and thus transfers heat to it by convection.—W. F. F.

Calcining-furnace. W. R. Clymer, Assignor to National Carbon Co., Cleveland, Ohio. U.S. Pat. 1,147,706, July 27, 1915. Date of appl., Sept. 29, 1911.

THE calcining chamber is vertical, material being fed in at the top and withdrawn at the bottom. A combustion chamber, which surrounds a part of the calcining chamber, is supplied with a combustible gas through a tortuous passage in the furnace walls around the upper part of the calcining chamber and with air through a similar passage around the lower part of the calcining chamber; the air on its way to the combustion chamber thus serves to

cool the calcined material. The hot gases from the calcining zone are utilised to preheat the material in the upper part of the calcining chamber above the combustion chamber.—A. S.

Emulsifier. M. Leitch and B. R. Wright, Poughkeepsie, N.Y., Assignors to The De Laval Separator Co., New York. U.S. Pat. 1,145,600, July 6, 1915. Date of appl., March 19, 1914.

THE emulsifier consists of a central chamber into which the materials are fed, provided with tangential discharge openings, through which the material passes to annular emulsifying chambers. The emulsifying chambers are formed by superposed plates, the lower plate of each pair having an annular face groove increasing in height from within outwards, and communicating with the discharge openings of the central chamber by grooves in the upper plate, decreasing in height from within outwards. The discharge passages are provided with vents for the escape of air.

—W. H. C.

Centrifugal machine for washing waste and other material. E. W. Phillips, Dorchester, Mass., Assignor to American Tool and Machine Co., Boston, Mass. U.S. Pat. 1,146,445, July 13, 1915. Date of appl., Feb. 10, 1909.

THE material is contained in a rotating cage mounted within a casing, on a vertical hollow shaft which also carries, above the casing, a turbine wheel driven by steam jets. The exhaust steam passes through the shaft to the interior of the cage.—W. F. F.

Separating the readily condensable, or absorbable, constituents of hot and compressed gaseous mixtures from the difficultly condensable, or absorbable, constituents. J. Ephraim, Berlin. Eng. Pat. 28,832, Dec. 13, 1913. Under Int. Conv., Dec. 13, 1912.

SEE Ger. Pat. 276,718 of 1912; this J., 1914, 1154.

Drying or cooling granular material; Apparatus for — J. A. Topf und Soehne, and E. Bornmann, Erfurt, Germany. Eng. Pat. 3375, Feb. 9, 1914. Addition to Eng. Pat. 29,835, June 4, 1912.

SEE Addition of Feb. 11, 1914, to Fr. Pat. 461,679 of 1913; this J., 1915, 16.

Filtering presses; Straining or — R. Christiansen, Harburg, Germany. Eng. Pat. 4124, Feb. 17, 1914.

SEE Fr. Pat. 468,565 of 1914; this J., 1914, 951.

Filtering; Process and apparatus for — C. Butters, Oakland, Cal., U.S.A. Eng. Pat. 9918, Apr. 22, 1914. Under Int. Conv., June 11, 1913. SEE U.S. Pat. 1,100,218 of 1914; this J., 1914, 781.

Filter-stuff; Process for the production of a — by the employment of coal or similar filter materials. L. von Jaraczewski, geb. Stern, Berlin. U.S. Pat. 1,147,991, July 27, 1915. Date of appl., Oct. 6, 1913.

SEE Eng. Pat. 23,736 of 1913; this J., 1914, 906.

Lubricating-packing and method for making the same. A. Barberis, Mexico. U.S. Pat. 1,145,877, July 13, 1915. Date of appl., June 8, 1914.

SEE Eng. Pat. 14,433 of 1914; this J., 1915, 479.

Hydro-extractor or like centrifugal machine. T. K. Irwin, London. U.S. Pat. 1,145,900, July 13, 1915. Date of appl., May 29, 1914.

SEE Eng. Pat. 13,508 of 1913; this J., 1914, 1041.

Centrifugal apparatus. W. Mauss, Johannesburg, Transvaal. U.S. Pat. 1,146,269, July 13, 1915. Date of appl., July 11, 1914.

SEE Eng. Pat. 15,930 of 1914; this J., 1915, 15.

Sampling liquids; Apparatus for —. R. L. Chambers, Broxburn, Scotland. U.S. Pat. 1,146,402, July 13, 1915. Date of appl., July 13, 1914.

SEE Eng. Pat. 17,828 of 1913; this J., 1914, 714.

Furnace for heating gases or the like. C. M. T. Olsson, Saltsjöbaden, Sweden. U.S. Pat. 1,148,331, July 27, 1915. Date of appl., May 18, 1914.

SEE Eng. Pat. 11,774 of 1913; this J., 1914, 954.

Rotary kilns for burning cement, ores, and like materials. Eng. Pat. 17,146. See IX.

Ovens or kilns for annealing iron castings, for burning bricks and pottery ware, and for similar uses. Eng. Pat. 16,970. See X.

Pyrometer method and apparatus. U.S. Pat. 1,147,483. See XXIII.

II.A.—FUEL; GAS; MINERAL OILS AND WAXES.

Ammonia and cyanogen; Formation of — during the carbonisation of coal. O. Simmersbach. Report of German Coke Oven Committee. J. Gas Lighting, 1915, 131, 246—247. (See also this J., 1914, 781.)

COAL was carbonised in an electrically heated tube, air being removed before each experiment by a current of carbon dioxide, and the residual gases at the end of a test by a current of pure nitrogen. Ammonia was absorbed in dilute sulphuric acid and cyanogen in an alkaline solution of ferrous sulphate. Tar was condensed by cotton wool from which it was washed out with chloroform and the ammonia extracted from the chloroform solution by dilute acid. Feld's method was used to determine the cyanogen, and a modified Kjeldahl method for the nitrogen in the coke. From a great number of experiments the following table was compiled:—

Distribution of nitrogen.

Silesian coal with 6.63% ash and 1.396% nitrogen.

Carbonisation temp. °C.	Nitrogen in ammonia, per cent.	Nitrogen in cyanogen, per cent.	Nitrogen in tar, per cent.	Free nitrogen in gas, per cent.	Nitrogen in coke, per cent.
600	7.81	0.25	2.12	18.13	71.69
700	18.13	0.66	3.65	12.13	65.43
800	21.28	0.87	3.47	10.73	63.65
850	23.68	1.11	3.72	10.37	61.12
900	24.12	1.19	4.15	12.14	58.40
1000	23.15	1.23	4.11	21.53	49.98
1100	23.09	1.31	3.70	30.51	41.39
1200	22.84	1.42	4.21	45.10	26.43

Westphalian coal with 5.7% ash and 1.391% nitrogen.

	Nitrogen in ammonia, per cent.	Nitrogen in cyanogen, per cent.	Nitrogen in tar, per cent.	Free nitrogen in gas, per cent.	Nitrogen in coke, per cent.
800	19.46	0.76	1.92	5.88	71.98
850	23.14	1.10	1.77	4.93	70.06
900	19.94	1.11	1.61	9.99	67.35
1000	19.61	1.25	1.87	21.54	55.73

The temperature of maximum formation of ammonia was found to be about 900°C.; for cyanogen the maximum had not been reached at 1200°C.—W. H. C.

Bomb calorimeter determinations; Effect of high ignition-voltages on the accuracy of —. E. J. Dittus. Met. and Chem. Eng., 1915, 13, 480—481.

THE average error introduced by employing a 118-volt current for igniting a charge of fuel by means of iron wire was found to be less than 0.2%, on the basis of an assumed heating value of 7000 calories per gram.; from this it is concluded that, except for very accurate work, the ignition-voltage is unimportant.—W. E. F. P.

Water-gas plant; Automatic operation of —. C. F. Zeck. J. Gas Lighting, 1915, 131, 245—246.

FROM careful observation of a water-gas plant it was concluded that better results could be obtained by shortening the cycle of operations. With a hand-controlled plant the cycle could not be less than six minutes, so arrangements were devised to operate the plant by compressed air. All the valves except the hot valve are closed by gravity and opened mechanically, the hot valve being both opened and closed mechanically. The compressed air acts on water in a container interposed between the air main and the valve cylinder, forces the water into the cylinder, and opens the valve. The air pressure to the water cylinder is controlled by a set of balanced piston valves, operated by cams on a shaft, which is driven by clockwork. Means are provided to close all valves if any part of the mechanism gives way. The best cycle even for the highest grade coke was found to be four minutes: 90 seconds blow and 150 seconds run. The fires are made up at intervals of 20 mins. and cleaned at intervals of 80 mins.—W. H. C.

Benzol in gas mixtures; Determination of —. G. A. Burrell and I. W. Robertson. J. Ind. Eng. Chem., 1915, 7, 669—670.

THE following method has given satisfactory results with the mixed coal- and carburetted water-gas of Pittsburgh. A double-bulbed tube provided with a stopcock and with a side tube connected to a manometer, is used; one bulb contains phosphorus pentoxide to absorb water vapour. The air is first exhausted from the tube by means of a Geryk pump, the gas mixture is then introduced at atmospheric pressure, and the two bulbs are immersed in a mixture of solid carbon dioxide and acetone or alcohol (temperature, —78°C.). After about 10 mins., the uncondensed gases are pumped off. The residue consists practically entirely of benzene. It is allowed to vaporise at the ordinary temperature and its pressure observed on the manometer. If applied to coke-oven gas the method would give the total content of easily condensable gases (benzene, toluene, etc.).—A. S.

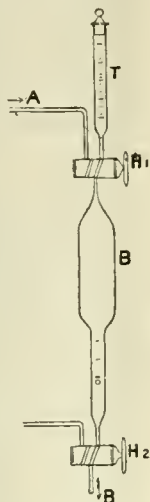
Ethane and ethylene; Vapour pressure of — at temperatures below their normal boiling points. G. A. Burrell and I. W. Robertson. J. Amer. Chem. Soc., 1915, 37, 1893—1902.

THE gases were confined in a glass bulb connected with a manometer and Töpler pump. The bulb was immersed in a bath of natural gas gasoline which was contained in a Dewar vacuum tube and was agitated by means of a small pump. The temperature of the bath, measured by means of a pentane thermometer, was kept constant within about 0.04°C. by means of a tube containing a regulated supply of liquid air. The vapour pressure of ethane was found to range from 760 mm. at —89.3°C. to 1 mm. at —159.8°C., whilst that of ethylene ranged from 760 mm. at —103.9°C. to 4 mm. at —159.9°C.—C. A. M.

[Gas] purifiers; Chemical control of —. C. J. H. Madsen. J. Gasbeleucht., 1915. J. Gas Lighting, 1915, 131, 246.

THE number of times the oxide in the purifiers

at the East Gas Works, Copenhagen, required to be changed before it was exhausted was reduced from 2.7 times per 100 million cub. ft. in 1912-13 to 0.9 times during 1914 by adopting a system of analytical control. Four purifiers were worked in series, and each day the last of the series was put first. The percentage of hydrogen sulphide in the gas at the inlet and outlet of each purifier was tested by the method described below. The burette, B, is filled by passing gas in at A, and out at B, until all air is displaced, and the taps, H₁ and H₂, are closed. Water is then forced in through H₂ till it reaches the zero mark, the excess of gas being blown out through A. Some of the water in B is then withdrawn by suction, and a few drops of starch solution drawn in through H₂. A standard solution of iodine in potassium iodide (1 c.c. = 0.1% H₂S) is then drawn in, a little at a time, from the titrating burette, T. The apparatus is shaken after each addition of iodine until the blue colour of starch-iodide persists.—W. H. C.



Adsorption of acetylene by colloidal platinum, iridium, and osmium, and platinum black. Progressive hydrogenation of acetylene in presence of colloidal platinum. Paal and Schwarz. *Sec XX.*

PATENTS.

Briquettes; Binding means for—. W. Schumacher, Osnabrück, Germany. U.S. Pat. 1,146,455, July 13, 1915. Date of appl., July 9, 1913.

A BINDER for briquettes of coal or ore consists of 5% wood tar and 1% calcium hydrate [hydroxide].—W. F. F.

Coke; Process for producing pressure-proof—containing a minimum of detrimental sulphur constituents. L. Franck, Differdingen. Eng. Pat. 28,941, Dec. 15, 1913.

SEE Ger. Pat. 274,853 of 1912; this J., 1914, 782. Manganese ore or manganese dioxide may be added to the mixture before coking, in order to oxidise sulphur compounds.

Coke-oven. F. Peiter, Assignor to Gas Machinery Co., Cleveland, Ohio. U.S. Pat. 1,146,442, July 13, 1915. Date of appl., Feb. 24, 1913.

THE coking chamber is provided with a series of vertical combustion chambers arranged in pairs adjacent to each side wall; the chambers of each pair communicate with each other at the bottom. Between each two successive pairs of combustion chambers is an air duct communicating with the combustion chambers at the top. Two horizontal flues beneath the coking chamber are connected each with alternate air ducts, and beneath each flue is a regenerator. Fuel supply nozzles extend downwards from the top of the outer casing and open into the top of the combustion chambers close to the air-supply openings; the nozzles opening into alternate pairs of combustion chambers are all connected to one of two fuel-supply pipes controlled independently, so that one of the sets of alternate pairs of combustion chambers may be cut out independently of the others.—W. F. F.

Steam produced from quenching hot coke or the like with water; Process of and apparatus for using—. W. Schöndeling, Essen-Ruhr, Germany. Eng. Pat. 10,180, April 24, 1914. Under Int. Conv., May 15, 1913.

The coke is quenched in a closed vessel, and the

steam passes through a tank, where it is washed by condensation water, to the top of a closed vessel containing oil (e.g., anthracene oil, which oscillates between this and a similar vessel in which it compresses air. The top of the first oil vessel is connected to a condenser, the vacuum produced being used to operate a motor and to draw back the liquid from the second oil vessel. The quenching water is forced out by excess of steam pressure, and the condensed water is used for quenching the coke.—W. F. F.

Explosive gaseous mixtures; Method of burning—*Method of burning liquid and other fuels.*

C. E. Lucke, Assignor to Gas and Oil Combustion Co., New York. U.S. Pats. (A) 1,146,724 and 1,146,725, and (B) 1,146,726, July 13, 1915. Date of appl., Sept. 21, 1912.

(A) A JET of explosive gaseous mixture, or gas and finely divided fuel, is driven, unconfined, at a velocity greater than that of flame propagation, against the surface of a bed of porous refractory material, the temperature of which is sufficient to cause ignition of the mixture. The mixture is burnt where the reduced velocity is equal to that of flame propagation, and the products of combustion pass through the bed. (B) A stream of combustion-supporting gas is driven at a velocity greater than that of flame propagation against a bed of porous refractory material, and vaporised or finely divided fuel is added at a point close to the bed. The mixture is burnt where the velocity is equal to that of flame propagation, and the products of combustion pass through the bed.—W. F. F.

Combustion of fuel. P. O. Perkins, Salt Lake City, Utah. U.S. Pat. 1,146,732, July 13, 1915. Date of appl., May 6, 1915.

A SHALLOW fuel bed is made up of a lower layer of bituminous coal and an upper layer of oil-bearing shale in such proportions that neither smoke nor clinker is produced.—W. F. F.

Gas; Apparatus for the manufacture of—. W. Climie, jun., and W. Lees, Glasgow. Eng. Pat. 19,954, Sept. 19, 1914.

IN a gas producer having its lower end immersed in a vessel or tank serving as a water seal and ashpit, an endless conveyor chain is arranged to discharge the ashes automatically. The conveyor passes from a sprocket wheel outside and above the level of the tank, down one of the sides, along the bottom, and up the opposite side to a similar sprocket, and then passes back below the tank.—W. G. C.

Gas producers. S. Glover, St. Helens, and J. West, Southport. Eng. Pat. 21,517, Oct. 26, 1914.

To obtain uniformity in quantity and quality of gas from producers, the movement of the door, by which access is obtained to the producer for clinking or cleaning purposes, is transmitted to dampers, the area of outflow being thus restricted when the door is opened.—W. G. C.

Gas-producers; Method of operating—. H. Koppers, Essen, Germany. Assignor to H. Koppers Co., Chicago, Ill. U.S. Pat. 1,146,627, July 13, 1915. Date of appl., July 27, 1914.

THE producer is operated so as to produce liquid slag, which is discharged with a portion of the hot gas into an outer chamber where it is quenched and granulated; the gas is returned to the producer by an injector.—W. F. F.

Gas-generator. W. C. Minniear, Kansas City, Mo. U.S. Pat. 1,146,764, July 13, 1915. Date of appl., Dec. 17, 1913.

A COMBINED retort and furnace is surrounded by a boiler, which extends above the top of the retort

A flue rising from the retort extends through the upper part of the boiler and is surrounded by a water chamber. Oil-feeding pipes and steam pipes from the boiler pass through the water chamber and discharge simultaneously or alternately into the retort. Gas is delivered from the lower part of the retort through a pipe above the grate.
—W. F. F.

Gas; Process of manufacturing —. H. F. Wallmann, Chicago, Ill. U.S. Pat. 1,146,776, July 13, 1915. Date of appl., June 4, 1908.

MOIST fuel is dried and distilled, the residue being burnt in two portions, the first to yield carbon monoxide and hydrogen and the second to yield carbon monoxide. The heat of the latter is used for the drying and distillation of the moist fuel. The steam from the moist fuel is used to produce the carbon monoxide and hydrogen referred to above. The products of combustion of the second portion, with the permanently gaseous distillation products, are mixed with the products of combustion of the first portion.—W. F. F.

Gas-producer for furnaces. W. O. Houston, Bellaire, Ohio. U.S. Pat. 1,149,056, Aug. 3, 1915. Date of appl., Feb. 9, 1911.

Two fire-boxes, with an arched crown, are formed side by side, with a common central wall. A horizontal passage, the ends of which open into the two fire-boxes, is formed between the top of the common end wall of the fire-boxes and the bottom of the crown. A passage, similarly bounded, extends from the horizontal passage to the combustion chamber.—W. F. F.

Sulphate of ammonia; Manufacture of — and purification of coal gas. J. Mackenzie, Middlesborough. Eng. Pat. 10,059, April 23, 1914.

AMMONIUM sulphate is made directly from the ammonia and the sulphur compounds contained in coal gas; after being freed from tar, the gas is passed, in a moist state, together with a nitrogen oxide, at about 200° F. (93° C.) into a vessel where the sulphur compounds are oxidised and ammonium sulphate is formed. The excess of nitrogen oxide is absorbed in 70–80% sulphuric acid, from which it can be liberated and used again; the coal gas is subsequently purified by lime treatment.—E. H. T.

Gases containing ammonia and sulphuretted hydrogen; Purification of — and recovery of ammonium salts. F. Duvieusart, Santiago de Chili, Chili. Eng. Pat. 17,475, July 23, 1914.

THE gases are washed, either hot or cold, with an aqueous or saline solution of sulphited organic bases obtained from tar or tar oils by treatment with sulphurous acid and water or salt solution. The solution from the washers is treated with sulphurous acid, and on heating, ammonium sulphate is produced.—W. G. C.

Gas washers and the like apparatus. G. K. Davis, London. Eng. Pat. 17,005, July 17, 1914.

IN gas washers of the type described in Eng. Pats. 2113 of 1909 and 4543 of 1910 (this J., 1910, 79, 1139) the centrifugal action of the rotating fanners is utilised for drawing the gas from chamber to chamber. The apparatus is provided with at least two shafts, but fanners are fixed on the same shaft only in alternate chambers. The apertures through which gases pass from chamber to chamber are preferably circular and are situated concentrically with the shaft, being placed immediately in front of the fanner in that chamber into which the gases are to be drawn. In cases where the pressure varies, the liquid is discharged positively and automatically from one chamber to the next by means of a small water or turbine

wheel in each compartment, working beneath a casing which deflects the liquid driven, tangentially, into the next compartment.—W. G. C.

Gas purifiers; Means for controlling the direction or manner of flow of gas within —. G. F. H. Beard, J. W. Scott, and R. and J. Dempster, Ltd., Manchester. Eng. Pat. 844, Jan. 19, 1915.

EACH box of a gas-purifier system is provided with valves, situated within the box and in connection with the inlet and outlet. By this means the direction of flow of the gas across the box may be reversed or altered, and the gas can be brought into contact with the purifying material which is least fouled.—W. G. C.

Fuel and illuminant from tar; Production of a liquid —. A. Markl, Prag-Zizkov, Bohemia. Eng. Pat. 10,383, Apr. 27, 1914. Under Int. Conv., May 2, 1913.

TAR, or the residue left after distillation of the light constituents, is mixed with warm alkali solution of about 0.5–1% strength. After standing, the tar is drawn off and distilled; the portion which distils at about 200°–280° C., is suitable as a heating and illuminating oil.—W. F. F.

Coke; Apparatus for quenching and removing discharged —. E. C. R. Marks, London. From Maschinenbau-Anstalt Humboldt, Cologne-Kalk, Germany. Eng. Pat. 4464, Feb. 20, 1914.

SEE Fr. Pat. 467,891 of 1914; this J., 1914, 953.

Coke poor in sulphur; Production of —. A. Fingerland, Zbeschau, Hungary, and A. Indra and A. Lissner, Brünn, Austria. Eng. Pat. 11,562, May 11, 1914. Under Int. Conv., June 5, 1913.

SEE Ger. Pat. 270,573 of 1913; this J., 1914, 411.

Coke oven. E. Hinselmann, Essen, Germany. U.S. Pat. 1,145,895, July 13, 1915. Date of appl., Jan. 10, 1914.

SEE Ger. Pat. 268,327 of 1913; this J., 1914, 411.

Gas generating apparatus. H. A. Carpenter, Sewickley, and Riter-Conley Manufacturing Co., Leedsdale, Pa., U.S.A. Eng. Pat. 5268, April 7, 1915.

SEE U.S. Pat. 1,140,797 of 1915; this J., 1915, 706.

Gas; Vertical retort for the production of — by the carbonisation of coal. A. McD. Duckham, Ashted, Assignor to Isbell-Porter Co., Newark, N.J. U.S. Pat. 1,147,790, July 27, 1915. Date of appl., May 13, 1914.

SEE Eng. Pat. 12,338 of 1913; this J., 1914, 684.

Sulphuretted hydrogen from coal gas and the like; Removal of —. K. Burkheiser, Hamburg, Germany. Eng. Pat. 1415, Jan. 19, 1914. Under Int. Conv., Mar. 4, 1913.

SEE Fr. Pat. 469,122 of 1914; this J., 1914, 953.

Ammonia from solid fuel; Process and apparatus for obtaining —. K. P. Sachs, Berlin, Eng. Pat. 28,735, Dec. 12, 1913. Under Int. Conv., Dec. 12, 1912.

SEE Ger. Pat. 274,011 of 1912; this J., 1914, 740.

Coal gas; Recovering as an ammonium salt the nitrogen of the hydrocyanic acid in crude —. E. V. Evans, Assignor to South Metropolitan Gas Co., London. U.S. Pat. 1,148,368, July 27, 1915. Date of appl., July 30, 1914.

SEE Eng. Pat. 29,047 of 1913; this J., 1914, 953.

Hydrocarbons; Treatment of liquid — J. Y. Johnson. London. From Badische Anilin und Soda Fabrik, Ludwigshafen, Germany. Eng. Pat. 11,611, May 11, 1914.

SEE FR. Pat. 472,776 of 1911; this J., 1915, 540.

Binding compounds for briquetting. [road-making.] and the like. Eng. Pat. 19,933. See III.

Apparatus for tracing or determining admixtures or variations in the composition of gases. Eng. Pat. 9344. See XXIII.

Tracing or determining admixtures or variations in the composition of gases. Eng. Pat. 11,236. See XXIII.

Means for detecting the presence of injurious gases in mines. Eng. Pat. 10,400. See XXIII.

IIB.—DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Distillation of hardwood; Preliminary experiments on the effect of temperature control on the yield of products in the destructive — R. C. Palmer. J. Ind. Eng. Chem., 1915, 7, 663—669.

IN laboratory tests with 70-lb. samples of wood, yields of wood alcohol 45% higher than those obtained on the large scale were attained by lowering the temperature of distillation and reducing the speed of distillation during the critical stage when the exothermic reaction takes place. The laboratory yields of calcium acetate were 40% higher than the commercial yields, but were not greatly affected by variations in the method of distillation. In tests with a commercial retort holding $4\frac{1}{2}$ cords of wood, with pyrometers installed in the heating flues, the best results were obtained by slow distillation during the critical stage rather than by lowering the temperature at which the reaction took place. This was accomplished by raising the temperature rapidly during the preliminary drying stage, and then reducing the amount of heat supplied at the commencement of the destructive distillation stage, *i.e.*, when particles of tar first appear in the distillate. With this method of firing, the yields were 10-66 galls. of 95% wood alcohol, 213-6 lb. of calcium acetate, and 54-8 bushels of charcoal per cord of wood, the corresponding yields with the ordinary method of firing being 8-2 galls. of wood alcohol, 187 lb. of calcium acetate, and 53-5 bushels of charcoal. The cycle of operations could be completed in the usual period of 24 hours, but the fuel consumption was increased somewhat. With the ordinary method of firing, the temperature in the retort flues ranged from about 420° to 440° C. during the drying stage and from 440° to 470° C. during the distillation stage, whilst with the improved method of firing, the temperature ranged from about 390° to 430° C. during drying and from 420° to 445° C. during distillation. The wood used in the large-scale tests was mainly maple.—A. S.

Kelps; Destructive distillation of Pacific Coast — D. R. Hoagland. J. Ind. Eng. Chem., 1915, 7, 673—674.

IN comparative laboratory tests, kelp (*Macrocystis pyrifera*) yielded only about one-tenth of the quantity of acetic acid and of methyl alcohol obtained from oak wood. The distillate from kelp contained considerable quantities of basic substances. The gases evolved were not combustible during the early stages of the distillation. From the residual soft charcoal practically the whole of the potash could be recovered by leaching. —A. S.

PATENTS.

Wood; Apparatus for treating and distilling — B. Loomis. Hartford, Conn.. Assignor to Loomis Utilisation Co., East Orange, N.J. U.S. Pat. 1,148,104, July 27, 1915. Date of appl., Mar. 22, 1912.

A TANK for the treatment and distillation of wood is connected at its upper part with the upper part of a closed expansion and depositing chamber, fitted about midway of its height with a hood, which separates it into a vapour space above and a rosin-depositing chamber below; the vapour space is connected with a condenser. An outlet pipe for water or liquor is connected with the top of the hood, and the liquor is forced, by means of a circulating pump, from the expansion chamber to a heater, and from the latter into the lower part of the treatment and distillation tank.—A. S.

Arc-light electrode. W. R. Mott, Lakewood, Ohio, Assignor to National Carbon Co., Cleveland, Ohio. U.S. Pat. 1,147,422, July 20, 1915. Date of appl., Nov. 19, 1912.

THE electrode contains a fluoride, together with zinc oxide to prevent the formation of glass-etching vapours in the arc; rare-earth oxides may also be added.—F. W. A.

Arc-lamp electrode. Electric-arc lamp. W. R. Mott, Lakewood, Ohio, Assignor to National Carbon Co., Cleveland, Ohio. U.S. Pats. (A) 1,148,183 and (B) 1,148,184, July 27, 1915. Date of appl., Sept. 28, 1914.

(A) THE electrode contains flaming materials, such as precipitated silica, incrustated in a protective coating, such as a phospho-boric compound. (B) A positive electrode prepared as in the preceding patent is used in an arc lamp for direct current.—F. W. A.

Electrode for arc lamps. G. M. Little, Pittsburgh, Pa., Assignor to Westinghouse Electric and Manufacturing Co. U.S. Pat. 1,148,696, Aug. 3, 1915. Date of appl., Mar. 2, 1910.

THE electrode contains ferruginous, titaniferous, and chromiferous substances, in proportions decreasing in the order given, together with a quantity of boric acid sufficient to cause the chromiferous substance to be consumed uniformly during the burning of the electrode.—A. S.

Filament for incandescence electric lamps. W. G. Hughes, Pittsburgh, Pa., U.S.A. Eng. Pat. 17,332, July 21, 1914.

SEE U.S. Pat. 1,106,384 of 1914; this J., 1914, 951.

Production of a liquid fuel and illuminant from tar. Eng. Pat. 10,383. See IIA.

III.—TAR AND TAR PRODUCTS.

Hydrocarbons of the formula $(C_6H_5)_2CH.R$; Method of preparing — F. Bodroux. Comptes rend., 1915, 161, 131—133.

TRIPHENYLMETHANE was prepared in 87% yield by adding an ethereal solution of bromodiphenylmethane, drop by drop, to an excess of an ethereal solution of phenylmagnesium bromide. Similarly, *p*-tolylmagnesium bromide yielded *p*-tolylidiphenylmethane, and *a*-naphthylmagnesium bromide gave a 60% yield of *a*-naphthylidiphenylmethane. —J. R.

Amino-H-acids; Note on identifying — B. C. Hesse. J. Ind. Eng. Chem., 1915, 7, 674—675.

THE following methods have been used successfully for detecting and identifying the 2- and 7-amino and the 2,7-diamino derivatives of H-acid

(1,8-aminonaphthol-3,6-disulphonic acid) and thus elucidating the composition of azo dyes of which H-acid is a component. One grm. of the dyestuff is heated to 60° C. with 10 c.c. of water, then well shaken, first with 1 grm. of zinc dust suspended in 5 c.c. of water, and next with 5 c.c. of sodium bisulphite solution (36° B., sp. gr. 1.33). The mixture is heated gradually to boiling and kept boiling till no further colour change takes place, then filtered rapidly, cooled, treated with 6 c.c. of hydrochloric acid (sp. gr. 1.16), and kept at 0° C. or below until solid no longer separates ($\frac{1}{2}$ to 2–3 hours). The precipitate is collected on paper in a Gooch crucible, washed with saturated salt solution and then with 95% alcohol and ether, and dried at 90° C. The amino-derivative of H-acid thus isolated is then identified by means of the following tests, applied in each case to a fraction of 1 mgrm. of substance. (1) The substance is boiled with a few drops of 40% caustic soda solution and diluted with 1 c.c. of water: the 2-derivative gives a yellow or brown colour, the 7-derivative a green, and the 2,7-derivative a violet colour changing to blue: in some cases it may be necessary to boil the diluted solution. (2) The substance is warmed with two or three drops of sulphuric acid of sp. gr. 1.84 until it begins to turn violet, then treated with one or two drops of 0.5% sodium nitrite solution, cooled, diluted with 0.5 c.c. of water, made nearly neutral with 40% caustic soda solution and then treated with a slight excess of a saturated solution of sodium carbonate: the 2- and 7-derivatives give a bluish red and the 2,7-derivative a yellow or brown colour. (3) The substance is dissolved in one drop of a saturated solution of sodium carbonate, treated with one drop of concentrated hydrochloric acid, then diluted to 0.5 c.c., heated to boiling, and cooled. A drop of the solution is placed on filter paper, treated with a drop or two of hydrogen peroxide solution, and, when the colour development has reached its maximum, a drop of 40% caustic soda solution is added. The 2-derivative gives a brown or yellow colour with hydrogen peroxide, changing to red with caustic soda; the 7-derivative gives a violet to red colour, changing to white or cream-coloured; and the 2,7-derivative gives a blue colour with hydrogen peroxide, changing to red to violet with caustic soda.—A. S.

Detection of β -naphthol in lysol and similar preparations. Bodmer. See XIXB.

PATENTS.

Binding compounds for briquetting, [road-making,] and the like. A. C. Evans, Hampton Wick, and P. J. Mitchell, London. Eng. Pat. 19,933, Sept. 18, 1914.

COAL tar is distilled at 270° C. to remove the light oils, then cooled below 250° C., and incorporated with coal dust or hydrocarbon soot. After being further heated to at least 270° C., until the volatile matter has been expelled, the mixture is cooled rapidly to below 100° C., and 0.25 to 1% of sulphuric acid (170° Tw., sp. gr. 1.85) or similar thickening agent added. The product is a suitable binding material for briquetting if $\frac{2}{3}$ to 15% of coal dust or soot has been used, and for road-making if up to 30% of the carbonaceous material has been added. Shale oil or other similar mineral oil may be used in place of coal tar.—F. W. A.

Chlorinating aromatic hydrocarbons, including toluene; Process of— C. Ellis, Montclair, N.J., Assignor to Chadeloid Chemical Co., New York. U.S. Pat. 1,146,142, July 13, 1915. Date of appl., Feb. 12, 1913. Renewed Nov. 27, 1914.

A CONTINUOUS process for the manufacture of benzyl chloride consists in subjecting a mixture of toluene and phosphorus trichloride vapours,

containing sufficient chlorine to combine with 25 to 50% of the toluene, at 180° to 220° C., to the action of ultraviolet light; the benzyl chloride is condensed, and the mixture of toluene and phosphorus trichloride vapours, to which toluene has been added, again treated with chlorine, etc.

—F. W. A.

Coal tar; Process for the treatment of— G. L. Davies and W. E. W. Richards, London. U.S. Pat. 1,148,011, July 27, 1915. Date of appl., July 18, 1910.

SEE Eng. Pats. 16,908 and 19,081 of 1909; this J., 1910, 1368.

Production of a liquid fuel and illuminant from tar. Eng. Pat. 10,383. See 11A.

IV.—COLOURING MATTERS AND DYES.

Indigotin content of some Japanese indigoes. S. Sato. J. Ind. Eng. Chem., 1915, 7, 675–676.

IN the primitive method of manufacture of indigo used in Japan, which has been modified but little since the introduction of indigo culture in that country over 200 years ago, there is no extraction to separate the dye from the plant fibre. An extraction method applicable to Japanese conditions has been devised by N. Nagai, but has not yet been generally adopted. In eight samples of commercial Awa indigo the moisture ranged from 9.2 to 12.4%, the ash from 27.2 to 35.2%, and the indigotin (Bergthell and Briggs' method; this J., 1899, 251; 1906, 734) from 1.3 to 6.8%. A sample prepared by the Nagai process gave 3.2% moisture, 33.3% ash, and 31.5% indigotin. The percentages of ash and of indigotin are in all cases referred to the dry material.—A. S.

Note on identifying amino-H-acids. Hesse. See III.

Phenolquinolinein [indicator], a heterocyclic analogue of phenolphthalein. Dox. See XXIII.

PATENTS.

[Azo] dyestuffs, and a process of development on the fibre. R. B. Ransford, London. From L. Cassella und Co., Frankfort, Germany. Eng. Pat. 28,925, Dec. 15, 1913.

THE disazo-dyestuffs obtained from aminoazo-compounds and aminoaryl-8-hydroxy-1,2-naphthimidazolesulphonic acids, are diazotised on the fibre and developed with phenylmethylpyrazolone, phenol, *o*- or *m*-cresol, or resorcinol. The developed dyeings possess yellowish to bluish green shades, and are fast to washing, soap, and light. The components used for the aminoazo compounds are amines of the benzene and naphthalene series or their sulphonic acids as first components, and primary amines containing a free *para*-position and capable of being coupled, e.g., aminocresolether, *α*- or β -naphthylamine-6- or 7-sulphonic acid, as middle components.—F. W. A.

[Azo] colouring matters for wool; Manufacture of new— P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Leverkusen, Germany. Eng. Pat. 29,567, Dec. 22, 1913.

THE monoazo-dyestuffs obtained by combining diazotised anthranilic acid, its homologues or substitution products, with 2,5-aminonaphthol-7-sulphonic acid or its alkyl or aryl derivatives in such a manner that the azo-group is in the nucleus containing the amino-group, are combined in alkaline solution with diazotised *o*-aminophenols or their derivatives. The dyestuffs produced dye

wool red to violet-black shades, which are converted by chroming into bluish-black to greenish-black shades very fast to light, alkalis, acids, mulling, and potting.—F. W. A.

Azo colouring matters. H. Jordan and W. Neelmeier, Leverkusen, Germany, Assignors to Synthetic Patents Co., New York. U.S. Pat. 1,147,803, July 27, 1915. Date of appl., July 7, 1914.

NEW yellow dyestuffs are obtained from an aminobenzoylamino-compound, such as di-*p*-aminobenzoyl-*p*-aminophenylurea-disulphonic acid, and an aminoarylpyrazolone, such as 1-*m*-aminophenyl-3-methyl-5-pyrazolone. The dyestuff produced from the compounds mentioned gives bright greenish-yellow shades on cotton which are made fast to washing by formaldehyde. When diazotised on the fibre and developed, the dye gives orange shades with β -naphthol, and yellow shades with 1-phenyl-3-methyl-5-pyrazolone, which shades may be discharged with hydrosulphite to a pure white. On treatment with zinc dust and acetic acid it gives di-*p*-aminobenzoyl-*p*-aminophenylurea-disulphonic acid and 1-*m*-aminophenyl-3-methyl-4-amino-5-pyrazolone.—F. W. A.

[*Vat*] *dyestuffs; Manufacture of*—. R. B. Ransford, London. From L. Cassella und Co., Frankfurt, Germany. Eng. Pat. 17,319, July 21, 1914. Addition to Eng. Pat. 1443, Jan. 19, 1914 (this J., 1914, 743).

AN aromatic monoaniline is heated with 1-amino-2-methylantraquinone and sulphur at an elevated temperature. Fast bluish red shades are obtained on cotton from a vat.—F. W. A.

Leuco-compounds of colouring matters; Manufacture of dry—. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen, Germany. Eng. Pat. 17,563, July 24, 1914.

DRY indigo white or other leuco-compound may be obtained by spraying a paste, solution, or suspension into a current of air at 100°–125° C., the time during which the air remains in contact with the leuco-compound being insufficient for objectionable oxidation to take place. Molasses or other substance may first be mixed with the leuco-dyestuff paste.—F. W. A.

Vat colouring matters of the anthracene series; Manufacture of—. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen, Germany. Eng. Pat. 1425, Jan. 19, 1914. Addition to Eng. Pat. 12,584, May 29, 1913.

SEE Addition of Feb. 13, 1914, to Fr. Pat. 458,949 of 1913; this J., 1915, 22.

Vat dyestuffs of the dihydro-1.2.2'.1'-anthraquinone-azine [indanthrene] series; Manufacture of finely subdivided—. O. Imray, London. From Farb. vorm. Meister, Lucius, und Brüning, Höchst, Germany. Eng. Pat. 9269, April 14, 1914. SEE Fr. Pat. 470,984 of 1914; this J., 1915, 221.

Vat dyestuffs; Finely-divided—and process of making same. A. Steindorff and R. Welde, Assignors to Farb. vorm. Meister, Lucius, und Brüning, Höchst, Germany. U.S. Pat. 1,145,934, July 13, 1915. Date of appl., Apr. 9, 1914.

SEE Fr. Pat. 470,984 of 1914; this J., 1915, 221.

Vat dye; Red—. W. Bauer and A. Herre, Opladen, Germany, Assignors to Synthetic Patents Co., New York. U.S. Pat. 1,147,778, July 27, 1915. Date of appl., Oct. 6, 1914.

SEE Eng. Pat. 7916 of 1914; this J., 1915, 829.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Cotton as Contraband of War. Board of Trade J., Aug. 26, 1915.

A ROYAL Proclamation, dated Aug. 20th, 1915, declares that raw cotton, cotton linters, cotton waste, and cotton yarn will be treated as Absolute Contraband.

Cotton; Action of mineral acids on—. M. Cohen. J. Soc. Dyers and Col., 1915, 31, 162–165.

THE concentration of acid at which tendering of cotton first occurs was determined in the case of hydrochloric and sulphuric acids. On boiling with cotton for one hour, hydrochloric acid of 1/128% and upwards increases the copper equivalent of the cotton (Schwalbe, this J., 1907, 548), whereas sulphuric acid produces no appreciable effect until of 1/32% concentration. If the cotton is soaked in cold acid, dried, and then heated at 120° C. for ten minutes, an acid of as low a strength as 1/400% in the case of hydrochloric acid, and 1/128% in the case of sulphuric acid affects the cotton, due to the acid becoming concentrated on the fibre. The increase in the copper equivalent corresponded to the decrease in the tensile strength of the yarn.—F. W. A.

Prizes for the solution of problems connected with paper-making.

THE Technical Section of the American Paper and Pulp Association offers prizes of \$100 for the best paper on each of the following subjects:—

(1) The causes for the deterioration of Fourdrinier wires, and means for prolonging the life of the wires.

(2) How can the pitch in sulphite pulp be eliminated?

(3) The effect of the order and time of adding alum, rosin, and colour on the retention of colour.

(4) The retention of various mineral fillers used in paper making and their effect on the life of the machine clothing and the quality of the paper.

The papers must reach the office of the Secretary of the Section on or before Dec. 31, 1916, and must not previously have appeared in print. The authors of papers must be resident in the United States or Canada.

Heating of cottonseed. Its causes and prevention. Barrow. See XII.

PATENTS.

[*Hemp*] *fibre process.* H. J. Young, Cincinnati, Ohio. U.S. Pat. 1,146,987, July 20, 1915. Date of appl., May 5, 1913.

HEMP stalks are separated from the rest of the plant, crushed lengthwise between rollers to facilitate the penetration of liquid, submerged in a 2% solution of alkali at 200° F. (93° C.), removed, rinsed with an acidulated solution, passed through a squeegee to eliminate the excess of liquid, dried, sprayed with oil, and finally broken transversely to permit of the liberation of the fibre by mechanical means.—J. F. B.

Fibre-plants; Process of retting and ungumming—. B. Loomis, Hartford, Conn., Assignor to Loomis Utilisation Co., East Orange, N.J. U.S. Pat. 1,148,698, Aug. 3, 1915. Date of appl., July 23, 1912.

FIBRE-PLANTS are crushed to express the contained juice, then extracted with warm water to remove tannic acid, and treated with a mixture of the expressed juice and a solvent for fatty acids. Gummy and resinous substances thus separated are removed from the liquor, and the latter is

circulated repeatedly through a heater and in contact with the material, until retting and un-gumming are effected. The liquor is then run off and the material dried by a current of warm non-oxidising gas.—A. S.

Cellulose or cellulose compounds; Manufacture of tubular threads from solutions of— and of compound threads, and apparatus therefor. Courtaulds, Ltd., London, and L. P. Wilson, Coventry. Eng. Pat. 17,195, July 23, 1914.

A TUBULAR thread is produced by the precipitation of viscose solution passed through an adjustable annular slit surrounding a central perforated projection of the required shape, immersed in a precipitating bath which has access both to the inner and outer surfaces of the thread. Compound threads are made by introducing a thread, which may be formed previously in the same bath and may be dyed, undyed, or twisted, into the interior of the tubular thread.—F. Sp.

Cellulose wadding; Method of producing—. Dr. Degen and Kuth, Düren, Germany. Eng. Pat. 24,183, Dec. 16, 1914. Under Int. Conv., Dec. 16, 1913.

DRY cellulose pulp board made in a paper-making machine, and hence having its fibres substantially parallel to one another, is passed over several rollers on which it is disintegrated by the action of rotating tools acting alternately on both sides of the board and parallel to the direction of the fibres. Preferably some of the tools rotate clockwise and some counterclockwise. Cotton-wool may be added before, during, or after the disintegration in order to produce a highly cohesive and absorbent material. The disintegrated mass of fibres is passed through pressure rollers to form a fleece, which may be combined with alternate layers of cotton-wool fleece.—F. Sp.

Insulating material [from Zostera marina fibre]. Method of producing insulating material. H. B. MacFarland and R. J. Shoemaker, Chicago, Ill. U.S. Pat. (A) 1,146,189 and (B) 1,146,190, July 13, 1915. Date of appl., Nov. 26, 1913.

(A) FIBRES of *Zostera marina* are mixed with 3/7 of their weight of hydrocellulose, which has been derived from the fibres of the plant and converted into a gummy substance by hydrolysis, and the product is formed into a felted sheet of homogeneous texture and uniform thickness. (B) The plant is treated in an alkaline solution, and the fibrous residue is subjected to acid treatment to convert the cellulose into a gummy product, the substances dissolved out by the treatments being removed. The gummy substance is mixed with plant fibres, which have been treated with alkali, and the mixture agitated, drained, and pressed to the desired form.—B. N.

Sheet material [paper and the like]; Process and apparatus for drying—. O. Minton, Brooklyn, N.Y. U.S. Pat. (A) 1,147,808 and (B) 1,147,809, July 27, 1915. Date of appl., Oct. 6, 1914.

(A) THE material, e.g. moist paper from the wet-end of the paper machine or from the sizing vat, is passed through a bath of liquid, such as mercury, which is without action on the material, the bath being heated to a temperature sufficient to evaporate the moisture. (B) The moist material is passed continuously through a vacuum drying chamber at a temperature below 100° C.; the chamber is closed at the entrance and exit by a liquid seal, e.g. mercury, which has no action on the material.—J. F. B.

Silk for felting; Manufacture of—. G. Diesser, Zürich, Switzerland. Eng. Pat. 12,374, May 19, 1914. Under Int. Conv., May 20, 1913.

SEE Fr. Pat. 472,351 of 1914; this J., 1915, 418.

Osier bark; Process for treating—. E. Pelz, Zelechowitz, Austria, Assignor to Filzkorkfabrik Ges., Vienna. U.S. Pat. 1,148,101, July 27, 1915. Date of appl., Feb. 21, 1914.

SEE Eng. Pat. 6555 of 1914; this J., 1915, 792.

Wood; Treatment of— and production of food-stuffs and other useful products therefrom. J. König, Münster, Westphalia. Eng. Pat. 8006, March 30, 1914.

SEE Fr. Pat. 469,768 of 1914; this J., 1915, 47.

Fibrous materials; Manufacture of stratified— especially for chemical and electric-insulating purposes. Meirovsky und Co. A.-G., and M. Meirovsky, Porz, Germany. Eng. Pat. 11,112, May 5, 1914.

SEE Fr. Pat. 471,836 of 1914; this J., 1915, 419.

Paper; Coated— and process of making the same. H. Wrede, Berlin, Assignor to Corn Products Refining Co., New York. U.S. Pat. 1,147,996, July 27, 1915. Date of appl., Nov. 8, 1912.

SEE Eng. Pat. 4706 of 1913; this J., 1914, 349.

Process of impregnating textile fabrics with rubber solution. Eng. Pat. 17,097. See XIV.

Tanning material [from waste sulphite lye] and process of preparing same. U.S. Pat. 1,147,245. See XV.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Action of mineral acids on cotton. Cohen. See V.

PATENTS.

Textile fibres and fabrics; Protective treatment of—. F. Ferrand, Manchester. Eng. Pat. 12,086, May 16, 1914.

TEXTILE fibres or fabrics are treated with a mixture of formaldehyde and a sulphonated fat or oil in order to prevent degradation of the cellulose in the subsequent boiling, chemicking, and bleaching. *Example:*—One part of a mixture of 10 parts of sulphonated maize oil and one part of 40% formaldehyde is added to 1000 parts of water, and in the liquid thus obtained cotton cloth from the loom is steeped for 10–20 hours. The liquid may also be forced through the fabric wound on perforated spindles. The treated fibres or fabrics take brighter and faster shades when dyed and are more amenable to subsequent processes. Loose cotton so treated can be more highly nitrated than untreated cotton.—F. Sp.

Bleaching fabrics in open form; Process for—. C. Taylor, Boston, Mass. U.S. Pat. 1,146,461, July 13, 1915. Date of appl., Nov. 11, 1914.

THE fabric is saturated with chlorine solution, passed through caustic soda solution, boiled with caustic soda solution under slight pressure, and then passed through a dilute and finally a stronger chlorine solution, being squeezed after each operation.—F. W. A.

Dyeing by the simultaneous application of tannin colouring matters and tannin to the fibre; Process for—. N. Wosnessensky, Prochoroff, Russia. Eng. Pat. 9052, Apr. 9, 1914.

RESORCINOL is used for the solution of the basic dyestuff in presence of tannin alone or for printing in presence of an antimony salt. The dyeings are in every respect faster, more especially to rubbing, than those hitherto produced.—F. W. A.

Dyeing fabrics; Method of and means for —. Bradford Dyers' Association, Ltd., Bradford, and E. J. Wilkinson, Manchester. Eng. Pat. 17,215, July 21, 1914.

INSTEAD of passing the fabric repeatedly through the dye-liquor until the dyestuff is fixed, the impregnated fabric is kept in motion in a separate enclosed chamber, which may have been freed from air, in such a manner that the moisture and substances taken up are evenly distributed throughout the mass. Suitable apparatus for carrying out the operations is claimed.—F. W. A.

Dyeing piece goods, yarn, or raw stock; Apparatus for —. G. W. Johnson, London. From Uniform Dyeing Machine Co., Groveville, N.J., U.S.A. Eng. Pat. 17,296, July 21, 1914.

THE apparatus consists of a vessel divided by a vertical partition into a dye-vat proper and a smaller auxiliary chamber. The walls of the dye-vat support removable, superposed, perforated shelves. The dye-vat is fitted at the bottom with branched pipes from which the liquor is distributed sideways, with a pump for circulating liquor in either direction through the dye-vat proper and auxiliary chamber, and with a waste-overflow conduit near the top. Means are provided for delivering cleansing fluid to the auxiliary chamber, and there is a removable gate at the top of the partition. Vertical tubes may be situated in the middle of the dye-vat, having a vertical slot and a perforated cap and open at the bottom, so that dye-liquor and wash-water may pass through the goods between the shelves in the dyeing chamber.—F. W. A.

Dyeing-machine. J. H. and D. M. Giles, Taunton, Mass. U.S. Pat. 1,146,324, July 13, 1915. Date of appl., Aug. 28, 1914.

THE dyeing-machine has an inner and an outer set of annular stick-supporting members, and suitable gearing for adjusting the relative positions of the two sets and thus varying the distances between the sticks.—F. W. A.

Warp dyeing-machine. J. G. King, Burlington, N.C. U.S. Pat. 1,148,695, Aug. 3, 1915. Date of appl., June 19, 1913. Renewed Jan. 23, 1915.

THE shaft of the dye-vat carries spools which rotate individually. Means are provided for drawing all the warps at once through the vat and round the spools, which taper from the ends towards the centre; and also means for guiding and spacing the warps, including relatively fixed elements co-operating with the warps before they pass on to the spools.—F. W. A.

Vat-dyeing; Process of —. J. C. Hebden, Providence, R.I., Assignor to W. R. Peabody, Cambridge, Mass. U.S. Pat. 1,148,966, Aug. 3, 1915. Date of appl., Dec. 30, 1912.

THE fibrous material is immersed in an alkaline solution of a leuco-compound, and the alkalinity of the bath gradually reduced, thus diminishing the solubility of the leuco-compound, which is hence fixed on the fibre.—F. W. A.

Bleaching and dyeing textiles; Apparatus for —. P. J. Grandsire, Darnétal, France. U.S. Pat. 1,148,377, July 27, 1915. Date of appl., July 21, 1913.

SEE Fr. Pat. 448,248 of 1912; this J., 1913, 423.

Fast shades on cotton fibre; Production of —. S. Sokal, London. From Kalle und Co. A.-G., Biebrich, Germany. Eng. Pat. 4656, Feb. 23, 1914. SEE Ger. Pat. 275,660 of 1912; this J., 1914, 828.

Woollen goods; Treatment of —. A. E. Garrett, St. Albans. U.S. Pat. 1,147,011, July 20, 1915. Date of appl., Oct. 6, 1914.

SEE Eng. Pats. 29,512 of 1913 and 2394 of 1914; this J., 1914, 1096.

[120] *Dyestuffs and a process of development on the fibre.* Eng. Pat. 28,925. See IV.

Process of making a novel starch product. Article of manufacture. U.S. Pats. 1,148,453 and 1,148,454. See XVII.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Ammonia; Action of uranium as catalyst in the synthesis of — from its elements. F. Haber and H. C. Greenwood. Z. Elektrochem., 1915, 21, 241—245. J. Chem. Soc., 1915, 108, ii., 443—444.

HABER and Le Rossignol (compare this J., 1910, 485) have shown that ammonia is produced when a mixture of nitrogen and hydrogen passes over uranium which contains carbon, and at the same time the uranium takes up nitrogen and falls to powder. It is now shown that when a mixture of nitrogen and hydrogen is passed over uranium carbide at about 500° C., and under high pressure, uranium nitride is formed, the major portion of which dissolves in acids with the formation of ammonia, whilst a small portion is insoluble, and is only decomposed by boiling with concentrated alkali. As the nitride formation proceeds, the contact material falls to a fine powder, and after prolonged use forms a hard, compact mass, the catalytic action increasing. The volume-time efficiency of the uranium catalyst increases very much with increase of pressure. A small scale apparatus is described, based on apparatus previously employed for the preparation of pure ammonia from nitrogen and hydrogen.

Potash situation. E. Hart. J. Ind. Eng. Chem., 1915, 7, 670—671.

IT is probable that in the near future a considerable amount of potash will be obtained from condensed fume from cement kilns. A sample obtained from this source was found to contain 94% of potassium sulphate and 5% of potassium carbonate. The use of felspar of high quality for potash recovery would not be profitable, but there are available large quantities of lower grade material. In the district near Erwin, Tenn., a plant is to be erected shortly to treat such material by heating it with barytes in a reducing atmosphere. A barium-aluminium-potassium silicate containing about 36% of SiO₂ is thus formed; this is run into water whilst molten, the granulated product is ground, floated in water, and, after settling, is treated as a paste with the requisite quantity of sulphuric acid. On evaporation and crystallisation, the solution of alum and aluminium sulphate yields alum free from iron, and crude aluminium sulphate equal in value to that made from bauxite. The white insoluble residue consists of a mixture of nearly equal parts of very finely divided barium sulphate and silica, and after ignition can be used as a pigment in printing ink, in rubber mixings, and as a coating for paper.—A. S.

Potash from Queensland prickly pear. O. C. Roberts. Chem. News, 1915, 112, 81.

EFFORTS are being made at Dulacca, Western Queensland, to destroy the prickly pear pest by means of arsenious chloride, and to recover potash from the burnt ashes. The yield of ash (including

wood ashes), containing 15% of potash, has reached 7 tons per acre. Work is now in progress on 10,000 acres of infested land, and it is hoped soon to produce potash in considerable quantity.

Phototropy of inorganic systems. Calcium sulphide system. J. R. Mourello. *Comptes rend.*, 1915, 161, 172—175.

THE author describes two series of experiments with calcium sulphide to show the colour changes caused by exposure to light, using in the one series manganese (0.1 to 0.0001 grm.) and in the other manganese and bismuth in the same proportion, as activating materials. The substances were prepared by mixing 100 grms. of pure calcium carbonate (obtained by precipitating the chloride with sodium carbonate) with 0.1 grm. of sodium chloride, 0.03 grm. of sodium carbonate, the necessary proportion of active material (manganese or manganese and bismuth), and flowers of sulphur. The mixture was heated to 300°—1000° C. for four hours, and on cooling, the mass was in general white, sensitive to light, but not phosphorescent, which latter fact is attributed to the high temperature of formation. The experiments show that within three minutes, colours varying from reddish-violet to intense violet are produced under the direct influence of light. In diffused light the bodies resume their white colour. The colour is formed with 0.1 grm. of manganese per 100 grms. of calcium carbonate, and its intensity is augmented as the proportion of manganese diminishes as far as 0.0001 grm.; if the manganese is still further lessened the colour decreases in intensity and soon vanishes. The colour changes are due to the presence of manganese; bismuth intensifies the colour without altering its tint.—W. G. C.

Sulphides of manganese. V. M. Fischer. *J. Russ. Phys. Chem. Soc.*, 1914, 46, 1481—1519. *J. Chem. Soc.*, 1915, 108, ii., 462—463.

THE methods given in the text-books for preparing the green manganous sulphide rarely give positive results, but the following procedure is invariably successful. Ten grms. of tetrahydrated manganous chloride or a corresponding quantity of the sulphate is dissolved, together with 5 grms. of ammonium chloride, in 25 c.c. of water in an Erlenmeyer flask, 100 c.c. of 25—20% ammonia solution being then added. From the clear solution thus obtained, the rose-coloured manganous sulphide is precipitated by gradual addition, from a dropping funnel, of 100 c.c. of cold ammonium hydrogen sulphide, prepared by saturating 2.5% ammonia solution with hydrogen sulphide; during the precipitation, the liquid is constantly shaken. After some hours, the manganous sulphide will have changed completely to the green form, which is separated by filtration, washed with dilute ammonium hydrogen sulphide solution, and dried in a current of hydrogen at 110° C. Green manganous sulphide is obtained either anhydrous or in a hydrated form, the content of water, which varies from 0 to 17% ($1\frac{1}{2}H_2O$), being dependent on the concentration of the ammonia, the presence or absence of ammonium chloride, and the length of time during which the precipitate remains in contact with the mother liquor. Any hydrated green sulphide becomes anhydrous if left long enough in the liquid. Manganous sulphide may be precipitated from a faintly acid solution of a manganous salt by means of hydrogen sulphide if the passage of the gas is sufficiently protracted: the precipitate is red or orange-red, and according to the degree of acidity of the solution, is either anhydrous or hydrated to a maximum of 17% of water. Rose-coloured manganese sulphide, formed on precipitation of a solution of a manganous salt

by means of an alkali sulphide, is amorphous. This, and also the red variety, are converted into the green modification by trituration. In presence of a considerable proportion of sodium hydroxide, addition of sodium sulphide to a solution of a manganous salt gives a white precipitate having the composition, $MnS.3Mn(OH)_2$. (See also page 925.)

Borates. The system $Na_2O-B_2O_3-H_2O$ at 60° C. I. U. Sborgi and F. Mecacci. *Atti R. Accad. Lincei*, 1915, [v], 24, i., 443—448. *J. Chem. Soc.*, 1915, 108, ii., 449.

THIS system, which was investigated by Dukelski (this J., 1906, 757) at 30°, has been studied by the authors at 60° C. over that part of the diagram where the solid phase lies between boric acid and the metaborate. After boric acid, the stable phase consists of $Na_2O.5B_2O_3.10H_2O$, and then of $Na_2O.2B_2O_3.5H_2O$.

Eutectic systems; Application of the method of heating to the investigation of binary —. New application of the method, principally to systems containing silicates. N. I. Bezborodko. *J. Russ. Phys. Chem. Soc.*, 1911, 46, 1830—1874. *J. Chem. Soc.*, 1915, 108, ii., 414.

THE author has applied the method of heating to the determination of the eutectic points of a number of binary systems already investigated by the cooling method by various authors. The results show that a mechanical mixture of two compounds in the eutectic proportions, when heated comparatively rapidly, generally begins to melt at the eutectic temperature. In order to obtain fusion without superheating, such intimate mixture of the two components as is attained by preliminary fusion and slow crystallisation is unnecessary, careful mechanical mixture of the finely ground components being sufficient. The method is applicable to the determination of the eutectic points of mixed salts, and also of mixed sulphides and silicates. It is especially suited to the investigation of: (1) substances which dissociate at high temperatures, such as (a) silicates, principally of the group of contact-metamorphic minerals, and other compounds unstable at high temperatures lower than their melting points; (b) silicates and other compounds unstable at their melting points, and separating into new components on solidification; (c) sulphides and other components dissociating, with evolution of gases, on heating. (2) Silicates exhibiting a tendency to form a glassy mass on solidification.

Ferrous compounds; Contact action of water vapour and carbon in the oxidation of —. A. G. Doroshevski and A. J. Bardt. *J. Russ. Phys. Chem. Soc.*, 1914, 46, 1669—1676. *J. Chem. Soc.*, 1915, 108, ii., 438.

THE charcoal used in the industrial purification of alcoholic liquids is always stored in a dry place, exposure to moisture resulting in a loss of activity. In absence of water vapour, ferrous oxide is not oxidised to ferric oxide at the ordinary temperature in presence of carbon. When mixed with carbon and placed in a desiccator over water, ferrous oxide becomes completely oxidised only after some months at room temperature, but after some days at 39°—41° C. From the results of experiments on the oxidation of ferrous oxalate and sulphate in presence of water vapour and in presence or absence of charcoal, the authors conclude that the rôle of the carbon consists in intensifying the catalytic effect of the water vapour, and that the alcohol is involved in the reaction of conjugated oxidation. Carbon itself undergoes oxidation in presence of water vapour at comparatively low temperatures.

Sodium selenate and selenic acid; Preparation of —. J. Meyer and K. Heider. Ber., 1915, 48, 1154—1158.

To prepare sodium selenate, selenium dioxide was cautiously heated in a porcelain crucible with somewhat more than the calculated amount of sodium peroxide. At the end of the ensuing violent reaction the product was dissolved in water, carbon dioxide was passed into the solution, and after filtration and concentration on the water-bath, the solution was allowed to crystallise. Recrystallisation was effected above 30° C. to ensure the deposition of the anhydrous salt. A second recrystallisation gave pure sodium selenate. The total yield was about 80%. By evaporating selenium dioxide suspended in the calculated amount of 30% hydrogen peroxide to dryness on the water-bath, a 47% yield of selenic acid was obtained; the yield rose to 70% upon repeating the operation with a second equal amount of hydrogen peroxide. The most favourable conditions for the anodic oxidation of selenium dioxide to selenic acid are represented by the following data: 3.2 grms. of selenium dioxide dissolved in 30 c.c. of nitric acid (sp. gr. 1.4); area of platinum foil anode, 6 sq. cm.; cathode of platinum wire; temperature, 70°—80° C.; current 2.5 to 3.5 amps. at 8 volts. The process was accelerated by the presence of small quantities of selenic acid; the current efficiency rose from 1% (after 15 mins.) to 8.3% (after 111 mins.) and then declined.—J. R.

Desluctive distillation of Pacific Coast kelps. Hoagland. See 11B.

Solubility of palladium in selenic acid. Palladous selenate. Hradecky. See X.

Determination of traces of carbon monoxide in the air. Gautier. See XIXB.

PATENTS.

Sulphuric acid; Manufacture of —. F. Curtius und Co., Duisburg, Germany. Eng. Pat. 28,550, Dec. 10, 1913. Under Int. Conv., March 11, 1913.

PURIFIED roasting gases are introduced, in a cold or relatively cool state, into a system of towers. The first tower is preferably built to a larger scale than usual and sprinkled with highly concentrated acid, poor in nitric acid or nitrosulphonic acid, obtained from other towers of the series, not acting as Gay Lussac towers.—F. SODX.

Acid sulphurous preparations; Apparatus for the manufacture of —. F. E. Coombs, Au Sable Forks, N.Y. U.S. Pat. 1,147,376, July 20, 1915. Date of appl., April 16, 1912.

AN apparatus for burning sulphur consists of a chamber containing a retort into which molten sulphur is run continuously; a jet nozzle, supplied with a regulated air current, and in open communication with the retort and chamber, directs a flame jet on to the bottom of the retort.—E. H. T.

Hydrochloric acid; Apparatus and process for making —. H. Howard, Brookline, Mass. U.S. Pats. 1,145,897 and 1,145,898, July 13, 1915. Date of appl., June 26, 1914.

SALT is carried from a storage vessel by means of a conveyor sealed by the salt in the storage vessel, to a closed mixing chamber, wherein it is mixed mechanically and continuously with predetermined quantities of sulphuric acid. From this chamber the mixture passes to a single-stage mechanical salt-cake furnace, connected with an absorption system for the hydrochloric acid.

—E. H. T.

Carbonic acid compounds of ammonia; Manufacture of —. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen, Germany. Eng. Pat. 8763 of 1915; date of appl., Dec. 15, 1914.

AMMONIA and carbon dioxide are introduced at ordinary pressure into a liquid hydrocarbon, e.g., petroleum or naphtha oil, or other indifferent liquid, immiscible with water. The gases may be dry or moist, pure or diluted, and the heat of reaction is removed by suitable cooling means. The products, ammonium carbamate, and carbonate or bicarbonate, separate immediately and are filtered off.—E. H. T.

Base-exchanging bodies; Manufacture of —. P. de Brunn, London. Eng. Pat. 10,997, May 4, 1914.

BASE-EXCHANGING substances are produced by precipitation in a solution in which chemically inert substances, preferably of a porous nature, such as hard coke, porous stone, powdered glass, are kept in suspension by mechanical stirring. The base-exchanging substance is thus deposited uniformly upon the inert substance.—J. H. J.

Base-exchanging bodies; Manufacture of —. W. E. Evans, London, and E. L. Leblanc, Paris. Eng. Pat. 17,663, July 25, 1914.

AN autoclave of 250 galls. capacity is filled with 100 galls. of sodium aluminate solution of 20° B. (sp. gr. 1.162). It is then closed and steam is blown in until a temperature of 150° C. is reached, when sodium silicate solution of 20° B. (sp. gr. 1.162) is pumped in, in quantity insufficient to combine with all the aluminate. The temperature is maintained at 150° C. for 6 hrs. A hard, fine precipitate is formed, which is suitable for use as a filtering medium. Instead of using steam, the autoclave may be heated with gas, and it may be oscillated or provided with an agitator, and may have a filter plate near the bottom, through which the solution may be filtered and the precipitate retained on the plate.—J. H. J.

Aluminium sulphate; Manufacture of —. J. Boulton, Clippens, Scotland. Eng. Pat. 20,227, Sept. 26, 1914.

CRUDE ore (oxidised shale, china clay, etc.) is treated with sulphuric acid and the liquid placed in a vat in which a magnetised steel wire framework is immersed. The framework has cross wires of copper from which zinc rods are suspended. The free acid is neutralised, and iron and other impurities are precipitated by the action of the magnet; the clarified liquid, on evaporation, yields crystals of pure aluminium sulphate. The process takes 6 hours when the temperature is about 100° F. (38° C.).—E. H. T.

Aluminium oxide; Manufacture of —. Elektro-Osmose A.-G. (Graf Schwerin Ges.), Frankfurt, Germany. Eng. Pat. 6727, May 5, 1915. Under Int. Conv., May 8, 1914.

CRUDE alkali aluminate lye is treated with acid to precipitate the aluminium as hydroxide, and the mixture is then exposed to an electric current in a compartment partitioned off by diaphragms (made preferably of viscose) from the cathode and anode compartments. For example, a 6% lye is made neutral to phenolphthalein with sulphuric acid, and the pulpy mass obtained is exposed to a current of 8—10 amps. per sq. dm. and 10—15 volts for about 3 hours. Aluminium oxide, in granular form, remains between the diaphragms, and pure caustic alkali passes to the cathode compartment.—F. SODX.

Alumina; Method of making —. H. T. Kalmus, W. L. Savell, and K. B. Blake, Kingston, Ontario, Assignors to The Exolon Co., Cambridge, Mass. U.S. Pat. 1,148,092, July 27, 1915. Date of appl., Mar. 21, 1914.

ALUMINOUS and silicious material is treated with sulphur dioxide and water, whereby alumina is dissolved as an unstable compound (or compounds) together with some silica. Silica and alumina are precipitated successively from the solution by heating it, with agitation, first to about 50° C. and subsequently to about 80° C.—E. H. T.

Aluminium chloride; Production of —. F. von Kügelgen, Holcombs Rock, Va., and G. O. Seward, East Orange, N.J., Assignors to Virginia Laboratory Co., New York. U.S. Pat. 1,147,832, July 27, 1915. Date of appl., Nov. 26, 1913.

BAUXITE or clay is mixed with sufficient carbonaceous matter to reduce iron and aluminium compounds but not silicon compounds. The mixture is heated first in chlorine to below 500° C. for a limited time to remove iron, and subsequently to about 900° C. in another apparatus to convert the aluminium into chloride.—E. H. T.

Cyanogen compounds; Production of —, and a furnace for carrying the same into effect. A. R. Lindblad, Ludvika, Sweden. Eng. Pat. 22,852, Nov. 21, 1914.

A HEATED mixture of carbon and a suitable metallic compound, such as potassium carbonate, is treated with nitrogen in an electric furnace of the type described in Eng. Pats. 4553 and 17,342 of 1909 (this J., 1909, 1047, 1145; 1910, 95), the furnace having a shaft and a melting chamber in which there are free spaces between the charge and the brickwork and the electrodes penetrate the charge at the free spaces, so that the body of the furnace is protected from the current and the molten alkali. Nitrogen is admitted near the electrodes, and the metallic compound is charged, with the carbon, through the shaft or is introduced directly into the melting chamber, near the point at which nitrogen is admitted, the cyanogen compounds formed being led off in the gaseous state at the opposite side of the chamber and passed to condensers. Uncondensed gas is returned to the furnace, and part of it may be forced in around the electrodes, to prevent condensed products from caking upon them. A modified design allows the cyanide produced to react with steam in the upper part of the furnace, so as to yield ammonia and caustic alkali, which latter sinks with the carbon of the charge, to be utilised afresh; supplementary electrodes supply heat to the furnace where the cyanogen is decomposed.—F. SODN.

Barium chloride; Process of making —. H. A. Gardner, Washington, D.C. U.S. Pat. 1,146,491, July 13, 1915. Date of appl., Jan. 20, 1915.

BARIUM sulphate and calcium chloride are fused together at above 1000° C., until acid products are evolved and the melt has become basic. The barium chloride is then extracted with water.—E. H. T.

Potassium-bearing minerals; Process of treating —. S. E. Melkman, Montreal, Canada. U.S. Pat. 1,148,850, Aug. 3, 1915. Date of appl., May 21, 1915.

THE potassium in a silicate rock is converted into soluble salts, by introducing the pulverised mineral, sodium chloride, and powdered carbon into a bath of concentrated sulphuric acid at about 200° C., pulverising the product, and roasting it in air at 1000°—1150° C.—E. H. T.

Ammonia; Catalytic agent for use in producing —. C. Bosch, A. Mittasch, and H. Wolf, Ludwigshafen, and G. Stern, Mannheim. Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen, Germany. U.S. Pat. 1,148,570, Aug. 3, 1915. Date of appl., Dec. 24, 1910.

SEE Fr. Pat. 425,099 of 1910; this J., 1911, 1012.

Purifying liquids which contain colloidal silicic acid as an impurity; Process for —. H. W. de Stucklé, Dieuze, Germany. Eng. Pat. 28,189, Dec. 6, 1913. Under Int. Conv., Dec. 7, 1912.

SEE Fr. Pat. 465,817 of 1913; this J., 1914, 615.

Radium and other radioactive substances; Manufacture, isolation, and enrichment of —. E. Ebler, Heidelberg, Germany. Eng. Pat. 28,414, Dec. 9, 1913. Under Int. Conv., Dec. 11, 1912. Addition to Eng. Pat. 2155 of 1912, dated March 6, 1911.

SEE Addition of Dec. 4, 1913, to Fr. Pat. 440,236 of 1912; this J., 1914, 641.

Radium, mesothorium, thorium, and other radioactive substances; Process for treating ores of —. E. Ebler, Heidelberg, Germany. Eng. Pat. 28,445, Dec. 9, 1913. Under Int. Conv., Feb. 27, 1913.

SEE Ger. Pats. 274,781 and 274,871 of 1913; this J., 1914, 789, 790.

Radioactive solid bodies; Manufacture of —. Radiogen Ges. m. b. H., Berlin. Eng. Pat. 28,757, Dec. 12, 1913. Under Int. Conv., Dec. 13, 1912.

SEE Fr. Pat. 466,015 of 1913; this J., 1914, 614.

Chromium salts; Manufacture of —. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen, Germany. Eng. Pat. 29,325, Dec. 19, 1913.

SEE Fr. Pat. 466,478 of 1913; this J., 1914, 864.

Silicate of alumina, kaolin, and other solid inorganic matter; Purification of —. Fritz Schulz, jun., A.-G., and H. Gruber, Leipzig, Germany. Eng. Pat. 2309, Jan. 28, 1914. Addition to Eng. Pat. 16,129, July 12, 1911.

SEE Fr. Pat. 469,271 of 1914; this J., 1915, 81.

Sulphurous acid and oxides; Process of extracting from sulphates. A. Bambach, Cologne, Germany. Eng. Pat. 3174, Feb. 6, 1914.

SEE Fr. Pat. 470,652 of 1914; this J., 1915, 282.

Hydrosulphites; Production of anhydrous — from aqueous hydrosulphite solutions. Chem. Fabr. Griesheim-Elektron, Frankfurt, Germany. Eng. Pat. 12,558, May 21, 1914. Under Int. Conv., Sept. 27, 1913.

SEE Ger. Pat. 279,389 of 1913; this J., 1915, 355.

Base-exchanging substances; Process of obtaining —. V. Kobelt, Berlin. U.S. Pat. 1,147,515, July 20, 1915. Date of appl., Jan. 19, 1914.

SEE Fr. Pat. 467,687 of 1914; this J., 1914, 938.

Alkali amide; Process for the manufacture of —. B. R. Seifert, Radebeul, and W. Leibrock, Dresden. Assignors to Chem. Fabr. von Heyden A.-G., Radebeul, Germany. U.S. Pat. 1,148,194, July 27, 1915. Date of appl., Dec. 5, 1911.

SEE Fr. Pat. 438,487 of 1911; this J., 1912, 641.

Hydrogen; Process of producing — by decomposing steam. J. E. Boustfield, London. From J. Pintsch A.-G., Berlin. Eng. Pat. 28,904, Dec. 15, 1913.

SEE Fr. Pat. 466,739 of 1913; this J., 1914, 920.

Oxygen: Process for obtaining—by fractional distillation of liquid air. L. Simon, Mannheim, Germany. Eng. Pat. 30,076, Dec. 31, 1913. Under Int. Conv., May 28, 1913.

SEE Fr. Pat. 466,685 of 1913; this J., 1914, 920.

Oxygen and nitrogen; Process of separating air into H. Runge, Hanover, Prussia. Eng. Pat. 3420, Feb. 10, 1914.

SEE Fr. Pat. 469,793 of 1914; this J., 1915, 29.

Acid, alkali, neutral, syrup or like concentrating plant. Eng. Pat. 23,414. See I.

Manufacture of sulphate of ammonia and purification of coal gas. Eng. Pat. 10,059. See IIa.

Process for manufacturing castings consisting of iron oxides or mixtures of iron oxides with other metallic oxides. Eng. Pat. 17,161. See X.

Method of utilising battery-waste. U.S. Pat. 1,148,062. See XI.

VIII.—GLASS; CERAMICS.

Porcelain bodies high in felspar; Viscosity of— A. V. Bleminger and C. S. Kinnison. U.S. Bureau of Standards. J. Franklin Inst., 1915, 180, 232—233.

SAMPLES of porcelain were subjected to a tensile stress of 14.5 lb. per sq. in. at a series of temperatures between 1275° and 1380° C. and their elongation was measured. In a porcelain containing 45% of clay, the greatest elongation is obtained with 35 to 40% of felspar; higher percentages of felspar reduce the elongation. A high proportion of clay reduces the elongation and may be regarded as essential. The effect of flint is inappreciable. In each case the change in viscosity with rise of temperature is irregular; the ware softens at first, then passes through a rigid state and does not commence to soften again until 1345° C., above which distortion occurs. Porcelains which show the same elongation at 1388° C. differ considerably from each other between 1300° and 1345° C. Between these two temperatures the greatest rigidity was shown by the following compositions:—

Clay	Felspar	Flint
40	30	30
45	35	20
45	50	5
50	30	20
50	50	—

—A. B. S.

Clays; Use of sodium salts in the purification of— and in the casting process. A. V. Bleminger. U.S. Bureau of Standards. J. Franklin Inst., 1915, 180, 225—227.

KAOLIN clays may be improved by the addition of a small amount of caustic soda or a mixture of caustic soda and water-glass to the water used for washing. The colour is improved except in clays containing ferric oxide. In Schwerin's electro-osmosis process, the real feature is the preliminary treatment with caustic soda or other electrolyte; electro-osmosis plays no part in the purification of the clay, but merely regulates the density of the deposit on the positive electrode. The effect of caustic soda and of water-glass on the viscosity of clay-slips varies with the nature of the clay, but water-glass effects a greater reduction in

viscosity than does sodium carbonate. Air, entrapped when the slip is prepared, has a marked effect on the viscosity and must be removed by stirring. The viscosity of slips made of several clays is irregular. Ball clay is particularly objectionable in a slip to be used for casting.

—A. B. S.

PATENTS.

Quartz or silica; Articles of— and means for the production thereof. P. L. Pfäferschmidt, Dewsbury, and W. B. Woodhouse, Leeds. Eng. Pat. 420, Jan. 7, 1914.

LARGE sheets of fused silica are made in an electric furnace provided with a number of resistances of constant length, connected in parallel or in series, or in a combination of both, and arranged so that they are readily accessible and can be withdrawn simultaneously and the product can be quickly handled. The furnace is provided with adjustable lining blocks whereby the thickness of the sheet may be varied.—W. C. H.

Glass; Methods of making air-tight joints between metal [wires] and— The British Thomson-Houston Co., Ltd., London. From Allegem. Elektrizitäts-Ges., Berlin. Eng. Pat. 1056, Jan. 14, 1914.

THE leading-in wires consist of a core sheathed with a material having a different coefficient of expansion. The relative proportions of the core and the cover vary within a short length of the compound wire, so that at one point at least the compound wire will have the same coefficient of expansion as the glass. The ratio of covering material to core may be varied by hammering or compressing the compound wire at one or several places within the range of the seal.—W. C. H.

Glass-furnace. L. Steelman, Millville, N.J. U.S. Pat. 1,145,815, July 6, 1915. Date of appl., March 30, 1912.

THE furnace is provided with a main tank and an auxiliary tank, and with a spout leading from the main tank and disposed in the glass in the auxiliary tank. The molten glass flows from the main tank into the spout at a point below the level of the glass in the latter. The spout extends upwards to the level of the glass in the main tank and affords a gathering point. Surplus glass lifted during the gathering operation flows into an overflow chamber surrounding the spout, and thence through a discharge spout to a pocketed conveyor wheel, which returns it to the main tank.—W. C. H.

Clay; Method of treating— J. L. Musser, Lancaster, Pa. U.S. Pat. 1,147,114, July 20, 1915. Date of appl., Aug. 31, 1911. Renewed Dec. 12, 1914.

THE clay pulp is decanted to remove heavy impurities, and then heated to expand the particles, the light particles thus separated being decanted off. The residual heated pulp is subjected to reduced pressure and then dried.—A. B. S.

Kiln for burning clay products and the like. G. W. Ogan, Danville, Ill. U.S. Pat. 1,147,117, July 20, 1915. Date of appl., Jan. 3, 1914.

A SEMI-CONTINUOUS kiln in which the heating gases enter and leave each chamber through openings in the floor, the chambers being connected by flues beneath the floor.—A. B. S.

Corundum; Apparatus for the manufacture of artificial— E. Gerbel-Strover, Westminster. Eng. Pat. 10,287, Apr. 25, 1914.

ALUMINA is fused in metal tubes made of two semi-cylindrical parts hinged at one side and secured together, a series of these tubes being connected

vertically to form a column. A set of electrodes supplied with polyphase current depends into the uppermost tube and is rotated in order to facilitate the complete fusion of the charge. The fused material solidifies in the lower tubes, and the lowest one is opened and removed, leaving a portion of the solidified mass exposed; this is broken off, and an empty tube is added at the top of the column to receive a further quantity of alumina.—H. H. S.

Abrasive; Electric furnace—and method of making same. H. T. Kalmus, Brookline, Mass., Assignor to The Exolon Co., Cambridge, Mass. U.S. Pat. 1,149,064, Aug. 3, 1915. Date of appl., June 11, 1915.

ALUMINOUS material containing magnesia, titania, etc., is mixed with carbon and fused in an electric furnace, the temperature being controlled so that only impurities other than those mentioned are reduced. The reduced impurities, e.g., ferrosilicon, etc., are separated, leaving a fused alumina abrasive containing magnesia and titania.—A. B. S.

Ceramic argillaceous materials; Method of preparing— E. Tuschhoff, Deutsch-Lissa, Germany. Eng. Pat. 29,421, Dec. 20, 1913.

SEE Fr. Pat. 473,001 of 1913; this J., 1915, 493.

Ovens or kilns for annealing iron castings, for burning bricks and pottery ware, and for similar uses. Eng. Pat. 16,970. See X.

IX.—BUILDING MATERIALS.

Wood preservatives; Toxicity of various— R. M. Fleming and C. J. Humphrey. J. Ind. Eng. Chem., 1915, 7, 652—658.

COMPARATIVE tests of the toxicity of a number of wood preservatives were made on the fungus, *Fomes annosus*, Fr., in a nutrient agar medium by the Petri dish method (Bull. 145 and 227, U.S. Dept. Agric.); cultures of the fungus from 2 to 3 weeks old were used, older cultures being less resistant. The results of the tests indicate that beechwood creosote is two to three times as effective as an average grade of coal tar creosote taken as standard. "Preservol" (probably a mixture of pyroligneous acid and wood tar), hardwood tar, and tar from wood of Douglas fir are about one-half, and "Spirittine" (creosote from soft wood) about one-third, as effective as coal tar creosote. The fractions of b.pt. 215°—305° C. contain the more highly toxic constituents of coal tar creosote, with the possible exception of the phenolic compounds present in lower-boiling fractions. Distillates from water-gas tar are less toxic than coal tar creosote. Zinc sulphate compares favorably with zinc chloride. Bruening and Marmetschke's preservative (6½% zinc chloride plus 3½% aluminium sulphate) is about as effective as zinc chloride alone. "Holzhelfer" (a partial emulsion of zinc chloride, creosote, and a small amount of copper) is much less effective than zinc chloride. Petroleum oils have little or no toxic action.—A. S.

PATENTS.

Artificial stone slabs; Manufacture of— A. Rinne, Butzbach, Germany. Eng. Pat. 28,417, Dec. 9, 1913.

HYDRATE [hydroxide] of calcium, magnesium, or other alkaline earth, is mixed with mineral filling materials and colouring matter, and the mixture is formed into slabs in polished steel moulds under pressure. The slabs are suspended vertically during treatment with carbonic acid, so that their own weight causes them to retain their shape. They are then polished to produce a marble-like appearance of the surface.—H. H. S.

Kilns for burning cement, ores, and like materials; Rotary— G. Polysius, Dessau, Germany. Eng. Pat. 17,146, July 20, 1914. Under Int. Conv., July 18, 1913.

IN rotary kilns adapted to burn powdered fuel, and in which the burning and cooling are effected in the same rotating tube, the nozzle, which comprises a fuel and an air pipe, one within the other, is movable in a longitudinal direction for the purpose of varying the length of the heating and cooling zones.—H. H. S.

Preservative; Method of treating materials with liquid— H. S. Loud, New York. U.S. Pat. 1,147,635, July 20, 1915. Date of appl., Jan. 11, 1915.

WOOD or other porous material is covered with a flowing film of a liquid preservative and then subjected to air under pressure. The liquid and air may be applied alternately or commingled.—A. B. S.

Wood fire-resisting; Method of rendering— H. A. Gardner, Washington, D.C. U.S. Pat. 1,148,013, July 27, 1915. Date of appl., Nov. 6, 1913.

WOOD is rendered fire-resisting by the application of a coating of soluble silicate or aluminate and subsequently treating the coating with a substance, such as oleic or other organic acid, which will decompose it, making it insoluble and waterproof.—A. B. S.

Cementitious material; Manufacture of— Alpine Maschinenfabr. Ges. m. b. H., vorm. Holzhäuersche Maschinenfabr. Ges. m. b. H., Augsburg, and F. M. Meyer, Saarbrücken, Germany. Eng. Pat. 1438, Jan. 19, 1914. Under Int. Conv., Feb. 8, 1913.

SEE Fr. Pat. 466,859 of 1913; this J., 1914, 961.

Wood; Impregnated—and process of producing the same. R. A. Marr, Assignor to American Wood Engraving Co., Norfolk, Va. Re-issue No. 13,952, July 27, 1915 (date of appl., June 10, 1915) of U.S. Pat. 1,121,644, Dec. 22, 1914.

SEE Eng. Pat. 2084 of 1914; this J., 1914, 867; also this J., 1915, 82.

Binding compounds for briquetting [road-making] and the like. Eng. Pat. 19,933. See III.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Oxygen; Possible applications of—in metallurgy. Oxygen blast for the iron blast furnace. [Production of high-percentage ferrosilicon.] J. E. Johnson, jun. Bull. Min. and Metall. Soc. of America, 1915, 8, No. 2. Met. and Chem. Eng., 1915, 13, 483—484.

THE efficiency of a blast-furnace depends not only on the total quantity of heat developed by combustion of the fuel, but also on the temperature at which the heat can be supplied (compare Howe, this J., 1913, 182). The author has calculated the quantities of heat (B.Th.U. per lb. of coke containing 85% fixed carbon) which can be supplied at various critical temperatures by burning the fuel with a dry air blast at 1000° F. (538° C.) or with a mixture of equal weights of oxygen and nitrogen at 70° F. (21° C.). For a critical temperature of 2200° F. (1204° C.) these quantities are 2270 B.Th.U. for the dry air blast and 2650 B.Th.U. for the 50% oxygen-nitrogen mixture, whilst for 3200° F. (1761° C.) the corresponding figures are 970 and 2150 B.Th.U. respectively. For the critical temperature of an iron blast-furnace using coke, i.e., about 2750° F. (1510° C.), the quantities are 1600 B.Th.U. for the hot air blast and 2400

B.Th.U. for the 50% oxygen, so that an ore which requires 2100 lb. of coke with ordinary hot dry blast would require only 1400 lb. with a 50% oxygen blast at the ordinary temperature. The reduction of the coke consumption by using a 50% oxygen blast would be still greater in the manufacture of ferromanganese and ferrosilicon, where a higher critical temperature is required, and it should be possible also to produce ferrosilicon containing more than 15% Si, which is the highest concentration at present attainable in the blast-furnace.—A. S.

Vanadium from oxide to steel. W. F. Bleecker and W. L. Morrison. *Met. and Chem. Eng.*, 1915, 13, 492—494.

THE losses occurring in the manufacture of vanadium steel by methods involving the intermediate production of ferro-vanadium are discussed, and it is concluded that, according to present practice, little more than 60% of the vanadium initially employed is actually recovered in the finished alloy. In the direct method now described, a mixture of calcium vanadate (or other vanadium compound) with a small proportion of iron scale and sufficient silicon (or aluminium) to allow an excess of 10% above the theoretical quantity, is added to the bath of molten steel; the proportion of silicon in the mixture is increased for an open-hearth, and decreased for a crucible charge and the iron scale wholly or partly omitted in the former case. Examples are given showing the greater efficiency of the direct method as compared with the older processes.—W. E. F. P.

Arsenical-antimonial sulphide [gold] ore; Treatment of —, K. B. Moore and H. R. Edmands. *J. Chamber of Mines, W. Australia, Feb.*, 1915. *Met. and Chem. Eng.*, 1915, 13, 508—509.

From sulphide ore containing Fe 8.3, Sb 0.21, As 0.96, S 5.62, MgO 2.74, Al_2O_3 2.02, CaO 3.36%, and gold to the value of 53s. per ton (the remainder being insoluble matter, water, etc.), the maximum extraction obtained by ordinary methods (amalgamation, cyanidation, concentration, etc.) was about 50%. In the method adopted, the finely-divided (practically 150-mesh) ore is roasted sufficiently to liberate the gold from the sulphides, then mixed with oxidised ore, and the mixture agitated with a solution of sodium cyanide and filtered under reduced pressure. The ore not being dead-roasted, lead acetate is added to the solution to remove soluble sulphides, and the gold is finally precipitated by means of zinc dust. The average extraction exceeds 84%, the consumption of sodium cyanide being about 1 lb., and the total cost 9s. per ton. The loss of gold during roasting rarely exceeds 3%.—W. E. F. P.

Silver extraction [by cyanide]; Effect of lead acetate and zinc salts on —, C. R. Morris. *Eng. and Min. J.*, 1915, 100, 189—190.

In cyaniding sulphide ores, the addition of lead acetate gave a slightly better extraction with fresh solutions, but a slightly lower one with mill solutions containing zinc: in a mill test, the omission of lead acetate increased the extraction by 3.2%, and the zinc content of the solution was reduced; the lead salt, by precipitating soluble sulphides, causes an accumulation of zinc in the liquor, which retards the rate of extraction. There should be only sufficient lead or zinc salt in solution to precipitate the alkali sulphides.—W. R. S.

Nickel on nickel-plated surfaces; Rapid method for determining the amount of —, M. Pontio. *Comptes rend.*, 1915, 161, 175—177.

THE method is dependent upon the time taken for mixed acids to dissolve the nickel and reach the underlying metal. The nickel-plated material is dipped in concentrated sulphuric acid, washed,

and dried, and one drop of an acid reagent (nitric acid of 36° B., 10 c.c., hydrochloric acid of 22° B., 20 c.c., hydrogen peroxide, 20 c.c., water 50 c.c.) is dropped on it. This is left for two minutes, and one drop of ammonia added and left for another minute. This mixture, viewed on a white surface, should not be blue in colour if the article is nickel-plated on copper, nor brown or yellow if nickel-plated on iron. The three minutes' contact corresponds to a minimum covering of 1 mgrm. of nickel per sq. cm. on copper, and 4 mgrms. per sq. cm. on iron coppered before plating. Silver plating on copper can also be tested in a similar manner.—W. G. C.

Lead; Physico-chemical studies on —, E. Cohen and W. D. Helderman. *Z. physik. Chem.*, 1915, 89, 733—741. *J. Chem. Soc.*, 1915, 108, ii., 456—457. (Compare this *J.*, 1910, 94.)

THE mean value of six determinations of the sp. gr. at 25°/4° C. of lead which contained not more than 0.001% Cu and 0.0006% Fe was 11.3299. When this pure lead is suspended in a 40% solution of lead acetate which contains 100 c.c. of nitric acid (sp. gr. 1.16) per litre, small ridges appear on the metal in a few days, which indicate that it has contracted. No evolution of gas takes place, so that the change is a physical one. The product formed at 15°, 50°, and 25° C. has a density of 11.3415, 11.3129, and 11.3283 respectively. Dilatometric measurements lead to the view that the changed lead is made up of several allotropic forms.

Aluminium; Preparation of — from Russian minerals. N. Puschin, E. Dischler, and M. Maksimenko. *J. Russ. Phys. Chem. Soc.*, 1914, 46, 1347—1365. *J. Chem. Soc.*, 1915, 108, ii., 459—460.

WHEN a current density of 2—3 ampères per sq. cm. of the anode surface, and a fused mixture containing about 40 mol. % of aluminium fluoride, are employed, and alumina is added periodically to the mixture, the extraction of aluminium may be carried on continuously for a long time, the yield approximating to that obtained in large industrial plant. Aluminium may be prepared from the simonite found in the Urals, the mineral being converted first into the oxide and then into the oxyfluoride, $Al_2O_3F_2$, which is more suitable than the fluoride for treatment in the electric furnace.

Palladium; Solubility of — in selenic acid. Palladous selenate. K. Hradecky. *Monatsh. Chem.*, 1915, 36, 289—297. *J. Chem. Soc.*, 1915, 108, ii., 472.

PALLADIUM, like gold and silver, dissolves completely in selenic acid. Solution occurs at the ordinary temperature when the metal is in the spongy condition, or when it is finely divided if 67% acid is used. The coherent metal, in the form of foil or wire, is dissolved very slowly, even on heating. A deep reddish-brown solution is produced, which on concentrating gives a mixture of palladous selenate and selenous acid. The pure compound, palladous selenate ($PdSeO_4$), is obtained by dissolving palladium in a mixture of selenic acid and nitric acid. It forms small, dark brownish-red, hygroscopic, rhombic prisms. When warmed with concentrated hydrochloric acid, chlorine is evolved. It forms double salts with ammonium sulphate and ammonium selenate when a mixture of the two salts is crystallised from a solution in concentrated hydrochloric acid. Alloys of gold and silver, and gold, silver, and palladium, also dissolve in selenic acid. The possible use of selenic acid in the analysis of such alloys is considered. Platinum-silver alloys are decomposed by selenic acid, the silver passing into solution, whilst the platinum remains undissolved.

Application of the method of heating to the investigation of binary eutectic systems. New application of the method, principally to systems containing silicates. Bezborodko. See VI.

PATENTS.

Iron ore; Process of smelting —. F. J. Mac-halske, Assignor to American Ferroelectride Corporation, Plattsburg, N.J. U.S. Pat. 1,148,700, Aug. 3, 1915. Date of appl., May 6, 1911.

A BASIC charge of iron ore containing titanium, phosphorus, or manganese, a quantity of artificial graphite corresponding to the amount of carbon required theoretically, and a basic (lime) flux is subjected to the action of an electric current, the charge being kept basic during the entire reducing process. Suitable proportions are 100 parts of iron ore and 14 parts of artificial graphite.—A. S.

Iron and steel, Process of pickling —. A. F. Hoffman, Pittsburgh, Pa. U.S. Pat. 1,146,071, July 13, 1915. Date of appl., Oct. 17, 1914.

IRON and steel articles are pickled in dilute sulphuric acid, the spent pickle liquor is passed to a settling tank to remove suspended solids, then aerated at the ordinary temperature, and heated to boiling. The basic ferric compounds thus precipitated are separated and calcined to recover sulphuric acid, which is added to the liquor to render it suitable for use again in the pickling process.—A. S.

Copper and lead; Process for the preparation of alloys containing —. L. Sempell, Duisburg, Germany. Eng. Pat. 28,492, Dec. 10, 1913.

HOMOGENEOUS alloys of lead and copper are obtained by passing hydrogen iodide through the molten mixture. To produce an alloy composed of 100 kilos. of lead and 50 kilos. of copper, about 50 litres of gas containing (say) 30% of hydrogen iodide and 70% of inert gas, is passed through the bath for 5 minutes. A harder final product is obtained if the passage of the gas is continued for a longer period.—T. St.

Agglomeration of ores and metallurgical products. W. Buddeus, Charlottenburg, Germany. Eng. Pat. 29,033, Dec. 16, 1913. Under Int. Conv., Jan. 13, 1913.

FINELY-DIVIDED iron-manganese ore or pyrites cinder is partially reduced, without sintering, by passing a hot reducing gas through the entire charge, and is then subjected to the action of an air blast to re-oxidise it, the heat developed being sufficient to sinter the material. The coherent mass obtained contains the whole of its iron in the form of ferric oxide. The process may be carried out in two stages in a single furnace, e.g., a shaft furnace or a converter, or in separate furnaces.—A. S.

Alkali metals; Production of — by the molten electrolysis of alkali compounds. Deutsche Gold und Silber-Scheide-Anstalt, vorm. Rössler, Frankfurt, Germany. Eng. Pat. 10,193, April 21, 1914. Under Int. Conv., April 26, 1913.

THE collecting vessel for the alkali metal obtained in the electrolysis of alkali compounds fusible by heat, in the Castner apparatus (see Eng. Pat. 13,356 of 1890 and 1933 of 1913; this J., 1891, 777; 1913, 948), is protected by a salt or salt mixture not affected by the products of the electrolysis. The salt or salt mixture is incorporated with calcium oxide, magnesium oxide, asbestos, or similar indifferent substance also unaffected by the electrolytic products. The salt mixture is maintained in a solid or semi-fluid condition by cooling with water, steam, or air.—W. G. C.

Annealing of iron and other metal goods; Process and apparatus for the continuous heating or —. O. Inray, London. From P. K. Siemens, Berlin. Eng. Pat. 11,103, May 5, 1911.

THE furnace consists of a single undivided chamber, through which the articles to be annealed are advanced, step by step, on trolleys. In the pre-heating and cooling zones the cross-section of the furnace conforms in shape and size as closely as possible to the trolleys, in order to reduce the free space and hence the movement of the gases within the furnace; in the heating zone proper the cross-section is somewhat larger. During the heating process the chamber is filled with reducing combustible gases; before opening the chamber for the introduction and withdrawal of a trolley, these are displaced by inert gases, e.g., the waste furnace gases, which are, in turn, displaced by combustible gases when the chamber is closed again.—A. S.

Oven or kiln for annealing iron castings, for burning bricks and pottery ware, and for similar uses. Gibbons Bros., Ltd., and R. Masters, Dudley, and R. Baker, Smethwick. Eng. Pat. 16,970, July 17, 1914.

THE oven is of the tunnel type, and is heated by the combustion, within the oven, of producer gas, the waste gases escaping through passages in the floor to an underground flue leading to the chimney. Longitudinal gas flues with vertical offshoots run within the two side walls from the producer, the supply of gas being controlled by dampers placed at the upper ends of the vertical passages. Longitudinal secondary air passages run between and at the side of the gas flues, and vertical air passages are formed adjacent to, and inclined at the top towards, the vertical gas passages. These vertical passages open into the bases of combustion cavities built within the side walls of the kiln and made with back walls inclined so as to direct the products of combustion into the interior of the kiln.—T. St.

Metals; Cutting — by fusion. K. Ilse, Mulheim, and Hans Reisert, G. m. b. H., Cöln-Braunsfeld, Germany. Eng. Pat. 11,380, May 8, 1914.

THE nozzle of the burner has a conical end with a central passage for the oxygen used for cutting, and two lateral passages for the gaseous heating mixture. The latter escapes therefore at a greater distance from the metal to be cut than does the oxygen. Hydrogen or acetylene and oxygen are led within the burner to annular grooves which communicate with the lateral mixing passages. Oxygen for cutting and that for the mixture are supplied to the burner by separate pipes which unite in a common regulating valve. The ports of this valve are so arranged that during the preliminary heating, before cutting, practically no oxygen passes through the central passage of the nozzle, but sufficient oxygen passes to the lateral passages to form an explosive mixture with the fuel gas, and the material is quickly brought to fusion point. A turn of the valve then allows oxygen to pass unrestrictedly at full pressure into the central passage, and at the same time the supply of oxygen to the mixing passages is considerably diminished, so that a flame only sufficient to maintain the requisite temperature is produced.—T. St.

Metal bodies [blooms]; Production of —. H. Coentges, Düsseldorf, Germany. Eng. Pat. 11,576, May 11, 1914. Under Int. Conv., May 9, 1913.

MOLTEN metal is introduced into a rotating drum by means of a gutter extending along the length of the drum and provided with an overflow edge. The metal first introduced forms a roll on the

bottom of the drum and serves as a core on which further quantities of metal form successive layers, which are compressed by the rolling action and by the weight of the metal itself to form a homogeneous bloom; a core may be placed in the drum to serve as a nucleus for the bloom. The gutter is so arranged that the overflowing molten metal is first drawn along by the drum to form a thin sheet. By using a narrow gutter which can be moved backwards and forwards within the drum, bands or strips may be disposed axially on the bloom. An inert gas is passed through the drum during the process and may serve as a heating or cooling medium.—A. S.

Electrolytic and metal cleaning processes: Method of, and apparatus for use in —. A. E. Battle, London. Eng. Pat. 14,513, June 17, 1914.

A VAT for the electro-deposition, pickling, or washing of thin sheets or plates not of continuous or extended length, is provided with slits in the ends made watertight by rubber flaps or valves, and the sheets are fed into and out of the electrolyte through these slits by means of rollers. By extending one of the entrance flaps within the vat, one side of the metal sheet or plate can be shut off from electrolytic action while the sheets are in motion through the vat. The rollers may be made to give electrical contact if required, and the anodes may be made to pass through rollers and slits in the same way as the sheets or cathodes.

—W. G. C.

Galvanic or electrolytic deposits: Apparatus for producing —. P. J. Ozil, Paris. Eng. Pat. 16,776, July 14, 1914. Under Int. Conv., July 15, 1913.

IN a tank for galvanizing or electro-depositing, the cathode consists of a series of studs arranged around the outer edge of the bottom of the tank. The studs are adapted to slide over a contact-making brush as the vat is rotated. The tank has the shape of a truncated pyramid of polygonal section, and rotates in an inclined position around its longitudinal axis, whereby the bath and the objects to be plated are kept constantly in motion.

—W. G. C.

Tin; Recovery and electrodeposition of —. A. E. Battle, London. Eng. Pats. 14,514, June 17, and 15,602, June 30, 1914.

AN electrolyte consisting of a concentrated or dilute aqueous solution of phosphoric acid is used in the electrolytic recovery of tin from its ores, the electro-deposition of tin on to other metals, and the removal of tin from the surfaces of other metals. Gelatin, gums, glucose, etc., may be added to improve the deposit and increase the permissible current density. In some cases it is advantageous to add 1–2% of sodium pyrophosphate.—W. G. C.

Castings consisting of iron oxides or mixtures of iron oxides with other metallic oxides; Process for manufacturing —. Soc. Italiana di Elettrochimica, Rome. Eng. Pat. 17,161, July 20, 1914. Under Int. Conv., Aug. 9, 1913.

CASTINGS of high chemical and mechanical resistance are yielded by iron oxides alone or mixed with isomorphous oxides, when the composition is such that the ratio $M_2O_3 : MO$ exceeds 3 (M =metal). The structure of the product is finer as the composition approaches M_2O_3 . This state of oxidation is obtained by oxidising the melted oxides with oxygen, or gases rich in oxygen (or air) under pressure, or by treating the mass with oxygen-carrying agents and strongly stirring the melted mass. The charge, which may consist of metallic iron, burnt pyrites or other iron oxides, even of moderate purity,

is melted in a closed electric furnace, and at once oxidised, or the oxidation may be carried out in a species of converter. The operation must be carried out quickly so as to prevent the solidification of the mass, which becomes pasty towards 1350° C., and the castings must be made while the oxidising gas is being injected.—T. ST.

Ore-reducing furnaces. H. Wade, London. From New Metals Process Co., Chicago, U.S.A. Eng. Pats. (A) 17,322 and (B) 17,323, July 21, 1914.

(A) THE furnace comprises a relatively low, vertical reducing chamber, connected at its upper part, by an elbow, with the lower end of a preheater, which has the form of a long inclined tube and is connected at its upper end with a stack. The upper part of the reducing chamber is hemispherical and the lower part has the shape of an inverted frustum of a cone; around the middle portion is a bustle pipe from which a gas-outlet pipe extends through the elbow into the lower end of the preheating chamber. A charge of mixed ore and fuel (coke or charcoal) is fed into the upper end of the preheater, which is slowly rotated, and descends slowly and passes into the reducing chamber, into which air is introduced at the upper part so as to maintain a deoxidising flame. The gases pass through the bustle pipe and gas outlet pipe into the lower part of the preheater, where they are burnt with a separate supply of air and serve to preheat the charge of ore and fuel. Fresh fuel, such as coal or wood, is introduced at intervals into the upper part of the reducing chamber, in which a temperature is maintained sufficient to fuse the reduced metal into globules without forming a molten bath. Unconsumed fuel discharged with the reduced metal is added to a subsequent charge. Either natural draught or an air blast may be used. The furnace may be used for the reduction of iron and copper ores, and, if a condenser be provided, of zinc and lead ores. (B) The furnace is similar to that described above, but the air is introduced into the reducing chamber through lateral tuyères in the lower part and through a central vertical tuyère projecting downwards into the chamber. The gases pass directly from the upper part of the reducing chamber into the elbow connected with the lower end of the preheater. The contents of the reducing chamber are preferably discharged into a soaking pit below, in which the reduction is completed. It is stated that nearly pure iron can be prepared directly from the ore in this furnace.—A. S.

Smelting-furnace. P. Plantinga, Cleveland, Ohio. U.S. Pat. 1,146,097, July 13, 1915. Date of appl., July 2, 1912.

A GAS-FIRED furnace is provided with several air-ducts parallel to the fuel gas-duct, and each separated from the latter by a movable member by which the point of communication of air and gas may be varied.—W. R. S.

Ores; Concentration of —. Minerals Separation Ltd., London. From G. A. Chapman, Anaconda, Mont., U.S.A. Eng. Pat. 17,327, July 21, 1914.

IN the concentration, by flotation, of ores containing colloidal gangue slimes, in addition to a mineral frothing agent, a small quantity of an electrolyte having a low dissociation constant, such as a weak organic acid (tartaric or citric acid), or a salt of such acid, is also added. The electrolyte may be dissolved in the ore pulp before adding the mineral frothing agent, or it may be dissolved in the water with which the ore is ground; an air emulsifying agent, such as cresol or eucalyptus oil, may also be added.—A. S.

Flotation: Concentration of minerals by —. A. R. Livingston, Canon City, Colo., Assignor to The New Jersey Zinc Co., New York. U.S. Pat. 1,147,633, July 20, 1915. Date of appl., Dec. 27, 1913.

THE ore is fed into a quantity of water contained in a rotating horizontal cylinder which raises it through the water. On emerging from the water the ore meets a downflowing film of aerated water by which it is floated back to the surface of the main body of water, the portion which floats being collected separately from that which sinks. —W. R. S.

Metal: Melling and casting of —. I. Hall, Birmingham. Eng. Pat. 19,712, Sept. 12, 1914.

THE apparatus is intended more especially for supplying molten metal direct to a press for coating cables without coming into contact with the air, and avoiding hand pouring. The melting pot is fixed within an outer casing, and is heated by gas burners controlled by a thermostatic device, the cover being so arranged that the products of combustion pass over the surface of the metal. Ingots are raised to the pot in a carrier fitted to a pair of endless chains, a stop which prevents the ingot from sliding out of the carrier being displaced by a catch fixed to the casing, when the carrier reaches the proper height. A telescopic pouring pipe leads from the bottom of the pot through a hole in the casing, a hole in the pipe on the opposite side to the nozzle, and near the casing, allowing unused metal to drip away without danger to workmen. The pipe may be heated by gas burners carried on a hinged pipe. —T. St.

[Precious] metals; Extracting — from their ores. J. F. Williams, San Francisco, Cal. U.S. Pat. 1,145,954, July 13, 1915. Date of appl., Jan. 2, 1912.

THE ore is treated in presence of mercury with a solution containing water 18 oz., sulphuric acid 1 oz., and potassium bromide 40 grains. —W. R. S.

Metals [e.g., copper and silver]; Process for the recovery of — from ores. C. S. Vadner, Salt Lake City, Utah. U.S. Pat. 1,146,373, July 13, 1915. Date of appl., Aug. 7, 1914.

THE ore, suspended in a solution of a chloride, is treated with smelter fume containing sulphur dioxide, and the excess of the latter eliminated. Air is passed through the neutralised liquor to precipitate iron, and the metals in the filtrate are precipitated on iron. —W. R. S.

Cyaniding-apparatus. F. E. Carman, Jamaica, N.Y., Assignor to M. E. Carman, Babylon, N.Y. U.S. Pat. 1,146,783, July 20, 1915. Date of appl., Oct. 22, 1912. Renewed Dec. 22, 1914.

A CYANIDING tank has the form of an inverted frustum of a cone and contains a partition of similar but flatter form; the inner and outer compartments communicate at the top by a narrow annular space, and at the bottom by a circular channel which contains a screw propeller to cause an upward movement of pulp in the outer, and a downward movement in the inner, compartment. The latter has an apron extending inwards from the upper annular aperture and inclined downwards towards the centre. —W. R. S.

Zinc-bearing materials; Process of treating —. W. McA. Johnson, Assignor to The Continuous Zinc Furnace Co., Hartford, Conn. U.S. Pat. 1,146,075, July 13, 1915. Date of appl., June 27, 1913. Renewed Dec. 10, 1914.

ZINC-BEARING material low in sulphur and containing silica (e.g., zinciferous slag) is smelted in an electric furnace in which molten iron forms the anode. The zinc vapour is condensed, and the ferruginous slag reduced by reversing the current. —W. R. S.

Aluminium alloy. W. A. McAdams, Bay Shore, N.Y. U.S. Pat. 1,146,185, July 13, 1915. Date of appl., Nov. 11, 1914.

AN alloy of Al 82, Ag 1, Cu 12, and Cd 5 parts by weight. —A. S.

Copper; Process of precipitating — from solution. G. D. Van Arsdale, East Orange, N.J. U.S. Pat. 1,147,466, July 20, 1915. Date of appl., Dec. 26, 1907.

COPPER is precipitated from a solution of its sulphate by impregnating the solution with sulphur dioxide and adding lime to neutralise the free acid formed. —A. S.

[Copper sulphate] electrolytes; Regenerating —. O. C. Martin and F. Jaeger, Perth Amboy, N.J. U.S. Pat. 1,148,522, Aug. 3, 1915. Date of appl., Jan. 17, 1912.

ARSENIC is removed from sulphuric acid and copper sulphate electrolyte solutions by first concentrating, then removing the greater portion of the copper sulphate, introducing sulphur dioxide into the remaining liquid, and diluting and cooling until the arsenic compound is precipitated. —B. N.

Copper; Metallurgy of —. L. Addicks, Perth Amboy, and C. L. Brower, Chrome, N.J. U.S. Pat. 1,148,814, Aug. 3, 1915. Date of appl., Aug. 9, 1913.

NEARLY pure copper is refined by melting it under mildly oxidising conditions, in presence of just sufficient acid material to slag the impurities; the molten charge is covered with a layer of carbonaceous material of minimum ash content, and the furnace is fired in such a way as to prevent ash coming in contact with the charge. The amount of slag formed is restricted to within 1% of the charge by avoiding contact of the molten mass with acid lining material. The small proportion of cuprous oxide formed, is subsequently removed by poling. —A. S.

Aluminium; Process of plating —. J. A. Hall, New Britain, Conn. U.S. Pat. 1,147,718, July 27, 1915. Date of appl., Feb. 5, 1915.

THE surface of the aluminium is cleansed by a bath relatively strong in nitric acid, and then plated for a few seconds in a bath containing sodium cyanide and zinc carbonate, a coating of another metal being afterwards applied to the zinc surface. —B. N.

Metals [e.g., lead]; Process for the reduction of — from their ores by carbon from solid fuel. W. D. Kilbourn, Tooele, Utah. U.S. Pat. 1,148,782, Aug. 3, 1915. Date of appl., Jan. 14, 1914.

IN the reduction of metals, e.g., lead, in the blast-furnace, the fuel is provided with a coating of appreciable thickness composed of the ore to be treated and fluxes; in the case of lead ores, the coating may consist of lead oxide, lead sulphate, and "impurities." The coating protects the fuel from combustion until it fuses, and the thickness of the coating is such that combustion takes place at a predetermined point in the travel of the charge through the furnace where the temperature is higher than the ignition point of the fuel. —A. S.

Roasting of sulphide ores and similar metallurgical products. W. Buddeus, Charlottenburg, Germany. Eng. Pat. 29,042, Dec. 16, 1913. Under Int. Conv., Feb. 26, 1913.

SEE Fr. Pat. 466,397 of 1913; this J., 1914, 599.

Alloys of high melting point having ductile properties; Production of —. Wolfram Lampen A.-G., Augsburg, Germany. Eng. Pat. 29,980, Dec. 30, 1913. Under Int. Conv., Aug. 19, 1913.

SEE Fr. Pat. 466,737 of 1913; this J., 1914, 835.

Ore slimes; Filtration and treatment of —. C. Butters, Oakland, Cal., U.S.A. Eng. Pat. 9921, Apr. 22, 1914. Under Int. Conv., June 18, 1913. SEE Fr. Pat. 472,017 of 1914; this J., 1915, 410.

Copper; Extraction of —. E. R. Weidlein, Pittsburgh, Pa., U.S.A. Eng. Pat. 10,500, Apr. 28, 1914. Under Int. Conv., Oct. 27, 1913. SEE U.S. Pat. 1,089,096 of 1914; this J., 1914, 359.

Binding means for briquettes. U.S. Pat. 1,146,455. See IIA.

Rotary kilns for burning cement, ores, and like materials. Eng. Pat. 17,146. See IX.

XI.—ELECTRO-CHEMISTRY.

Electric furnace; Thermal efficiency of the —. W. McA. Johnson, Proc. Eng. Soc. W. Penn., 1915, 31, 488—498.

THE thermal efficiency of an electric furnace may be ascertained by determining the radiation and conduction losses, either by direct measurement or by calculation from available conductivity data; by calculating the net heat requirements of the charge; or by determining the power required to keep the furnace at its working temperature when running on dry slag. The efficiency may be increased by increasing the smelting rate; by increasing the size of the furnace, and giving it a shape approaching a cube or sphere; and by increasing the thickness of its walls and painting the outside with aluminium.—W. R. S.

Preparation of sodium selenate and selenic acid. Meyer and Heider. See VII.

PATENTS.

Electric accumulators. Van Raden and Co., Ltd., and M. Metz, Coventry. Eng. Pat. 2548, Jan. 31, 1914.

THE cells of electric accumulators, unaffected by heat, are made of an alloy of lead and antimony (3.5 to 7.5% Sb), and to increase the rigidity and minimise weight the body is cast with integral panels or corrugations. A glass cover is fixed in liquid-tight manner in a lead frame, which is soldered or burnt to the walls of the cell.—W. G. C.

Storage batteries; Regenerating —. C. S. Palmer, Newtonville, Mass. U.S. Pat. 1,147,261. July 20, 1915. Date of appl., Jan. 12, 1915.

SULPHATED lead storage batteries are charged and discharged with an electrolyte consisting of a concentrated solution of an acid alkali sulphate containing a small amount of sulphuric acid, the sp. gr. of the electrolyte being maintained above 1.1. Low current density is employed in the first cycle, and successively increased in later cycles, the successive charges and discharges being so regulated as to secure uniform regenerative action upon the negative and positive plates.—B. N.

Battery [depolariser]; Dry —. L. J. Schatzel, Fostoria, Assignor to O. V. Maurer, Cleveland, Ohio. U.S. Pat. 1,147,753, July 27, 1915. Date of appl., Dec. 19, 1910. Renewed Jan. 2, 1915.

A DEPOLARISING compound consisting of carbon, manganese dioxide, and potassium persulphate is used.—B. N.

Depolariser; Battery —. M. E. Holmes, Lakewood, Assignor to National Carbon Co., Cleveland, Ohio. U.S. Pat. 1,148,230, July 27, 1915. Date of appl., Nov. 22, 1913.

THE depolariser contains a perhydrol of manganese of the formula, HO.O.Mn.O.H. —B. N.

Battery-waste; Method of utilising —. C. E. Tucker, Hyde Park, Mass. U.S. Pat. 1,148,062, July 27, 1915. Date of appl., May 22, 1908.

THE waste, containing lead sulphate and peroxide and an acid, is treated to remove the acid, heated to reduce some of the peroxide to a lower oxide, a flux and an oxidising agent added, and the whole heated to a low temperature to produce lead monoxide. The mixture is ground, leached, and the solid residue, consisting of litharge, is isolated.—B. N.

Electrolytic cell. E. A. and H. I. Allen, Assignors to Electron Chemical Co., Portland, Me. U.S. Pat. 1,148,274, July 27, 1915. Date of appl., Jan. 2, 1914.

THE anode chamber of the cell is composed of bottom and end integral concrete portions and a detachable top, forming a chamber open at opposite sides. The top portion is provided with vertical holes carrying anode-supporting members smaller in cross-section, so that the holes also form gas chambers communicating with the anode chamber. Other holes are arranged transversely in the top between the gas chambers, with rods in them which co-act with suitable means for fastening the cathodes in position outside the anode chamber, the cathodes co-operating with the open sides of the latter. Portions of the concrete base are provided with troughs to collect the liquid dripping from the cathodes.—B. N.

Electrode; Furnace —. W. E. Evans, London. From Elektrochem. Werke, Ges. m. b. H., Berlin. Eng. Pat. 17,425, July 22, 1914.

THE electrode is made in the form of a bell or cage, with walls of such varying thickness that the cross-sections at all levels are equal, whilst the height and cross-section are such that at its closed end the electrode acquires the temperature of the molten bath, owing to the development of Joule heat. The wide open end of the electrode is provided with a hollow reinforcing ring adapted to be cooled, whilst the upper molten end rests on a refractory support capable of resisting mechanical forces exerted by the material treated in the furnace.—W. G. C.

Molten masses of electrical furnaces; Method of and apparatus for producing flows in the —. W. E. Evans, London. From Elektrochem. Werke, G. m. b. H., Berlin. Eng. Pat. 17,426, July 22, 1914.

THE current conductors are arranged at an angle to one another, and at least two of them are provided by portions of the molten or liquid electrically conducting mass within the furnace, forming a closed loop, so that the material is set in motion by the electro-dynamical interaction of the conductors. This flow can also be reinforced by the "pinch" effect.—W. G. C.

Furnace; Electrical —. W. H. Hampton, New York. Assignor to The Conley Electric Furnace Co., Inc., Wilmington, Del. U.S. Pat. 1,147,165, July 20, 1915. Date of appl., Feb. 28, 1913.

THE furnace comprises a vertical shaft into which the material is fed at the top, having guide blocks with sloping surfaces arranged so that the material flows over them by gravity in a zigzag course. Non-arcing carbonaceous resistance conductors are located in the interior of part or all of the blocks, for heating the sloping surfaces and the material passing over them. Means are provided for delivering gas, heated by the material leaving the furnace, to the shaft at different levels beneath certain blocks, to react with the heated material, and the resulting gases are conducted from the shaft at intermediate levels.—B. N.

Electric furnace. J. W. Brown, Lakewood, Assignor to National Carbon Co., Cleveland, Ohio. U.S. Pat. 1,147,703, July 27, 1915. Date of appl., Apr. 22, 1914.

A FURNACE for treating granular carbonaceous material comprises a chamber for untreated material above an upper electrode and a chamber for treated material below a lower electrode, the two chambers being connected by a constricted passage in which the material is subjected to the action of an electric current passing between the electrodes. The material is supplied to, and withdrawn from, the furnace at a predetermined rate. Hot gases from the material under treatment are drawn upwards through the untreated material to preheat it, and after being thus cooled are withdrawn from the top of the furnace and introduced again at the bottom to cool the treated material in the lower chamber.—A. S.

Furnaces; Preventing punctures in electric flame-arc —. E. Troye, Assignor to Norsk Hydro-Elektrisk Kvaestofaktieselskab, Christiania, Norway. U.S. Pat. 1,148,343, July 27, 1915. Date of appl., Aug. 13, 1914.

AIR or gas streams are conducted at a suitable temperature and pressure from opposite sides of the furnace to the space between the furnace wall and the cover, thus forming insulating layers. The gas is then introduced into the furnace chamber in jets distributed over the opposite sides.—B. N.

Ozone; Production of —. J. R. Quain, London. U.S. Pat. 1,147,265, July 20, 1915. Date of appl., Oct. 4, 1913.

SEE Eng. Pat. 22,854 of 1912; this J., 1913, 1075.

Electric battery. F. S. Bandeira de Mello, Rio de Janeiro, Brazil. U.S. Pat. 1,148,152, July 27, 1915. Date of appl., Oct. 23, 1913.

SEE Eng. Pat. 21,471 of 1913; this J., 1914, 601.

Insulating material [from Zostera marina fibre]. Method of producing insulating material. U.S. Pats. 1,146,189 and 1,146,190. See V.

Manufacture of aluminium oxide. Eng. Pat. 6727. See VII.

Electric furnace abrasive and method of making same. U.S. Pat. 1,149,064. See VIII.

[Electrically] treating liquids [water] U.S. Pat. 1,146,942. See XIX.

XII.—FATS; OILS; WAXES.

Cottonseed; Heating of —. Its causes and prevention. E. H. R. Barrow. J. Ind. Eng. Chem., 1915, 7, 709—712.

THE most important factor inducing heating of cottonseed in storage is excessive moisture; seed containing 10% of moisture or more cannot be stored safely. The rise of temperature in a pile of cottonseed is very slow from 60° to 85° F. (15.6°—29.4° C.), sometimes requiring 2—3 weeks, but it then becomes rapid, showing increases of 10° F. (5.5° C.) or more in 24 hours. A process devised by the author for preventing this tendency to heat (see U.S. Pat. 1,119,672; this J., 1915, 39), consists in treating the cottonseed, whilst passing through conveyors, with about 5% of dry, very finely powdered salt. The coating of salt absorbs moisture from the seeds, so that they appear to "sweat," but they gradually dry again, and any excess of salt adhering to the outer surface is removed in the seed-cleaning operations. About

1.25% of salt is absorbed by the cottonseed; the lint of the treated seeds contains, on the average, 5%, the hulls 2.5%, and the meal 0.5% of salt. The quality of the lint and of the oil appears to be improved by the treatment.—A. S.

Corean beeswax. S. Ueno, Analyst, 1915, 40, 343—344.

IN 1912 there was produced in Corea 450,536 kin (1 kin=1½ lb.) of beeswax derived from *Apis indica*. Samples of the wax from different parts of Corea had the following average character: Sp. gr. at 100°/4° C., 0.8229; m.pt., 65.6° C.; refractive index at 85° C. (calculated to 40° C.), 1.4580; butyrefractometer reading at 85° C. (calculated to 40° C.), 48.0; acid value, 5.85; ester value, 78.71; ratio number, 13.45; and iodine value (Wijs), 11.41. Corean and Japanese beeswax are closely similar in character to each other and to Indian beeswaxes.—C. A. M.

PATENTS.

Fats and oils; Device for emulsifying —. E. Böhm, Hamburg. Eng. Pat. 28,840, Dec. 13, 1913. Under Int. Conv., Nov. 24, 1913.

RAPID and intimate emulsification is effected by agitating the mixture of oil, etc., by means of concentric worms, alternately right and left handed, the inner edge of the inner worm extending nearly to the driving shaft and the outer edge of the outer worm almost to the wall of the vessel. A heating coil surrounds the worms for part of their length.—C. A. M.

Palm nuts and the like; Process of and means for separating the husks and kernels of —. Mather and Platt, Ltd., and O. G. Smith, Manchester. Eng. Pat. 24,249, Dec. 18, 1914.

THE cracked husks and kernels are delivered in a thin layer on to an endless band or lattice which passes between one or more revolving cylinders studded with spikes and one or more resilient beds of rubber, etc. The kernels are impaled upon the spikes and are subsequently removed by brushes, whilst the husks are carried forward on the band.—C. A. M.

Oils and fats; Method of refining —. O. C. Hagemann, Yonkers, Assignor to C. A. Dieterich, Mount Vernon, N.Y. U.S. Pat. 1,147,392, July 20, 1915. Date of appl., Nov. 4, 1913.

THE fat is treated with caustic alkali, the action of which is subsequently stopped by neutralising with a weak acid which does not appreciably reverse saponification.—C. A. M.

Lubricants; Preparation of —. S. H. Blichfeldt, Southall. Eng. Pat. 17,411, July 22, 1914.

WATER or an aqueous solution is distributed in oil or fatty material in such a way that the emulsified particles have a diameter not exceeding 1μ. (See also Eng. Pat. 15,463 of 1914; this J., 1915, 841.)—C. A. M.

Sulpho compounds of hydrogenised fats and oils; Preparation of — and of compositions therewith. I. Levinstein, and Levinstein Ltd., Manchester. Eng. Pat. 16,890, July 16, 1914.

HYDROGENATED saponifiable fats and oils are melted, cooled, and treated with sulphuric acid until, when washed, they are practically soluble in ammoniacal water. They are then poured into salt water at about 30° C., and the white sulphonated mass is separated. Sulphonated fatty acids of hydrogenated oils (e.g., linseed oil), give when melted and mixed with paraffin wax, fats, etc., products which are soluble in, or miscible or emulsifiable with water.—C. A. M.

Soap for disinfecting purposes; Manufacture of —. F. W. Howorth, London. From Schülke und Mayr Nachf. Dr. Raupenstrauch, Vienna. Eng. Pat. 20,818. Sept. 15, 1913.

SEE Fr. Pat. 462,724 of 1913; this J., 1911, 325.

Edible fat product. Eng. Pat. 21,549. See XIXA.

XIII.—PAINTS; PIGMENTS; VARNISHES. RESINS.

PATENTS.

Calcium sulphate-zinc sulphide pigment; Process for manufacturing —. J. L. Carpenter. Palmerton, Pa. U.S. Pat. 1,146,690, July 13, 1915. Date of appl., July 1, 1913.

SULPHIDE of sodium or other alkali is added to a solution of calcium chloride until the liquid is just alkaline, and then zinc sulphate is added together with sufficient sodium sulphide to maintain the alkaline reaction during the precipitation.

—C. A. M.

Turpentine and resin from resinous woods; Process of obtaining —. J. H. Castona. Moss Point, Assignor to Castona Improved Process Co., Gulfport, Miss. U.S. Pat. 1,149,027, Aug. 3, 1915. Date of appl., May 7, 1912.

THE wood is heated with direct steam, without pressure, and at a relatively low temperature, so as to expel turpentine, but not the pine oils. During the condensation of the turpentine vapours the bottom of the vessel is superheated to retard condensation of steam. The residual wood is treated with superheated steam to expel the pine oils, then extracted with a volatile solvent to remove the rosin, and finally treated with steam to expel the solvent, which is condensed and recovered.

—C. A. M.

Insoluble bodies derived from phenol-alcohols; Process of making —. L. H. Baekeland, Yonkers, N.Y., Assignor to General Bakelite Co., New York. U.S. Pat. 1,146,045, July 13, 1915. Date of appl., Oct. 4, 1909.

PHENOL-ALCOHOLS are freed from water and hardened by heat and pressure in the presence of suitable condensing agents of acid character.

—C. A. M.

Protective coating and method of applying the same. C. P. Townsend, Washington, D.C. U.S. Pat. 1,146,214, July 13, 1915. Date of appl., Nov. 30, 1909.

THE composition consists of an electrolytically-conductive solution of a metallic salt, containing also a phenolic condensation product. When applied to an electrically conductive base, an adherent coating of the metal forming the base of the salt is deposited, and also a film of the phenolic condensation product, the latter overlying and protecting the metallic coating.—C. A. M.

Plastic moulding composition and method of producing same. Method of forming phenolic condensation products. J. W. Aylsworth, East Orange, Assignor to Condensite Co. of America, Glen Ridge, N.J. U.S. Pats. (A) 1,146,299 and (B) 1,146,300, July 13, 1915. Dates of appl., July 22 and Aug. 4, 1913.

(A) A FINELY divided phenolic resin is mixed with water and an alkaline substance (alkaline oxide) to effect solution. Absorbent filling material is saturated with the solution and the alkali neutralised so as to precipitate the resin and an alkali salt. Or the alkaline solution may be prepared from a fusible phenolic resin and a substance containing a methylene group and

capable of forming a hard compound with the resin when heated. (B) Phenol and a methylene-containing substance (formaldehyde) are made to react in the presence of a base and a substance (e.g., stearic acid) capable of forming electrically insulating salts with the base. The reaction is stopped after the formation of a condensation product soluble in alcohol but insoluble in water.

—C. A. M.

Amber-like substance; Process of making an —. A. H. Peter, New York. U.S. Pat. 1,147,264, July 20, 1915. Date of appl., Oct. 5, 1909.

RESORCINOL (10 parts) is heated with 36 to 40% formaldehyde solution (7½ to 10 parts).—C. A. M.

Varnish; Manufacture of —. E. Girzik, Vienna. Eng. Pat. 1575, Jan. 20, 1914. Under Int. Conv., April 10, 1913.

SEE Fr. Pat. 468,003 of 1914; this J., 1914, 973

Apparatus for treating and distilling wood. U.S. Pat. 1,148,104. See IIB.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Rubber analysis; Hydrochloric acid-ether mixture as a reagent for —. D. F. Twiss, India Rubber J., 1915, 50, 199. (Cf. Stevens, this J., 1915, 724.)

THE author has employed a mixture of equal volumes of concentrated hydrochloric acid and ether for the purpose of removing mineral accelerators (PbO, etc.) from partially cured mixings containing high proportions of these substances and free sulphur, in order to be able to estimate with accuracy the organically combined sulphur. If such mixings be extracted direct with acetone further combination of the sulphur may occur during the extraction. Two samples, each of 1—2 grms. of the rubber, are treated with the mixture of acid and ether until the reagent has completely penetrated the mass. This takes about a day. The rubber mass is removed, or the ether is distilled off, and the mass washed in running water and dried, after which it is extracted with acetone. The total sulphur is then estimated in one extracted sample and the mineral sulphur (sulphates) in the other. The difference is sulphur in organic combination, which, in the absence of substitute, means sulphur of vulcanisation.—E. W. L.

PATENTS.

Rubber solution; Process of impregnating textile fabrics with —. G. W. Beldam, Ealing, and A. U. B. Ryall, Brentford, Middlesex. Eng. Pat. 17,097, July 18, 1914.

THE fabric on a roller is immersed in rubber solution and is wound off on to another roller, also immersed in the solution, passing, on its way, across the surface of one or more perforated, revolving rollers, or between two plane-surfaced perforated boxes, to the interior of which rubber solution is supplied under pressure. This treatment causes the fabric to vibrate or "dither," producing a movement of the warp and weft threads the effect of which is greatly to assist the penetration of the fabric by the rubber solution.—E. W. L.

India-rubber and like articles; Manufacture of —. R. B. Price, New York. Eng. Pat. 17,193, July 20, 1914.

IN articles formed of rubber combined with fibrous material or textile fabrics, the removal of air, gases, moisture, or other fluids from the interior layers of the article is ensured by subjecting these to a lower pressure, either before or during vulcanisation, than the external (mechanical or vapour) pressure applied during vulcanisation.—E. W. L.

Butadiene, its homologues and the like; Polymerisation of —. A. Heinemann, London. Eng. Pat. 17,253, July 21, 1914.

ISOPRENE, or a mixture of isoprene and butadiene, pure or commercial, is dissolved in an equal volume of acetone, and sulphur dioxide is passed into the cooled solution so long as a white precipitate continues to form (about 4½ hrs.). The saturated liquid is allowed to stand for 4 days, then the precipitate is separated and washed with acetone. When dry it possesses little strength, but when placed in a mould under a pressure of 6000 lb. per sq. in. for say 4 days, to press out the oily substances and ensure homogeneity of the mass, the product possesses great strength and has properties similar to gutta-percha and balata. It can be vulcanised by heat without further addition of sulphur, yielding a soft product or one similar to vulcanite.—E. W. L.

Caoutchouc from isoprene; Production of —. A. Heinemann, London. U.S. Pat. 1,146,253, July 13, 1915. Date of appl., June 9, 1911.

SEE Eng. Pats. 14,011 and 24,237 of 1910; this J., 1911, 909.

[Rubber] latex; Treatment of —. S. C. Davidson, Belfast. U.S. Pat. 1,146,851, July 20, 1915. Date of appl., May 16, 1914.

SEE Eng. Pats. 13,438 and 20,183 of 1913; this J., 1914, 758.

XV.—LEATHER; BONE; HORN; GLUE.

Valonia; Extraction of —. L. Balderston. J. Amer. Leather Chem. Assoc., 1915, 10, 417—420.

VALONIA suffers practically no loss of tannin with long heating. The amount of tannin obtained from a leaching extending over six days, was almost exactly the same as that shown by analysis. A sample was further extracted by boiling for ten periods of 24 hours. The extract made on the third day showed only a slight trace of tannin by the gelatin test, but other soluble matter was obtained, decreasing from 2.2% on the second day to 0.33% on the eleventh day. The material was then dried and extracted on each of four days and still yielded soluble matter. The amount of such matter lost in consequence of the boiling was only 1% on the original material.—F. C. T.

[Tanning extracts.] Colour due to copper extractors. T. G. Greaves. J. Amer. Leather Chem. Assoc., 1915, 10, 414—417.

CHESTNUT wood was leached under exactly the same conditions in both glass and copper vessels. The extracts made in copper vessels were in every case slightly darker in colour than the others. The differences in colour, measured by Kerr's method (this J., 1914, 1163) were smallest with new and clean copper extractors.—F. C. T.

Leather analysis; Influence of method of subdivision on results of —. R. Lauffmann. Ledertechn. Rundschau, 1915, May 22, 161—164. J. Amer. Leather Chem. Assoc., 1915, 10, 436—437.

A LEATHER containing little fat (about 2%) showed slightly more on analysis when cut than when ground. The contrary was the case with leathers containing much fat (16%—20%). The same leathers showed a higher percentage of both water-soluble matter and mineral matter when ground than when cut, and in particular a greater amount of iron and aluminium oxides. Sulphuric acid, both free and combined, was distinctly less with

the ground leather than with the cut. The author advocates cutting as the better method of subdivision.—F. C. T.

PATENTS.

Tanning agents; Manufacture of —. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen, Germany. Eng. Pat. 3382, Feb. 9, 1911.

SEE Fr. Pat. 469,359 of 1914; this J., 1915, 42. The reaction mixture is preferably kept alkaline during the whole course of the reaction.

Tanbark; Process of preparing and packing —. W. S. Shaw, Boyne City, Mich. U.S. Pat. 1,146,963, July 20, 1915. Date of appl., Sept. 5, 1913.

BARK is simultaneously shredded and removed from the wood by high-speed blunt-edged tools, subsequently dried by hot air, and finally compressed into blocks or bales.—F. C. T.

Tanning hides and skins; Composition for —. M. B. Larson, Molson, Wash. U.S. Pat. 1,147,178, July 20, 1915. Date of appl., Jan. 11, 1915.

A COMPOSITION for tanning is made of 83.3% of gambier and 16.7% of common salt separately dissolved in hot water and then mixed; 1 lb. of magnesium sulphate is added for each 5 lb. of gambier.—F. C. T.

Tanning material [from waste sulphite lye] and process of preparing the same. H. H. Hurt, Covington, Va., Assignor to Robeson Process Co., New York. U.S. Pat. 1,147,245, July 20, 1915. Date of appl., Feb. 26, 1914.

A NEUTRAL, highly concentrated sulphite waste liquor is treated successively or simultaneously with sulphuric acid and alkali sulphate to remove lime and to liberate lignosulphonic acids. The precipitate is separated, leaving a tanning liquor of 28° to 31° B. (sp. gr. 1.24—1.27).—F. C. T.

XVI.—SOILS; FERTILISERS.

Sulphates in soils; Determination of —. P. E. Brown and E. H. Kellogg. J. Ind. Eng. Chem., 1915, 7, 686—687.

DILUTE hydrochloric acid is not suitable for the extraction of sulphates from soil, because organic substances and iron compounds are also extracted and interfere in the subsequent determination of the sulphate. Sulphates can be extracted completely by shaking the soil with twice its weight of water in a shaking machine for 6—8 hours. (See also this J., 1915, 673).—A. S.

Potash manures; Growing of crops without —. E. J. Russell. J. Board Agric., 1915, 22, 393—406.

As imported potash manures will probably be unavailable for 1916, a consideration of possible native sources of supply and of the means of rendering available the potash supply of the soil, is imperative. Potatoes, mangolds, and leguminous crops stand in most need of this fertiliser. Of the possible sources of supply, the ashes of seaweeds, bracken, hedge trimmings, waste cavings and waste from threshing, wood waste, and flue dust from saw mills (see this J., 1915, 675) have all been recommended. Except in the last case, the potassium is present as the very soluble carbonate, hence these materials should be kept dry and would be safely applied with superphosphate, at the rate of about 3 cwt. per acre. Of farm products, hay and root crops contain by far the most potassium. Mangold leaves should be utilised by ploughing in, and damaged straw should be returned to the soil. Liquid manure, properly

collected and protected before application, is rich in potash, as three-quarters of the potash in the food assimilated by animals is excreted in the urine. The ploughing up of grassland and of previous crops, particularly of clover leys, causes liberation of potash stored in the roots, stems, and leaves; and it has been shown that the decay of clover roots enhances the solubility of the potassium constituents of the soil. The potassium in soils can, as a war measure, be made available by the addition of sodium, either as chloride or sulphate. The application of salt particularly favours mangolds, and it might well be tried for such cereal land which is known to respond to potash fertilisers. For leguminous crops, clover, etc., lime or chalk should be used—their effect is very marked—but neither these nor sodium can take the place of potash; they merely liberate and make available the potassium already present in the soil. As their application to potato-land is attended with risk, this should receive all the potash manure available. For meadow land deficient in potash, liquid manure should be used.—E. H. T.

Basic slag; Solubility of the different constituents of —. Sirot, Maurice, and Joret. J. d'Agric. prat., 1914, 78, i. 78. J. Chem. Soc., 1915, 108, ii., 452–453.

The silica, phosphoric acid, calcium, magnesium, iron, manganese, and sulphuric acid present in basic slag are all soluble in various dilute acids, the amounts dissolved varying with the fineness of the slag and with different acids, citric and malic acids dissolving the most, then lactic, acetic, tartaric, and oxalic acids. About 90% of the total silica is dissolved by citric, lactic, and malic acids. The variations in the solubility of other constituents were: P_2O_5 , 24–87.2; CaO, 48.8–89.4; MgO , 3.1–67.6; Fe, 10.8–41.4; and Mn, 7.7–39.7%.

PATENTS.

Calcium cyanamide; Apparatus for granulating —. G. W. Sinclair. Odda, Norway. Eng. Pat. 9821. April 21, 1914. (See Eng. Pat. 15,713 of 1913; this J., 1914, 933.)

IN order to facilitate the flow of semi-fluid material to the granulating apparatus, one or more plungers having a reciprocating motion are placed inside the hopper. The granulating apparatus contains two cylinders, plain or grooved, either in contact or with a small space between them. The rollers are rotated in opposite directions, and the calcium cyanamide is fed on to the line of contact or clearance space.—E. H. T.

Molasses [fertiliser]; Solidified — and process of making same. J. McAdams, Sausalito, Cal. U.S. Pat. 1,116,337, July 13, 1915. Date of appl., Nov. 29, 1913.

MOLASSES is mixed with an equal weight of slaked lime at 120°–130° F. (49°–55° C.) for thirty minutes, then spread in a layer and subjected to a blast of cold, dry air; the product is granulated and applied as a fertiliser.—J. F. B.

Fertilisers; Manufacture of —. W. B. Chisolm, Charleston, S.C. U.S. Pat. 1,147,926, July 27, 1915. Date of appl., Aug. 16, 1909.

A FERTILISER consisting of a ground mixture of sulphur and phosphatic rock is moistened or steamed to start the reactions which produce sulphuric and phosphoric acids in the mass; it is then packed tightly to prevent loss of moisture by evaporation.—E. H. T.

Fertiliser. T. L. Willson and M. M. Haff, Ottawa, Assignors to Southern Investment Co. of Canada, Montreal, Canada. U.S. Pat. 1,146,222, July 13, 1915. Date of appl., Aug. 18, 1913.

SEE Eng. Pat. 25,856 of 1913; this J., 1914, 1217.

XVII.—SUGARS; STARCHES; GUMS.

Battelle process; White [cane] sugar manufacture by the —. E. E. Battelle. Intern. Sugar J., 1915, 17, 357–359.

ALTHOUGH in the beet sugar factory the Steffen and similar processes for the extraction of the sucrose remaining in the molasses have been successful, attempts to introduce them in the cane industry have resulted in failure, owing to the presence of a large quantity of dextrose (absent in beet molasses), which combines with the lime used. In the Battelle process the dextrose in the juice is destroyed by heating with $1\frac{1}{2}$ to 3% of caustic lime. Double carbonatation follows, and the clarified juice is evaporated to 65% of solids, sulphured, and filtered; the resulting syrup, which is clear and "free of colour," is boiled to white granulated sugar, while the molasses is boiled to a second quality sugar. The second molasses is desaccharified by the Steffen process, in a special apparatus (U.S. Pats. 1,044,003 and 1,044,004; this J., 1912, 1195), the resulting cake of calcium trisaccharate being sent to the first carbonatation tanks, where it is decomposed into calcium carbonate and a comparatively pure sugar solution. It is claimed that by this method of working the raw cane sugar industry can compete favourably with the white granulated beet sugar manufacture in respect of quality and quantity, with a lower cost of production.—J. P. O.

White sugar manufacture; Experiments on the use of sodium phosphate in —. P. de Sornay. Bull. Soc. Chim. de Maurice, 1915, 6, 41–44.

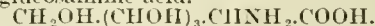
LABORATORY experiments indicate that the use of sodium phosphate as a clarifying agent leads to an increase in the purity of the juice treated. The lime is reduced by 23–34%, and is carried into the scums, while sodium displaces potassium. Practical trials carried out in a Mauritius cane sugar factory show that the colour of the sugar is improved, that there is less incrustation in the evaporators, and that boiling is more readily effected than in the ordinary method of working. The sodium phosphate used contained 25% of phosphoric acid, and was added to the defecated juice in the proportion of 10 grms. per hectolitre.—J. P. O.

Sulphitation of thick-juice and run-off syrups; Sulphur utilised in the —. C. L. Brunings. Tijdschrift. Intern. Sugar J., 1915, 17, 365–367.

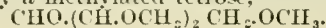
FROM data relating to the alkalinity of thick-juices and run-off syrups before and after sulphitation, and the amount of sulphur burnt in the oven, the author calculates the actual utilisation of the sulphur in a number of different beet sugar factories in Holland. These calculations show that the amount of sulphur actually utilised in the sulphitation, as compared with that burnt in the oven, varies from 64–82% in the case of factories using sulphitation with the thick-juices alone, but are as low as 25–38% when both thick-juices and run-off syrups are treated. This difference is explained by the fact that thick-juice sulphitation in the beet sugar factory is continuous, whereas with run-off syrups the operation is intermittent, which system is wasteful, more sulphur being burnt at intervals than is necessary.—J. P. O.

Glucosaminic acid; Methylation of —. (Production of betaine from sugar.) H. Pringsheim. Ber., 1915, 48, 1158–1161.

WHEN glucosaminic acid,



is treated with dimethyl sulphate in presence of barium hydroxide the products are betaine, and a syrup which reduces Fehling's solution and which is possibly a methylated tetrose,



The reaction is of physiological interest as illustrating the possibility of proceeding from sugar to betaine; it may also be connected with the occurrence of considerable amounts of betaine in the sugar beet, and with the transformation of sugar to albumin.—J. R.

Sucrose; Behaviour of — in presence of the silent discharge. W. Löb. *Biochem. Zeits.*, 1915, 69, 36—38. *J. Chem. Soc.*, 1915, 108, ii., 409.

SUCROSE undergoes hydrolysis under the influence of the silent discharge.

PATENTS.

Sugar; Manufacture of —. W. Searby, Puunene, Hawaii. U.S. Pat. 1,146,456, July 13, 1915. Date of appl., June 29, 1914.

SUGAR cane is crushed between rolls and the crushed material is beaten into a loose fibrous mass, which is then re-pressed several times, being sprayed before each successive pressing.—J. F. B.

Starch product [for laundries]; Process of making a novel —. Article of manufacture [starch product]. A. S. Hoyt, Assignor to Arthur S. Hoyt Co., New York. U.S. Pats. (A) 1,148,453 and (B) 1,148,454, July 27, 1915. Date of appl., Dec. 26, 1914.

(A) STARCH from wheat flour or similar material, freed from the greater part of the naturally occurring proteins, is gelatinised by heating with just sufficient water to prevent burning, and then dried and powdered. (B) A starch product made as described above, which forms an opalescent jelly on addition of water.—J. H. L.

Sugar in the form of fine crystals; Process for the preparation of —. J. F. P. Kestner, Lille, France. U.S. Pat. 1,149,067, Aug. 3, 1915. Date of appl., July 17, 1914.

SEE Eng. Pat. 17,010 of 1914; this J., 1915, 241.

Acid, alkali, neutral, syrup or like concentrating plant. Eng. Pat. 23,414. See 1.

Solidified molasses [fertiliser] and process of making same. U.S. Pat. 1,146,337. See XVI.

XVIII.—FERMENTATION INDUSTRIES.

PATENTS.

Malting apparatus. J. F. Dornfeld, Chicago, Ill. U.S. Pat. 1,146,339, July 13, 1915. Date of appl., July 22, 1912.

IN a pneumatic malthouse a number of parallel hoppers, which serve as receptacles for the green malt, are arranged with spaces between them. Each has a perforated cover on which the grain rests during germination. The spaces between the hoppers serve as ducts for the fresh air, which passes upwards, between parallel walls bounding the germinating surfaces, into the space above the grain; thence it is drawn downwards through the grain into the hoppers, which communicate with a foul air duct provided with an exhaust fan at its outlet.—J. H. L.

Diastatic product and process for producing the same. J. Takamine, New York. U.S. Pat. 1,148,938, Aug. 3, 1915. Date of appl., Feb. 2, 1910.

A DIASTATIC product, moyashi, is prepared by growing repeated generations of *Aspergillus oryzae* in the presence of increasing proportions of an antiseptic, such as formaldehyde. (See also U.S. Pat. 1,054,626; this J., 1913, 444; and Takamine, this J., 1914, 1098.)—W. P. S.

Beverage [non-alcoholic] and method of preparing same. W. O. Kaiser and G. F. Stroebel, Burlington, Iowa. U.S. Pat. 1,146,171, July 13, 1915. Date of appl., Aug. 12, 1914.

A MIXTURE of malt, rice, cereals, dextrin, and hops is fermented, then boiled to rupture the yeast cells and expel the alcohol, and cooled.—W. P. S.

Distillery slop; Manufacture and recovery of by-products from —. A. von Laszloffy, Peoria, Ill. U.S. Pats. 1,147,767 to 1,147,770, July 27, 1915. Dates of appl., Jan. 30, 1911, Aug. 25, 1911, Feb. 26, 1912, and Oct. 20, 1913.

(A) THE slop is concentrated to a syrup and mixed with an alcoholic solvent; the insoluble matter which contains precipitated albuminoid and gummy substances is separated and used as fodder, and the solvent is recovered from the liquid portion. (B) The slop, or material derived from it, e.g., the liquid portion, acidified if necessary, is concentrated or dried, and treated with a solvent which dissolves succinic and lactic acids and fats but which is immiscible with glycerol, and the undissolved matter is separated. (C) To recover succinic and lactic acids, slop freed from albuminoid and gummy substances is treated with a solvent capable of dissolving the organic acids and immiscible with glycerol, and after the insoluble matter has been separated the solution is concentrated to eliminate the added solvent; the fat which then separates is removed, and the succinic and lactic acids are separated by allowing the former to crystallise. (D) Material derived from slop is treated with a solvent as in (B) (above), and the undissolved residue is further treated with an alcoholic solvent.—J. H. L.

Diastase preparations; Manufacture of —. I. Pollak, Vienna. Eng. Pat. 11,329, May 7, 1914. Under Int. Conv., May 23, 1913.

SEE Ger. Pat. 283,061 of 1913; this J., 1915, 729.

Diastase preparations; Manufacture of —. I. Pollak, Vienna. Eng. Pat. 11,330, May 7, 1914. Under Int. Conv., May 23, 1913.

SEE Fr. Pat. 473,476 of 1914; this J., 1915, 729.

Brewing. M. Hessberg, London. U.S. Pat. 1,146,793, July 20, 1915. Date of appl., May 7, 1913.

SEE Eng. Pat. 29,143 of 1912; this J., 1913, 620.

XIXA.—FOODS.

Hydrogen peroxide in milk: Delicacy of different tests for —. I. T. Darlington. *J. Ind. Eng. Chem.*, 1915, 7, 676.

OF the various reagents in general use for detecting hydrogen peroxide in milk, *p*-phenylenediamine and benzidine were found to be the most sensitive; they are capable of detecting 0.075 mgrm. of peroxide in 10 c.c. of raw milk. Hydrogen peroxide in quantities such as would be added to milk as a preservative is completely decomposed when the milk is allowed to stand for 18 hours. —A. S.

Butter fat; Apparent effect of acetic acid upon the constants of —. C. Bahlman. *J. Ind. Eng. Chem.*, 1915, 7, 680—681.

WHEN fat is separated from milk, cream, etc., in presence of acetic acid, some of the acid is retained mechanically by the fat and affects the refractometer reading, saponification value, and Reichert-Meissl value of the latter; the acetic acid may be removed completely by heating for 1 hour at

90°—95° C. Hydrochloric and sulphuric acids, under similar conditions, are not retained by the fat to any appreciable extent.—A. S.

Cottonseed meal; The official method for determining crude fibre as applied to—C. K. Francis. J. Ind. Eng. Chem., 1915, 7, 676—680.

THE following method, in which but one filtration is required, is stated to give more reliable results than the U.S. official method: 2 grms. of the meal is dried at 105° C., and the fat removed by extraction with ether. The residue is transferred to a 800 c.c. beaker, treated with 200 c.c. of boiling 1.25% sulphuric acid, and the mixture boiled for 30 mins., a round-bottom flask filled with water being placed on the beaker to serve as a condenser. After adding 200 c.c. of boiling 3.52% sodium hydroxide solution, the boiling is continued for a further 30 mins., and the mixture filtered rapidly, with the aid of suction, through a 9 cm. S. & S. 575 filter paper, placed in a Buchner funnel, and preferably protected by a glass filter-plate. The residual fibre is washed successively with boiling water, 1.25% hydrochloric acid, hot water, and alcohol, and is then transferred from the paper, with the aid of a small quantity of 80% alcohol, to a Gooch crucible, which has been fitted with a pad of asbestos, 1mm. thick, and heated to redness for 15 mins. The crucible is heated at 105°—110° C. till of constant weight (2 to 6 hours), then partially covered and heated to dull redness for 15 mins. or until a white or light grey ash is obtained: the loss in weight represents crude fibre.—A. S.

Heating of cottonseed. Its causes and prevention. Barrow. See XII.

PATENTS.

Edible fat product. J. L. A. Paré, Montreal, Canada. Eng. Pat. 21,549, Oct. 26, 1914.

MELTED lard is incorporated with a substance, preferably of a nutritive character, such as flour, pulverised fish, or molasses, which will neutralise or change its flavour, and also with a flavouring, as meat extract, and a small quantity of condiments, and the whole is stirred until cool. The materials added to the lard are in such quantity as to give the product the consistence of butter. The lard used may be a compound lard.—J. H. J.

Margarine; Manufacture of—K. Erslev, Nijmegen. Assignor to Ant. Jurgens Vereenigde Fabrieken, Oss, Netherlands. U.S. Pat. 1,147,626, July 20, 1915. Date of appl. Feb. 24, 1915.

AN alkali lactate is added to the margarine, in the proportion of not less than 0.5%, for the purpose of preserving the buttery aroma.—W. P. S.

Bread; Manufacture of—H. A. Kohman, C. Hoffman, and T. M. Godfrey, Pittsburgh, Pa. Assignors to C. Adams, New Rochelle, N.Y. U.S. Pats. (A) 1,148,328 and (B) 1,148,329, July 27, 1915. Dates of appl. April 21 and Nov. 27, 1914.

(A) POTASSIUM bromate is added to the mixture of flour, yeast, etc., used for making bread, in the proportion of 0.015 part per 1000 parts of flour. (B) Potassium iodate is added in the proportion of 0.005 part per 1000 parts of flour.—W. P. S.

Food for cattle and other animals; Manufacture of—J. J. Eastick, London, and J. J. A. de Whalley, Lee, Assignors to The Molassine Co., Ltd., East Greenwich. U.S. Pat. 1,147,489, July 20, 1915. Date of appl., Feb. 26, 1914.

SEE Eng. Pat. 14,607 of 1913; this J., 1914, 803.

Meat and other foodstuffs; Process for the preservation of—O. Bocandé, Paris. U.S. Pat. 1,148,823, Aug. 3, 1915. Date of appl., Sept. 16, 1913.

SEE Eng. Pat. 19,921 of 1913; this J., 1914, 842.

Manufacture and recovery of by-products from distillery slop. U.S. Pats. 1,147,767—1,147,770. See XVIII.

Preservation of organic matter. Eng. Pat. 15,478. See XIXB.

XIXB.—WATER PURIFICATION ; SANITATION.

Bacteriological examination of water; Studies on the culture media employed for the—II. *Lactose-peptone media.* E. M. Chamot and C. M. Sherwood. J. Amer. Chem. Soc., 1915, 37, 1949—1959. (See this J., 1915, 730.)

THE fermentation of lactose by *B. coli* and other micro-organisms in water increases to a maximum with the concentration of the peptone or meat extract employed. The composition of the gas produced depends upon the concentration of the nitrogenous constituents of the medium. The most rapid and uniform diagnostic results were obtained by the use of media containing 3 to 3.5 or 4% of peptone, 0.6 to 1% lactose, and 0.5 to 1.5% of potassium chloride, or 0.5 to 1% of sodium chloride, preferably the former. Neutral media yield the greatest volume of gas, but its appearance is slower and greater variations in the final volume are obtained than with a medium containing about 1% (not exceeding 1.5%) of acid. The addition of meat infusion to weak peptone media is an improvement, but the reactions of such media change rapidly.—C. A. M.

Water; Absorption of chlorine by—as an index of quality. I. A. Zaleski and N. A. Elmanovitch. J. Russ. Phys. Chem. Soc., 1914, 46, 1270—1283. J. Chem. Soc., 1915, 108, ii., 479—480.

THE absorptive capacity of water for chlorine is determined by addition of an exact volume of clear bleaching powder solution to a definite volume of the water (usually 4 litres), followed, after a certain time, by estimation of the free chlorine present by titration with N/50-thio-sulphate solution; the result is expressed in mgrms. of chlorine absorbed per litre of the water. Any marked increase in the chlorine absorption indicates contamination of the water with the products of protein decomposition. For the water of the Neva, the mean value is 7.5—8, its oxygen absorption, similarly expressed, being 18—20.

Carbon monoxide; Determination of traces of—in the air. A. Gautier. Bull. Soc. Chim., 1915, 17, 256—260.

THE author claims priority over Graham and Wimmill (this J., 1911, 944) for the determination of the conditions required for the iodometric estimation of carbon monoxide in the air. The reduction of iodic anhydride by carbon monoxide begins at 30°—35° C., and even at dilutions of 1 in 200,000 and more, oxidation to carbon dioxide is complete at 75° C. If the carbon monoxide is accompanied by a considerable excess (10—20 vols.) of ethylene, acetylene, or hydrogen, it is however only partially oxidised, and recourse must be had to other methods of estimation, or the gas may be diluted; at dilutions of 1 in 100,000, the hydrocarbons do not react sensibly with iodic anhydride. The iodine, liberated according to the

equation $5\text{CO} + \text{I}_2\text{O}_5 = 5\text{CO}_2 + \text{I}_2$, may be estimated conveniently by direct weighing, after sublimation on to copper turnings heated to 80°C ., or colorimetrically by passing the vapour into carbon bisulphide and comparing with a standard tint. Sulphur dioxide or hydrogen sulphide must be previously removed from the air before it comes into contact with the iodic anhydride by passing through potassium hydroxide solution and over soda-lime.—G. F. M.

Antiseptics for wounds: Certain chlorinated —.

H. D. Dakin. *Comptes rend.*, 1915, 161, 150—153.
THE use of commercial hypochlorites as antiseptics is debarred by their varying composition and their content of free alkali or chlorine. Such objections do not apply to the following mixture, the strong bactericidal action of which is unaccompanied by any marked toxic or irritant effect. Bleaching powder (200 grms.) is mixed with water (10 litres) containing sodium bicarbonate (140 grms.) and the filtered liquid rendered neutral or acid by the addition of boric acid (25 to 40 grms.). With stronger solutions than the above an excess of boric acid should be avoided. *Staphylococci* are killed in 2 hours by a 1:500,000 hypochlorite solution prepared in this way; but to produce the same result in presence of blood serum a concentration of 1:1000 to 1:2500 is necessary. The solution is a very suitable antiseptic for infected wounds when applied according to Carrel's method. The antiseptic effect is attributed to the formation of chloro-amines by the interaction of the hypochlorite with proteins. Benzenesodiumsulphochloramide, $\text{C}_6\text{H}_5\cdot\text{SO}_2\cdot\text{NNaCl}$, and *p*-toluenesodiumsulphochloramide, $\text{CH}_3\cdot\text{C}_6\text{H}_4\cdot\text{SO}_2\cdot\text{NNaCl}$, are active antiseptics and possess little toxic effect. *B. Perfringens* and *Staphylococci* when suspended in water being killed in 2 hours by *p*-toluenesodiumsulphochloramide at concentrations of 1:10,000,000 and 1:1,000,000 respectively. Unlike hypochlorites, these substances do not dissolve dead tissue. Since they possess marked hæmolytic power they must not be injected into the veins.—J. R.

β -Naphthol in lysol and similar preparations: Detection of —. R. Bodmer. *Analyst*, 1915, 40, 341—343.

ONE c.c. of the sample in 100 c.c. of distilled water is treated with about 1 c.c. of diazotised benzidine hydrochloride solution (1 gm. benzidine, 4 c.c. of strong hydrochloric acid, and 1 gm. of sodium nitrite made up to 100 c.c. and neutralised). Pure lysol gives an orange-coloured solution, but a fine red colour is obtained in the presence of as little as 0.2% of β -naphthol. The test may be made quantitative by comparing the coloration with that given by a solution of lysol containing a known quantity of β -naphthol.—C. A. M.

PATENTS.

Water intended for commercial and drinking purposes; Eliminating the iron from and partly sterilising —. B. Kohnstein and J. M. Muchka. Vienna. Eng. Pat. 2020, Jan. 26, 1914.

A POROUS substance with a large surface, such as carbon, kaolin, magnesia, cork waste, or exhausted leather waste, is saturated with a solution of any natural or artificial tanning material, gallic acid, phenols, or phenol-sulphonic acids, or their condensation products with formaldehyde. The saturated substances are washed with clean water and are ready for use in a filter or in a rotating drum to absorb iron and other salts, colloids, and albuminous substances from water; the number of bacteria in the water is reduced by the treatment. (Reference is directed in pursuance of Sect. 7, Sub-sect. 4, of the Patents and Designs

Act. 1907, to Eng. Pats. 2525 of 1866, 2178 of 1873, and 4512 of 1886.)—J. H. J.

Purifying effluent and other liquids and softening water; Method of and means for —. Royles, Ltd., Manchester, and L. Jouvenel, Wimbledon. Eng. Pat. 761, Jan. 18, 1915.

A RECTANGULAR tank is divided into a series of right-angled channels running in the direction of two adjacent sides of the tank and communicating with each other at alternate ends, such communication taking the form of a short sill in the dividing wall of the channels, each succeeding sill being slightly lower than the one preceding it. The liquid enters the tank at the head of the outside channel and passes through all the channels in succession in zig-zag fashion. Each channel may have one or more transverse partitions slightly below the level of the liquid, so as to retain a stationary body of liquid in the channel and to cause the incoming liquid to flow over the surface of the other. The suspended matter is deposited and retained in the stationary liquid. The end channels, being shallower than the first ones, afford a surface for oxidation of the liquid after the suspended matter has been deposited. Means are provided for removing sludge from the channels. For softening water, two small chambers containing the reagents are placed outside the corner of the tank at the head of the first channel, and connected thereto.—J. H. J.

Catalytic oxidising or purifying means. N. Statham, Yonkers, N.Y., Assignor to Industrial Chemical Co., New York. U.S. Pat. 1,146,363, July 13, 1915. Date of appl., Aug. 15, 1913.

A HIGHLY porous, granular, carbonised vegetable material, substantially free from hydrocarbons, is employed in the form of a deep percolating bed; the oxidising capacity of the material is about 20 to 35 mgrms. of oxygen per gm.—W. P. S.

Liquids [water]: [Electrically] treating —. C. P. Landreth, Philadelphia, Pa. U.S. Pat. 1,146,942, July 20, 1915. Date of appl., Aug. 2, 1912.

A PORTION of the liquid, such as water, is treated to produce a precipitant including the foreign matter to be removed, by causing the liquid to flow continuously under pressure through a substantially closed vessel forming part of a conduit, in contact with and between oxidisable electrodes, whereby a coagulating body is formed electrolytically. The liquid is diverted across the surface of the electrodes and mechanically agitated during its passage, whereby a motion independent of its direction of flow is imparted to it, and the electrodes are swept free of precipitated matter. A chemical precipitating agent is introduced after it has passed the electrodes, and the liquid is mixed with the untreated water in a settling tank to separate the flocculent or other suspended matter produced by the chemical and electrical treatments.—B. N.

Organic matter; Preservation of —. E. Hill, Bradford. Eng. Pat. 15,178, June 27, 1914.

THE organic matter, such as foods or cloth, etc., is packed in boxes or tins and a small opening left or made in these after closing. Several of the boxes are placed in a special container which is hermetically closed, connected to a pump, and most of the air removed and replaced by nitrogen. The container is then opened, the boxes taken out, and the small opening sealed up. The air left in contact with the organic matter should contain not more than 14% by volume of oxygen.—J. H. J.

Nicotine solutions; Method for concentrating —. R. G. Mewborne, Louisville, Ky., Assignor to The Kentucky Tobacco Products Co. U.S. Pat. 1,146,014, July 13, 1915. Date of appl., July 8, 1912.

NICOTINE solutions are concentrated by distilling off the water at a low temperature in a chamber maintained under a high vacuum, and the vapours are passed through water to condense and remove any volatilised nicotine, which is then returned to the still.—J. F. B.

Water; Purifying and clarifying —. O. Vollenar, Dresden, Saxony. Eng. Pat. 28,816. Dec. 13, 1913. Under Int. Conv., Dec. 17, 1912.

SEE Fr. Pat. 466,177 of 1913; this J., 1914, 663.

Base-exchanging substances from natural rocks; Production of —, and utilisation of the same for the elimination of bases from aqueous solutions. Ges. für Verwertung Chem. Produkte m. b. H., Berlin. Eng. Pat. 2286. Jan. 28, 1914. Under Int. Conv., Jan. 29, 1913.

SEE Fr. Pat. 467,687 of 1914; this J., 1914, 938.

Water; Method of softening —. K. Schrempp, Karlsruhe, Baden. Eng. Pat. 2971, Feb. 5, 1914.

SEE Fr. Pat. 468,047 of 1914; this J., 1914, 981.

Water; Apparatus for treating flowing — with gas. G. Ornstein, New York. Eng. Pat. 10,374, April 27, 1914. Under Int. Conv., May 9, 1913.

SEE Fr. Pat. 469,275 of 1914; this J., 1915, 16.

Manufacture of base-exchanging substances. Eng. Pats. 10,997 and 17,663. See VII.

Means for detecting the presence of injurious gases in mines. Eng. Pat. 10,400. See XXIII.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Eserine. Alkaloids of the Calabar bean. I. M. Polonovski. Bull. Soc. Chim., 1915, 17, 235—244.

ESERINE gives a very hygroscopic methiodide when treated with methyl iodide in benzene solution. On treatment with sulphur dioxide in ethereal solution it gives a crystalline substance which is probably a sulphite of eserine, but which is certainly not a new base. "eseridine," as suggested by Böhringer. Eserine is decomposed by warm aqueous barium hydroxide solution, each molecule giving one mol. of carbon dioxide, one mol. of methylamine, and one mol. of eseroline, $C_{13}H_{18}N_2O$ (Salway, this J., 1912, 509). The presence of a $-CO.NHCH_3$ group is further indicated by the evolution of methyl isocyanate when eserine is heated to 150° — $160^{\circ}C$. Eseroline is obtained most readily in a pure condition by the action of cold alcoholic sodium ethoxide on eserine, methylurethane being the other product. It forms white crystals, m.pt. $129^{\circ}C$. $[a]_D$ (in absolute alcohol) = -107° . Its salts are crystalline substances, and it forms a crystalline methiodide, m.pt. $188^{\circ}C$. Evidence of the existence of a hydroxyl group in eseroline which is generated during the formation of this substance from eserine, and that this latter alkaloid is, therefore, a urethane of the structure, $CH_3NH.CO.OC_{13}H_{17}N_2$, is afforded by the formation of an ethyl ether of eseroline when either the alkaloid or its saponification product is treated with ethyl toluenesulphonate and sodium ethoxide in alcoholic solution. This ether, eserethol, $C_{13}H_{17}N_2OC_2H_5$, is a very stable, strongly alkaline liquid, b.pt. 308° — $310^{\circ}C$. $[a]_D$ (in alcohol) = -81° . It gives well character-

ised derivatives and is therefore a very suitable starting point for the further degradation of eserine.—G. F. M.

Geneserine, a new alkaloid of Calabar beans. Alkaloids of the Calabar bean. II. M. Polonovski and C. Nitzberg. Bull. Soc. Chim., 1915, 17, 244—256.

WHILST extraction of the finely powdered beans with warm alcohol in presence of tartaric acid gave almost pure eserine, extraction with ether, either with or without previous treatment with sodium carbonate or hydroxide, yielded up to a maximum of 1 gm. per kilo. of a new alkaloid, $C_{15}H_{21}N_3O_3$, m.pt. 128° — $129^{\circ}C$, which is apparently an oxy-eserine, and is named geneserine. It is a very feeble base and does not give crystalline salts with mineral acids. On the other hand the salicylate, m.pt. 89° — $90^{\circ}C$, and the picrate, m.pt. $175^{\circ}C$, are well defined crystalline salts. Geneserine in alcoholic solution has $[a]_D = -175^{\circ}$. Treated in the same manner as eserine (see preceding abstract), geneserine gives rise to a perfectly parallel series of degradation products. Geneseroline, $C_{13}H_{18}N_2O_2$, is formed along with methylurethane when the alkaloid is treated with sodium ethoxide. It melts at $150^{\circ}C$, and in alcoholic solution has $[a]_D = -176^{\circ}$. Its ethyl ether, geneserethol, melts at $83^{\circ}C$, and distils without decomposition. Like eserethol it is also produced by the ethylation of geneserine itself. Geneserine and all the above degradation products are converted into eserine or its corresponding derivatives by gentle reduction with zinc and acetic acid, or with sulphurous acid. Geneserine is a fundamental alkaloid of Calabar bean and is not identical with either eseramine or physovenine, isolated by Salway (this J., 1912, 509), from which it differs moreover in physiological action.—G.F.M.

Strophanthin from Strophanthus Kombé and S. Gratus; Reactions of —. C. Reichard. Pharm. Zentr.-h., 1915, 56, 159—163, 174—178. J. Chem. Soc., 1915, 103, ii., 496.

THE strophanthin obtained from *Strophanthus Kombé* is an amorphous, yellow powder, whilst that from *S. Gratus* occurs as colourless crystals. The former dissolves readily in 90% sulphuric acid, whilst the latter dissolves with difficulty. When treated with concentrated sulphuric acid, *Kombé*-strophanthin yields an intense green coloration, but *Gratus*-strophanthin remains unaltered; on heating, both mixtures yield a green coloration, which, in the case of *Kombé*-strophanthin, changes to grey-blue if the heating is not continued. *Gratus*-strophanthin dissolves in warm potassium bichromate solution, and yellow crystals are deposited when the solution is cooled; *Kombé*-strophanthin behaves similarly, but the former crystals yield only a slight green coloration when treated with sulphuric acid, whilst the latter give a green coloration with dilute sulphuric acid.

β -Nataloin and β -homonataloin; Resolution of — into optical isomerides. E. Léger. Comptes rend., 1915, 161, 133—135.

β -NATALOIN, obtained by hydrolysing the optically inactive penta-acetyl derivative (Comptes rend., 1914, 158, 1189), usually exhibits, after several recrystallisations, a feeble *d*- or *l*-rotation. A product thus obtained, having $a_D = -24^{\circ}$, after three recrystallisations from alcohol at $60^{\circ}C$, showed the same rotatory power as naturally occurring nataloin, namely, $a_D = -145^{\circ}$. The highest *d*-rotation obtained was $a_D = +63^{\circ}$. A specimen of β -homonataloin, having $a_D = +8^{\circ}$, when fractionally precipitated from alcoholic solution also gave a fraction having $a_D = +63^{\circ}$; and from the mother liquors a fraction was

obtained having $\sigma_D = -147.6^\circ$, whereas for natural β -homonataloin $\sigma_D = -149.7^\circ$.—J. R.

Bay oil. J. C. Umney. Perf. and Ess. Oil Rec., 1915, 6, 251—252.

IN several of the British West Indian Islands are found bay trees of the variety most suitable for producing oil, and in certain districts, notably in Montserrat, considerable areas are being planted. In view of the probable increase of output of bay oil, new uses should be found: at present it is used almost entirely for making bay rum. As a source of eugenol it could not compete with clove and cinnamon leaf oils, but it might be used with advantage in soaps and other toilet articles. The purchase of bay oil on the basis of phenol content is not satisfactory, since it affords an opportunity for sophistication with eugenol. In two oils containing 55 and 45% of phenols, respectively, the odour of the latter was much superior, whilst the former was higher in price. It is hoped that the official efforts in the West Indies to bring the production of the oil within controlled conditions will remove some of the difficulties in the valuation of the oil.

Black bergamot oil. Perf. and Ess. Oil Rec., 1915, 6, 253—254.

A "BLACK oil of bergamot" is now being produced at Reggio from the fallen fruits, and 100 kilos. was delivered recently at Messina. The manufacturers state that the sp. gr. varies between 0.893 and 0.897 and the ester content between 23% and 28%. An examination of the oil in London gave sp. gr. 0.890, ester content, 25.2%, non-volatile residue, 11%.

Hernandia oil. Perf. and Ess. Oil Rec., 1915, 6, 264.

THE essential oil of *Hernandia pellata*, a Madagascar plant known as a false camphor, has been examined. From the stem wood from 1.03 to 2.06% of oil was obtained, having the following characters:—Sp. gr. (15°C.), 0.958 to 0.963; $\sigma_D = +83^\circ 45'$ to $+101^\circ 12'$; $n_D = 1.49695$ to 1.50111 . It contains from 75 to 80% of aldehydes (dihydrocinnamic aldehyde), with traces of free acids and a small amount of esters. The root wood yielded 0.5% of oil having a sp. gr. of 0.9667, $\sigma_D = +126^\circ 15'$, $n_D = 1.50383$, and aldehyde content 92.5%. The whole fruit gave 0.5% of oil of sp. gr. 0.9528, $\sigma_D = +50^\circ 10'$, $n_D = 1.49554$, and aldehyde content 49%. The almond-like seeds gave 1.38% of oil, sp. gr. 1.0044, $\sigma_D = +87^\circ$, $n_D = 1.50614$, acid value 7.3, and ester value 110.4. The fruit oil does not appear to contain any dihydrocinnamic aldehyde.

Phenacetin and salol in admixture; Determination of —. W. O. Emery, G. C. Spencer, and C. C. Le Febvre. J. Ind. Eng. Chem., 1915, 7, 681—681.

(1) THE phenacetin and salol are first extracted together from the sample, and the mixture is digested with dilute sulphuric acid, whereby the phenacetin is converted into phenetidine sulphate, whilst the salol is partially volatilised. The remainder of the salol is removed by extraction with chloroform, in which phenetidine sulphate is insoluble, and the latter is re-converted into phenacetin by treatment with sodium bicarbonate and acetic anhydride. The phenacetin is isolated by extraction with chloroform, and weighed. The salol is estimated by difference. (2) The mixture of phenacetin and salol is digested with 2.5% sodium hydroxide solution for 5 mins. at 100°C. , and the unaltered phenacetin is separated by extraction with chloroform and weighed. The

salol is converted into sodium salicylate and sodium phenoxide and is determined by treating the alkaline solution successively with excess of a standard bromide-bromate solution, hydrochloric acid, and potassium iodide, and then titrating the liberated iodine with thiosulphate: 12 atoms $\text{Br} = 1 \text{ mol. salol}$.—A. S.

Per-acids; Organic —. J. D'Ans and A. Kneip. Ber., 1915, 48, 1136—1146. (See also this J., 1914, 41.)

A MIXTURE of 20 grms. of formic acid, 25 grms. of 100% hydrogen peroxide, and 6.5 grms. of sulphuric acid after standing for 2 hours, gave, upon distilling *in vacuo*, a first fraction of 10.6 grms. containing 89.9% of performic acid and 2.6% of hydrogen peroxide, and a second fraction of 8.6 grms. containing 74.9% of performic acid and 3.3% of hydrogen peroxide, while the residue of 31.6 grms. contained 20.4% of performic acid and 31.2% of hydrogen peroxide. 90% performic acid is a colourless liquid readily miscible with water and organic solvents. It decomposes spontaneously upon keeping: the decomposition is accelerated by nickel powder, cupric oxide, chromic acid, and solid matter generally; while in presence of mercury, sodium peroxide, zinc dust, litharge, sodium azide, etc. explosive decomposition occurs into carbon dioxide and water. 50% peracetic acid was prepared by gradually bringing the calculated amounts of acetic anhydride and hydrogen peroxide into a vessel cooled in ice-water, the hydrogen peroxide being always kept in slight excess. The reaction, when accelerated by the addition of a trace of sulphuric acid, is complete in half-an-hour. The resulting solution, which is extremely stable, showed strong oxidising action: thus, formaldehyde, α -naphthol, benzaldehyde, etc., were converted quantitatively to the corresponding acids when mixed in the cold with the calculated amount of 50% peracetic acid and subsequently warmed for 15 mins. on the water-bath. Primary amines were oxidised in the cold to nitroso-compounds, and, when warmed, to nitro-compounds; azo- and azoxy-compounds were also produced in varying amounts, according to the conditions. Azo-compounds in acetic acid solution were oxidised quantitatively to azoxy-compounds at 50°C. —J. R.

Acetylene; Adsorption of — by colloidal platinum, iridium, and osmium, and by platinum black. C. Paal and A. Schwarz. Ber., 1915, 48, 1195—1202.

THE rate of adsorption of acetylene by palladium hydrosol or palladium black, which is rapid at first, gradually slackens; after the attainment of equilibrium further quantities are adsorbed when the temperature or pressure is increased. The superficially condensed acetylene is thereby converted to liquid or solid polymers which surround the metallic particles and eventually prevent further action. Palladium hydrosol has a greater adsorptive action than palladium black. Platinum hydrosol and platinum black behave similarly; on the other hand, neither iridium nor osmium hydrosol adsorbs acetylene. 10 c.c. of water containing 0.16 gm. of colloidal platinum with 58.7% Pt ($= 0.0939 \text{ gm. Pt}$) when shaken with acetylene for $29\frac{1}{2}$ hours took up 19.36 c.c., of which 9.16 c.c. (at 0°C. and 760 mm.) was adsorbed by the platinum, *i.e.*, 1 volume of colloidal platinum adsorbed 2175 volumes of acetylene. Similarly, 0.25 gm. of platinum black in 10 c.c. of water adsorbed 9.09 c.c. in 74 hours, *i.e.*, 1 volume of platinum black adsorbed 781 volumes of acetylene. These values are less than the corresponding values for palladium.—J. R.

Colloidal metals of the platinum group; Catalytic action of—. XIV. *Progressive hydrogenation of acetylene in presence of colloidal platinum.* C. Paal and A. Schwarz. Ber., 1915, 48, 1202—1207. (See also this J., 1915, 574.)

SINCE the adsorption of acetylene is less pronounced with colloidal platinum than with colloidal palladium (see preceding abstract), it was anticipated that the conversion of acetylene into ethylene in presence of the former would be more complete than in presence of the latter; actually the reverse was the case. When equal volumes of acetylene and hydrogen were used the product contained about half the calculated amount of ethylene, in addition to a considerable amount of ethane and some unchanged acetylene. In all cases, hydrogenation in presence of colloidal platinum proceeded more slowly than in presence of colloidal palladium.—J. R.

Pharmaceutical products of which the Patents have expired. Second Series. Chem. and Drug., July 31, Aug. 7, 21, and 28, 1915. (See also this J., 1915, 301, 635).

Adorin. Powder containing paraformaldehyde (wound dressing). Eng. Pat. 21,531 of 1893. Paraldehyde is mixed with infusorial earth, starch, inert salts, etc.

Albacid. Halogen derivatives of albumins. Pat. 7097 of 1898. Sodium bicarbonate and iodine are added to a solution of albumin, and soda-lye is then added, the solution precipitated with acetic acid, and the precipitate washed and dried. The product (Iodalbumin) contains 6 to 7% I. Chloralbumin and Bromalbumin are analogous chlorinated and brominated albumins.

Albargine. Silver gelatose (for treating gonorrhoea). Pat. 23,507 of 1900. A neutralised aqueous solution of gelatose is mixed with silver nitrate solution and the product evaporated to dryness *in vacuo*.

Amyloform. Condensation product of starch and formaldehyde (substitute for iodoform). Pat. 1147 of 1897. A mixture of starch with 40% formaldehyde is heated in a closed vessel for 5 or 6 hrs. at 100°—120° C.; the product is heated for 24 hrs. in an open vessel at 120° C. and the mass is again stirred with formaldehyde solution, the excess of which is removed by washing with water or other solvent.

Anaesthesine. *p*-Aminobenzoic acid ethyl ester (local anesthetic). Pat. 16,684 of 1903.

Antalgine. Salicylaldehyde- α -methylphenylhydrazine (for neuralgia and rheumatism). Pat. 3698 of 1892. Molecular proportions of salicylaldehyde and α -methylphenylhydrazine are caused to interact, either alone or in presence of a solvent (methyl or ethyl alcohol).

Antiarthrin. Condensation product of tannic acid and saligenin (for uric-acid diathesis). Pat. 13,714 of 1898. A physiological tanning material (*i.e.*, one which gives no gallic acid when treated with dilute acid) is heated with 5% hydrochloric acid at 90° C. until it is decomposed into tannin and glucose: excess of salicin is then added and the mixture further heated until saligenin has been formed. The brown resinous substance which separates is the compound of tannin and saligenin.

Antispasmin. Compound of narcine and sodium salicylate (narcotic and sedative). Pat. 7979 of 1892. Sodium salicylate is added to an alkaline solution of narcine and the mixture evaporated at a low temperature.

Anytols. Solutions of phenols in sulpho compounds. Pat. 20,215 of 1893. Phenols are mixed with the substances obtained by treating with sulphuric acid the sulphur compounds of mineral and other oils and neutralising the products.

Aperitol. Phenolphthalein di-isovalerate (aperient). Pat. 27,095 of 1908. Phenolphthalein

is heated with isovaleryl bromide, the product is dissolved in benzene, and the solution is washed with dilute caustic soda solution and evaporated.

Apolysin. Monophenetidine citrate (antipyretic and analgesic). Pat. 1254 of 1895. Citric acid (42 parts) is heated with *p*-phenetidine (27.5 pts.) to 100°—200° C. for several hours, the product is dissolved in alkali, and the solution precipitated by means of hydrochloric acid.

Barutin. Compound of sodium salicylate and barium theobromine (diuretic). Pat. 4959 of 1905. A solution of barium chloride and sodium salicylate is added to a solution of theobromine in dilute sodium hydroxide; after standing the mixture is evaporated *in vacuo*.

Bismon. Colloidal bismuth oxide (for infants' stomach and bowel troubles). Pat. 12,773 of 1903. A solution of an alkali salt of protalbinic acid, lysalbinic acid, or albumose is mixed with a solution of bismuth nitrate, caustic soda solution is added, and the product is dialysed against water until the nitrates and free soda have been removed; the residue is then evaporated *in vacuo*.

Blutan. Solution of iron-manganese peptone free from alcohol. Pat. 20,273 of 1904. A solution of commercial iron-manganese peptone is slightly acidified with hydrochloric acid, and the solution is impregnated at 0° C. with carbon dioxide under a pressure of 6 atmos. The resulting liquid is stored in air-tight vessels in a cool place for two or three months. It contains 0.6% Fe and 0.1% Mn.

Bromlecithin. A lecithin derivative containing 30% Br. Pat. 13,285 of 1904. A chloroform solution of bromine is added to a cooled solution of lecithin in chloroform, the mixture is filtered, and the filtrate evaporated *in vacuo*.

Bromocoll. Compound of bromine and tannin (used in epilepsy, nervous affections, and insomnia). Pat. 5122 of 1900. Bromine is added to an alcoholic solution of tannin, water is added, and then an aqueous 1.5% gelatin solution until no further precipitate is formed. After standing, the precipitate is filtered, washed, and dried at a low temperature.

Calometol. Colloidal mercurous chloride. Pat. 19,168 of 1903. Aqueous solutions of sodium chloride and mercurous nitrate are added successively to an aqueous solution of peptone, albumin, gelatin, etc., and the solution is acidified to precipitate the colloidal mercurous chloride, which is dissolved in water, neutralised with alkali, and separated from solution by evaporation at a low temperature or by precipitation with alcohol.

Captol. Condensation product of chloral and tannin (used in dermatology). Pat. 2882 of 1898. A concentrated solution of chloral hydrate is introduced into the viscous paste obtained by adding 70% sulphuric acid to a solution of tannin. The mixture is heated for several hours at 70°—80° C., until it has become a pasty mass; the precipitate is separated, washed with cold water, and dried at a low temperature.

Chinocol. Compound of hydroxyquinoline and potassium sulphate (antiseptic and disinfectant). Pat. 1409 of 1896. Powdered potassium pyrosulphate is added gradually to an alcoholic solution of hydroxyquinoline, and the mixture is boiled for ten hours under a reflux condenser. The alcohol is removed from the product by centrifuging or filtration.

Chinolotropin. Urotropine quinate (used for treating gout). Pat. 14,831 of 1899. A solution of hexamethylenetetramine and quinic acid in water, alcohol, etc., is evaporated *in vacuo* or at the ordinary pressure.

Clarin. Crystalline active principle from ergot. Pat. 239 of 1906. An aqueous extract of ergot is completely precipitated by means of saturated barium hydroxide solution, the excess of barium is removed from the solution by passing carbon dioxide, the filtrate is evaporated, the residue

extracted with warm alcohol, and the solution evaporated until crystallisation commences. Or the aqueous extract of ergot is evaporated and the syrupy residue extracted with boiling 75% alcohol; the crystalline product separates on cooling.

Desichthol. Deodorised ichthyol. Pat. 10,875 of 1898. Ichthyol-ammonia is deodorised by treatment with hydrogen peroxide solution.

Diaspirin. Succinyl disalicylic acid (action similar to aspirin). Pat. 5842 of 1907. Succinyl chloride is added to a cooled solution of salicylic acid in benzene and dimethylaniline, the mixture is poured into water, and the new product separated by adding hydrochloric acid.

Digipuratum. Purified preparation of digitalis. Pat. 6019 of 1908. Digitalis leaves are extracted with strong alcohol, the extracts are neutralised, and ether is added until no further precipitation occurs. The separated extract is concentrated *in vacuo*, and mixed with milk sugar.

Dionin. Ethylmorphine hydrochloride (used in bronchitis, whooping cough, etc.). Pats. 13,703 of 1899 and 14,366 of 1901. Morphine is treated with ethyl bromide.

Dithion. Sodium dithiosalicylate (antirheumatic). Pat. 14,443 of 1888. Salicylic acid is heated with sulphur chloride at 100°–150° C. until evolution of hydrochloric acid ceases, and the dithiosalicylic acid is converted into its sodium salt.

Eigon. Compounds of bromine and iodine with albumin and peptone (substitutes for alkali bromides and iodides). Pats. 7710 of 1898 and 17,931 of 1899. A mixture of 90 parts of dry egg albumin and 11 parts of iodine is made into a thick paste with 90% alcohol, the mixture is heated in covered vessels for half an hour at 85° C. and then allowed to dry at about 35° C. and washed.

Eka-iodoform. Sterile iodoform. Pat. 11,228 of 1897. Iodoform is mixed with 0.05 to 0.25% of paraformaldehyde.

Empyroform. Formaldehyde-tar preparation (for treating eczema). Pat. 12,282 of 1903. *Oleum rusci* or *Oleum jagi* is boiled with formaldehyde solution, the boiling mixture is poured into hydrochloric acid, and the resulting solid mass is washed with water until colourless.

Epicarlin. Condensation product of chloromethylsalicylaldehyde with β -naphthol (antiseptic in scabies, etc.). Pat. 17,118 of 1899. The components are heated in glacial acetic acid solution to 100°–120° C. until evolution of hydrochloric acid ceases.

Eston. Basic aluminium acetate (antiseptic powder for wounds, etc.). Pat. 8576 of 1907. Dry "commercial alumina hydrate" is ground to paste with glacial acetic acid; after standing this sets to a solid cake, which is powdered and heated to 100°–150° C. to remove excess of acetic acid.

Erocin. Diacetylrufugallie acid tetramethyl ether (aperient). Pat. 22,163 of 1903. Rufugallie acid tetramethyl ether is converted into its diacetyl derivative by boiling with glacial acetic acid and sodium acetate, and pouring the mass into water.

Forman. Chloromethyl menthyl ether (used for treating catarrh). Pat. 5293 of 1902. Dry hydrogen chloride is passed for 2 to 3 hours into a solution of 160 grms. of menthol in 90 grms. of 35% formaldehyde solution; the upper layer is dried over sodium sulphate and freed from hydrochloric acid by means of air at 50°–60° C.

Formeston. Basic aluminium formate (used in wound-dressing, nose-bleeding, etc.). Pat. 8643 of 1907. The thick paste produced by mixing aluminium hydroxide with anhydrous formic acid is heated for several hours at about 120° C.

Guaiaecetin. Sodium salt of catecholmonoacetic acid (used in bronchitis and phthisis). Pat. 17,160 of 1895. Sodium hydroxide or carbonate solution is added to a boiling aqueous solution of chloro-

acetic acid and catechol, and boiling is continued until the solution is neutral. The sodium salt separates on cooling.

Helcosol. Bismuth pyrogallate (used in disorders of the digestive tract). Pats. 13,291 of 1892 and 15,361 of 1894. Pyrogallol is treated with bismuth nitrate in presence of caustic soda.

Hippol. Methylenehippuric acid (urinary antiseptic). Pat. 10,095 of 1903. A mixture of hippuric acid with paraformaldehyde and sulphuric acid is allowed to stand for four days and is then poured on ice. The unchanged hippuric acid is separated from the precipitate by washing with sodium acetate solution.

Hyrgotum. Colloidal mercury. Pat. 13,800 of 1898. A 10% solution of mercurous nitrate containing nitric acid is added slowly to a solution of stannous oxide in nitric acid, and concentrated ammonium citrate solution is added until the colloidal mercury has been precipitated.

Ichthargan. Silver ichthyolate (30% Ag). Pat. 14,389 of 1899. "Petrosulphol" is decomposed by milk of lime and the free acid obtained by introducing carbon dioxide into the solution. The acid is partially oxidised by means of hydrogen peroxide and then converted into its silver salt. *Ichthargol* is an insoluble silver ichthyolate containing 12% Ag. *Ichthermol* is mercury ichthyolate, obtained as above, and *Ferrichthol* is iron ichthyolate.

Ichthoform. Compound of ichthyol and formaldehyde (intestinal antiseptic). Pat. 9157 of 1899. An aqueous solution of ichthyolsulphonic acid is heated with formaldehyde solution for ten hours, and the precipitate is washed and dried at 100° C.

Ichthyol (see this J., 1915, 302). In Pat. 6044 of 1893 the use of different solvents for the individual constituents of the sulphonated mixture is claimed.

Iodoformat. Iodoform-ethyl-hexamethylene-tetramine iodide. Pat. 21,203 of 1895. An absolute alcoholic solution of ethyl iodide-hexamethylene-tetramine and iodoform is heated for a short time. The product separates on cooling.

PATENTS.

Inoculating substances; Preparation of— from bacteria. S. Sokal, London. From Kalle und Co., Biebrich, Germany. Eng. Pat. 10,176 of 1914, date of appl., Oct. 3, 1913.

NOX-ACID-PROOF bacilli, such as those of anthrax, typhus, etc., are dried, finely ground, and extracted first with alcohol and then with a fat solvent such as ether. The two extracts (which may be evaporated to dryness and used in any desired concentration) and the residue are efficacious inoculating substances.—F. SP.

Nicotine and other products from tobacco or tobacco products: Apparatus for the extraction of—

Treatment of tobacco and tobacco-products. F. T. Birdwood, London. Eng. Pats. (A) 17,024, July 17, and (B) 17,265, July 21, 1914.

(A). *VOLATILE* products, chiefly nicotine and ammonia, are expelled from tobacco, preferably after preparation as cigars, cigarettes, etc., by heating to 160° to 180° C. The apparatus consists of a central cylinder divided into compartments, containing the tobacco in suitable holders, and surrounded by a second double-walled cylinder, the intermediate space being supplied with hot air so as to obtain a fairly uniform temperature in the drying chamber. The latter is closed at the top by a conical condenser provided with an internal trough and kept cool by a water jacket. (B). The evaporation of the nicotine, etc., is carried out in a partial vacuum. The heating jacket may be dispensed with and hot air passed directly into the evaporation chamber, and the conical condenser may also be omitted.—B. V. S.

2-Phenylquinoline-4-carboxylic acid; Preparation of —. S. Sokal, London. From Kalle und Co. A.-G., Biebrich, Germany. Eng. Pat. 17,725, July 27, 1914.

2-PHENYLQUINOLINE-4-CARBOXYLIC acid is made by the condensation of isatin with acetophenone in aqueous alkaline solution, without employing alcohol. *Example*: 16 kilos. of isatin, 12 kilos. of acetophenone, and 60 kilos. of caustic potash (33%) are heated and stirred on the water-bath for 8 hours, diluted with water, and filtered from brown flakes. Acetic acid is added as long as brownish-red flakes separate. These are filtered off, and the 2-phenylquinoline-4-carboxylic acid (m.pt. 209° C.) is precipitated by adding the calculated quantity of acetic acid.—F. Sp.

Urea; Manufacture of —. J. Y. Johnson, London. From Badische Anilin u. Soda Fabr., Ludwigshafen, Germany. Eng. Pat. 24,117, Dec. 15, 1914.

UREA is obtained by heating the compounds of carbon dioxide and ammonia in a closed vessel, and removing the unchanged ammonium compound by distillation under reduced pressure at about 80° C. *Example*: The reaction mixture from the autoclave in which the partial conversion has been effected is transferred to a vacuum still and heated to about 75° C. Carbon dioxide and ammonia distil over, and recombine in the cooled receiver to form solid ammonium carbonate or carbamate, which may be used again. Urea and water remain in the still and the latter may be removed by continuing the vacuum distillation below 80° C. with a fresh receiver.—F. Sp.

Ethylene; Process for purifying — for catalytic reactions, particularly for the production of ethane. Elektrochem. Werke Ges. m. b. H., Berlin. Eng. Pat. 21,311, Sept. 20, 1913. Under Int. Conv., Oct. 15, 1912.

SEE Ger. Pat. 266,519 of 1912; this J., 1913, 1170.

Ethylene or gases containing ethylene; Process for purifying — for the purpose of producing ethane by means of a catalytic agent. Elektrochemische Werke Ges. m. b. H., Berlin. Eng. Pat. 21,312, Sept. 20, 1913. Under Int. Conv., Oct. 15, 1912.

SEE Ger. Pat. 265,297 of 1912; this J., 1913, 1087.

Mercury; A preparation of — for therapeutic purposes. Dr. Bayer és Társa, Budapest. Eng. Pat. 28,984, Dec. 16, 1913. Under Int. Conv., Dec. 19, 1912. Addition to Eng. Pat. 11,302 of 1913, dated June 28, 1912.

SEE Ger. Pat. 267,412 of 1912; this J., 1914, 220.

Hydrogenisation and dehydrogenisation. Hydrogenisation and dehydrogenisation of compounds containing carbon. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen, Germany. Eng. Pats. 2306 and 2308, Jan. 28, 1914.

SEE Fr. Pat. 473,697 of 1914; this J., 1914, 734.

Esters of oryquinolines; Manufacture of —. R. Wollenstein, Berlin. Eng. Pat. 16,585, July 11, 1914.

SEE Ger. Pat. 281,007 of 1913; this J., 1915, 452.

Solvents; Production of organic —. F. Sparre, Assignor to E. I. du Pont de Nemours Powder Co., Wilmington, Del. U.S. Pat. 1,148,258, July 27, 1915. Date of appl., Oct. 19, 1912.

SEE Eng. Pat. 29,963 of 1912; this J., 1914, 502.

Chlorination; Apparatus for —. F. Sparre and W. E. Masland, Assignors to E. I. du Pont de Nemours Powder Co., Wilmington, Del. U.S. Pat. 1,148,259, July 27, 1915. Date of appl., April 17, 1913.

SEE Fr. Pat. 453,406 of 1913; this J., 1913, 767.

Pyrrrolidine derivative. A. Thiele, Assignor to Chem. Fabr. auf Actien, vorm. E. Schering, Berlin. U.S. Pat. 1,148,637, Aug. 3, 1915. Date of appl., Nov. 14, 1913.

SEE Ger. Pat. 280,971 of 1913; this J., 1915, 636.

Method for concentrating nicotine solutions. U.S. Pat. 1,146,014. See XIXB.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Phototropy of inorganic systems. Calcium sulphide system. Mourello. See VII.

PATENTS.

Photo-mechanical printing surfaces; Preparation of —. H. C. Knudsen, Brooklyn, N.Y., U.S.A. Eng. Pat. 2818, Aug. 7, 1914.

IN making an enlarged copy of a continuous tone picture for printing purposes the image is projected on to the sensitised surface through the globular screen described in Eng. Pat. 2817 of 1914 (this J., 1915, 890), the prepared side of the screen being in contact with the sensitive film. Sharper dots are obtained by suitably colouring the globules of the screen.—B. V. S.

Photographic film. P. D. Brewster, East Orange, Assignor to Brewster Film Corporation, Newark, N.J. U.S. Pat. 1,145,968, July 13, 1915. Date of appl., July 1, 1913.

SEE Fr. Pat. 468,297 of 1914; this J., 1914, 986.

XXII.—EXPLOSIVES; MATCHES.

PATENTS.

Detonating composition. W. L. Main, Chester, Pa., Assignor to E. I. du Pont de Nemours Powder Co., Wilmington, Del. U.S. Pat. 1,147,958, July 27, 1915. Date of appl., May 7, 1914.

A PRIMARY detonating compound (e.g., mercury fulminate) is incorporated with a bromate to form a charge for blasting caps.—C. A. M.

Match and method of making the same. C. L. Gabriel, New York. U.S. Pat. 1,147,159, July 20, 1915. Date of appl., Oct. 11, 1913.

THE splints are impregnated with a solution of phosphorus trichloride in a liquid hydrocarbon (benzol), mixed with a petroleum derivative.—C. A. M.

Explosive charges of fusible explosives; Process of and apparatus for the manufacture of —. H. G. C. Fairweather, London. From G. Issler, Rheinland, Germany. Eng. Pat. 29,152, Dec. 17, 1913.

SEE Fr. Pat. 469,247 of 1914; this J., 1915, 101.

XXIII.—ANALYTICAL PROCESSES.

Paraffined apparatus for volumetric analyses. G. Povarnin. J. Russ. Phys. Chem. Soc., 1914, 46, 1898—1905. J. Chem. Soc., 1915, 108, ii., 477—478.

THE author recommends that the measuring vessels, bottles for stock solutions, etc., used in

volumetric analysis, be coated internally with a thin layer of paraffin wax. Perfectly white, crystalline paraffin wax, m.p. 55°C ., should be employed, and, before use, should be freed from any mechanical admixtures by fusion and decantation, or by filtration through a hot filter. The use of solutions of the wax in commercial amyl acetate, ether, or chloroform does not give good results. The ordinary dilute solutions employed in volumetric analysis are without action on the wax, and wet it very slightly indeed; this slight wetting seems to be conditioned by the inclusion of water by minute crystals of the paraffin wax. The general advantages of paraffined apparatus are that the necessity of keeping the interior of measuring vessels free from fatty matter is avoided, and that water vapour from standard solutions does not condense on the upper parts of the vessels. Paraffined pipettes deliver completely and rapidly, and, in general, need not be washed out during use. Solutions of alkali hydroxide do not change in titre when stored in paraffined bottles. With iodine solutions or alcoholic alkali solutions, paraffined vessels cannot be employed. The filling of burettes is best effected from the bottom, since with the ordinary constant-level burettes filled from the top, air-bubbles remain attached to the walls; this difficulty is, however, avoided by bending the delivery tube so as to deliver the liquid against the side of the burette and by filling the latter slowly. The correction for the volume occupied by the wax coating is about 0.0033 c.c. per 1 c.c. The height of the liquid, which is read at once, without waiting for the solution to drain from the walls of the burette, is determined, not by means of the meniscus, but at the line of contact of the liquid with the wax; an accuracy of 0.01 c.c. is easily attainable, but, owing to the slight wetting of the coating, this may be diminished to about 0.02 c.c. The magnitude of a drop is rendered far more constant by the layer of wax. It is advantageous to coat the upper two-thirds of the inner surface of the Erlenmeyer flasks used for titration. Measuring cylinders, when treated in this way, deliver their contents quantitatively. Measuring flasks should be coated over a space on each side of the mark, or, if they are to be used as pipettes, over the whole of the inner surface. Owing to the increased ease and speed with which waxed burettes and pipettes are manipulated, their use is of particular advantage in technical laboratories where large numbers of analyses are carried out.

Coloured fluids; Standardised —. H. V. Army and C. H. Ring. J. Franklin Inst., 1915, **180**, 200—213.

To produce solutions of definite tint and colour intensity which can be easily prepared and are more readily accessible than the Lovibond tintometer glasses, the authors suggest *N/10* solutions of simple metallic salts in acid and ammoniacal solvents respectively. (The concentration *N/10* in all cases refers to the metal present). The standard *red* solution is prepared by dissolving 13.5 grms. of roseo-cobaltic chloride ($\text{CoCl}_2 \cdot 5\text{NH}_4\text{OH}$) in sufficient 2.8% ammonia solution to make one litre. The *yellow* solution is prepared by dissolving 2.1 grms. of ammonium bichromate in 50 c.c. of 1% hydrochloric acid, then adding 50 c.c. of 2.8% ammonia solution, and diluting with water to 1 litre. The standard *blue* solution is made by dissolving 12.486 grms. of copper sulphate crystals in 200 c.c. of water, adding 100 c.c. of 2.8% ammonia solution, and diluting with water to 1 litre. Other similar series of blue, yellow, and green solutions are made by dissolving cobalt, iron, and copper salts in dilute hydrochloric acid. Pink tints are obtained from potassium permanganate solution. It is stated that practically every tint of colour manifested in fluids can be

duplicated by the proper blending of eight standard fluids. In use, the various fluids are mixed in such proportions that the total volume employed is exactly 12 c.c. The volume of any solution in the mixture is always a whole number of c.c. If fractions are required the standard solutions are diluted to one-fifth of their strength. It is seldom that more than three solutions are required to match a tint. Although most of the solutions are permanent in colour when blended, it is preferable to blend when required. The colour of the separate solutions is quite permanent for more than a year.—A. B. S.

Phenolquinolinein [indicator], a heterocyclic analogue of phenolphthalein A. W. Dox. J. Amer. Chem. Soc., 1915, **37**, 1948—1949.

PIENOLQUINOLINEIN, $\text{C}_{15}\text{H}_{13}\text{NO}_4$, which may be prepared by condensing quinolinic anhydride with phenol in presence of concentrated sulphuric acid, behaves like phenolphthalein as an indicator, giving with alkalis an intense pink colour, which is discharged by acids.—C. A. M.

Lead; Determination of —, as sulphite. G. S. Jamieson. Amer. J. Sci., 1915, **40**, 157—160.

LEAD can be precipitated quantitatively from slightly acid solutions by adding an excess of sodium or ammonium bisulphite or of sulphurous acid, provided that excessive acidity be avoided by addition of ammonia. As an example, 22 c.c. of a solution of lead acetate containing 7.832 grms. Pb and 10 grms. of free acetic acid per litre was diluted to about 100 c.c. and treated with an excess of 2% sodium bisulphite solution, the mixture being well stirred and allowed to settle for not more than an hour. The precipitate was collected in a Gooch crucible and washed with cold water without allowing the whole of the liquid to drain until the final washing. After drying at 150°C . the lead sulphite weighed 0.239 gm., corresponding to 0.1723 gm. Pb.; error, —0.0001 gm. The lead was also precipitated with sulphurous acid containing 36.8 grms. SO_2 per litre. The addition of sodium acetate is recommended in this case, and a large excess of sulphurous acid must be avoided. The method was successfully applied to mixtures of lead with copper and zinc: it is inadmissible in presence of the alkaline-earth metals or of metals which are reduced by sulphites (see also this J., 1914, 435).—J. R.

Manganese; Separation of — as manganous sulphide from alkali and alkaline-earth metals. V. M. Fischer. J. Russ. Phys. Chem. Soc., 1914, **46**, 1519—1526. J. Chem. Soc., 1915, **108**, ii., 487—489.

The separation of manganese as sulphide by precipitation with an alkali sulphide in presence of ammonia and ammonium chloride is attended with difficulty, the precipitate being usually the rose-coloured, amorphous form, troublesome to filter and wash, and readily oxidisable in the air. The author, having determined the conditions under which the green sulphide may invariably be obtained in the cold (see page 903), gives the following method for separating manganese as sulphide from solutions containing metals of the alkalis and alkaline earths. To 100—200 c.c. of the liquid are added 5—15 grms. of ammonium chloride and 50—60 c.c. of ammonia solution (sp. gr. at 16°C ., 0.895); the solution should remain perfectly clear. From a dropping funnel with an orifice 0.75 mm. in diameter, 50—100 c.c. of ammonium hydrogen sulphide solution, freshly prepared from 2.5% ammonia solution, is slowly added, the addition occupying ten to fifteen minutes, and the vessel being meanwhile constantly and vigorously shaken. Conversion of the flesh-coloured manganese sulphide into the green variety proceeds during the addition of the pre-

cipitant, and, when it is not immediately completed, the Erlenmeyer flask should be corked; the change occupies from a quarter to one and a half hours, according to the proportion of ammonium chloride present and the rapidity of the precipitation. When all the precipitate is green, the liquid is diluted to 500—700 c.c. with cold, recently boiled water, and filtered. The precipitate is washed with dilute ammonium hydrogen sulphide solution containing a little ammonium chloride, and is subsequently either heated with sulphur in a current of hydrogen and weighed as sulphide, or dissolved in dilute hydrochloric acid and converted into phosphate. This method yields very accurate results, and, as it is not affected by the presence of ammonium acetate, it is applicable after the removal of the iron by the acetate method. When sufficient ammonia is present and the precipitation is effected slowly, it becomes unnecessary to convert the rose-coloured into the green sulphide, since the former is then obtained in a dense form, which can be readily filtered and washed, and does not undergo oxidation. In this case, the following quantities should be used: 150—200 c.c. of solution, 5—10 grms. of ammonium chloride, 50—75 c.c. of ammonia solution, and 75—100 c.c. of the cold ammonium hydrogen sulphide solution. After diluting with 500—1000 c.c. of cold, boiled water, the precipitate usually settles rapidly, leaving the supernatant liquid clear; filtration, etc., may then be carried out immediately. If, however, the liquid remains turbid, the precipitate is allowed to change into the green form before filtration. Either procedure gives excellent results, which are not affected by the presence in the solution of hydroxylamine hydrochloride (*loc. cit.*).

Effect of high ignition voltage in bomb calorimeter determinations. Dittus. See II A.

Determination of benzol in gas mixtures. Burrell and Robertson. See II A.

Chemical control of [gas] purifiers. Madsen. See II A.

Note on identifying amino-H-acids. Hesse. See III.

Rapid method for determining the amount of nickel on nickel-plated surfaces. Pontio. See X.

Hydrochloric acid-ether mixture as a reagent for rubber analysis. Twiss. See XIV.

Influence of method of subdivision on results of leather analysis. Lauffmann. See XV.

Determination of sulphates in soils. Brown and Kellogg. See XVI.

Delicacy of different tests for hydrogen peroxide in milk. Darlington. See XIX A.

Apparent effect of acetic acid upon the constants of butter fat. Bahlman. See XIX A.

The official method for determining crude fibre as applied to cottonseed meal. Francis. See XIX A.

Studies on the culture media employed for the bacteriological examination of water. Lactose-peptone media. Chamot and Sherwood. See XIX B.

Absorption of chlorine by water as an index of quality. Zaleski and Elmanovitsch. See XIX B.

Detection of β -naphthol in lysol and similar preparations. Bodmer. See XIX B.

Determination of traces of carbon monoxide in the air. Gautier. See XIX B.

*Reactions of strophanthin from *Strophanthus Kombé* and *S. Gratus*.* Reichard. See XX.

Determination of phenacetin and salol in admixture. Emery and others. See XX.

PATENTS.

Gases; Apparatus for tracing or determining admixture or variations in the composition of —. F. Haber and R. Leiser, Berlin. Eng. Pat. 9344. April 15, 1914. Under Int. Conv., May 5, 1913.

In determining the variation of composition of a gas by observing the tone vibrations in two pipes, one of which is blown by a standard gas and the other by the gas under examination, the necessity of a large supply of standard gas is avoided by providing a flexible diaphragm, which is stretched across the pipe just behind the lip. If the portion of the one pipe so closed is filled with standard gas, both pipes may be blown with the air under observation and the variations in vibration observed.—W. H. C.

Gases; Tracing or determining admixtures or variations in the composition of —. F. Haber and R. Leiser, Berlin-Dahlem, Germany. Eng. Pat. 11,236. May 6, 1914. Under Int. Conv., May 13, 1913.

In apparatus in which the indication is given by means of beats produced in two stopped labial pipes, one at least being a membrane pipe, the gas is first passed through a pressure regulator and then through a throttle valve, and both pipes are blown to an overtone.—W. F. F.

Mines and like places; Means for detecting the presence of injurious gases in —. Schoeller und Co., and M. Albrecht, Frankfort, Germany. Eng. Pat. 10,400, April 27, 1914.

The change in pressure of the gas within a porous diffusion chamber is indicated by a U-tube containing coloured liquid which is caused to pass from one limb into the other, the gas then bubbling through the liquid. The tube is of small bore, but substantially larger than a capillary tube, and is placed in the path of the rays from the miner's lamp. Traps are provided at the top of the U-tube to prevent loss of liquid.—W. F. F.

Pyrometer method and apparatus. T. W. Clark, Assignor to Gibb Instrument Co., Pittsburgh, Pa. U.S. Pat. 1,147,483, July 20, 1915. Date of appl., July 31, 1914.

A TEST body of negligible mass is immersed in the liquid, e.g., molten metal, and the time of melting compared with that of a similar test body in liquids at various known temperatures. The test body supports a pointer which is moved over a temperature scale at a uniform rate, the movement being stopped by the melting of the test body. Alternatively two test bodies of different melting points may be used, the difference in the times of melting giving the required temperature. The recorder in this case is started by the melting of one body, and stopped by the melting of the other.—W. F. F.

XXIV.—MISCELLANEOUS ABSTRACTS.

Water; Different chemical activity of free and of combined —. H. C. Jones and J. E. L. Holmes. Chem. News, 1915. 112, 73—74.

VARIOUS salts of magnesium, calcium, strontium, and barium which are very strongly hydrated in aqueous solution accelerated the velocity of hydrolysis of methyl acetate and methyl formate to a greater degree than certain slightly hydrated salts of the alkali metals. This effect decreased much more rapidly with the hydrated than with the non-hydrated salts as the concentrations of

the salt solutions decreased. With hydrated salts containing a common anion, the effect was in the order of the decreasing atomic weights of the cations. With due regard to the degree of hydrolysis of the salts employed, it is concluded that the above differences are due primarily to the chemical difference between free and combined water, and it is suggested that the latter is more highly ionised than the former.—J. R.

Books Received.

THE ANALYSIS OF NON-FERROUS ALLOYS. By F. IBBOTSON and L. AITCHISON. Longmans, Green and Co., London. 238 pages. Price 7s. 6d.

THE literature of the subject dealt with in this book is very widely scattered in the various technical and chemical journals and an undue proportion is found in foreign journals. One is struck by the preponderance of foreign names in the index of authors quoted, which indicates that British chemists have somewhat neglected the details of the analytical methods applicable to non-ferrous metals and alloys. This is not surprising to those intimate with the industrial conditions obtaining in a large number of British industries, as there is no doubt that in many works anything like detailed analysis is considered to be either unnecessary or an expensive luxury.

The first two chapters deal with electrolytic analysis, and the authors would have added considerably to the value of this portion of the book had they given additional details of arrangements for obtaining current in a simpler manner than by the use of a low voltage dynamo and a large battery of lead accumulators, which is obviously only suitable for large laboratories or public institutions.

In Chapter III are summarised the results of recent exhaustive investigations on the precipitation of metals by means of sulphuretted hydrogen, the work of Strell, Scharrer, Brauner, and Tomicek and Vestner being considered in some detail.

Chapters IV to XIV deal with the methods used in the analysis of the metals from the point of view of pure solutions or pure substances, including one chapter on the separation of arsenic, antimony, and tin.

The procedure followed in these chapters is to describe generally the methods available for the determination of the various elements, pointing out the advantages and disadvantages of the methods described and then to give in detail, gravimetric, volumetric, and electrolytic methods, or such of these as are available.

Chapter XV deals with the analysis of commercial alloys, including brass, bronze, German silver, lead-antimony-tin alloys, aluminium-zinc alloys, etc. This chapter will prove of special value as a guide to methods suitable for general laboratory or works practice.

The book can be confidently recommended to all interested in the analysis of non-ferrous alloys, and should prove a source of inspiration to young chemists in the search of problems still requiring attention and a valuable aid to those carrying out investigations on methods of analysis suitable for non-ferrous alloys.

C. O. BANNISTER.

PETROLEUM TECHNOLOGISTS' POCKET BOOK. By Sir BOVERTON REDWOOD, Bart., and A. W. EASTLAKE. Chas. Griffin and Co., Ltd., Exeter Street, London, W.C. 454 pages. $3\frac{1}{2} \times 5\frac{1}{2}$ in. Price 8s. 6d.

THE authors have succeeded in presenting, in a small volume, an immense amount of valuable

information on all phases of the petroleum industry. The work is divided into nine parts, of which the first contains general information about petroleum, natural gas, and oil-shale (origin, occurrence, distribution, prospecting, acquiring lands, etc.). Part II. deals with the geological side of the subject, and Part III. with the physical and chemical side, containing much data as to characters of crude oils from most of the producing areas, as well as analyses of natural gases and asphalt rocks. Parts IV. and V. contain a concise account of methods used in the production, refining, transport, storage, and testing of oils, and Part VI. deals with the various uses of petroleum products, natural gas, and asphalt. Part VII. contains a mass of information on weights and measures, including several useful conversion tables, and Part VIII. much interesting miscellaneous matter. Part IX. gives tables showing the production of crude oil, asphalt, oil-shale, ozokerite, and natural gas in the various producing centres. A series of eight maps, showing the petroleum, shale, and natural gas areas of the world, is also included. The Pocket Book will be found indispensable to all who are connected with the mineral oil industry in its many branches.

THE GAS CHEMISTS' SUMMARY, 1914. By A. V. HENDRICKSON. Published by Walter King, 11, Bolt Court, Fleet Street, London, E.C. 167 pages. $8 \times 5\frac{1}{4}$ in. Price 3s. 6d.

THIS volume gives an excellent epitome of the literature published during 1914 of interest to those concerned with the gas industry. The subjects dealt with are classified under the following headings:—I. Carbonization. II. Condensation, washing, purification, and naphthalene and cyanogen extraction. III. Tar and ammonia. IV. Oil and carburetted water-gas. V. Photometry and calorimetry. VI. Gaseous heating and ventilation. VII. Gas analysis. VIII. Tests. IX. Miscellaneous. The references given in the Bibliography would perhaps have been more useful had they been placed at the foot of the pages to which they referred, especially if the subject index were supplemented by a name index. No attempt has been made to include a review of the Patents published during the period under notice. The book is well printed and illustrated, and should prove a very useful work of reference for the gas chemist.

IDENTIFICATION OF COMMON CARBON COMPOUNDS. By J. N. RAKSHIT. The Collegian Office, 33, Dixon Lane, Calcutta. 222 pages. $7\frac{1}{4} \times 5$ in.

THE tests described in this book are mainly derived from Allen's "Commercial Organic Analysis," supplemented by information from other standard works. The subjects are dealt with in the following order:—Preliminary examination. Hydrocarbons. Alcohols and phenols. Aldehydes and ketones. Acids. Ethers and esters. Carbohydrates. Halogen and nitro derivatives. Nitrogenous organic acids and their derivatives. Nitrogen-containing bases. Alkaloids. Glucosides. Colouring matters. On the whole, the author has made a judicious selection of the compounds noticed, and has given some useful tables, showing distinguishing reactions of related substances, the alkaloids in particular. A table of consecutive melting points and a subject index complete the book, which is, unfortunately, marred by an unusually large number of typographical errors.

PROHIBITIONS OF EXPORT IN FORCE IN THE UNITED KINGDOM AND CERTAIN ALLIED AND NEUTRAL COUNTRIES. Supplement to the Board of Trade Journal, July 29, 1915. 74 pages. Price 3d.

THESE lists of prohibitions of exports have been

collected and revised in the light of information received at the Board of Trade up to July 27th. They relate to the following countries:—United Kingdom, Bulgaria, Denmark, France, Greece, Italy, Netherlands, Norway, Portugal, Roumania, Russia, Serbia, Spain, Sweden, and Switzerland.

CHEMICAL GERMAN. By Prof. F. C. PHILLIPS, University of Pittsburgh. Second Edition. Chemical Publishing Co., Easton, Pa., U.S.A. 252 pp. $9 \times 5\frac{1}{2}$ in. Price \$2.00.

THE earlier pages of this book deal with the spelling of German chemical terms and the nomenclature of the elements and various compounds. Following these are 170 pages of extracts from German chemical literature (textbooks and periodicals). The remainder of the volume is occupied by a few explanatory and biographical notes and a useful vocabulary of German chemical terms. The extracts from literature might have been curtailed, or even omitted, without detracting from the value of the book, since the student would have been better occupied in translating modern literature dealing with the particular branch of the subject in which he was interested.

TRANSACTIONS OF THE AMERICAN INSTITUTE OF METALS. Vol. VIII. 1914. Published by the Institute, Buffalo, N.Y., U.S.A.

This volume contains the papers read at the Eighth Annual Meeting of the Institute at Chicago, on Sept. 8th to 11th, 1914, many of which have been abstracted in this Journal (1914, pp. 966, 967, 1012, 1013, 1054, 1055). This portion occupies 394 pages, and is followed by copies of six Bulletins of the Institute, containing abstracts of metallurgical literature, patents, notes, and reports, together with a list of members.

* New Books.

[The Roman numerals in thick type refer to the similar classification of abstracts under "Journal and Patent Literature" and in the "List of Patent Applications."]

I. Callendar, H. L.: The Callendar steam tables. Svo. Arnold. 1915. Net 3s.

Dalby, W. E.: Steam power. Medium Svo. pp. 782. Arnold. 1915. Net 21s.

Frantz, G. Dampfkesselschäden, deren Ursachen u. möglichste Verhütung. (XV. 179 S.) kl Svo. Kattowitz, Gebr. Bohm. 1915. Cloth. M.2.50.

Hodgson, J. T. Modern boiler room practice and smoke abatement. Cr. Svo. pp. 321. "Railway Engineer." 1915. Net 3s. 6d.

Tenney, E. H.: Test methods for steam power plants; a reference book for the use of power station engineers, superintendents, and chemists; 85 ill. N.Y., Van Nostrand. e. $16 \times 22\frac{1}{2}$ p. D. leath. 1915. \$2.50 n.

Gottsche, G.: Die Kältemaschinen u. ihre Anlagen. Eine gemeinverständl. Bearbeitg. der Eis- u. Kühlm. Maschinen u. ihrer Anlagen. 5. vollständig neu bearb. Aufl. (824 S. m. 734 Fig. u. 154 eingedr. Tab.) Lex So. Hamburg, Verlag f. Kälteindustrie. 1912-15. Cloth. M.20.

IIA. By-product coking; references to books and magazine articles. Carnegie Library, Pittsburgh, Pa. 40 p. O pap. 1915. 5 c.

Burrell, G. A. and others. The condensation of gasoline from natural gas. Wash., D.C., Gov. Pr. Off. $6 \times 10\frac{1}{2}$ p. il. diagrs. Svo. (Bu. of mines bull. 88) 1915.

McLaughtin, R. P. and Waring, C.A.: Petroleum industry of California. (San Francisco. Cal. State

Mining Bu.) 1914. 519 p. (12 p. bibl.) ils. diagrs. Svo. and atlas of pls. (part fold., incl. maps, plans, diagrs.) obl. fo. (Bulletin) 1915.

IV. Dyestuffs for American textile and other industries. U.S. Dept. of Commerce. 1915. Gov. Pr. Off.

VII. Cameron, F. K.: Potash from kelp. Wash., D.C., Gov. Pr. Off. 122 p. tabs. fold. plans and atlas of 69 maps (7 fold.) obl. fo. (Dept. of Agric. Rept. no. 100). 1915.

Hedvall, J. A.: Ueber Reaktionsprodukte v. Kobaltoxyden m. anderen Metalloxyden bei hohen Temperaturen. (Diss.) (VII. 170 s. m. Fig. im. Text u. auf. 8 Taf.) gr. So. Uppsala. (Västra Agatan 16). Almqvist & Wiksell. 1915. M.6.

Jaeger, W. u. H. v. Steinwehr, Prof. Die Wärmekapazität des Wassers zwischen 5° u. 50° in internationalen Wattsekunden. (S. 424—432.) Lex. So. Berlin. G. Reimer. 1915. 50 Pf.

Meyer, S., V. F. Hess u. F. Paneth: Neue Reichweitenbestimmungen an Polonium, Ionium u. Actiniumpräparaten. (30 S. m. 8 Fig.) gr. So. Wien. Holder. 1914. M.1.05.

Kohtrausch, K. W. F. u. E. Schrödinger: Ueber die weiche (3) Sekundärstrahlung v. γ -Strahlen. (49 S. m. 17 Fig.). Mitteilungen aus dem Institut f. Radiumforschung, gr. So. Wien. Kolder. 1914. M.1.70.

VIII. Singer, Dr. F.: Ueber den Einfluss v. Tonerde auf die Schmelzbarkeit v. Gläsern. (16 S.) Svo. Berlin. Keramische Rundschau. 1915. 75 Pf.

IX. Whipple, H.: Concrete stone manufacture. Detroit. Concrete-cement Age Pub. c. 255 p. il. plans. forms 16mo. 1915. \$1.

Rudloff, Prof. M. Erfahrungen bei der Herstellung v. Eisenbetonsäulen. Längenänderungen der Eiseneinlagen im erhärtenden Beton. 4. Teil. Bericht üb. Versuche im königl. Materialprüfungsamt Berlin-Lichterfelde-West. Mit. 50 Textabbildgn. u. 4. Zusammenstellgn. (III. 40 S.) Ausschuss. Deutscher. f. Eisenbeton. 34 Heft. Lex. So. Berlin. W. Ernst & Sohn. 1915. M.2.40.

Shoop, C. F.: Investigation of the concrete road-making properties of Minnesota stone and gravel. Univ. of Minn. 1915. 25 c.

Weiss, H. F. and Teesdale, C. H.: Tests of wood preservatives. Wash., D.C., Gov. Pr. Off. 20 p. tabs. diagr. Svo. (Dept. of Agric. bull. 145).

X. Brearley, H.: The case-hardening of steel; an illustrated exposition of the changes in structure and properties induced in mild steels by cementation and allied processes. N.Y., Van Nostrand. 1914. 8 + 164 p. il. figs. tabs. O. 1915. \$2.50 n.

Clennell, J. E.: The cyanide handbook. 2nd ed., rev. and enl. N.Y., McGraw-Hill. c. 12+601 p. il. Svo. 1915. \$5 n.

Denuth, T.: Grundriss der mechanischen Technologie der Metalle. 2., verb. Aufl. (VI. 187 S. m. 337 Abbildgn.) gr. So. Wien. F. Denticke. 1915. Cloth. M.3.

Morgan, J. J.: Aids to the analysis and assay of ores, metals, fuels, etc. 2nd ed. 18mo. swd. Bailliere. 1915. Net 2s. 6d.

Schrader, F. C.: Mineral deposits of the Santa Rita and Patagonia Mountains, Arizona, with contributions by J. H. Hill. Wash., D.C., Gov. Pr. Off. 373 p. il. pls. (part fold.) col. fold. maps O (Geological Survey bull. 582). 1915.

Tensen, T. D.: The effect of boron upon the magnetic and other properties of electrolytic iron melted in vacuo. Urbana, Ill., Univ. of Ill. 19 p. Svo. pap. 1915. 10 c.

Whitman, A. R.: Notes on the copper ores at Ely, Nevada. Berkeley, Cal., Univ. of Cal. 1914. 309-318 p. 4to. (Bull. of the Dept. of Geology.) pap. 1915. 10 c.

XIII. *Printing inks*; Composition, properties, and testing of —. U.S. Bu. of Standards. Gov. Pr. Off.

XIV. *Ditmar, Dr. R.*: Die Technologie des Kautschuks. (VIII, 597 S. m. 520 Abbildgn.) gr. So. Wien. A. Hartleben. 1915. Cloth. M.22.

XVI. *Bjorlykke, Prof. K. O.* Ueber frühere u. gegenwärtige Bodenuntersuchungen in Norwegen. (14 S. m. 1 einge dr. Kartenskizze.) gr. So. Berlin. Verlag f. Fachliteratur. 1915. M.1.20.

Livingstone, B. E. and Hawkins, L. A.: The water-relation between plant and soil; the water-supplying power of the soil as indicated by osmometers. Wash., D.C., Carnegie Inst. 84 p. (3 p. bibl.) tabs. diagrs. Svo. pap. 1915. 75 c.

Mosier, J. G. and Gustafson, A. F.: Soil moisture and tillage for corn. Urbana, Ill. Univ. of Ill. 564-586 p. il. Svo. (Agric. Exper. Station bull.)

Quear, C. L.: 39 experiments in soil. (Muncie, Ind., The Author.) c. 90 p. il. forms obl. Svo. 1915. 35 c.

Whiting, A. L.: Biochemical study of nitrogen in certain legumes. Urbana, Ill., Univ. of Illinois. 471-542 p. tabs. diagrs. Svo. (Agric. Exper. Station bull.) 1915.

XVIII. *Musprall's* encyclopädisches Handbuch der technischen Chemie. Ergänzungswerk. Hrsg. v. Prof. B. Neumann, Prof. A. Binz, F. Hayduck. Lex 8o. Braunschweig. F. Vieweg & Sohn. I-III not out yet. IV. Bd. 1 Halbbd. (Chemische Technologie der Gärungsgewerbe, Nahrungs- u. Genussmittel. Hrsg. v. Dr. F. Hayduck. (XI, 516 S. m. 331 Abbildgn.) 1915. Cloth. M.25.

XIXA. *Donne, C. F. & Eldredge, E. E.*: The use of *Bacillus bulgaricus* in starters for making Swiss or Emmental cheese. (Wash., D.C., Gov. Pr. Off.) 16 p. tabs. diagr. O. (Dept. of Agric. Bull. No. 148). 1915.

Gibson, A. E.: Destructive and constructive food mixtures. (Los Angeles, Cal., Phillips Pr.) c. 112 p. Svo. 1915. \$1.

Jone, H.: An easy test for bacteria in milk and cream. (Barthel's reductase test improved). Brooklyn, N.Y. (The author.) c. 23 p. 4to. 1915. 50 c.

Leffmann, H.: Analysis of milk and milk products. 4th ed. Phil., Blakiston. il. 12mo. 1915. \$1.25 n.

Lippold, Dr. E.: Obstkonserven, Fruchtsäfte, Marmeladen. (VI, 143 S. m. 16 Abbildgn.) 1914. 8o. Leipzig. Dr. M. Jänecke. Cloth. M.3.60.

XIXB. *Gerhard, W. P.*: The sanitation, water supply and sewage disposal of country houses. 2nd ed. N.Y., Van Nostrand. c. 709. 20+328 p. il. diagrs. fold. plan. D. 1915. \$2 n.

Stein, M. F.: Water purification plants and their operation. N.Y., Wiley. c. 8+247 p. figs. charts. Svo. 1915. \$2.50 n.

Watkins, O. S.: Some common spray mixtures. (3rd ed.) Urbana, Ill. (Univ. of Ill.) 20 p. il. Svo. (Agricultural Exper. Station Circ.) 1915.

Wilson, H. F.: Orchard insect pests and methods of control; with a preface by A. B. Cordley. Portland, Ore., Pacific Horticultural Corr. Sch. c. 126 p. il. tabs. O. pap. 1915. 75 c.

XX. *Holland, J. W.*: A text-book of medical chemistry and toxicology. 4th ed., thoroughly rev. Phil., Saunders. c. 678 p. il. col. pls. Svo. 1915. \$3 n.

Curtius, T. u. Hartwig, F.: Über die chemischen Bestandteile grüner Pflanzen. S. Mitteilg. Zum Nachweis des Formaldehyds in den Pflanzen. (S. S.) 1915. 40 Pf.

Fischer, E. u. W. Brieger: Studien ub. die Allylpropyl-cyanessigsäure. Eine neue Prüf. der Theorie des asymmetr. Kohlenstoffatoms. (S. 408-422). Lex 8o. Berlin, G. Reimer. 1915. 50 Pf.

XXII. *Munroe, C. E. and Hall, C.*: A primer on explosives for metal miners and quarrymen. Wash., D.C., Gov. Pr. Off. 125 p. il. 8vo. (Bu. of Mines Bull. 80.) 1915.

XXIII. *Woker, Dr. G.*: Die Katalyse. Die Rolle der Katalyse in der analyt. Chemie. 11. Spezieller Tl. 1. Abtlg. Anorganische Katalysatoren. (XXII 793 S. m. 13 Abbildgn.) Die Chemische Analyse. Stuttgart, F. Enke. 21 u. 22 Bd. 1915. Lex 8o. Cloth. M.29.20.

XXIV. *Bragg, W. H.*: X-rays and crystal structure. 4to, swd. pp. 22. Dulau. 1915. Net 1s. 6d.

Jones, H. C.: The electrical nature of matter and radioactivity. 3rd ed. completely rev. N.Y., Van Nostrand. c. '09-'15. 8+212 p. O. 1915. \$2 n.

Townsend, J. S.: Electricity in gases. (N.Y., Oxford Univ.) 15+496 p. tabs. figs. pls. O. 1915. \$4.75 n.

Cohn, Dr. G.: Geschmack u. Konstitution bei organischen Verbindungen. (100 S.) Lex 8o. Stuttgart. F. Enke. 1915. M.3.

Gmelin u. Kraut's anorgan. Chemie. 7. Aufl. v. Friedheim u. Peters. 185-188. Lfg. Hdlbg., C. Winter. 1915. Each Lfg. M.80.

Hoff, J. H. van't: Die Gesetze des chemischen Gleichgewichtes f. den verdünnten, gasförmigen od. gelösten Zustand. Uebers. u. Hrsg. v. G. Bredig. 2. Aufl. (107 S. m. 7 Fig.) 1915. bds. M.2.

Jellinek, Dr. K.: Lehrbuch der physikalischen Chemie. (4 Bd.) 2. Bd. Die Lehre v. den Aggregatzuständen (2. Tl.) (XII, 939 S. m. 149 eingedr. Tab., 401 Abbildgn. u. 3 Bildnissen.) Lex 8o. Stuttgart. F. Enke. 1915. Cloth. M.35.

Kossel, A. u. S. Edlbacher. Beiträge zur chemischen Kenntniss der Echinodermen. (13 S.) 50 Pf.

Lovibond, J. W.: Light and colour theories and their relation to light and colour standardisation. Svo. pp. 102. Spon. 1915. Net 6s.

Traulz, M.: Die Theorie der chemischen Reaktionsgeschwindigkeit u. e. neues Grenzgesetz f. ideale Gase: Die Additivität der inneren Atom-Energie. (44 S.) 1915. M.1.50.

W'eed, H. T.: Chemistry in the home. N.Y., Am. Book Co. 385 p. il. 12mo. 1915. \$1.20.

Wright, A. S.: ed. German science reader; chemistry, physics, technology; comp. and ed. with notes and vocabulary. N.Y., Holt. c. '14. 8×242 p. il. 12mo. 1915. 90 c. n.

Bach, C.: Ingenieurlaboratorium u. Materialprüfungsanstalt der kgl. technischen Hochschule Stuttgart. (32 S. m. 26 Fig. u. 4 Taf.) 32×25, 5 cm. Stuttgart. K. Wittwer. 1915. M.1.50.

* Dissertations.

[Prices vary, ranging from three to four shillings.]

IIA. *Gleich, W.*: Beitrag zur Kenntnis eines Mineralschmieröles. München (Techn. Hochschule.) 1914. 45 S. 8°.

Otto, C.: Theoretische und praktische Ermittlung von Koksofenwärmebilanzen. Breslau (Techn. Hochschule.) 1914. 32 S. m. Abb. 8°.

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Hodénus, L.: Ueber aromatische Sulfarylide. Bonn 1913. 48 S. 8°.

Wahl, R.: Ueber die 2.1.5-Naphtylamindisulfonsäure, die 2.5.1-Aminonaphtolsulfonsäure und ihre Derivate. Dresden (Techn. Hochschule.) 1913. 71 S. 8°.

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X. *Herrmann, F.*: Ueber die thermoelektrischen Eigenschaften einiger irreversibler Nickel- und Manganstahle. B. Ueber Nebenvaleenzverbindungen der Arsenhalogenide mit Kupfer, Silber, Quecksilber, sowie mit Pyridin. Berlin 1914. 42 S. m. 5 Fig. 8°.

Proske, O.: Studien über die Einwirkung von Schlacken und Dämpfen auf die Muffelmassen des Zinkhüttenbetriebes und Untersuchungen über die Aufnahmefähigkeit des Tones an ZnO. Berlin (Techn. Hochschule.) 1914. 36 S. m. 4 Fig. gr.-8°.

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Wahmhoff, Fr.: Zur Zuckerbestimmung im Blutplasma. Hannover (K. Tierärztl. Hochschule.) 1913. 25 S. 8°.

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XIXB. *Mildner, H.*: Ueber den Nachweis und die Bestimmung kleiner Mengen Mangan im Wasser. Erlangen 1914. 93 S. 8°.

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Ramsauer, C.: Ueber die Analyse radioaktiver Substanzen durch Sublimation. Heidelberg 1914. 21 S. m. 6 Fig. 8°.

Canadian Section.

Meeting held at Montreal, on Friday, April 23rd, 1915.

PROF. J. W. BAIN IN THE CHAIR.

TREATMENT OF WATER WITH HYPOCHLORITE.

BY JOSEPH RACE, F.I.C.

Contact period.

In a paper presented to this Section in 1912 (this Journal, 1912, 31, 611) the author dealt at considerable length with this important phase of hypochlorite treatment, and pointed out that efficient mechanical intermixture of the hypochlorite solution is much more effective than a prolonged contact period without this admixture. Certain conditions in Ottawa enabled further observations to be made on this important point. In June, 1914, a sedimentation basin was placed in operation at the mouth of the Ottawa intake pipe, and during July the hypochlorite solution was added at the entrance to this basin. The method of addition was by means of a perforated pipe which stretched across the entrance to the basin, and the bleach solution and water were there mixed as thoroughly as was possible without having recourse to mechanical methods. The basin was baffled and had a normal capacity equal to approximately two hours' consumption. The results obtained were as follows:—

Available chlorine = 1.88 p.p.m.

Bacteria per c.c.

	Agar 3 days at 20° C.	Agar 1 day at 37° C.	<i>B. coli</i> index per c.c.
Raw water	410	104	0.280
Treated water	49	26	0.036
Percentage purification	88.2	75.0	87.5

During August the connection at the entrance to the basin was closed and the bleach liquor added directly to the suctions of the low lift pumps, which take water from the sedimentation basin, and place it in the intake pipe under a small positive pressure until it reaches the high lift pumps. During both months the samples of treated water were taken from the well which receives the mixed discharges of the low lift pumps. The results for August were:—

Available chlorine = 1.55 p.p.m.

Bacteria per c.c.

	Agar 3 days at 20° C.	Agar 1 day at 37° C.	<i>B. coli</i> index per c.c.
Raw water	448	100	0.600
Treated water	26	12	0.005
Percentage purification,	91.9	88.0	99.2

These results, which are the averages of daily analyses, show that the efficient mechanical admixture produced much superior results with a smaller consumption of chlorine.

It is probable that the superior efficiency claimed for "liquid chlorine" is due to the fact that the older plants using bleach have been slow to recognise this essential factor, whilst the plants using "liquid chlorine" have, by various devices, secured more or less efficient admixture, with the consequence that equally satisfactory results have been obtained with a decreased dosage. As shown above, 1.55 p.p.m. of chlorine as bleach gave good results with the Ottawa River water, whilst Harrington (Journ. Amer. Water Works Assoc., Vol. 3, p. 438) stated that 1.50 p.p.m. of available chlorine, as liquid chlorine, was required for the sterilisation of the Ottawa River water at Montreal.

During January, 1915, laboratory experiments were made to ascertain what proportion of chlorine would be required when the admixture was as perfect as could be obtained by shaking. The results with a water containing 45 parts per million of colour and to which a culture of *B. coli* was added were as follows:—

Contact period.	Chlorine, parts per million.			
	0.30	0.40	0.55	1.21
Raw water	380	380	750	750
1 min.	140	12	<0.1	<0.1
10 min.	72	0.5	<0.1	<0.1
20 min.	35	<0.1	<0.1	<0.1

These figures show that, with satisfactory admixture, 0.4 to 0.5 part per million of available chlorine is sufficient to secure good results, and they led to various changes being made in the pipes delivering the hypochlorite solution at the mouth of the intake, in the direction of securing a still greater efficiency in the mechanical admixture. Up to date this has enabled the quantity to be reduced from 1.3 parts per million to 0.83 part per million, which is equivalent to a saving of \$1400 per annum calculated on the present price of bleach.

Effect of temperature.

During the present winter there have been several periods during which the results obtained with the city supply seemed to indicate that the low temperature had a retarding effect upon the velocity of the reaction, but as these results were somewhat complicated by the length of time that elapsed between sampling and examination, laboratory tests were made to determine this point. The original water contained 45 parts per million of colour and was, after seeding with *B. coli*, treated with 0.51 part per million of available chlorine. The results were as follows:—

Temperature, ° F.

	34	40	52	70
Initial	34	40	52	70
Final	40	44	55	68

Colonies per c.c.

	750	750	750	750
Raw water	750	750	750	750
Treated water—				
After 1 min.	3.2	1.0	0.2	nil
After 10 min.	2.5	0.8	0.2	nil
After 20 min.	2.2	0.6	0.1	nil
After 60 min.	1.0	0.5	0.1	nil

These results show clearly that the velocity of the reaction is undoubtedly lowered by a reduction of the temperature: a similar conclusion is reached by a study of the rate of absorption of free chlorine as indicated by the starch and iodide reaction.

Colour and turbidity.

The organic matter, which is the cause of the colour of many waters, undoubtedly increases the amount of chlorine required for the sterilisation of such waters, though probably not to the extent that it is usually considered to do. This former hypothesis was based on results obtained with imperfect admixture, when areas of unequal concentration occur, with the consequent loss of chlorine owing to its prolonged localised action upon the organic matter. The point of interest in water purification is not the amount of chlorine a coloured water will absorb before showing a free chlorine reaction, but what quantity of organic matter it is necessary to oxidise before the chlorine causes the delicate organic structure of the bacteria to lose its anabolic functions. These two quantities may approach each other when the temperature of the water is near the freezing point and the contact period is short, but with a temperature of 70° F. and a contact period of but 10 minutes the former quantity is approximately three times as great as the latter for the Ottawa River water.

The increase of this factor is a matter of considerable importance to sanitarians, as it involves a decrease in æsthetic objections in addition to an increased economy in working costs.

Increased turbidity also usually decreases the efficiency of the hypochlorite treatment, though the reason for this is by no means clear. If the turbidity is caused by finely divided silt or other mineral matter, no effect should be produced by it, as such matter is inert: the inferior results obtained with such waters are probably due to factors which are introduced concomitantly with the turbidity and by the same cause. When turbidity is caused by the flooding and scouring of cultivated areas, much of the suspended matter is of an organic nature and often encloses masses of bacteria which can only be destroyed by a large increase in the proportion of chlorine. In the case of coloured river waters an increased turbidity is usually accompanied by a decreased colour, so that these two adverse factors counterbalance each other to some extent.

Benefits from treatment with hypochlorite.

During the two years immediately preceding the installation of hypochlorite treatment in Ottawa, the typhoid rate averaged 85 deaths per 100,000; after treatment commenced the rate was reduced to 21 the first year and to 13, 4 of which were due to disease contracted outside the city, in the subsequent year. It is only fair to add, however, that this decrease is not entirely due to the chlorine treatment, as the epidemic rates were caused by a leakage of sewage into water intakes which were subsequently replaced by comparatively water-tight pipes. During 1914, however, a concrete example of the benefits derived from hypochlorite treatment was obtained. In the autumn of 1914 an epidemic of typhoid broke out in a village on the Ottawa River, about 8 miles above the mouth of the Ottawa intake pipe, and in a few weeks about 150 to 200 cases developed. During November and December about 200 cases of typhoid were discovered in Hull, which takes its water supply from the Ottawa River within 400 yards of the Ottawa intake mouth, whilst in Ottawa only 28 cases were reported and of these 60% were due to outside sources. Hull, with the untreated water supply, had a typhoid incidence of 1000 cases per 100,000

of population, and Ottawa, using a treated supply from the same current of the same river, only 27 cases per 100,000 during the same period. In this example all the factors were favourable to the infection of the Ottawa and Hull supplies, as the temperature and volume of the water were low, thus increasing the viability of the typhoid organisms and decreasing the dilution of the infecting sewage. The enormous volume of the river even at low water mark (probably about 20,000 cubic feet per second) alone prevented a still more serious epidemic.

Hypochlorite plants.

Material of construction.—The great difficulty in this connection is to obtain materials which are economical and yet capable of resisting the corrosive action of hypochlorite solutions. For very dilute solutions (0.2% of bleach) this problem presents little difficulty, but the use of solutions of this strength is not good policy on account of the large increase in capacity involved. Two years ago a plant was constructed in Ottawa capable of treating 20 million gallons per day, and consisting of three large, circular, wooden tanks in which the bleach and water were thoroughly mixed by electrical motors connected directly to a shaft to which propeller blades were attached. Two of these tanks were of oak and one of cypress, and it was found that a 1% bleach solution rapidly leached the wood and produced leaks that it was impossible to repair. The inside surfaces of these tanks were then thoroughly washed and painted with several coats of what was claimed to be an acid-resisting mixture. This treatment was efficacious for a time, but after a few months the leakage was as great as ever. The tanks were then lined with a three-inch coat of concrete, the surface of which was painted with asphaltum. This has been comparatively satisfactory and, when a new plant was erected about twelve months ago, was instrumental in deciding to eliminate all wood material and to use concrete painted with asphaltum wherever it was possible. Lead-lined wooden tanks may be used for vessels of small dimensions in which the sheet lead can be placed without joints. In tanks employed for mixing bleach solutions by mechanical methods, the author's experience has shown that cast aluminium blades attached to a bronze shaft produce the best results. After considerable use the aluminium blades become coated with an incrustation which prevents corrosion of the metal. For piping, the Ottawa results show that galvanised iron gives good results when the piping is of generous dimensions and when plugged "T's" are placed at all bends for removing incrustation. In piping systems experience shows that it is incrustation rather than corrosion that produces difficulties, and that the material has but little effect. In valves the converse holds true, as the friction of the various parts prevents the formation of a protective coating and constantly presents fresh surfaces for the action of the solution. Soft brass valves are useless, but gate valves made of hard bronze have been found satisfactory. Vulcanite valves may also be used but are expensive as regards first cost and require careful manipulation to prevent fracture. When gravity systems are used for the introduction of the hypochlorite solution, the ball valve used for maintaining a constant head should be made of bronze with a glass float, and the orifice, of glass. This method of operating with a known head of water on a circular orifice has given perfectly satisfactory results in Ottawa and at many other places. The mixing operations of a hypochlorite plant should be checked by daily analyses of the liquor, so as to prevent wastage and irregular addition.

Complaints.

Numerous objections have been raised against the use of water which has been treated with hypochlorite. Some of these have been previously mentioned in connection with the Toronto supply (*loc. cit.*), but these might again be considered, as the water under discussion, being entirely different in character, presents new aspects of this problem. A typical analysis of the Ottawa River water is as follows:—Free ammonia, 0.004 part per million; alb. ammonia, 0.096; nitrites, trace; nitrates, 0.055; chlorine, 1.5; total hardness, 37.0; carbonic acid, 1.0; oxygen absorbed in 4 hours at 27° C., 5.50. The physical characteristics are:—

	Average.	Maximum.	Minimum.
Colour	67	90	40
Turbidity	16	300	3
Alkalinity	26	47	14

With such variations in colour and turbidity it is obvious that the addition of hypochlorite cannot be maintained at a constant rate, but it has been regulated so as to have, whenever possible, no free chlorine, as indicated by the starch and iodide reaction, in the water delivered to the mains at the high-lift pumping station. This has resulted in a comparative absence of complaints regarding the cold water; but there is no doubt that, after heating, the water possesses a peculiar odour, due to chlorine compounds. This odour is not the sharp, acid odour of chlorine, but a fishy one which is possibly caused by such compounds as chloramines.

Complaints regarding the effect on animals have been made, and a number of these have been investigated. It is undoubtedly true that when the amount of free chlorine in water reaches 0.5 part per million, both small and large animals refuse to drink such water entirely or absorb only small quantities. This possibly has had an adverse physiological effect. When the water is capable of absorbing as much as 1.5 parts per million of chlorine without showing free chlorine, naturalists who deal in small animals and fishes state that no effect is observed. Continuous physiological tests on minnows and gold fish confirm this. The Dominion Department of Fisheries has informed the author that free chlorine in the water had a markedly adverse effect on the hatching of the eggs of Atlantic salmon, Great Lake trout, pickerel, and whitefish, but no effect was noticed when free chlorine was absent. The Department has, however, decided to remove all the hatcheries to places where water free from chlorine can be obtained.

The effect of the treated water upon seeds, plants, and flowers has been investigated by the Dominion Department of Agriculture, and Dr. Gussow (Dominion Botanist) and Dr. Shutt (Agricultural Chemist), who were in charge of this work, have reported that water treated with hypochlorite caused no apparent injury to carnations and hybrid roses. Six varieties of wheat seed after soaking in freshly prepared hypochlorite solutions (0.05 to 10 parts per million available chlorine) were all sown on the same day. Germination was found to be uniform throughout and no influence could be detected either as regards the rate of germination or the development of the young plants. Experiments on barley and oats produced similar results. Radishes, turnips, cucumbers, and beans also showed no retardation in development after treatment with the water.

All these experiments were conducted with solutions of bleach in distilled water, but the same results were obtained in a later series when the

treated city supply was used. These results prove conclusively that statements alleging damage to plants, flowers, and seeds by the hypochlorite treatment of water are absolutely unfounded and do not merit the slightest consideration.

The author has had, on several occasions during the past year, to investigate cases of alleged corrosion of piping due to the hypochlorite treatment of water, but before discussing these it will be advisable to review briefly the latest work on the corrosion of iron piping by water. The Committee on Water Supplies of the American Public Health Association have reported that, in general, hard waters have given little or no trouble in corroding metal pipes, and that this is apparently due in considerable measure to the formation of protective coatings upon the metal by the water itself. Soft waters do not seem to form such coatings naturally, and allow the carbonic acid in the water to dissolve such metals as iron and to retain the iron in solution. This process is maintained until the whole of the dissolved oxygen has been absorbed.

Jackson and Hale (New York Water Department Report, 1912) found that the first reaction is the solution of iron as bicarbonate by carbonic acid, with the formation of hydrogen. In experiments carried out in the cold, about 20% of the hydrogen formed was oxidised to water by the dissolved oxygen near the surface of the iron. The dissolved oxygen at the same time oxidises the soluble iron bicarbonate to insoluble red oxide, setting free again carbonic acid. The carbonic acid liberated again dissolves more iron and is again set free until all the dissolved oxygen is exhausted.

These reactions are in accordance with the facts which have been observed in connection with corrosion of piping systems, and account for the rapid corrosion of both domestic and heating hot water systems. Methods which reduce the oxygen content will reduce the corrosion, but it is much more economical to eliminate the catalytic agent which enables the oxygen to produce its deleterious effect.

In view of the alleged corrosion of hot water systems in Ottawa, the author made routine determinations of the amount of free carbonic acid in the raw and treated waters: the average results for the year 1914 are as follows; raw water, 0.8 part free carbonic acid per million; treated water, 1.6 parts. During the early part of the year, when a bleach of high chlorine content was being used, the free carbonic acid in treated water was invariably higher than in the raw water, but the reverse was found later in the year, when the bleach invariably contained free lime. As the total amount found (maximum 2.7 parts per million) is insignificant compared with the 10 to 12 parts per million of half-bound carbonic acid which would be set free during heating, it is inconceivable that the treatment of water with hypochlorite has any effect on the corrosion or erosion of piping systems.

One example of the complaints received is worthy of mention. A large company alleged that hot water pipes had been damaged by the hypochlorite treatment to the extent of \$10,000. On investigation it was found that the system had been supplied by the treated city water after passage through a mechanical filtration plant, and finally sterilised by heat. In this plant aluminium sulphate and soda ash were employed, and it was found that a large excess of soda ash was being used. At one time the water passing to the filter showed an alkalinity to phenolphthalein equivalent to 65 parts of sodium carbonate per million. The New York experiments have shown that an excess of lime or soda ash beyond what is sufficient for the neutralisation of the free carbonic acid is not

only unnecessary but positively injurious, inasmuch as it rapidly attacks the galvanising coat of pipes. These facts were pointed out to the company, and the suggestion made that a small amount of lime should be substituted for the excess of soda ash. Since then no further complaint has been received.

During 1914 laboratory studies were made as to the effect of water which had been treated with hypochlorite upon galvanised iron pipes, and in these, both hot and cold water were used. Stated shortly, the results show that the effect of the treated Ottawa River water upon galvanised iron pipe of good quality is not appreciable unless the available chlorine exceeds 3 parts per million. The quantity used during 1914 has been invariably less than this amount and averages 40% less. A number of short lengths of pipe, procured for these tests from a firm which is supplied by makers manufacturing most of this class of pipe used in this section of the country, was found to be of very inferior quality. The galvanising coat was evenly and thoroughly distributed on the outside, but on the inside large patches of bare iron were found in some places and an excess of zinc, which was brittle and easily detached, in others. Such places would undoubtedly act as foci of corrosion, and if the pipes received were at all representative of those ordinarily used, it is surprising that the trouble from this source has not been even greater than it is.

Manchester Section.

Meeting held at the Grand Hotel, on Friday, May 7th, 1915.

MR. JULIUS HÜBNER IN THE CHAIR.

THE ACID "TENDERING" OF COTTON CLOTH.

BY J. H. LESTER.

In view of the frequent complaints of "tenderness" met with in the Manchester cotton trade, it is surprising that careful quantitative results have not been published to show the loss of strength sustained by fabrics which have been treated with known amounts of acid and exposed to known conditions of drying. The present note does not pretend to fill this gap in technical literature, but in view of its value to the author, and as an inducement to further research, it appears to be worth placing on record.

A sample of cotton cloth with a breaking strain of 82 lb. gave results of 82, 75, and 20 lb. when treated with 0.01, 0.02, and 0.08% of sulphuric acid. The acidified samples were dried in the water oven and exposed to air for some hours before having the strength test applied to them. These results did not appear to correspond with tests made upon samples of alleged tender goods, however, for cases had been observed where the degree of tendering was either much more or less than my figures appeared to indicate. In short, it became obvious that the mere temperature at which the goods were dried was of but little consequence, whilst everything depended upon the amount of moisture left in the cloth at the termination of a particular process of drying.

For example, the strength of a cloth containing 0.35% of hydrochloric acid dropped from 82 lb. to 65 lb. when the cloth was dried in air at 25° C. On the other hand, a sample containing only 0.05% of acid lost practically the whole of its

strength when completely dried under a hot iron. It may be mentioned in passing that the hot iron test is of far greater practical value than any number of quantitative tests for acidity, for it is very difficult indeed to interpret the meaning of results where very small amounts of acidity are involved. In applying the test in question, it is necessary to have samples of cloth known to be entirely free from acidity, and other samples containing known amounts of acidity are also useful for comparison. Strips of cloth about one inch in width are placed alongside each other on an ironing blanket, and a hot smoothing iron is passed over all the samples so that each receives exactly the same treatment. It is very easy by this means to scorch the acid samples without discolouring the sample of known purity. The degree of scorching is generally found to be proportionate to the tendering effect, though of course the "finish" contained in some goods may influence the result.

The following trials will give some idea of the degree of tenderness produced in certain cases, and the details of the method will indicate some of the precautions which must be observed in order to obtain reliable results.

Three samples of a fine bleached cloth cut from the same piece, each weighing 15 grms., were boiled three times for 15 minutes each time, using fresh changes of water. This treatment being necessary to ensure the neutrality of the samples. The necessary quantity of decinormal hydrochloric acid to give 0.01 and 0.1% on the weight of cloth, was made up to 15 c.c. and the cloth sample saturated with the solution. By taking equal weights of cloth and of solution, and by working the cloth with a glass rod, it is easy to saturate the cloth without leaving any solution unabsorbed.

The three samples were then dried on a thin ironing blanket with a hot iron, and were weighed. To obtain some idea of the amount of acid lost by evaporation with steam during ironing, a portion of one of the ironed samples was tested for acidity, using decinormal caustic soda and phenolphthalein. The original 0.1% was found to be reduced to 0.07%, but part of the loss would doubtless be due to combination of the acid with the cotton. It was found that the samples weighed 3% less than their original air-dry weight, thus indicating that, as intended, the drying with a hot iron had by no means removed all the natural moisture of the cotton, but had left about 5%. One half of each sample was then cut off and placed in the hot water oven for an hour and a half. All the samples were then exposed to the air for some hours, cut into strips 2½ inches wide, and tested on a Goodbrand strength-testing machine adjusted to 6 inches between the clamps. The results may be tabulated as follows:—

Description.	Method of drying.	Average breaking strain.
Blank	{ Under hot iron	lb.
	{ " " " and 1½ hour	105
	{ " " " in water oven	95
Treated with 0.01% HCl {	" " " and 1½ hour	100
	" " " in water oven	92
Treated with 0.1% HCl {	" " " and 1½ hour	90
	" " " in water oven	13

To assess the value of the strength-tests in question, and in view of the false deductions frequently made from such tests, it is well to mention that where, for example, 100 lb. is given as the average breaking strain, further tests might bring out a corrected average of from 97 to 103 lb.,

and where 13 lb. is given as the average, the corrected average might be from 10 to 16 lb. This rule does not apply to all strength tests, and considerable experience is often necessary to estimate the probable errors to be found in practice, quite apart from mathematical calculations. All the tests were made upon strips running across the cloth, so that it is the weft strength alone that is indicated.

Portions of the above samples submitted to the scorching test already described, showed slight but distinct scorching and tenderness when 0.01% of HCl was present, and of course the stronger acid scorched and tendered the sample considerably. Under the conditions of this particular test, the blank or neutral sample of cloth was very slightly discoloured, showing that the test had been about as severe as it would be safe to make such a test.

Conclusions.

(1) It is possible for cotton cloth to contain as much as 0.3% of hydrochloric acid or perhaps more, and to be dried so carefully and incompletely that complaint of tenderness may not arise.

(2) The degree of tenderness caused by sulphuric and hydrochloric acid is of something like the same magnitude.

(3) No cotton cloth should be allowed to contain as much as 0.1% of free hydrochloric acid, for although this amount might be contained in finished goods without complaint of tenderness, local tendering would be sure to occur sooner or later, either before or after leaving the finisher.

(4) The maximum limit allowable in cotton cloth would appear to be 0.01% of free hydrochloric acid, so far as the above experiments show, for it is only the severest test that shows this amount to have any tendering effect, and that test would be an unreasonable one to apply on the large scale, that is to say, otherwise than in the laboratory.

(5) The permissible amount of free hydrochloric acid in cotton cloth may be said to be dependent upon the purpose to which the goods are to be put, the severest test being that of ironing before laundering.

(6) The tendering effect of acids upon cotton may be regarded as mainly dependent upon:—

(a) The concentration of acid referred to the total moisture in the cotton; that is to say that if a sample contains 0.1% of acid and in the "air-dry" state contains 8% of total moisture, the concentration of acid solution will be 1.25%.

(b) The temperature and time to which the cotton is exposed whilst the content of moisture is unchanged.

DISCUSSION.

Mr. F. WHOWELL and Mr. C. O'NEILL were of opinion that the test indicated in the paper was of great value, as by its adoption merely a slight trace of acid was distinguishable.

Mr. W. THOMSON considered the paper clearly indicated that when cloth was treated with acid the cellulose appeared to combine with the acid. If an attempt were made to remove the acid by the application of boiling water the result was not always satisfactory, as tendering frequently occurred when a hot iron was applied. The cloth must be exceedingly well washed with water, or better, treated with weak sodium carbonate solution, if tendering under such conditions was to be obviated. Although the use of the hot iron was a good test, a flat metallic ribbon wound on to a flat piece of talc and heated by the electric current constituted a better source of heat for such tests, the cloth to be tested being held at a definite distance from the hot wires. The presence of minute quantities of hydrochloric acid appeared

to have a more detrimental effect than that of exceedingly minute quantities of sulphuric acid.

Mr. L. E. VILES doubted whether minute quantities of acid could be estimated accurately by means of $N/10$ caustic soda and phenolphthalein. He had made tests in connection with the tendering of sulphide colours on cotton and found it necessary to use $N/100$ caustic soda in the presence of an indicator more delicate than phenolphthalein, i.e. methyl red.

Mr. HÜBNER associated himself with the views expressed by the author, and by Mr. Thomson in his remarks with respect to the combination of the acid with the cellulose. His experience had been mainly confined to paper which had been tendered after prolonged storing. It was impossible to detect any acid in the paper although it had been tendered by acid. Some fibres appeared to possess a special capacity for retaining acid. Some years ago he had examined a fabric, composed of linen and cotton, which had been treated with hydrochloric acid and washed apparently free from acid. After storing for some months the linen threads were tendered while the cotton threads were not affected. Separate analysis of the linen and cotton threads proved that the latter were free from acid but that the former still contained appreciable quantities which could only be removed by prolonged washing.

Mr. F. W. ATTACK said he found it difficult to detect slight traces of acid in finished goods. A test he had employed was to take two samples of the cloth and saturate one with borax solution. The samples were then placed in a drying oven at 120°C . for half an hour. The sample which had not been treated with borax would become brown in the presence of only a small amount of free acid; whether this occurred most with hydrochloric acid or sulphuric acid he was not quite clear. Probably browning by sulphuric acid would be more pronounced than that by hydrochloric acid. If a low class of goods with a glycerin-starch finish were heated for an hour at 120°C ., there was decided tendering but no browning, so that the test appeared to be satisfactory for acidity.

Mr. LESTER, in reply, said that the statement he had made as to the relative effects of hydrochloric and sulphuric acids being of about the same dimensions, was based entirely upon the results shown in his paper. A much yellower shade was obtained with hydrochloric acid than with sulphuric acid. As far as he had been able to ascertain, the amount of actual tendering was about equal, though before coming to a final decision on the point further experiments should be undertaken. In the phenolphthalein test about 5 grms. of the cloth was boiled with 100 c.c. of water, constantly pressing the cloth with a glass rod, running in a few drops of phenolphthalein and then decinormal caustic soda until a permanent pink colour was obtained. The reaction was certainly not quite as satisfactory as it might be, but was fairly accurate. Possibly the process might be improved by taking centinormal caustic and acid. He had examined a number of bleached cloths, in some cases quite high-class goods, and in no case did he find that less than 0.3 c.c. of decinormal caustic soda was required for 5 grms., and the figures ran up to 2 c.c. in quite normal goods of which there was no complaint. It was generally recognised that linen was more susceptible to acid tendering than cotton, and consequently in the bleaching of linen considerably weaker solutions were used than in the case of cotton. His experience did not coincide with that of Mr. Attack, in that in any case where tendering was caused browning also obtained. In one of the cases he had previously referred to, of samples which were actually tested for strength,

there was a sample which in the pure state gave a breaking strain of about 100 lb., and after 1½ hours in the water oven the sample treated with 1% of hydrochloric acid came down to 13 lb. There was only the least shade of yellowing perceptible and the sample was still quite a decent white.

Mr. F. H. TERLESKI said that a cotton cloth containing a percentage of moisture and also sulphides when stoved in a water oven for 1½ hours at 120° C., would certainly have a tendency to tender, though it would brown at the same time if it were acid.

Mr. LESTER said that the particular sample which was finished with glycerin and starch was a print, and the last process after printing was drying up with very diluted bleaching powder solution. He understood that that was a process which was frequently carried out in clearing up prints at the end of the process. Apparently it had the effect at any rate of making the cloth either neutral or slightly alkaline. The sample in question was certainly the most resistant of the series to the browning or tendering test under the hot iron, and he believed that equally satisfactory results had been obtained with other cloths subjected to the same process. The treatment was carried out with very dilute bleaching solution, thus leaving the cloth slightly alkaline owing to the lime which was present.

The CHAIRMAN observed that browning need not necessarily take place, although tendering might have occurred, even if acid were present.

Mr. LESTER confirmed the Chairman's statement, but said that in the scorching test they did generally occur together.

The CHAIRMAN agreed that that was so in the scorching test. Cotton containing no acid if allowed to remain in a drying stove at 100° for a long period turned brown.

A NEW REAGENT FOR THE DETECTION AND COLORIMETRIC ESTIMATION OF ALUMINIUM.

BY F. W. ATAK, M.SC.TECH., B.SC. (LOND.), A.I.C.

The formation of characteristic lakes of certain metals with Alizarin and other *ortho*-dihydroxy-anthraquinones is well known, but, so far as the author is aware, no attempt has been made to apply the formation of these highly coloured substances in the detection of the metals. The author has for some time used an alcoholic solution of Alizarin paste more particularly as a confirmatory test for aluminium (compare "Intermediate Practical Chemistry for University Students," Notes on Solution Analysis, p. 120; "Chemists' Year Book, 1915," p. 56). On account of the interference of other metals with the test and the great care necessary to carry out the reaction successfully, due to the susceptibility of the aluminium lake to acids (even a small amount of acetic acid destroys the red coloration), this test is not recommended for general use.

It has now been found that a similar coloration is obtained with Alizarin (red) S, the sodium salt of alizarinmonosulphonic acid, an aqueous solution of which constitutes, under certain conditions, an extremely delicate and characteristic test for aluminium. Moreover, by carefully controlling the manner in which it is formed, the coloration may be employed in the estimation of small amounts of aluminium. Although the research is as yet incomplete in so far as it relates to the constitution of the lakes of the substituted anthraquinone dyestuffs, it is interesting to note that the analysis of the red precipitate obtained by the action of an excess of a soluble aluminium salt on a solution of Alizarin S under varying conditions indicates that it is *not* a lake, but the aluminium salt of Alizarin S containing a slight

excess of aluminium (found, 2.95 and 3.00% Al; theoretical for $[C_{14}H_5O_2(OH)_2SO_3]_3Al$, 2.76% Al). The air-dried salt contained about ten molecules of water. Attempts to prepare a salt in presence of an excess of Alizarin S gave a gelatinous red mass from which no solid could be isolated for analysis: in both cases the salts are probably of a colloidal character when first formed, the one produced in presence of an excess of aluminium being rapidly coagulated by the acidic character of the aluminium salts in solution. Of the other salts of Alizarin S, it may be remarked that the calcium salt contains an excess of calcium over the theoretical amount, whether prepared in presence of an excess of calcium or of Alizarin S.

Detection of aluminium. The reagent used is a 0.1% filtered solution of commercial Alizarin S, which is pale yellow in presence of acids, but purple in presence of alkalis, and is suitable as an indicator for certain acidimetric and alkalimetric titrations. To about 5 c.c. of the neutral or acid solution under examination is added 1 c.c. of the reagent, and then ammonia until the solution is alkaline, as shown by the purple colour. The solution is boiled for a few moments, allowed to cool, and then acidified with dilute acetic acid, when a red coloration or precipitate remaining is conclusive evidence of the presence of aluminium. The red calcium, strontium, barium, zinc, and magnesium salts, and salts of other metals later than Group II. of the analytical classification, are readily soluble in cold dilute acetic acid, and do not interfere with the coloration. In fact, the precipitate appears to be more voluminous in presence of a calcium or zinc salt, probably due to the formation of a double salt or possibly lake, and this prevents the extension of the test to the gravimetric estimation of aluminium. Although all metals other than aluminium are dissolved from the precipitate by boiling with acetic acid, it was found that a portion of the aluminium salt was also dissolved by this treatment. The best example found by the author of this double salt or lake formation is the one in which a trace of aluminium (frequently present in commercial nickel salts) causes the precipitation of large amounts of the nickel compound, although a precipitate is not obtained with a pure nickel salt even on long standing with an ammoniacal solution of Alizarin S. The precipitate obtained by boiling a solution of a cobalt salt with Alizarin S solution to which has been added a large amount of ammonia (converting the cobalt into the trivalent condition), is not dissolved by cold dilute acetic acid, and hence the use of an excess of ammonia is to be avoided if cobalt is present, as is readily detected by the method recently suggested (Atak, this J., 1915, 641).

By this test it is possible to detect readily 1 part of aluminium in 10 million parts of water. The test is not interfered with in any way by the presence of phosphates or of chromium, and only by comparatively large amounts of iron. It is hence possible to detect aluminium direct without proceeding to the separation of Group III. precipitate; for example, 0.003 mgrm. of aluminium was readily detected direct in presence of 1 mgrm. of iron as ferric salt and 10 mgrms. of chromium as chromium salt. Larger amounts of iron may be kept in solution by the addition of citric acid, the presence of which does not interfere with the coloration. It is, in fact, inadvisable to attempt to separate the aluminium as hydroxide and then confirm, as all commercial samples of sodium peroxide, caustic soda, and hydrogen peroxide contain distinct traces of aluminium. It has been found that all chromium compounds contain traces of aluminium, which is present even in the purest guaranteed "Kahlbaum" potassium bichromate, and in larger amounts in commercial samples of chrome alum and potassium chromate.

Aluminium could also be detected readily in commercially pure glucinum (beryllium) salts.

Colorimetric estimation of aluminium. It has been found possible to adapt the above test to a colorimetric process by standardising the conditions for the formation of the coloration. The intensity of the coloration is not affected by the presence of moderate amounts of calcium, magnesium, or zinc salts, but is interfered with by the presence of large amounts of iron and chromium salts and of phosphates. Precipitation, which takes place more readily in presence of salts of other metals, is prevented by the addition of glycerin. It has been found essential to use a very large excess of Alizarin S, the original colour of which in acid solution is not, however, of sufficient intensity to interfere. The colorations must also be compared within a short time of their formation, as the acetic acid gradually attacks the finely divided precipitate, more particularly in presence of phosphates.

The procedure adopted is as follows: The original solution (5 to 20 c.c.) is acidified with hydrochloric or sulphuric acid, as acetic acid would form the highly dissociated aluminium acetate, and this has been found to give a somewhat more intense coloration than the inorganic salts; nitric acid in considerable amounts leads to the partial destruction of the coloration. 10 c.c. of glycerin and 5 c.c. of a 1% solution of Alizarin S are added, the solution made up to about 40 c.c. with water and then rendered slightly ammoniacal. After standing for five minutes it is acidified with dilute acetic acid, the Alizarin S acting as indicator, acetic acid being added until no further change in the coloration occurs. The liquid is then made up to 50 c.c. and compared with a standard. Suitable amounts of aluminium for estimation are 0.005 to 0.05 mgrm., the solution under examination being suitably diluted if necessary. The temperature at which the coloration is produced appears to be immaterial, provided the acetic acid is added in the cold. Iron and chromium may be prevented from interfering by conversion into the double citrates by addition of a citrate to the acidified solution before adding ammonia; in this manner it was found that the coloration given by 0.015 mgrm. of aluminium was not affected by the presence of 10 mgrms. of iron.

If produced under these conditions, the coloration appears to be of a quantitative character, as the coloration obtained by dilution is identical with that obtained by using a corresponding aliquot portion of the aluminium solution to produce the coloration. By this method it was found that a sample of commercial chrome alum contained less than 0.2% of aluminium.

The author desires to thank the British Alizarine Co. for their kindness in providing a sample of dyestuff for the research.

THE OXIDATION OF SEWAGE WITHOUT THE AID OF FILTERS. PART III.

BY E. ARDERN, M.S.C., AND W. T. LOCKETT, M.S.C.

In the concluding paragraphs of a paper* presented to this Section of the Society in November last, it was stated that attention was being devoted to certain factors controlling the activated sludge process of sewage purification, which has been developed by the authors.

It is proposed in the present communication to give the results which have so far been obtained in regard to:—

- (1) the initial production of activated sludge;

- (2) the volume of air essential for the successful working of the purification process;
 - (3) the most advantageous proportion of activated sludge to employ;
- together with a description of certain experiments relating to the purification of a dilute domestic sewage.

(1) Production of activated sludge.

In the original experiments described in Part I. of this series of papers, the activated sludge was obtained in the following manner:—Manchester sewage was continuously aerated until complete nitrification ensued. At the end of this period the clear oxidised liquor was removed by decantation and a further sample of raw sewage aerated in contact with the original deposited matter until the sewage was again completely nitrified. This method of treatment was repeated a number of times, with the retention in each case of the deposited solids. Working in this manner, it is obvious that a considerable amount of time must elapse before a quantity of activated sludge has accumulated sufficient to deal effectively with the sewage, with consequent considerable expenditure of air in proportion to the volume of sewage dealt with in the meantime. The time required for the production, by this method, of an effective quantity of activated sludge will vary naturally with the character and composition of the sewage dealt with. In the case of Manchester sewage, the production of an adequate supply of sludge requires a period of at least six months.

As noted in Part II. of this series of papers, slurry or humus from efficient percolating filters forms a good starting point for the rapid production of activated sludge. On aerating such material in contact with raw sewage, an initial deflocculation effect is observable. Within a reasonable period of time, dependent upon the state of oxidation of the slurry, nitrification of the sewage is obtained, and after dealing with a few successive volumes of sewage, under favourable temperature conditions, the slurry becomes thoroughly activated and capable of producing well clarified and highly nitrified effluents.

In connection with the use of slurry, it is important that it should be, as far as possible, free from grit, etc., resulting from the disintegration of the filtering media, which is liable to cause difficulty in connection with the circulation of the activated sludge.

As this method of producing activated sludge only applies where percolating filters are available, it was important to investigate the possibility of accelerating the rate of production of activated sludge from the sewage *per se*.

Quite early in the course of the investigation of the activated sludge method of purification of sewage, it was observed that a sludge capable of effecting satisfactory clarification of sewage and of promoting a vigorous carbonaceous fermentation could be produced by subjecting successive volumes of sewage to periods of aeration not exceeding 48 hours. It appeared from these early experiments that possibly nitrifying power could be imparted to this partially activated sludge, and although the difficulty of establishing healthy growths of nitrifying organisms in the presence of excessive quantities of nitrogenous organic matter was known, this question seemed worthy of investigation.

The possible means of rendering partially activated sludge completely active were first of all studied in the laboratory. Under suitable temperature conditions it was found that this could be effected by treatment of the sludge with successive volumes of sewage which in each case were aerated continuously until complete nitrification was obtained.

* This Journal, 1914, 33, 1122—1124.

With a view to obtaining reliable quantitative data in regard to the time required to produce activated sludge in bulk by this method, and also to determine the total sludge production from a given volume of sewage, a carefully controlled out-door experiment was carried out on similar lines. For this purpose two 50-gallon casks were employed, similar to those used in the out-door experiments described in a previous paper. The two casks were subjected to similar working conditions except as regards the means of aeration. In the one cask the air was admitted through a porous tile of 1 sq. foot area; in the other cask aeration was effected through a plain pipe. The bottoms of the casks in each case were so constructed as to ensure complete admixture of the accumulated sludge and sewage.

For the production of partially activated sludge the casks received in the early stages one filling of raw sewage per day—21 hours aeration and 2 hours settlement being allowed—for twelve successive days. At the end of this period sectional samples showed that clarification of the sewage could be obtained with a reduced aeration period. Accordingly the period was reduced from 21 to 9 hours, the casks thus receiving two fillings per day. Shortly afterwards the casks were operated in the following manner:—

Filling.	Aeration period.	Settlement.
7.0 a.m. 2.0 p.m. 10.30 p.m.	7.0—11.0 a.m. 2.0—8.0 p.m. 10.30 p.m.—4.30 a.m.	11.0 a.m.—1.0 p.m. 8.0—10.0 p.m. 4.30—6.30 a.m.

Throughout the above operations three-fourths only of the total contents of the casks was removed at each discharge.

Working in the manner described, in 26 days each cask, having received 48 fillings, had dealt with approximately 1600 gallons of sewage, and the volume of sludge accumulated, measured after 2 hours settlement, was equal to 18.6% of the total contents of the cask. Determinations of the suspended matters of the sewage dealt with and of the resulting effluents, showed that the amount of sludge obtained was practically equivalent to the suspended solids removed from the sewage.

At this point it was considered advisable to commence the complete activation of the sludge accumulated.

In the following table are given the results of the treatment of sewage during this initial accumulation of partially activated sludge.

TABLE I.
Manchester sewage.
Results in parts per 100,000.

	Period 1.			Period 2.			Period 3.		
	Aeration—21 hours.			Aeration—9 hours.			Aeration—6, 6, and 4 hours.		
	Raw sewage.	Effluents obtained using:—		Raw sewage.	Effluents obtained using:—		Raw sewage.	Effluents obtained using:—	
		Diffused air.	Plain pipe aeration.		Diffused air.	Plain pipe aeration.		Diffused air.	Plain pipe aeration.
Four hours' oxygen absorption	13.67	3.27	3.73	10.76	2.13	2.44	12.27	2.26	2.99
Free and saline ammonia	3.14	3.34	3.40	3.86	2.86	2.93	3.67	3.50	3.34
Albuminoid ammonia	1.19	0.335	0.39	0.94	0.17	0.24	1.07	0.24	0.33
Suspended matters:—									
Mineral	13.1	1.1	1.6	6.6	1.0	1.4	8.6	0.6	1.6
Organic	15.6	0.7	1.8	10.3	0.6	1.8	12.9	0.7	2.4
Total	28.7	1.8	3.4	16.9	1.6	3.2	21.5	1.3	4.0

In connection with the complete activation of the sludge, accumulated as described previously, owing to the fact that excess of air was employed in each case, little difference was observed in the results obtained with the two methods of aeration employed, and accordingly the account of this part of the work is confined to the experiment using diffused air.

For this conversion, the partially activated sludge was continuously aerated in contact with sewage until nitrification was complete. The first volume of sewage thus dealt with required a period of 15 days.* During this interval there was initially a definite nitrogenous fermentation of the partially activated sludge, as indicated by a considerable rise in the free and saline ammonia content, as will be seen from the following analytical returns of samples taken periodically.

TABLE II.
Results in parts per 100,000.

	Raw sewage	After 5 days aeration	After 7 days aeration	After 12 days aeration	After 14 days aeration
Free and saline ammonia	2.00	7.28	8.86	6.70	1.80
Nitrite and nitrate in terms of NH_3	—	0.06	0.57	5.70	12.86

The nitrated effluent resulting from the above treatment was removed by decantation and replaced by a further volume of raw sewage. Three days' continuous aeration was sufficient to complete the nitrification of this volume of sewage. No evidence of ammoniacal fermentation of the sludge was observed during this period. Repeating this method of operation, it was found that a succeeding volume of sewage was fully nitrified in about 26 hours, and subsequently the aeration period required for further volumes of sewage was reduced, with the result that within a period of four weeks from the commencement of the complete activation of the sludge, entirely satisfactory results were obtained with an 8 hours' aeration period. Shortly afterwards the aeration period was further reduced to six hours.

Once having obtained the sludge in a state of complete activation, the volume of which amounted to 25% (measured after 2 hours' settlement), an endeavour was made to determine the amount of

* In this case, to obtain a completely nitrified effluent it was necessary to add quantities of alkali (Na_2CO_3) from time to time, as required.

sludge resulting from the treatment of a definite volume of sewage, and also to follow the question of the nitrogen content of the sludge in relation to the total nitrogen content of the sewage.

At the commencement of the experiment a careful determination was made of the volume of sludge and of the amount and character of the solid content. The cask fitted with the diffuser was then continuously operated over a period of seven days. Aeration periods varying from six to eight hours were found sufficient to produce well-nitrified effluents with a very low free and saline ammonia content. At the conclusion of this period of working, the volume and character of sludge were re-determined. The whole of the data thus obtained are given in the following table.

TABLE III.

Sludge production—Manchester sewage.

Results in parts per 100,000.

	Raw sewage	Effluent.
Average total solids	109.0	74.0
In suspension	23.7	2.0
In solution	85.3	72.0
Organic nitrogen (Kjeldahl)	1.72	0.25

	At commencement of experiment.	At end of experiment.
Volume of sludge (after 2 hours settlement)	25.0%	44.0%
Sludge in cask	52½ litres	88½ litres
Water content	97.6%	97.6%
Specific gravity	—	1.000
Weight of dry matter	1291 grm.	2147 grm.

Total volume of sewage dealt with = 1558 litres.

Total weight of solids calculated from suspended matters in sewage and effluent = $(23.7 - 2.0) \times 15.88 = 345$ grms. (Mineral—149 grms. Organic and volatile—196 grms.).

Weight of solids calculated from increase in sludge = $2147 - 1291 = 856$ grms. (Mineral—372 grms. Organic and volatile—484 grms.)

Analysis of sludge.

	At commencement of experiment.	At end of experiment.
Mineral matter	44.6	44.1
Organic matter	55.4	55.9
Total nitrogen	3.80	3.51
Greasy matter (CCl ₄ extract)	4.30	3.80

Total organic nitrogen in sewage =	grms.
" " " " effluent =	26.8
Difference	3.0
Organic nitrogen in final sludge =	grms.
" " " initial " =	75.4
Difference	49.0
	26.4

According to the above results the sludge production was equivalent to 24.5 tons of sludge (calculated as containing 90% water) per million gallons of sewage dealt with.

Reference to the figures obtained shows, however, a considerable discrepancy between the amounts of solid matter removed from the sewage and that found in the resultant sludge, even after allowing for the complete removal of colloid matter from the sewage.

In the absence of further evidence, the authors do not feel justified in drawing any definite conclusions in regard to sludge production and amount of nitrogen recovered.

Use of mineral precipitates.

In the course of the laboratory experiments previously referred to, extended trials were made of the effect of the use of mineral precipitates, e.g., hydroxides of iron and aluminium, during the initial accumulation of partially activated sludge. This series of experiments was undertaken with a view to ascertain whether the increased surface action afforded by the bulk of precipitate employed was advantageous in regard to the purification effected and to the rate of activation of the sludge.

So far as Manchester sewage is concerned, the results obtained indicated that no material advantage in regard to either of these questions ensued from the employment of such precipitates in the manner stated; in fact, with the precipitated hydroxides a deflocculating action was frequently obtained, with the production of a distinctly turbid effluent. The addition of a small proportion of thoroughly activated sludge prevented this deflocculation and produced well-clarified effluents.

Similar experiments to the above were carried out with a very dilute domestic sewage, which is received at the Davyhulme Works from the parish of Davyhulme. In this series of experiments a precipitate of manganese hydroxide was employed instead of alumina, having in view the possibility of the catalytic action of iron and manganese salts.

For the purpose of studying the effect of mineral precipitates on the production of activated sludge, the "original" method was reverted to, in which the sewage was continuously aerated until the nitrification was completed.

No appreciable difference was observed in the time thus required for the sewage alone, as compared with the samples of sewage to which hydroxide of iron and manganese respectively had been added. It was found, however, that in the case of the control experiment (i.e., sewage alone) a rather longer aeration period was required for the succeeding volume of sewage. The differences exhibited in the rate of production of activated sludge were not such as to render the adoption of such hydroxides desirable. With a dilute domestic sewage of the character of the sewage dealt with, a period of continuous aeration of 3 weeks only was required for the complete oxidation of the first volume of sewage, and subsequently the times required for the complete nitrification of succeeding volumes of sewage diminished very rapidly, with the consequent production of a considerable bulk of activated sludge within a reasonable period of time.

During the course of the experiments, the alternate method of activated sludge production described previously was also employed, which demonstrated that a greater bulk of activated sludge could be produced in a similar period of time as compared with the original method, and in the meantime considerably increased volumes of sewage had been dealt with.

Further experiments in regard to the possibly catalytic action of oxides of manganese added under varying conditions have yielded negative results.

Before leaving this section relating to Davyhulme Parish sewage, it may be of interest to give some results which have been obtained in the purification of this sewage.

TABLE IV.

Davyhulme Parish sewage.

Results in parts per 100,000.

Average results obtained when working with aeration periods of:—

Temperature 18° C. Proportion of sludge to sewage approx. 1:4.	3 hours.		2 hours.		1 hour.		
	4 fillings per day.		5 fillings per day.		5 fillings per day.		
	Raw sewage.	Effluent plain pipe aeration.	Raw sewage.	Effluent plain pipe aeration.	Raw sewage.	Effluent plain pipe aeration.	Diffused air.
Four hours' oxygen absorption.....	2.01	0.50	3.88	0.54	1.81	0.57	0.54
Free and saline ammonia.....	1.65	0.03	2.37	0.43	2.36	1.90	1.54
Albuminoid ammonia.....	0.42	0.06	0.64	0.07	0.285	0.09	0.07
Nitrite } in terms of NH ₃	{	0.015		0.07		0.02	0.05
Nitrate }		1.55		1.09		0.46	0.75
Dissolved oxygen absorbed 5 days at 18° C.		—		0.96		1.85	1.20

These results confirm the statement made in previous papers, that the period of aeration required for the purification of a sewage by the activated sludge process naturally depends upon the strength and character of the sewage dealt with.

Throughout extended trials with this class of sewage, no difficulty arose in regard to the maintenance of the complete activity of the sludge both as regards clarification and nitrification.

(2) *Volume of air required for the efficient working of the process.*

In the previous experimental work the volume of air employed for aeration purposes was always

In the following paragraphs are described laboratory experiments undertaken to obtain data in regard to this question of air supply. For the purpose of these experiments it was necessary to design an apparatus in which the volume of air could be regulated and controlled so as to admit certain definite volumes of air to various aeration vessels.

The construction of the apparatus employed will be seen from the following diagrams.

The aeration vessels were contained in an enclosed chamber the temperature of which could be regulated, and for these experiments three aerating vessels were used, filled with equal volumes of a mixture of sewage and activated sludge. The

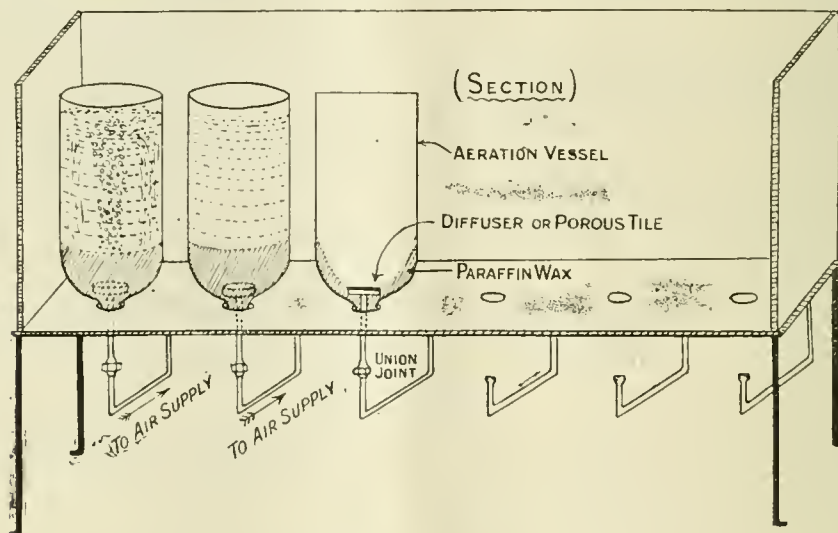


DIAGRAM 1. Aeration apparatus (front and top removed).

at least sufficient to obtain complete admixture of the activated sludge and sewage. As stated in the earlier papers, this volume varied from 12 to 15 cubic feet of free air per square foot of tank area per hour.

The cost of the purification process will be, of course, largely controlled by the volume of air required, and therefore it became important to determine, if possible, the minimum air supply necessary for the maintenance of the purification process.

volume of sludge in each vessel was strictly one-fourth of the volume of sewage dealt with. Through the three aerating chambers, on the average 13, 27, and 6 cubic feet of air per hour per square foot, etc., were passed respectively for a period of 4 hours, when samples were taken and the oxidation effected in each was determined by analysis.

To arrange for the respective mixtures of sludge and sewage to receive the required amounts of air, the aerating vessels before each experiment were filled with tap water and the mercury regulation

columns roughly adjusted to allow the required amounts of air to pass through the porous tiles. A finer adjustment was then made according to the measurements, of the amounts of free air issuing from each vessel.

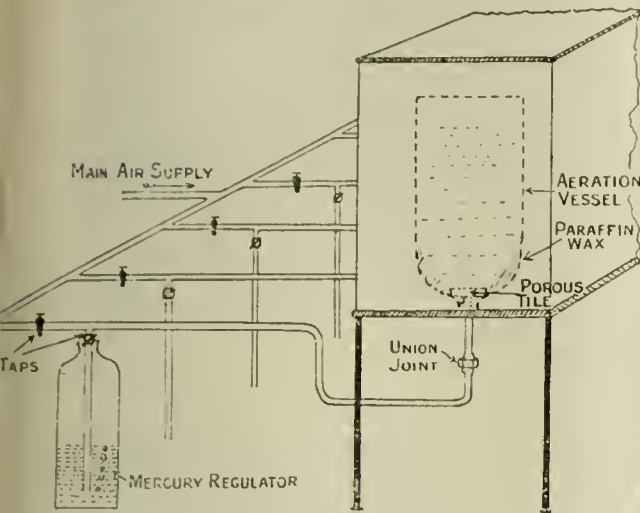


DIAGRAM 11. Showing arrangement for regulating air supply.

Having fixed the mercury levels so that the required amount of air for each vessel was obtained, the tap water was replaced by the mixture of sludge and sewage. Throughout the experiments particular care was taken that the amount of air passing through the liquids per minute should be fairly constant for each vessel, and careful measurements of the amounts of free air were made at least twice during each experiment.

The following table contains the average results of a series of experiments using:—(1) the usual; (2) excessive; (3) reduced amounts of air.

TABLE V.
Manchester sewage.
Results in parts per 100,000.

	Raw sewage.	Effluents obtained after 4 hours' aeration.		
		Usual air-supply.	Excessive air-supply.	Reduced air-supply.
Four hours' oxygen absorption	0.12	1.54	1.63	1.40
Free and saline ammonia	3.32	1.03	1.03	1.03
Albuminoid ammonia ...	0.84	0.12	0.13	0.12
Nitrite and nitrate as NH_4 ..		1.56	1.44	1.62
Average amount of air used in cubic ft. per sq. ft. tank area per hour..		13	27	6

The oxidation of the free ammonia in particular has been taken as the guide to studying the effects of varying amounts of air, and in the preceding table, a remarkable similarity of results is shown, so that it does not appear to be beneficial, under the conditions of experiment, to increase the air supply above 6 cubic feet per hour, etc. Further, excessive amounts of air appear to have a slight detrimental effect on the clarity of the effluent.

Having found that under the conditions of experiment 6 cubic feet of air per hour, etc., ensured efficient working of the process, it became of interest to ascertain whether the air could be even further reduced.

Further experiments were therefore made using 6, 4, and 2 cubic feet of air per hour, etc., and the following are the average results obtained:—

TABLE VI.
Manchester sewage.
Results in parts per 100,000.

	Raw sewage.	Effluents obtained with 4 hours' aeration using:—		
		6	4	2
		cubic ft. of air per hour per sq. ft. tank area.		
Four hours' oxygen absorption	10.67	1.41	1.40	1.47
Free and saline ammonia	3.46	1.67	1.83	2.33
Albuminoid ammonia ..	1.08	0.12	0.13	0.17
Nitrite and nitrate as NH_4 ..		1.60	1.41	0.73

Astonishing purification was obtained with the further reduction in the air supply, and the results given above show that even 2 cubic feet of air per hour, etc., was sufficient to produce a vigorous carbonaceous fermentation. It will be seen, however, that the reduction of air supply from 6 to 4 cubic feet per hour, etc., had a slight inimical effect on the amount of nitrification obtained, and with the further reduction to 2 cubic feet per hour, etc., a very perceptible diminution in the amount of nitrate produced was observed. Two cubic feet of air per hour, etc., was insufficient to maintain complete admixture and circulation of the sludge and sewage, and consequently a certain proportion of the active sludge was removed from the sphere of action. Under working conditions the banks of sludge thus formed would eventually become deoxygenated and would be liable to give rise to secondary changes inimical to clarification and nitrification. It may be taken, therefore, that the results given for "2 cubic ft. of air per hour, etc." could not be maintained under ordinary working conditions.

From the foregoing results, it appears that the minimum amount of air required, under the conditions of experiment, to obtain the maximum oxidation of sewage is approximately 6 cubic feet per hour per sq. ft. of tank area, only slightly inferior effluents being produced when using 4 cubic ft. of air per hour.

From a consideration of the whole of the results obtained when using varying amounts of air, it has been concluded that the minimum air supply necessary to maintain the maximum rate of oxidation of the sewage does not exceed the amount of air which is required to obtain an adequate mixture of the sludge and sewage.

The amount of air required to produce adequate mixture of activated sludge and sewage on the practical scale, of course, will depend upon the design and depth of tank used. Observations made during large-scale experiments indicate that the original estimate of 12 to 15 cubic feet of air per hour per square foot of tank area, certainly need not be exceeded.

Proportion of activated sludge to sewage.

In the experimental work previously published the proportion of sludge to sewage in general varied from 1:4 to 1:3 (measured after 2 hours' settlement). The former proportion was usually employed, as satisfactory results were obtained within a reasonable aeration period without requiring an excessive tank capacity.

The results of certain experiments, however, led to a re-consideration of the question of the most advantageous proportion of activated sludge

to employ, particularly with reference to the purification of a sewage liable to contain appreciable quantities of inhibitory trade effluents.

For the purpose of obtaining information with regard to this question, the apparatus described in the previous section was employed. Preliminary trials with excessive volumes of activated sludge indicated that, from the point of view of practicability, when working on the fill and draw system, the proportion of 1 volume of sludge to 1 vol. of sewage should not be exceeded, mainly on account of the difficulty of settlement of the sludge.

The detailed investigation was therefore confined to a study of the effect of varying the proportions of the activated sludge present from 1:4 to 1:1. In each experiment the same sample of sewage was aerated in the aeration vessels with a definite proportion of sludge, with an air supply sufficient to allow complete circulation of the sludge and sewage.

increased expenditure of total volume of air, by using higher proportions of sludge than those which had been employed previously. The activated sludge used throughout was free from ammonia and in a high state of activity.

It is very difficult to say with any certainty what will be found the most advantageous proportion of activated sludge to employ on the working scale, as so many factors are involved, *c.g.*, character of sewage, maintenance of the activity of sludge, air supply, tank capacity, degree of purification required, etc. From a consideration of the available data it has been concluded, however, that in the case of Manchester sewage considerable advantage would result from increasing the proportion of activated sludge from 1:4 to at least 2:3. Reference to the table below will show that, when working with this last proportion of sludge, a 2-hour aeration period yields a superior effluent to that obtained with a 4-hour aeration

TABLE VII.
Manchester sewage.
Varying proportions of sludge and sewage.
Results in parts per 100,000.

Results in parts per 100,000.												
	Raw sewage.	20 vols. of sludge to 80 vols. of sewage.	30 vols. of sludge to 70 vols. of sewage.	40 vols. of sludge to 60 vols. of sewage.	50 vols. of sludge to 50 vols. of sewage.							
		Effluents obtained after aerating for:—										
		4 hrs.	2½ hrs.	3 hrs.	3½ hrs.	2 hrs.	2½ hrs.	3 hrs.	1½ hrs.	2 hrs.	2½ hrs.	
Four hours' oxygen absorption.....	12.41	1.76	1.47	1.43	1.50	1.39	1.29	1.21	1.29	1.30	1.19	
Free and saline ammonia.....	3.71	1.83	1.49	1.23	0.96	1.14	0.84	0.54	0.83	0.57	0.39	
Albuminoid ammonia.....	1.16	0.19	0.13	0.115	0.115	0.11	0.10	0.115	0.115	0.12	0.10	
Nitrite } in terms of NH ₃	{	0.14	0.13	0.13	0.14	0.13	0.14	0.14	0.11	0.14	0.14	
Nitrate }		1.39	1.40	1.71	1.94	1.59	1.99	2.21	1.67	1.91	2.16	
Percentage purification of raw sewage calculated on.....												
(1) 4 hours' oxygen absorption ..		86	88	88	88	89	90	90	90	90	91	
(2) Albuminoid ammonia.....		84	89	90	90	91	91	90	90	90	91	
Percentage loss of ammonia.....		51	60	67	74	72	77	85	77	85	89	
„ ammonia oxidised (NO ₂ , NO ₃)		41	41	50	56	46	57	63	52	57	62	

In table VII are given the average results of the aeration, for stated periods of time, of Manchester sewage mixed with varying proportions of activated sludge.

It will be seen that with the proportion of sludge to sewage of one to four a maximum aeration period of 4 hours was allowed. As the proportion of sludge was increased the maximum aeration period allowed was reduced in proportion to the reduction in volume of sewage dealt with, and thus the results obtained with the maximum aeration period represent in each case a similar air expenditure. In the experiments where increased volumes of sludge were employed, samples were taken at intervals during the total aeration period.

A general consideration of these results shows that better effluents can be obtained, without an

period when a sludge proportion of 1:4 is employed.

Provisional Estimate of Cost of Aeration.

The experiments described previously render it possible to estimate approximately the volume of air required for the purification of a given volume of sewage.

In consultation with Mr. S. L. Pearce, City Electrical Engineer, Manchester, and Dr. Gilbert J. Fowler, Consulting Chemist, Rivers Department, Manchester Corporation, a provisional estimate of the cost of aeration has been made on the basis of these determinations, which have been translated by an expert in pneumatic engineering into terms of power required. The latter figures have been confirmed by information obtained through the

TABLE VIII.
Provisional estimate of cost of aeration.

Vol. of sludge (measured after 2 hrs. settlement).	Vol. of effluent removed at the end of each period.	Aeration period.	Tank capacity.		Vol. of free air per million gallons.		Cost per million gallons of sewage.	
			Per million gallons.	Per daily flow.	Min. 6 cub. ft. per sq. ft. per hour.	Max. 15 cub. ft. per sq. ft. per hour.	Min. air supply.	Max. air supply.
20%	75%	4 hrs.	Area, 11,800 sq. ft.		cub. ft. 860,000	cub. ft. 2,150,000	s. d. 11 0	s. d. 27 6
40%	50%	2 hrs.	Depth, 6 ft. Capacity, 442,500 galls.	10.6 hrs.	640,000	1,600,000	8 3	20 6

courtesy of Mr. A. E. Collins, City Engineer, of Norwich.

For the purpose of the provisional estimate given in the following table, the depth of the aeration tank has been assumed to be 6 feet, and the cost of electricity 0.5d. per unit (K.W.H.).

Under working conditions it would scarcely be practicable to receive the purified effluent as far as the sludge level, and therefore a margin of 5% and 10% by volume has been allowed in the two respective estimates, using 20 and 40% activated sludge (see Cols. 1 and 2).

The tank capacity of the two estimates works out similar, and has been arrived at by calculations according to the following cycle :—

	20% sludge.	40% sludge.
Filling	1 hour	40 minutes
Aeration	4 hours	2 hours
Settlement	2 hours	2 hours
Discharge	1 hour	40 minutes
Number of fillings per day	3	4½
Volume of sewage dealt with per sq. ft. of tank area per day	84 gallons	84 gallons

In estimating the cost, allowance has been made for friction in air pipes and diffusers. The actual cost of the aeration process naturally depends on the aeration period required, which, as previously stated, will vary with the strength and character of the sewage dealt with. The periods given in the above table are sufficient to produce, under suitable conditions, satisfactory effluents from average strength Manchester sewage.

From the foregoing results it may reasonably be concluded that some advance has been made with regard to the economics of the process.

It has been demonstrated :—

1. That apart from the use of slurry from percolating filters, the initial production of activated sludge can be facilitated and obtained with considerably less air cost than originally was the case.

2. That under certain controlled conditions the volume of air required may be considerably less than previously estimated.

3. That there is an economic advantage in employing an increased volume of activated sludge with special reference to the rate of nitrification.

In conclusion, it may be said that the estimated costs of aeration given in Table VIII. indicate that the activated sludge method of sewage purification is eminently a practical process.

The authors are again indebted to Dr. Gilbert Fowler for his continued interest in the research, to the Worshipful Company of Grocers for extended facilities, and to the Rivers Committee of the Manchester Corporation for permission to publish the results of the work which has been carried out at the Corporation Sewage Works, Davyhulme.

Sydney Section.

DISCUSSION ON A PROPOSAL BY THE COUNCIL OF THE SOCIETY TO ESTABLISH AN INFORMATION BUREAU FOR THE PURPOSE OF COLLECTING INFORMATION LIKELY TO BE USEFUL TO MANUFACTURERS.

At a meeting of the Sydney Section on May 19th, 1915, the above proposal was the subject of an interesting discussion, in which the Chairman (Professor C. E. Fawsitt) and Messrs. B. J. Smart, E. Elliott, Loxley Meggitt, and A. B. Hector took part.

As a result of the discussion, the following proposals were carried.

1. "That the Sydney Section of the Society of Chemical Industry approve of the institution of a permanent central Information Bureau of the Society which has for its object the collecting and giving of information useful to chemical manufacturers."

2. "That this Section inform the Council of the Society that it is endeavouring to prepare as completely as possible an Australian Register of chemical manufacturing establishments and the products prepared by these."

3. "That in addition to the contemplated list of chemical manufacturers, the Bureau be asked to prepare a Register of Universities and Colleges within the Empire where instruction in technical chemistry is given, detailed information regarding the course of instruction being made available."

4. "That the Society endeavour to get special technical courses started by Universities and Technical Schools in special districts where such are not already being held."

5. "That the Bureau be asked to prepare a list of Technical Experts and Scientific Advisers and Specialists for the Empire."

6. "That the Society be asked to take steps to impress on His Majesty's Government the advisability of laying the foundation of a Technical Research Establishment on the lines of the German Zentralstelle for the investigation of technical problems."

7. "That owing to the great distance of Australasia from Great Britain it is advisable that the Sydney Section should appoint a committee which would be constituted as an Information Bureau for Australasia, and that this Bureau shall have for its first object the collecting and giving of information useful to chemical manufacturers."

8. "That the local sub-committee shall consist of the Chairman, Vice-Chairman, and Secretary of the Section who shall have power to add to their number any other members of the Society resident in Australasia."

9. "That the Australasian Bureau Committee shall endeavour to prepare as completely as possible an Australasian Register of refiners of natural chemical products, of manufacturing chemists, and of manufacturers of metals and metallurgical products, fuels, refractory materials, building materials, chemical plant, and chemical apparatus, and of other products involving chemical operations."

10. "That the Sydney sub-committee be asked to consider further the whole question of chemical industry in Australasia as to how it can be helped and extended to meet the demands of the present and of the future; and that the following matters be especially considered :—

(a) If and how the chemical industries presently going on in Australasia should be assisted.

(b) What (other) manufactures of a chemical nature would be likely to be profitably carried out in Australasia with or without Government assistance (say, by bounties, labour laws, patent laws, etc.).

(c) How such proposals as the committee makes may be best given effect to."

Meeting held at Sydney on Wednesday, 21st July, 1915.

PROF. C. E. FAWSITT IN THE CHAIR.

SEPARATION OF WHITE METAL AND GUNMETAL BORINGS.

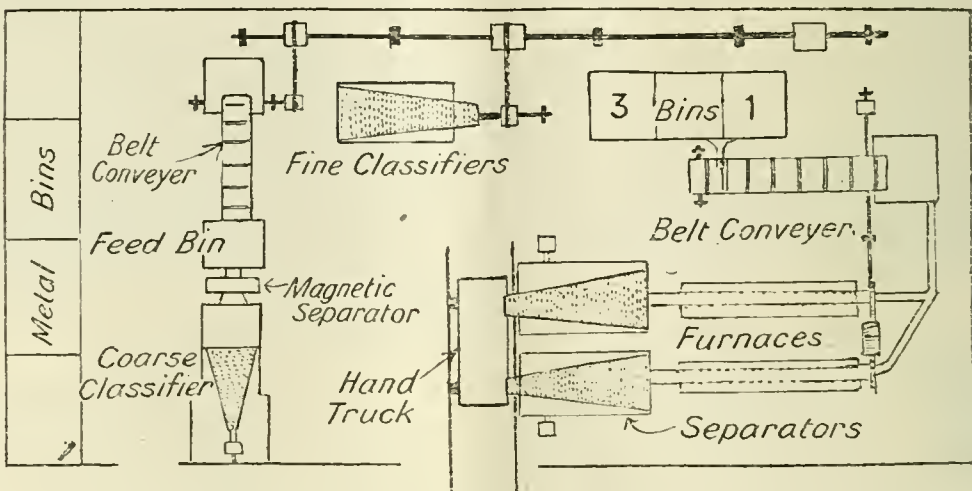
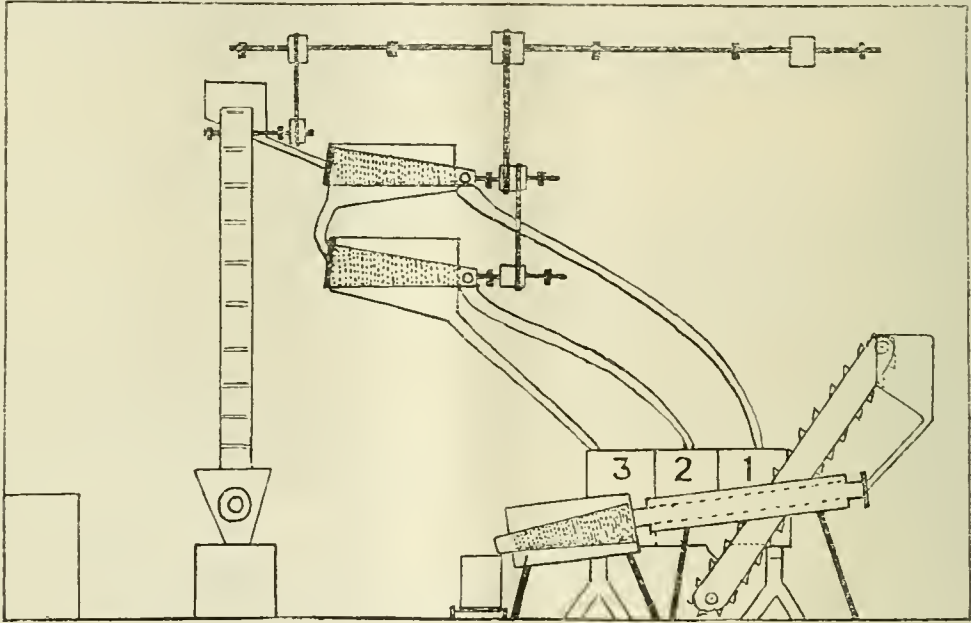
BY R. H. WALTON AND G. T. BAILEY.

In locomotive machine shops there is produced a large quantity of gunmetal borings mixed with white metal which, in certain cases, is very difficult

to deal with. So far as we are aware, the only method used for effecting a separation is liquation on an iron plate, or in a furnace. This process is only suitable for coarse borings and absolutely useless for the finer grade material. Owing to the rapid accumulation of fine borings in New South Wales Railway Workshops, it was necessary to devise a scheme for the recovery and separation of these two classes of metal. The borings cannot be smelted straight out and used generally for castings on account of the high antimony content—0.6%. They could, perhaps, be used for a few special castings, but for general railway purposes, a mixture of this kind would probably soon lead to serious trouble.

removal of the white metal in the fine borings is the problem we were asked to solve.

After a few experiments it was decided to pass the small borings from the bin to a magnetic separator, pick them up by a revolving belt fitted with pockets, and convey them to an overhead bin, from which they gravitate to classifiers, and are separated into three grades. From bins Nos. 1 and 2, containing the coarser material, the borings gravitate on to a short revolving belt fitted with pockets and are delivered into a bin above the furnaces, from which they gravitate to the furnaces. These furnaces are constructed of iron tubes, one fitting inside the other. The outer one, being several inches larger in diameter than the



Arrangement of plant for the separation of White Metal from Gun Metal borings.

Under present conditions, the borings taken from the machines are shaken on a $\frac{1}{4}$ -inch mesh sieve and the coarse white metal separated from the gunmetal by liquation on an iron plate. The

inner one, is supported by means of brackets to the floor, and carries in the intervening space between the two tubes, a coil of iron pipe with suitable sized perforations for heating the walls of the inner

tube by gas. The inner tube revolves, and the hot borings and liquid white metal pass into revolving screens smaller in mesh than the last classifier, and the liquid white metal escapes through the screen into an outer surrounding vessel, heated by a gas coil. In this way the white metal does not cool but collects at the bottom and can be run into moulds.

The clean borings pass along the screen into a hand truck on wheels, and are taken to the foundry,

smelted, and utilised for ordinary gunmetal castings.

Each grade is treated separately. The finest grade in No. 3 bin, which is only a small percentage of the total, will probably have to be smelted, and the bulk of the antimony got rid of by oxidation.

The sketch on page 944 shows the arrangement of the scheme suggested for the treatment of the above class of material at the Railway Workshops.

Journal and Patent Literature.

PATENT SPECIFICATIONS may be obtained by post by remitting as follows:—

English.—6d. each, to the Comptroller of the Patent Office, Southampton Buildings, Chancery Lane, London, W.C.

United States.—1s. each, to the Secretary of the Society.

French.—1 fr. 05 c. each, as follows: Patents dated 1902 to 1907 inclusive, Belin et Cie., 56, Rue Ferou 8, Paris (6e.)

Patents from 1908 to date, L'Imprimerie Nationale, 87, Rue Vieille du Temple, Paris.

I.—GENERAL; PLANT; MACHINERY.

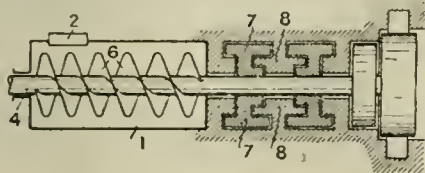
PATENTS.

Roller mills. Mühlenbauanstalt und Maschinenfabr. vorm. Gebr. Seck. and H. Krusemark, Dresden, Saxony. Eng. Pat. 2941, Feb. 4, 1914.

THE baffle for breaking up the grist as it leaves the rollers, and which has an edge for cleaning one roller, is adjustable by turning about the axis of the latter roller.—W. F. F.

Grinding or disintegrating machines. H. Kändler, Berlin-Friedenau, and B. Grünthal, née Regensburg, Kassel, Germany. Eng. Pat. 4304, Feb. 19, 1914.

THE material is fed through the hopper, 2, into the casing, 1, and is carried forward by the screw conveyor, 6, into the grinding chamber proper.



Undercut projecting blades, 7, mounted on the shaft, 4, interengage with undercut wall projections, 8, and provide long dividing lines or edges which ensure a thorough division of the material.

—W. H. C.

Grinding or breaking mills. J. Y. Johnson, London. From Gebr. Pfeiffer, Kaiserslautern, Germany. Eng. Pat. 4792, Feb. 24, 1914.

THE charging opening and the upper part of the grinding chamber are of polygonal cross-section, tapering downwards and merging into a circular cross-section at the base of the grinding chamber. In chambers of this shape the material is more efficiently acted upon by the grinding cone than in cylindrical chambers.—W. F. F.

Crushing, disintegration, or pulverisation of materials; Apparatus for the— G. S. Higginson and N. G. Bithrie, London. Eng. Pat. 14,894, June 23, 1914.

DETACHABLE discs with shaped teeth are fastened to the end wall of a casing and to a fly-wheel which is rotated within the casing, so that the

teeth interengage. Annular toothed members, attached to the central portion of the end wall and of the fly-wheel respectively, subject the material to a preliminary shearing and crushing action before it passes to the spaces between the toothed discs.—W. H. C.

Grinding or crushing machines. J. S. Fasting, Frederiksberg, Denmark. Eng. Pat. 18,432, Aug. 7, 1914. Under Int. Conv., Aug. 7, 1913.

A GRINDING member disposed obliquely within a rotary drum, is mounted at the free end of a pivoted shaft supported by a bearing, which is adjustable vertically so as to vary the minimum distance between the drum and grinding member.—W. F. F.

Grinding mill. F. Ansley, Spokane, Wash. U.S. Pats. (A) 1,147,067 and (B) 1,147,068, July 20, 1915. Dates of appl., Jan. 14 and Feb. 1, 1915.

(A) Two concentric drums are mounted on and rotated by a common axis. The ends of the annular space between the two drums, which forms the grinding chamber, are closed by plates. Arc-shaped slots are formed in the end plates, hollow rollers are mounted in the slots, with a certain amount of side play, and grinding rods, which pass longitudinally through the annular chamber, are loosely laid in the hollow rollers. (B) The grinding rods are loosely supported by plates, which slide in the slots.—W. H. C.

Classifying crushed material; Method and apparatus for— F. W. Huber, Los Angeles, Cal. U.S. Pat. 1,146,624, July 13, 1915. Date of appl., Dec. 23, 1914.

SEVERAL long, superposed, vertical chambers are connected by pipes of smaller cross section. A current of air is forced in at the bottom of the series and is withdrawn near the top, and the material to be treated is fed into the uppermost chamber at a point somewhat below the air outlet. The constrictions between the chambers produce eddies and variations in the speed of the air current and assist in sorting out the finer particles, which are discharged with the air.—W. H. C.

Furnaces and apparatus for transferring and utilising the heat of combustion. E. L. Pease, Hurworth Moor. Eng. Pat. 12,877, May 26, 1914.

HEAT is transferred from the inner face of a furnace wall of firebrick or the like, to the plates of gilled tubes embedded in the wall, and utilised for heating

air, generating steam, etc. The outer ends of the tubes may be exposed, or the outer face of the wall of the furnace may be backed by a heat insulating material. Applications to steam generators, heating stoves, and gas producers are described.

—W. F. F.

Furnaces: Reversing regenerative — L. L. Knox, Pittsburgh, Pa., U.S.A. Eng. Pat. 17,584, July 24, 1914. Under Int. Conv., Sept. 4, 1913.

A HOLLOW, Π -shaped cooling box, having narrow connecting channels below and through which water is circulated, surrounds the nose-piece of the gas port. A current of air is circulated around the cooling box and gas port.—W. H. C.

Kiln, J. C. Schaffer, Toledo, Ohio. U.S. Pat. 1,147,446, July 20, 1915. Date of appl., Apr. 29, 1912.

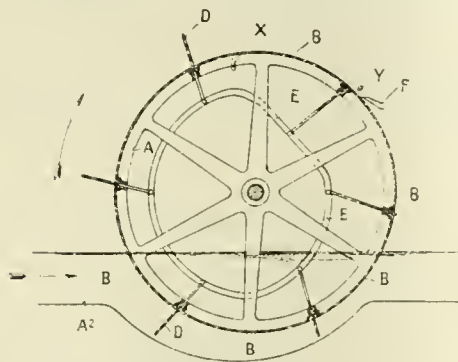
SEVERAL kilns are arranged in series, the first of the series being heated by down-draught gases, which are burned in the kiln, whilst the spent gases from the first kiln pass in succession through the series, alternately as up and down draught. When the firing of the first kiln is completed, it is cut out of the series and cooled, and the second kiln becomes the first and is fired. The third next becomes the first, and the first, after cooling, emptying, and recharging, becomes the last of the series.—W. H. C.

Waste heat in kilns: Means for utilising the — T. A. Edison, West Orange, N.J. U.S. Pat. 1,148,832, Aug. 3, 1915. Date of appl., Nov. 25, 1908.

THE waste gases are passed successively through two settling chambers, each of which has a stack provided with a damper. A steam generator is fixed in the second chamber and is provided with means for withdrawing continuously, at a constant rate, the steam generated by the heat of the waste gases.—W. H. C.

Straining liquids; Apparatus for — R. Mensing, Neustadt, Germany. Eng. Pat. 16,946, July 16, 1914. Under Int. Conv., July 24, 1913.

A ROTATING frame, A, carries a perforated drum, B, provided with flat or curved sliding sieve blades, D, which carry rollers working in fixed cam grooves,



E, so that the blades are withdrawn during one part of the revolution of the frame. The blades are thereby scraped and the material is removed from the drum by the scraper, F. Air or steam blasts may be provided at X and Y, for cleaning the perforated drum. The liquid passes through the trough, A², in a direction opposite to that of the rotation of the drum. In an alternative form the blades are carried on a movable endless perforated band, and are withdrawn and cleaned at one point in their travel in a similar way.—W. F. F.

Filtering apparatus, W. E. Holderman, Salt Lake City, Utah. U.S. Pat. 1,150,369, Aug. 17, 1915. Date of appl., June 26, 1913.

THE filtrate is withdrawn from a series of hollow filter-leaves in a tank, and an alternate series is simultaneously flushed by introducing liquid and reversing its flow. Valved outlets are provided for draining the tank.—W. F. F.

Dust: Protecting machinery against — Fortuna-Werke A. Hirth, Cannstatt-Stuttgart, Germany. Eng. Pat. 711, Jan. 16, 1915. Under Int. Conv., Jan. 19, 1914.

DELICATE parts of machinery, such as ball bearings and the like, are protected against dust by enclosing them in a chamber, into which compressed air is forced so as to create therein a higher pressure than exists in the external air. The compressed air may be mixed with a finely divided lubricating agent and caused to flow over the parts to be protected.—W. H. C.

Drying finely-divided material: Apparatus for — R. S. Kent, Brooklyn, N.Y. U.S. Pat. 1,146,265, July 13, 1915. Date of appl., May 9, 1913.

AN inclined rotary drum is provided with a casing at each end, and has also a furnace located within the receiving end from which heated gases are passed into a flue extending through the drum.—W. H. C.

Drying liquids: Method of — O. S. Sleeper, Assignor to Buffalo Foundry and Machine Co., Buffalo, N.Y. U.S. Pat. 1,146,965, July 20, 1915. Date of appl., Dec. 1, 1908.

THE liquid is fed continuously from a reservoir into a shallow trough into which the lower side of an internally heated drum dips. As the drum rotates it picks up a film of liquid, which is dried, and the dried material is stripped off by a scraper. Any excess of liquid delivered to the trough flows back to the reservoir. The whole of the apparatus is enclosed in a casing in which a vacuum is maintained.—W. H. C.

Desiccating; Process of — S. H. Bunnell, New Canaan, Conn., Assignor to The Griscom-Russell Co. U.S. Pat. 1,149,627, Aug. 10, 1915. Date of appl., June 9, 1914.

VAPOUR is withdrawn by suction from the material in a confined space partly filled with it, and the cooled and concentrated material is then transferred to a desiccating apparatus, where it is converted into a powdered product.—W. F. F.

Centrifugal separator, J. McL. Murphy, Habana, Cuba, Assignor to W. Wood, Philadelphia, Pa. U.S. Pat. 1,146,438, July 13, 1915. Date of appl., Aug. 14, 1912.

A PERFORATED, globular separating bowl, rotated by a vertical shaft within a casing, has an inner hemispherical concentric outlet bowl rotated with it. The material is fed into the bottom of the space between the two bowls by a central vertical screw conveyor, which passes through the inner bowl, and the treated material passes to the inner outlet bowl, from which it is removed by another screw conveyor concentric with the feed conveyor.—W. H. C.

Gases or fumes; Device for removing particles from — C. G. Collins, Wordmere, N.Y., Assignor to C. A. Stevens, New York. U.S. Pat. 1,148,501, Aug. 3, 1915. Date of appl., Dec. 6, 1913.

THE gas is passed through a casing divided into several communicating compartments. Receptacles containing filtering material are mounted in each compartment and receive a reciprocating motion from cams mounted on a shaft below the casing.—W. H. C.

Gases; Method of separating — H. L. Doherty, New York. U.S. Pat. 1,150,837, Aug. 17, 1915. Date of appl., Mar. 3, 1910.

A LIQUID solvent for one or more constituents of the gaseous mixture is atomised and injected upwards into a vertical chamber through which the previously cooled gases are passed in the same direction. The mixture issuing from the top of the chamber is cooled and conducted through a spiral passage, at a comparatively high velocity, to separate the liquid, and the residual gas is re-treated with fresh solvent as often as necessary. —W. E. F. P.

Kilns and furnaces; Lining for rotary — Dynamidon Ges. m. b. H., Mannheim-Walldorf, Germany. Eng. Pat. 11,824, May 13, 1914. Under Int. Conv., July 31, 1913.

SEE Fr. Pat. 472,033 of 1914; this J., 1915, 426.

Separation of finely divided solids from liquids; Apparatus for the — J. Van N. Dorr, Denver, Colo., U.S.A. Eng. Pat. 13,606, June 4, 1914. Under Int. Conv., June 5, 1913.

SEE U.S. Pat. 1,135,997 of 1915; this J., 1915, 602.

Steam generators adapted to be heated by means of liquid slag, incandescent coke, or the like. C. Semmler, Wiesbaden, Germany. Eng. Pat. 14,826, June 20, 1914.

SEE Addition of Dec. 4, 1913, to Fr. Pat. 463,298 of 1913; this J., 1914, 835.

Filtering process and apparatus therefor. J. von Kruszewski, Berlin-Friedenau, Germany. Eng. Pat. 17,503, July 23, 1914.

SEE Ger. Pat. 275,888 of 1913; this J., 1915, 130.

Filtering apparatus. C. G. Osgood, Tonopah, Nev., U.S.A. Eng. Pat. 21,221, Dec. 17, 1914.

SEE U.S. Pat. 1,128,495 of 1915; this J., 1915, 314.

Evaporator. O. Söderlund, Assignor to Techno-Chemical Laboratories, Ltd., London. U.S. Pat. 1,150,713, Aug. 17, 1915. Date of appl., Oct. 31, 1911.

SEE Eng. Pat. 12,462 of 1911; this J., 1912, 971.

II.A.—FUEL; GAS; MINERAL OILS AND WAXES.

Mineral oils; Exports of — from the United States. U.S. Dept. of Commerce. Oil, Paint, and Drug. Rep., Aug. 16, 1915.

THE exports of mineral oils from the principal customs districts of the United States, representing about 98 % of the total shipments, during the year ending June 30, 1915, were as follows:—

	Gallons.	Value, \$.
Crude oil	149,222,262	4,808,317
Illuminating oil	884,030,246	53,408,473
Lubricating and paraffin oil	213,323,222	2,011,973
Naphthas, gasoline, etc. ..	240,018,306	27,102,501
Residuum, gas oil, fuel oil, etc.	689,833,269	18,709,520
Total	2,176,427,305	\$132,040,784

The totals for the year ending June 30, 1914, were 2,269,218,073 gallons and \$150,879,856, respectively. Losses were shown in the values of crude and illuminating oils, and gains under the other headings.

Testing mineral oils for liability to stain fabrics. Gray. See V.

PATENTS.

Peat fuel and ammonia; Manufacture of — from crude peat. B. P. Halvorsen, Trondhjem, Norway. Eng. Pat. 17,882, July 28, 1914. Under Int. Conv., July 29, 1913.

PEAT is heated under pressure to 160°–300° C., together with small quantities of an acid such as hydrochloric, sulphuric, or sulphurous acid, or a salt of iron, calcium, magnesium, or the like, and ammonia is recovered from the expressed liquid by distilling in a column apparatus with lime or other base. —W. F. F.

Fuel for internal combustion engines and the like. H. Goldstein, Johannesburg, Transvaal. Eng. Pat. 21,316, Oct. 21, 1914.

A MIXTURE of 95 % alcohol 86 %; ether 10 %; wood spirit 1 %; benzol 3 %. —W. F. F.

Coke ovens; Collecting gas main for — C. Still, Recklinghausen, Germany. Eng. Pat. 14,243, June 13, 1914.

To obtain uniform pressure in a series of coke ovens when discharging by suction, the gas is withdrawn through an auxiliary gas main by the side of the principal main, and connected with it by openings which increase in size with their distance from the point of withdrawal. —W. F. F.

Coke-ovens; Method of heating — H. L. Doherty, New York. U.S. Pat. 1,150,840, Aug. 17, 1915. Date of appl., Jan. 17, 1911; renewed Feb. 18, 1915.

THE products of combustion from the heating flues of the oven are divided into three streams. The first is utilised for preheating air under pressure, a part of which is mixed with the second stream and passed downwards through the fuel bed of the gas-producer. The gas is withdrawn from the latter at a point above the ash zone, into which a regulated quantity of air is introduced simultaneously from below to consume the residual carbon. The downward and upward streams of gas from the producer are united, and the mixture passed through a recuperator heated by the third stream of combustion products and thence to the combustion flues of the coke-oven, into which the remainder of the preheated air is also discharged. On issuing from the recuperator, the third stream of combustion products is mixed with the first stream at a point in the air recuperator where their temperatures are approximately equal.

—W. E. F. P.

Heat recuperation; Method of — H. L. Doherty, New York. U.S. Pat. 1,150,838, Aug. 17, 1915. Date of appl., Jan. 17, 1911.

THE products of combustion from a furnace fired with producer gas are divided into three streams, the first of which is mixed with a minimum quantity of air and passed through the fuel bed of the producer, the second utilised to preheat the producer gas, and the third to preheat the air for combustion. The second and third streams are subsequently mixed at a point in the air recuperator where their temperatures are approximately equal. —W. E. F. P.

Gaseous fuel; Method of regulating combustion of — H. L. Doherty, New York. U.S. Pat. 1,150,842, Aug. 17, 1915. Date of appl., May 15, 1911; renewed Feb. 18, 1915.

To secure uniform heating in a gas-fired furnace chamber, the air for combustion is mixed with a portion of the waste gases, and the mixture preheated by the remainder of the latter, before being

introduced into the chamber with the gaseous fuel. The proportion of waste gases employed is such as to cause the fuel to burn with a flame sufficiently large to fill the chamber.—W. E. F. P.

Retorts for carbonisation of coal or the like. A. McD. Duckham, Ashted, Surrey. Eng. Pat. 13,935, June 9, 1914.

THE retorts, made of steel or iron plate, are considerably wider than they are deep, and have their sides vertical and the top and bottom arched to the same curvature. The retorts are arranged alternately with heating flues in a vertical column, built of channel iron bars which constitute the sides of the retorts and flues, and of arched plates held at the edges between the bars to constitute the tops and bottoms of the retorts and flues.

—W. G. C.

[Gas] *retort furnace. Retort furnace construction.* H. A. Carpenter, Sewickley, Pa., Assignor to Riter-Conley Manufacturing Co., Pittsburgh, Pa. U.S. Pats. (A) 1,150,807, (B) 1,150,808, (C) 1,150,809, and (D) 1,150,810, Aug. 17, 1915. Dates of appl., (A) and (B), July 3, 1913, (C) Apr. 7, 1914, (D) Sept. 2, 1914.

(A). THE products of combustion circulate through non-communicating flat chambers at right angles to the retorts. The distance between the centre lines of adjacent dividing walls is less than one foot, and the thickness of each wall is not less than that of a chamber. (B). A series of retort chambers is formed of flanged blocks fitting with one another, the flanges bridging the spaces between the parallel walls formed by the blocks. (C) Retorts, arranged in parallel series of vertical tiers, have their side walls formed of blocks of appropriate shape, arranged in columns and bridged by other blocks forming arches. The blocks are fitted to form flues for combustion products. (D). A retort structure as in (C) is assembled in such a way as to provide vertical expansion spaces, one of which intersects the retorts and combustion flues.

—W. F. F.

Gas manufacture: Condensers or coolers for use in —. W. B. Climie, jun., and W. Lees, Glasgow. Eng. Pat. 4264 of 1915, date of appl., Sept. 19, 1914.

THE cooler consists of a series of vertical pipes, arranged in pairs with connecting pipes at their upper ends, and their lower ends open and dipping into a liquor receptacle. The pipes are connected near their lower ends by an opening in the side of each pipe, facing its neighbour, and a cover plate which connects the two pipes. The pipes are formed preferably by folding a channel-shaped bar on itself, and covering the meeting edges with side plates to form a gas-tight joint. The liquor receptacle has sloping sides and is fitted with a conveyor band to discharge the deposits.—W. G. C.

Gas producer. W. O. Amsler, Pittsburgh, Pa. U.S. Pat. 1,149,611, Aug. 10, 1915. Date of appl., Oct. 3, 1911.

THE grate of the producer is caused to revolve and also to move vertically, by means of a waved rack, a waved bearing member, and a wheel having gear engaging with the rack and also with the bearing member.—W. G. C.

Fuel for gas-producers: Prepared —. H. L. Doherty, New York. U.S. Pat. 1,150,839, Aug. 17, 1915. Date of appl., Jan. 17, 1911.

COAL is mixed with limestone or lime, iron compounds, and silica in such proportions as to form, on combustion of the coal, a silicate fusible below 2600° F. (about 1430° C.).—W. E. F. P.

Gases derived from the carbonisation of fuel; Process for separating tar and ammonia from —. C. Otto und Co., Bochum, Germany. Eng. Pat. 12,818, May 25, 1914. Under Int. Conv., June 28, 1913.

THE crude gases are washed in one or more washers with cold water flowing in the opposite direction. A portion of the washing water is withdrawn from the middle of the washer, where it has the highest possible content of ammonia. The hot washing water flowing from the end of the washer is freed from tar, enriched in fixed ammonia compounds by evaporating part of the water, and returned to the washer, thus making the process continuous.—W. G. C.

Fuel oil: Process for the production of —. E. Höppermann, Cologne, Germany. Eng. Pat. 2515, Jan. 30, 1914. Under Int. Conv., Jan. 30, 1913.

THREE mixtures are formed: (1) Purified petroleum (distilling from crude petroleum at 150°–270° C.), 3.5 litres, benzine (distilling at 65°–110° C.), 0.5 litre, and ligroin (distilling at 110°–150° C.), 0.25 litre; this is allowed to stand for one day. (2) Alcohol, 0.1 litre, ligroin, 0.1 litre, sulphuric ether, 40 drops. (3) 96% spirit, 0.2 litre, ligroin, 0.1 litre, petroleum ether (distilling from crude petroleum up to 65° C.), 25 drops. The second and third are mixed and the first added.—W. F. F.

Low-boiling hydrocarbons (benzine substitutes): Obtaining — from bituminous coal. H. Plauson and P. Schröder, Hamburg, Germany. Eng. Pat. 4340, Feb. 19, 1914.

Brown coal or lignite is mixed with an equal amount of crude naphtha, and finely ground in a drum mill. From 3 to 5% of an alkali or alkaline-earth nitrate is added, and the mixture sprayed into a distillation chamber into which a mixture of air and steam at 600°–700° C. also passes. The portion distilling at 80°–150° C. may be used as a benzine substitute, and that distilling at 150°–200° C. as a turpentine substitute, while heavy oils distilling above 200° C. may be treated again.

—W. F. F.

Light oils; Production of — from carbonaceous substances. A. Rollason, Long Eaton. Eng. Pat. 18,490, Aug. 10, 1914.

TO produce light oils of sp. gr. from 0.90 to 0.98, from coal, cannel, coal shale, and crude oils, 4–6% of limestone is added to the material, the amount depending on the density of oil required. The mixture is distilled at 175°–400° C. The furnace setting has a large heat capacity, so that the charge is heated during the period when water vapour and hydrocarbons are formed. The water vapour prevents the decomposition of the hydrocarbons when in the retort. (See also Eng. Pat. 19,697 of 1913; this J., 1914, 345.)—W. F. F.

Hydrocarbon products from gas; Apparatus for recovering —. A. E. Roberts, San Francisco. U.S. Pat. 1,150,454, Aug. 17, 1915. Date of appl., Feb. 25, 1911.

THE gas is delivered at suitable pressure to a cooler connected with a series of expansion and condensing traps, into which the gas is admitted at different temperatures and pressures to precipitate various grades of oil.—W. G. C.

Coking coal briquettes; Method and apparatus for —. B. Gratz, Berlin. Eng. Pat. 12,153, May 16, 1914. Under Int. Conv., Jan. 26, 1914.

SEE FR. Pat. 472,402 of 1914; this J., 1915, 413.

Coal briquettes; Manufacture of —. H. J. Phillips, London, and A. Phillips, Tredegar, Assignors to Pure Coal Briquettes, Ltd., Cardiff. U.S. Pat. 1,149,536, Aug. 10, 1915. Date of appl., Jan. 31, 1914.

SEE Eng. Pat. 29,009 of 1913; this J., 1915, 70.

Gas producers; Method of operating — with withdrawal of the slag in a liquid state, and apparatus therefor. H. Koppers, Essen-Ruhr, Germany. Eng. Pat. 17,678, July 25, 1914.

SEE U.S. Pat. 1,146,627 of 1915; this J., 1915, 896.

Tar separators. Berlin-Anhaltische Maschinenbau-A.-G., Dessau, Germany. Eng. Pat. 16,981, July 17, 1914. Under Int. Conv., Sept. 5, 1913.

SEE Ger. Pat. 282,279 of 1913; this J., 1915, 650.

Hydrocarbons; Process of treating liquid — for the production of hydrocarbons of lower boiling points. H. Wade, London. From Standard Oil Co., Whiting, Ind., U.S.A. Eng. Pat. 21,273, Oct. 20, 1914.

SEE U.S. Pat. 1,122,003 of 1914; this J., 1915, 132.

Petroleum distillation for the production of low-boiling-point hydrocarbons. E. M. Clark, Alton, Ill., U.S.A. Eng. Pat. 1424, Jan. 28, 1915. Under Int. Conv., Apr. 20, 1914.

SEE U.S. Pat. 1,119,496 of 1914; this J., 1915, 20.

Apparatus for detecting the presence of injurious gases in mines. Eng. Pat. 11,721. See XXIII.

[Gas] calorimeter. U.S. Pat. 1,150,836. See XXIII.

IIb.—DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Wood pitch and tar in Russia; Production of —. U.S. Comm. Rept. No. 191, Aug. 16, 1915.

THE production of wood pitch and tar is a highly important industry of the timber districts of Russia. England alone takes over 100,000 barrels yearly of Russian pitch and tar. In normal times pitch is exported chiefly to England from Archangel, where it is one of the principal articles of trade, while turpentine has been shipped to Germany from the Baltic ports and overland. In recent years in western Russia, especially near the Vistula River, large quantities of pitch and turpentine have been distilled from the stumps left after the clearance of woods, this having been in great demand in Germany on account of its good quality and low price. It has been estimated that the Russian forests produce yearly about 124,000,000 lb. of pure pitch, 62,000,000 lb. of tar, 5,400,000 lb. of resin, and 2,160,000 lb. of turpentine. Up to the present time the methods employed in this industry have been, for the most part, of a primitive character, and carried on in small establishments. Pine wood is almost the only material used, the most resinous parts being the stump and roots. The stumps are allowed to remain 10 or 20 years in the ground before removal, the best parts of the tree being the long vertical roots. In making tar, the method of distillation ordinarily in vogue requires the digging of pits from 10 to 60 feet in diameter, similar to those made for burning charcoal. They are usually dug on the slopes of river banks. About 20 to 30 feet from the pit an excavation is made in the form of a ditch, the bottom of which is on a lower level than that of the pit. From this excavation a sloping trough is pushed into the centre of the pit, a hole being made in the middle of the latter

leading straight into the trough, and in this manner a funnel is made through which the product flows into pails. There is a tendency, however, for improved methods to be adopted. There is a large production of what is called "polovinchik" (half-pitch), which is used as a dressing for leather, this being the result of distillation of tar mixed with some birch or aspen bark.

PATENTS.

Carbonaceous material; Process and apparatus for the distillation of —. H. G. Hills, Manchester, and R. W. Thom, Southport. Eng. Pat. 18,576, Aug. 12, 1914.

POWDERED coal without agglutinants is carried on a tray, divided into a large number of compartments, and passed successively through a vacuum chamber and three distillation chambers at different temperatures, the highest being approximately that at which tar is formed. The plastic mass passes into a cooling chamber, where it is pressed into briquettes of smokeless fuel by the top of the chamber, which is provided with dies corresponding to the tray compartments. (See also Eng. Pat. 3284 of 1913; this J., 1914, 245.) —W. F. F.

[Destructive] distillation [of wood]; Process of —. T. W. Pritchard, Wilmington, N.C., U.S.A. Eng. Pat. 20,867, Oct. 12, 1914.

To obtain uniform heating of the material, a fan in a conduit, outside the distillation chamber, withdraws some of the distillation vapours from the bottom of the chamber at one end, and returns them to the top of the chamber at the other end. The vapours circulate through the charge of material by the aid of suitable baffles. The chamber is filled with an inert gas before distillation, and the charge is kept stationary throughout. —W. F. F.

Gases from carbonaceous material [peat]; Method of carrying and condensing volatile —. J. R. H. and W. L. St. J. Prioleau, London. Eng. Pat. 23,165, Nov. 27, 1914.

THE gases, from different points in the retort, are drawn off into a series of separate or coupled condensers by means of ejectors which have one or more nozzles, and are operated by a stream of non-condensable gas forced through under pressure by a pump. The condensable portion of the gases is recovered, and the non-condensable portion is used again for operating the ejectors. —W. G. C.

Incandescence electric lamps. C. Gladitz, London. Eng. Pat. 13,511, June 3, 1914.

A CLOSE-COILED tungsten filament is coated with a paste composed of thorium and cerium oxides mixed with sodium silicate, and the bulb is filled with hydrogen or nitrogen. —B. N.

Pyroligneous acid; Process of producing —. E. H. French, Smethport, Pa. U.S. Pat. 1,150,589, Aug. 17, 1915. Date of appl., Sept. 5, 1911. Renewed Dec. 23, 1914.

SEE Ger. Pat. 249,333 of 1911; this J., 1912, 914.

Manufacture of [tungsten] wire. Eng. Pat. 12,358. See X.

Rendering tungsten ductile. Eng. Pat. 14,381. See X.

Manufacture of pure ductile tungsten. Eng. Pat. 23,496. See X.

Ductile filament. U.S. Pat. 1,149,701. See X.

III.—TAR AND TAR PRODUCTS.

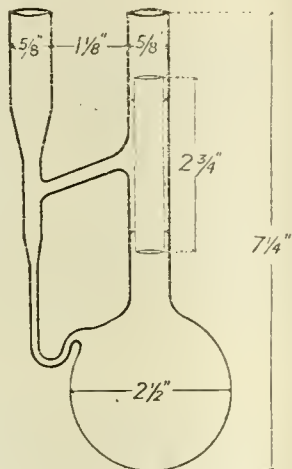
Toluene in commercial toluols; Determination of
—, D. Northall-Laurie. Analyst, 1915, 40,
384—389.

Two hundred c.c. of the sample, measured at tap-water temperature, is placed in a distillation flask of just sufficient capacity, with the neck cut off just above the side tube. The contents are distilled at the uniform rate of 7 c.c. per minute through an efficient condenser into a 50 c.c. cylinder. When 50 c.c. has been collected, the cylinder is quickly changed for a 100 c.c. cylinder and, when 98.5 c.c. of distillate has been collected, the burner is removed and the contents of the flask allowed to cool; by the time that all drops from the condenser have ceased, 100 c.c. of distillate will have collected. Should the first 50 c.c. be turbid from the presence of water, it is shaken with a pellet of calcium chloride. The contents of the distillation flask are now cooled under the tap and transferred to a boiling point apparatus (see fig.). In the neck of the flask is placed a thin glass cylinder with a hole in the side, corresponding with the outlet in the neck of the flask and sealed to its sides; this glass screen protects the bulb of the thermometer from draughts. The apparatus is connected with a reflux condenser, and the liquid is boiled at such a rate that the condensed, liquid runs back at the uniform rate of 1 drop per second. The observed boiling point is corrected for atmospheric pressure and length of the exposed mercury thread of the thermometer. The b.pt. of the first 50 c.c. of distillate is then determined in the same way. On reference to a table or graph, constructed from results obtained with known mixtures of benzene, toluene, and xylene, the quantity of toluene present is read off. A graph is given in the original, on which the percentages of toluene and benzene present can be read off directly; the difference between the sum of these percentages and 100 represents the quantity of xylene. The method will give results with an accuracy within 0.1% and is applicable to all possible combinations of toluene with benzene and xylene when the sample contains from 50 to 100% of toluene. In the case of samples containing less than 50% of toluene, a known quantity of pure toluene should be added so as to bring the results on the graph given. Any paraffin present in the sample would appear in the analysis as toluene, but a correction may be made for its quantity by taking the sp. gr. of the fractions distilling between 107° and 115° C.: every unit in the third place in the sp. gr. less than the sp. gr. of toluene (0.870) will represent 0.66% of paraffin in the quantity of toluene found. Carbon bisulphide may be present in samples containing less than 60% of toluene, and must be removed previously by treatment with alcoholic potassium hydroxide solution.

—W. P. S.

Nitration of benzene and some of its derivatives; Velocity of —, J. P. Wibaut. Rec. Trav. Chim. Pays-Bas, 1915, 34, 241—258.

NITRATION was effected with a 0.75 N solution of



nitric acid in acetic anhydride, the benzene or other compound being used in the form of a 0.5 N solution in acetic anhydride. The velocity constant, k , was calculated from the bimolecular equation $k = 2.302/t(c_0 - c'_0) \times \log c'_0 c / c_0 c'$, c_0 and c'_0 being the respective initial concentrations (gram-mols. per litre) of nitric acid and of the substance being nitrated, c and c' the corresponding concentrations at the end of t minutes, and the factor 2.302 being the reciprocal of the base of Napierian logarithms. The values of k found were for benzene (25° C.), 0.0025; chlorobenzene (25° C.), 0.0020; bromobenzene (25° C.), 0.0013; toluene (0° C.), 0.0080. Referring to the ratios deduced by Holleman (this J., 1915, 788) from the results of experiments on the nitration of disubstituted benzenes, the author points out that there is no direct relationship between the figures thus obtained and those obtained by the nitration of mono-substituted benzenes; for example, according to Holleman's figures chlorobenzene should nitrate $1\frac{1}{2}$ times more readily than toluene, whereas according to the author's results the speed of the latter reaction is very much greater than that of the former. The results are discussed from the point of view of the general problem of substitution in the benzene series.—E. W. L.

Acetylene; Syntheses with the aid of —, A. E. Tschitschibabin. J. Russ. Phys. Chem. Soc., 1915, 47, 703—713. J. Chem. Soc., 1915, 138, i., 638.

THE reactions undergone by acetylene when heated in presence of different catalysts consist of three principal processes: (1) Local decomposition of the acetylene into carbon and hydrogen, accompanied by polymerisation into aromatic hydrocarbons; (2) condensation to solid hydrocarbons, similar to cuprene; (3) hydrogenation of acetylene and aromatic hydrocarbons with formation of hydrocarbons of the paraffin, olefine, and cyclic series. Acetylene and ammonia, when passed over alumina, ferric oxide, or chromic oxide heated at slightly above 300° C., react, giving principally pyridine bases. These consist mainly of α - and γ -picolines in almost equal proportions, together with 2-methyl-3-ethylpyridine. Pyrrole, secondary piperidine bases, neutral compounds, and hydrogen are also formed; the proportion of pyrrole is lower with alumina than with ferric oxide as catalyst. Similar mixtures are obtained when the catalyst consists of an oxide of a quadrivalent element, such as titanium, thorium, or silicon, or of various salts of trivalent metals, such as aluminium phosphate, kaolin, etc., but the latter require somewhat higher temperatures. Ethylene also yields pyridine bases under the above conditions, but here, also, higher temperatures are necessary, and it is probable that the reactions are preceded by decomposition of the ethylene, with formation of acetylene. The condensation of acetylene with ammonia by heated alumina sometimes yields acetaldehyde-ammonia, and the conclusion is drawn that the first phase of the reaction consists of the combination of acetylene and water with formation of acetaldehyde, which then takes part in the condensation, the water thus liberated uniting again with acetylene, and so on. Thus, the traces of water which cannot be excluded play the part of a catalyst. Acetaldehyde-ammonia is the principal product obtained when moist acetylene and ammonia are passed through a heated tube charged with oxides of the heavy metals of the type RO, such as ferrous, zinc, or nickel oxide; under the same conditions, moist acetylene alone gives a liquid product containing, besides compounds of high boiling point, acetaldehyde and crotonaldehyde. When ammonia and an aldehyde are passed together over alumina heated at above

300° C., they yield all those pyridine bases which have been obtained from the reagents under other conditions, and exhibit also a new type of condensation, resulting in the formation of homologues of pyridine with the side-chain in the 4-position; thus, ammonia, acetaldehyde, and benzaldehyde give 2- and 4-phenylpyridines. Doebner and Miller's reaction between acetaldehyde and aniline yields 2-methylquinoline, together with a small proportion of 4-methylquinoline, and acetylene and aniline vapour, when passed over alumina at 360°—420° C., give, together with other products, indole and homologues of quinoline, 4-methylquinoline and not 2-methylquinoline being formed in predominating proportion. When passed over heated alumina, a mixture of acetylene with either hydrogen sulphide or sulphur vapour condenses to form thiophen at comparatively low temperatures, but the reaction proceeds rapidly only at temperatures rather higher than those employed by Steinkopf and Kirchhoff (Ger. Pat. 252,375; this J., 1912, 1201) for the action of acetylene on pyrites. The thiophen is accompanied by small proportions of higher homologues, such as ethylthiophen. This method is even more satisfactory than that of Steinkopf and Kirchhoff for the preparation of thiophen on a large scale, since it yields a purer product and is not accompanied by appreciable charring of the acetylene. Furan may be similarly obtained by passing acetylene and water-vapour over alumina heated at 400°—125° C. Dry acetylene, in presence of alumina at 400° C., gives a mixture of unsaturated and aromatic hydrocarbons, benzene constituting less than 10% of the liquid product.

Pyridine bases; Sulphonation of —. H. Meyer and W. Ritter. *Monatsh. Chem.*, 1914, 35, 765—774. *J. Chem. Soc.*, 1915, 108, i., 715—716.

THE sulphonation of pyridine may be readily accomplished by boiling with sulphuric acid in the presence of vanadyl sulphate. If the pyridine is impure, poor yields are obtained. Prolonged heating also diminishes the yield, part of the sulphonic acid being completely destroyed by the vanadyl sulphate and part reconverted into pyridine. Weidel and Murrmann (*Monatsh.*, 1895, 16, 749), who investigated the influence of various metallic sulphates on the sulphonation of pyridine, found that, after heating for sixty hours, aluminium sulphate gave an increased yield of the sulphonic acid, whilst ferric sulphate considerably diminished the yield; zinc, ammonium, magnesium, chromium, and the alkali sulphates were without action. By reducing the period of heating the authors show that, with the exception of ferric sulphate, none of these metallic salts exercises a catalytic action on the formation of the sulphonic acid, the increased yield, in the case of aluminium sulphate, being due to the fact that this salt exerts no decomposing effect on the sulphonic acid formed in the reaction. Ferric sulphate, on the other hand, acts as a catalyst during the sulphonation, but at the same time decomposes the sulphonic acid, the latter effect becoming more pronounced when the period of heating is prolonged. *α*-Picolinesulphonic acid, prepared by sulphonating picoline in the presence of vanadyl sulphate and purified by means of its ammonium and barium salts, forms colourless crystals.

Pyrogallol; An oxidation product of —. M. Nierenstein. *Chem. Soc. Trans.*, 1915, 107, 1217—1220.

WHEN a current of air is passed for about two to three hours through a 10% solution of pyrogallol in potassium hydroxide solution, and the solution is acidified, extracted with ether, and the evaporation residue from the ether solution dissolved in alcohol and treated with chloroform, a substance,

"pyrogallol-black," is obtained from which carbon tetrachloride extracts 2,3,2',3',2'',3''-hexahydroxytriphenylquinone, which forms small yellow needles, m.pt. 274°—275° C. with decomposition. This on reduction with acetic anhydride and zinc dust yields the corresponding 2,3,2',3',4',2'',3'',4''-octahydroxy-1,1-diphenylbenzene, crystallising from water in needles resembling pyrogallol and containing one mol. of water, m.pt. 329°—333° C. with decomposition. The anhydrous substance melts and decomposes at a lower temperature. It absorbs oxygen in alkaline solution and on oxidation yields a red product resembling purpurogallin in every respect. Its octa-acetyl derivative crystallises from alcohol in long needles, m.pt. 262°—264° C. The quinone gives a pure green and the reduction product a pure blue coloration with ferric chloride.—T. C.

Nitrophenols; Solubility of — and other isomeric disubstitution products of benzene. N. V. Sidgwick, W. J. Spurrell, and T. E. Davies. *Chem. Soc. Trans.*, 1915, 107, 1202—1213.

A DETERMINATION of the solubility curves of the three isomeric cresols and of the three isomeric toluic acids indicates that a difference in orientation among the di-derivatives of benzene does not produce any marked change in the solubility of the substance in the liquid state. Although the melting points and the solid-liquid curves may differ to any extent, the liquid-liquid curves remain similar. In the case of the three nitrophenols the *meta*- and *para*-compounds follow this general rule, but the *ortho*-compound exhibits a wide deviation, from which the conclusion is drawn that *o*-nitrophenol is structurally different from its *m*- and *p*-isomerides.—T. C.

p-Chloro- and *p*-bromo-*m*-cresol. I. R. von Walther and W. Zipper. *J. prakt. Chem.*, 1915, 91, 364—414. (Compare this J., 1906, 555.)

p-CHLORO-*m*-CRESOL is superior as a disinfectant to all other analogous phenol derivatives, and is used in conjunction with sodium or potassium ricinoleate or other such substance added to increase its solubility. It is only slightly poisonous to higher organisms. It is best prepared according to Raschig's method (Ger. Pat. 232,071; this J., 1911, 483) by the action of sulphuryl chloride on cresol. Direct chlorination of *m*-cresol led to the formation of 2,4,6-trichloro-*m*-cresol, m.pt. 45° C., and to chlorotoluquinones and quinonedichlorides. Bromination of *m*-cresol, on the other hand, gave an 83% yield of *p*-bromo-*m*-cresol, m.pt. 62° C., and bromination of *p*-chloro-*m*-cresol gave the 4-bromo- and 2,4-dibromo-derivatives. The 4-carboxylic acid of *p*-chloro-*m*-cresol, *p*-chloro-*m*-cresotic acid, was obtained from the phenol by Kolbe's reaction, the anhydrous sodium salt being heated at 160°—175° C. with carbon dioxide under pressure. After crystallisation from chloroform the free acid forms white leafy crystals, m.pt. 206°—207° C., readily soluble in hot water or alcohol. It is volatile in steam and gives a bluer reaction with ferric chloride than does salicylic acid. *p*-Chloro-*m*-cresotic acid was also obtained by chlorination of *m*-cresotic acid in carbon tetrachloride or chloroform. A large number of esters, ethers, salts, and other derivatives of this acid, including compounds with hexamethylenetetramine, antipyrine, quinine, and cinchonine, were prepared. A number of salols prepared from the acid had similar saponification curves to those of ordinary salol. Acetyl-*p*-chloro-*m*-cresotic acid is an almost tasteless crystalline substance, m.pt. 146° C. It decomposes on boiling with water. The acid chloride of *p*-chloro-*m*-cresotic acid was obtained in long needles, m.pt. 48° C., by the action of thionyl chloride on the acid. It forms the usual derivatives, and a phenetide,

$C_6H_2Cl(CH_3)(OH).CO.NH.C_6H_4.OC_2H_5$, is also described, crystallising in white leaflets, m.pt. $215^\circ C$. 4-Nitro- and 2,4-dinitro-*p*-chloro-*m*-cresol were obtained by nitration of the chlorocresol in acetic acid solution with dilute nitric acid.

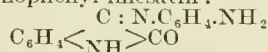
—G. F. M.

Phenolketones: New synthesis of —. K. Hoesch. Ber., 1915, 48, 1122—1133.

PHENOLALDEHYDES have been prepared by Gattermann by the combined action of hydrocyanic and hydrochloric acids on phenols, the aldimide salts formed being readily saponified to aldehydes. The method has been extended to phloroglucinol, and to the use of nitriles in addition to hydrocyanic acid, ketones being obtained *via* the ketimide hydrochlorides, $C_6H_5.CR:NH.HCl$. Using acetoneitrile, resorcinol, orcinol, and phloroglucinol gave 2,4-resacetophenone, 2,5-oracetophenone, and phloracetophenone respectively, the last-named being obtained in absence of the zinc chloride usually employed as condensing agent. The general method of preparation is to mix equimolecular amounts of the phenol and the nitrile in ethereal solution, add powdered zinc chloride, and pass well dried hydrogen chloride into the mixture for several hours; an oil separates, and the solvent gradually evaporates. The residue is treated with ice-cold water, the mixture extracted with ether, and after neutralising with ammonia the solution is boiled for 15–30 mins. to obtain the ketone. Benzoresorcinol and the previously unknown compounds, benzo-orcinol (m.pt. $141^\circ C$.) and benzophloroglucinol (m.pt. $165^\circ C$.) have been prepared in this manner, the last-named being prepared *via* the ketimide sulphate.—F. W. A.

*Isatin [; Reaction of — with *p*-phenylenediamine]*. A. Binz and R. Hueter. Ber., 1915, 48, 1038—1041.

THE action of isatin on *p*-phenylenediamine first gives *p*-aminophenyl-imesatin:



If an excess of isatin be used, two mols. of the above substance condense with one mol. of isatin to give di-*(p*-aminophenyl-imesatyl)-imesatin: $[(C_6H_5ON).C:N.C_6H_4.NH]_2C(C_6H_5ON)$ which was incorrectly considered by Möhlau and Litch (J. prakt. Chem., 1906, 73, 471) to be *p*-aminophenyl-imesatin.—F. W. A.

Sulphones from Rongalite. A. Binz, O. Limpach, and W. Janssen. Ber., 1915, 48, 1069—1077.

THE behaviour of formaldehyde-sodium sulphoxylate, $CH_2(OH).OSONa.2H_2O$ (Rongalite) and of formaldehyde-sodium sulphite, $CH_2(OH).O.SO_2Na.H_2O$, towards hydrochlorides of amines is very different; the former gives sulphoxyl derivatives of strong reducing properties, whereas the latter gives a product which no longer has reducing properties. The formula previously assigned to the sulphone obtained from dimethylaniline hydrochloride by mixing with Rongalite and formaldehyde in aqueous solution (Binz and Isaac; this J., 1908, 1108) is incorrect; the product contains two dimethylaminobenzyl groups: $[(CH_3)_2N.C_6H_4.CH_2]_2SO_2$. Aniline gives a sulphone $(C_6H_5.NH.CH_2)_2SO_2$, which in presence of hydrochloric acid passes into the sulphone $(H_2N.C_6H_4.CH_2)_2SO_2$ by a change similar to the formation of benzidine. Tetramethyl-*pp'*-diaminodibenzylsulphone behaves similarly to tetramethyl-*pp'*-diaminodiphenylethane in not giving dyestuffs as obtained from tetramethyl-*pp'*-diaminodiphenylmethane; on treatment with amines or phenols, this sulphone liberates sulphur dioxide and diphenylmethane, phenyl-naphthylmethane, and analogous derivatives are obtained,

e.g., with a naphthol in cumene solution, $R_2N.C_6H_4.CH_2.C_{10}H_7OH$ is obtained.—F. W. A.

Mixtures of nitro-explosives and nitration of toluene. Guia. See XXII.

PATENTS.

4-Halogen-1-[hydr]oxyanthraquinone; *Manufacture of — and substitution products thereof*. F. Ullmann, Berlin. Eng. Pat. 14,954, June 23, 1914. Under Int. Conv., Nov. 20, 1913.

PTHALIC anhydride or a substitution product is condensed with a 4-halogenphenol or a substitution product by means of aluminium chloride, and the 5-halogen-2-hydroxybenzoylbenzoic acid or substitution product is converted into the corresponding anthraquinone derivative by a condensing agent, such as sulphuric acid monohydrate.—F. W. A.

Arylsulphaminoanthraquinone-sulphonic and -carboxylic acids; *Method of producing —*. Act.-Ges. f. Anilinfabr., Berlin. Eng. Pat. 8109, June 1, 1915. Under Int. Conv., June 2, 1914.

HALOGEN-ANTHRAQUINONE-SULPHONIC and -carboxylic acids condense readily at $100^\circ C$. with arylsulphamides in aqueous alkali solution, giving the sparingly soluble, pure arylsulphaminoanthraquinone-sulphonic and -carboxylic acids, which are valuable intermediate products for the manufacture of dyestuffs.—F. W. A.

Anthraquinone; *Manufacture of —*. A. G. Bloxam, London. From Chem. Fabr. Griesheim-Elektron, Frankfurt, Germany. Eng. Pat. 12,053, May 15, 1914.

SEE U.S. Pat. 1,119,546 of 1914; this J., 1915, 22.

Sulphonic acids of aromatic aminothiazoles. J. Huisman, Cologne, Germany. Assignor to Synthetic Patents Co., New York. U.S. Pat. 1,149,582, Aug. 10, 1915. Date of appl., June 2, 1914.

SEE Ger. Pat. 281,048 of 1913; this J., 1915, 545.

Manufacture of soluble condensation products of sulphonic acids of aromatic hydrocarbons [tanning agents]. Eng. Pat. 17,172. See XV.

IV.—COLOURING MATTERS AND DYES.

Indigo in Bihar: First and second reports on the improvement of —. A. and G. L. C. Howard. Bull. Nos. 51 and 54. 1915, Agric. Research Inst., Pusa.

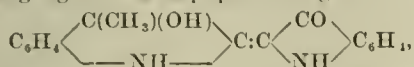
THE wilting of the Java indigo plant is due to long-continued wetness of the soil, and may be checked if the plants are pruned at the first cut. After the second cut in an ordinary monsoon, indigo ceases to be profitable. The growth of indigo for leaf and for seed should be carried out separately; seed should not be raised from old plants which have been cut for leaf. The best conditions for obtaining seed, improving yield by suitable drainage and manuring, etc., are discussed. In the second report indirect improvements are suggested, such as the production of more valuable cover crops for Java indigo, and the better utilisation of *seeth* (plant residues from the extraction process) as a manure for tobacco.

—F. W. A.

Indigoid dyes: Leuco-derivatives of — and their etherification. M. Tschilikin. J. Russ. Phys. Chem. Soc., 1915, 47, 539—552. J. Chem. Soc., 1915, 108, i., 722—723.

INDIGOTIN and other indigoid dyes are characterised by the presence of an indophoric grouping,

which determines their principal chemical properties. One of the fundamental reactions consists in the formation, on reduction, of two isomeric leuco-derivatives; etherification of these gives only derivatives of the keto-form, that is, quinols and not true ethers. A number of these derivatives have been prepared, the reaction being carried out on the water-bath in an atmosphere of hydrogen, sodium hydrosulphite being used as reducing agent. Methylquinolindigotin.



prepared by the action of methyl sulphate on leuco-indigotin, forms crystals which appear almost black by reflected light, but are nearly transparent, m.pt. about 209° C.; it begins to decompose at 235° C. and yields an olive-green coloration with concentrated sulphuric acid. The corresponding ethyl derivative, $\text{C}_{13}\text{H}_{16}\text{O}_2\text{N}_2$, m.pt. about 216° C. (decomp.), forms a bright yellow zinc salt, and the amyl derivative, $\text{C}_{21}\text{H}_{28}\text{O}_2\text{N}_2$, m.pt. 160°—162° C., gives a red solution in methyl alcohol, and a greenish-blue solution in sulphuric acid. "Leucothioindigo" yields a benzyl derivative, which forms a red, microcrystalline powder, m.pt. about 56°—57° C. The quinols of indigotin, with the exception of the methyl derivative, are difficult to obtain in the crystalline form, owing to the readiness with which they resinify, but those of thioindigo crystallise readily and often yield well-developed colourless crystals. The ethylquinol of thioindigo (2,2'-bisoxethionaphthene), prepared by the action of ethyl iodide on the leuco-derivative, forms white crystals, m.pt. 104°—105° C., exhibits normal cryoscopic and ebullioscopic behaviour in benzene, and gives a bright orange coloration with sulphuric acid. The corresponding benzyl derivative forms small, rose-red crystals, m.pt. 211°—211.5° C. Similarly, Thioindigo Scarlet R gives an ethylquinol, which forms white crystals, m.pt. 166.5° C., and gives an orange coloration with concentrated sulphuric acid. The corresponding benzyl derivative forms a yellowish-white, microcrystalline powder, m.pt. 198.5°—200° C., and gives an orange coloration with concentrated sulphuric acid. Thioindigo Scarlet GG, or Ciba Scarlet G, gives an analogous ethyl derivative, which forms a bright orange-yellow, microcrystalline powder, m.pt. 191°—195° C., and gives a grass-green coloration with concentrated sulphuric acid.

p-Cyano- and *p*-carboxy- derivatives of Malachite Green. B. Rassow and H. Gruber. J. prakt. Chem., 1915, 91, 341—357.

p-CYANOBENZALDEHYDE was prepared in 45% yield from diazotised *p*-aminobenzaldehyde and cuprous cyanide, and, after distillation *in vacuo*, formed white flat needles, m.pt. 92° C. It readily condensed with dimethylaniline in presence of phosphorus oxychloride, with formation of the *p*-cyanoderivative of the leuco-base of Malachite Green, yellowish crystals, insoluble in water, soluble in hot alcohol, and melting at 158°—160° C. Oxidation with freshly prepared hydrated manganese dioxide converted it into the carbinol, $\text{HO.C}(\text{C}_6\text{H}_4.\text{CN})[\text{C}_6\text{H}_4.\text{N}(\text{CH}_3)_2]_2$, colourless crystals, m.pt. 132° C., which on exposure gradually became coloured owing to formation of salts of the colour base. The *p*-cyano derivative of Malachite Green dyes mordanted wool and cotton green with a distinct yellowish shade, in conformity with the rule which has been found to hold with other *para*-derivatives of Malachite Green. Hydrolysis of the *p*-cyano-leuco base with alcoholic potassium hydroxide led to the formation of the corresponding *p*-carboxylic acid in almost theoretical yield. It forms white

needles, m.pt. 252° C., which on oxidation with hydrated manganese dioxide in sulphuric acid were converted into the intense green acid sulphate of the colour base. Potassium hydroxide converted this first into the neutral sulphate and then into the corresponding carbinol, which was obtained as colourless needles, m.pt. 230°—268° C. (with decomp.). The *p*-carboxylic acid of Malachite Green dyes with a yellowish tinge similar to the *p*-cyano-derivative. It is less intense than the parent dye but stronger than the *m*-carboxylic acid; moreover the latter produces, in contrast with the *p*-acid, a bluish tinge.—G. F. M.

Hydrazines; Ditertiary. Contribution to the knowledge of divalent nitrogen. XI. X. H. Wieland. Ber., 1915, 48, 1078—1095.

It has been found previously that the presence of negative groups (NO_2 , C_6H_5) tends to diminish the extent to which tetra-arylhydrazines dissociate at the nitrogen linkage into radicals, whereas methyl and methoxyl groups favour the dissociation; for example, *p*-tetra-amisylhydrazine, $(\text{C}_6\text{H}_4.\text{OCH}_3)_2\text{N.N}(\text{C}_6\text{H}_4.\text{OCH}_3)_2$, has been found (Wieland and Lecher: Ber., 1912, 45, 2600) to dissociate even in cold solution, the colourless hydrazine solution becoming green due to the production of the radical dianisylnitrogen, $(\text{C}_6\text{H}_4.\text{OCH}_3)_2\text{N}$, containing divalent nitrogen. The influence of basic groups has now been found to be in favour of dissociation. Tetra-[*p*-dimethylamino]-tetraphenylhydrazine,

$[(\text{CH}_3)_2\text{N.C}_6\text{H}_4]_2\text{N.N}[\text{C}_6\text{H}_4.\text{N}(\text{CH}_3)_2]_2$, is colourless in the solid state, but dissolves to intense yellow solutions in ether, acetone, and benzene; its degree of dissociation into $[(\text{CH}_3)_2\text{N.C}_6\text{H}_4]_2\text{N}$, as determined by ascertaining the molecular weight by the freezing-point method, is 10% in benzene and 21% in nitrobenzene solution, a degree of dissociation which is 3—6 times greater than that of hexaphenylethane into triphenylmethyl. The green colour of the benzene solution is destroyed by the addition of petroleum ether. The new diarylnitrogen gives addition products with nitric oxide and triphenylmethyl of formulae $[(\text{CH}_3)_2\text{N.C}_6\text{H}_4]_2\text{N.NO}$ and $[\text{C}_6\text{H}_4.\text{N}(\text{CH}_3)_2]_2\text{N.C}(\text{C}_6\text{H}_5)_3$, respectively. The original hydrazine decomposes rapidly in solution *via* the radical into a secondary amine and a perazine; trimethylindamine is formed by a secondary reaction. Oxidising agents such as silver oxide convert the new diarylnitrogen into the red indamine; with water two molecules of the radical give the colourless tetramethyldiaminodiphenylamine (m.pt. 121° C.) and the colour base of Bindschedler's Green, the latter of which rapidly decomposes into Phenol Blue and dimethylamine, especially in presence of alkalis. The hydrazine forms colourless solutions with acids; it gives a double salt with stannous chloride, but may be reduced to the tetramethyl-base by zinc dust and hydrochloric acid. The preparation of Bindschedler's Green and of Phenol Blue (m.pt. 162° C.) are described, the latter being prepared by the method of Möhlau (this J., 1884, 236), recrystallising from petroleum spirit.—F. W. A.

Phenol Blue: Note on the best method for the preparation of —. G. Heller. Ber., 1915, 48, 1288—1289.

MÖHLAU (see this J., 1886, 28) has stated that the action of alkalis on Bindschedler's Green gives dimethylamine and a red coloration, and hence the method used by Wieland (see preceding abstract) for preparing Phenol Blue is open to objection; the melting point of Phenol Blue prepared by Gnehm's method (Annalen, 1912, 392, 47) is 167° C. The necessary *p*-aminodimethyl-aniline may be prepared by the reduction of nitroso-

dimethylaniline hydrochloride by zinc dust at 40° C. without further addition of hydrochloric acid.—F. W. A.

Tar products and dyestuffs; Manufacture of—*in the United States.* T. H. Norton. U.S. Comm. Rept. No. 115.

THE erection of adequate recovery plants in connection with coke works is making rapid progress in the United States. At the new Laclede Coke Works at St. Louis, built at an expense of \$2,000,000, active operations began on June 1. The daily consumption of coal is 1000 tons. Ample provision is made for the collection of by-products. The Zenith Coke Works at Duluth have recently completed the installation of a benzol-recovery plant. The daily output of benzol from American coke works is said to exceed 50 tons. The demand for benzol and for toluol in the manufacture of high explosives has become so pressing that the prices are at least four times those prevailing a year ago. This hampers to some extent the efforts of those engaged in the manufacture of intermediates. The price of naphthalene, also, has rapidly risen during the last few months.

Hitherto American makers of artificial dyestuffs have depended almost exclusively upon intermediates of German origin. Since the outbreak of the war in Europe it has become evident that the manufacture of the leading intermediates on a generous scale is necessary to the continued activity of American dyestuff plants and the evolution of an independent, self-contained industry. The equipment of a large plant for the manufacture of aniline by the Benzol Products Co. has been the most important factor in the situation. The output of the works at Frankford and Marcus Hook, in Pennsylvania, is now sufficient to meet the needs of American dyestuff makers. The Edison Co. has likewise established a large plant for the production of aniline at Orange, N.J. It is in active operation and will be enlarged. The E. I. du Pont de Nemours Powder Co., of Wilmington, Del., has acquired the large works of the Bayway Distilling Co. at Elizabeth, N.J., used for rectifying and preparing pure benzol and toluol, and has arranged for manufacturing aniline from such benzol as may not be required in the production of high explosives. At Elizabeth, also, the Midvale Chemical Works of St. Louis is erecting a large plant destined for the manufacture of aniline and other intermediates, and ultimately of finished dyestuffs. The plans are extensive and include separate buildings for each product. There will thus be an adequate supply of aniline for manufacturers who are engaged in the preparation of more complex intermediate products—dimethylaniline, etc.—and of the dyes made from them. There will also probably be a large amount of aniline salt available for use in dyeing Aniline Black.

Aniline was sold in American markets at 10 cents per pound a year ago. Evidently a minimum of about 11 cents is regarded as the lowest price at which it can be produced in the United States at a fair profit.

The Schoellkopf, Hartford, and Hanna Co., at Buffalo, has now seven complete plants for the preparation of various intermediate products. A sufficient variety is now in regular process of manufacture to enable the company to produce regularly such colours as formed the bulk of its output before the war. The W. Beckers' Aniline and Chemical Co. at Brooklyn is erecting 23 buildings in its new plant. Of these, 7 are completed and manufacturing operations have already been started. This firm will make all of the 14 intermediates required in the production of the

group of dyes that it carried on successfully before the war.

Both Heller and Merz and the Central Dyestuff Co. at Newark, N.J., are erecting new buildings and starting the manufacture of the intermediates formerly imported from abroad. Two new companies have been organised for the manufacture of coal-tar products, the American Synthetic Color Co., at Stamford, Conn., and the Standard Aniline Co. at Wappingers Falls, N.Y. Both have well-equipped plants and have already begun the manufacture of intermediates, delaying for the time being any attempt to turn out finished dyes.

The more important intermediate products hitherto imported from Germany and now being manufactured regularly in the United States are: Aniline oil and salts, α - and β -naphthols, *p*-nitroaniline, dinitrobenzol, dinitrotoluol, toluidine, nitrotoluidines, toluenylenediamine, α - and β -naphthylamines, phenylenediamine, phthalic acid, acetylsalicylic acid, salicylic acid. One manufacturer is also making a satisfactory grade of dinitrochlorobenzene.

There is now a steady increase in the output of American-made coal-tar colours. The large works at Buffalo are running night and day, with 600 operatives. The volume of the output is at least double what it was before the war. Manufacture is concentrated upon a few staple dyes, chiefly in demand, the lack of which would be felt most severely by the great textile interests. This firm has brought out a direct black, capable of replacing satisfactorily, as far as quality is concerned, both Aniline Black and Sulphur Black. E. C. Klipstein, of New York City, is establishing the manufacture of Cachou de Laval, and is extending operations to other sulphur colours.

The American branch of the Bayer Co., at Rensselaer, N.Y., has been practically closed for some months, but will resume active operations on July 1. Prior to the war the firm manufactured Nigrosines, Alkali Blue, and a few other colours especially in favour in the American market. The intermediates required were imported from Germany. The company has decided to resume the manufacture of the same colours, making also the intermediates from American crude products. The firm will employ 350 operatives, some of whom, however, will be occupied in the manufacture of the pharmaceutical specialties owned by the Bayer Co.—aspirin, phenacetin, etc.

The combined efforts of these works will unquestionably do much to mitigate the difficulties inevitable upon a cessation of a supply of German dyes. Still, at the best, they can replace for the next few months, or even for a year, only a relatively small quantity of the lacking colours. The firms devoted to the production of dye-wood extracts are making ample preparations for meeting heavy demands during the coming months. The four establishments extracting American quercitron are in a position to expand their output rapidly. The supply of cutch seems to be fairly adequate. Largely increased amounts of log-wood, fustic, and brazil-wood have been ordered from the West Indies and southern countries. Increased attention is being devoted to the manifold applications of quercitron, the only natural dyestuff indigenous to the United States. The enlarged demand for the various extracts of the bark of the *Quercus nigra*, or black oak, will be welcomed in Pennsylvania, Virginia, Georgia, and the Carolinas, where the tree is found in abundance.

Japan; Manufacture of dyestuffs and chemicals in—Board of Trade J., Sept. 9, 1915.

JAPAN, like most other countries, has suffered severely from the shortage of dyes and chemicals arising out of the condition of affairs caused by the European war. Dyes were imported to the

value of £700,000 annually, nearly all of this supply coming from Germany. As most of these dyes were used in the important textile industries of Japan and prices have been advancing rapidly, the Government introduced a Bill, which has passed both Houses of the Diet, for the granting of subsidies to companies engaged in the manufacture of dyes (including aniline salt, aniline dyes, alizarin dyes, and synthetic indigo) and chemicals in Japan, provided that more than half of the capital of any such company is subscribed by Japanese subjects. The amount of subsidy to be granted will be sufficient to enable the companies to pay a dividend of 8% per annum on their paid-up capital. The subsidies will be for a period of 10 years from the date of the promulgation of the Law. Medicines or perfumery specified by Imperial Ordinance, manufactured from by-products of coal tar, will be regarded as manufactured dyes and chemicals. The manufacture of the materials for gunpowder and explosives, and of certain medicines to be determined by Imperial Ordinance, will also be regarded as the manufacture of dyes and chemicals.

PATENTS.

Sulphurised dyestuffs; Manufacture of blue —. O. Imray, London. From Soc. Chem. Ind. in Basic. Eng. Pat. 15,949, July 3, 1914.

CARBAZOLE-INDAMINES are obtained by condensing arylsulphiminoarylenechloroimides $Cl.N:R:N.SO_2(aryl)$, where R is an arylene residue of the benzene or naphthalene series, with carbazole or its derivatives in presence of concentrated sulphuric acid. Blue dyestuffs are obtained by treating these products, or the corresponding leuco-indamines of the general formula, $XNC_{12}H_7.NH(aryl).NH_2$, with alkali polysulphides in presence or absence of copper or copper compounds. The sulphurised product is a mixture containing a dyestuff which is easily soluble in warm sodium sulphide solution, giving intense blue tints on cotton, and a dyestuff which is insoluble in sodium sulphide but gives similar tints from a hydrosulphite vat. The dyeings possess excellent fastness.—F. W. A.

Alumina [and barium] colour lakes from quinizarin sulphonic acids; Process for producing —. Farbenfabr. vorm. F. Bayer und Co., Leverkusen, Germany. Eng. Pat. 17,743, July 27, 1914. Under Int. Conv., July 31, 1913. Addition to Eng. Pat. 15,557, July 5, 1913 (this J., 1914, 492).

THE sulphonic acids of quinizarin, in place of those of purpurin or its 1-amide claimed in the main patent, are converted into aluminium lakes or pigments, which are bluer in shade and are characterised by great purity of shade and excellent fastness. By adding barium chloride solution to the reaction mixture the barium lake is also formed.—F. W. A.

Leuco-preparations from quinone rat-dyestuffs; Manufacture of concentrated —. Farb. vorm. Meister, Lucius, und Brüning, Höchst, Germany. Eng. Pat. 19,272, Aug. 31, 1914. Under Int. Conv., Sept. 18, 1913.

READILY soluble concentrated leuco-preparations are obtained by adding soaps, such as "monopole" soap or "turcone" oil, or glycerin, to the difficultly soluble alkali salts of leuco-compounds of vat dyestuffs of the benzoquinone or α -naphthoquinone series, including sulphurised products, but not those of the anthraquinone series, such as Indanthrene.—F. W. A.

Alizarin: Process of making —. F. Singer, Offenbach, Assignor to Chem. Fabr. Griesheim-Elektron, Frankfurt, Germany. U.S. Pat. 1,150,152, Aug. 17, 1915. Date of appl., July 23, 1914.

MESO-NITRO derivatives of anthracene are heated with an alkali, with or without addition of either an oxidising agent or a sulphite and lime or both.—F. W. A.

Thio-ureas of the anthraquinone series; Manufacture of —. Act.-Ges. f. Anilinfabr., Treptow, Germany. Eng. Pat. 12,237, May 18, 1914. Under Int. Conv., Oct. 13, 1913. Addition to Eng. Pat. 8917 of 1914, dated June 30, 1913.

SEE Fr. Pat. 470,562 of 1914; this J., 1915, 171.

Sulphurised dyestuffs; Manufacture of —. Act.-Ges. f. Anilinfabr., Treptow, Germany. Eng. Pat. 15,752, July 1, 1914. Under Int. Conv., Oct. 23, 1913. Addition to Eng. Pat. 3660, Feb. 12, 1913.

SEE Ger. Pat. 282,163 of 1913; this J., 1915, 710.

Azo dyestuffs insoluble in water; Manufacture of —. A. G. Bloxam, London. From Chem. Fabr. Griesheim-Elektron, Frankfurt, Germany. Eng. Pat. 12,820, May 25, 1914.

SEE Fr. Pat. 472,889 of 1914; this J., 1915, 486.

Alizarin; Manufacture of —. A. G. Bloxam, London. From Chem. Fabr. Griesheim-Elektron, Frankfurt, Germany. Eng. Pat. 16,859, July 15, 1914.

SEE U.S. Pat. 1,150,152 of 1915; preceding.

Dyes of the triphenylmethane series; Manufacture of new —. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Leverkusen, Germany. Eng. Pat. 13,604, June 4, 1914.

SEE Ger. Pat. 278,423 of 1913; this J., 1915, 273.

Chrome-dyestuffs; Manufacture of —. Farb. vorm. Meister, Lucius, und Brüning, Hoechst, Germany. Eng. Pat. 13,813, June 8, 1914. Under Int. Conv., Nov. 5, 1913.

SEE Fr. Pat. 472,737 of 1914; this J., 1915, 486.

Chrome-mordant dyestuffs; Yellow — and process of making same. H. Wagner, J. Erber, and E. Hoffa. Assignors to Farb. vorm. Meister, Lucius, und Brüning, Hoechst, Germany. U.S. Pat. 1,149,231, Aug. 10, 1915. Date of appl., July 6, 1911.

SEE Fr. Pat. 472,737 of 1914; this J., 1915, 486.

Aryldio-anthraquinonesulphonic acids; Manufacture of new —. Farb. vorm. Meister, Lucius, und Brüning, Hoechst, Germany. Eng. Pat. 14,869, June 20, 1914. Under Int. Conv., Aug. 25, 1913.

SEE Fr. Pat. 473,904 of 1914; this J., 1915, 709.

Triarylmethane dyestuff. R. Gartner, Elberfeld, and G. Köhres, Leverkusen, Germany. Assignors to Synthetic Patents Co., New York. U.S. Pat. 1,149,575, Aug. 10, 1915. Date of appl., June 2, 1914.

SEE Ger. Pat. 278,423 of 1913; this J., 1915, 273.

Azo dyestuffs. A. Blank, C. Heidenreich, and J. Jansen, Leverkusen, Germany. Assignors to Synthetic Patents Co., New York. U.S. Pat. 1,150,656, Aug. 17, 1915. Date of appl., Apr. 4, 1914.

SEE Ger. Pat. 276,140 of 1913; this J., 1914, 855.

Trisazo dyestuffs; Claret-red —. F. Klingemann, Mainkur, Germany. Assignor to Cassella Color Co., New York. U.S. Pat. 1,150,825, Aug. 17, 1915. Date of appl., Oct. 8, 1914.

SEE Eng. Pat. 6900 of 1914; this J., 1915, 829.

V.—FIBRES ; TEXTILES ; CELLULOSE ; PAPER.

Wool ; Tensile strength and elasticity of——. R. F. Miller and W. D. Tallman. J. Agric. Res., 1915, 4, 379—390.

THE authors refer to some previous work on the subject and discuss from a mathematical standpoint the probable error in the determinations, or the deviation of the measurements for a single fibre from the mean obtained for a number of fibres. The quality of a fabric depends upon the tensile strength, i.e., the breaking stress divided by the cross section of the fibre. The latter was measured by a microscope fitted with a micrometer eyepiece, and the former by a fibre-testing machine (J. M. Matthews, "The Textile Fibres," 1904, pp. 272—274), the accuracy of the measurements being increased by employing an optical method of reading the scale. A fibre was put between the jaws of the machine and a force of 10 mgrms. applied to remove the crimp from the fibre. A reading was taken, a force of 15 mgrms. applied and then 5 mgrms. at a time till the fibre passed the elastic limit. Force was applied gradually till the fibre broke, and its diameter was then measured. Tests were made of the breaking stresses, diameters, tensile strengths, Young's moduli, and elastic limits of fibres.—W. C. H.

Mineral oils ; Testing——for liability to stain fabrics. T. T. Gray. Oil, Paint, and Drug Rep., Aug. 9, 1915.

To ascertain the liability of oils to stain textile fabrics, it is proposed to expose pieces of tape, treated with the oils, to the light from a Cooper-Hewitt quartz lamp, using a standard oil for purposes of comparison. Half an hour's exposure, at a distance of six inches from the lamp, was found to be sufficient to develop a stain with oils likely to discolour fabrics.

Production of alcohol from wood. Hägglund. See XVIII.

South African sheep dips. See XIXB.

PATENTS.

Resistance of cloth to wearing ; Process for testing——. R. B. Ransford, London. From L. Cassella und Co., Frankfort, Germany. Eng. Pat. 4820, Feb. 24, 1914.

THE cloth is treated so that the interior portions and surface become uniform, and is then tested on a scraping, rubbing, grinding, or beating machine. Samples may be prepared by suitable combination of the following processes: (A) thoroughly wetting, drying, and evenly pressing; (B) boiling with water alone or water containing small quantities of alkalis, acids, glycerin, sulpholeates, etc., then drying, and if necessary pressing; (C) treatment with alcoholic or ethereal liquids or hydrocarbons, and drying; (D) mechanical treatment, followed by pressing. The results obtained by treating the sample for an hour with alcohol, immersing in water at 80° to 90° C. for half an hour, drying, and pressing, and then testing on a scraping machine, were more in agreement with the actual quality of the cloth due to the presence of added matter and with practical wearing tests than those given by the dynamometer method.—F. W. A.

Textile fabrics ; Process for rendering——relatively non-inflammable. J. W. Banister and C. A. Rittel, Manchester. Eng. Pat. 1744, Feb. 3, 1915.

WOOL or cotton fabrics, flannelette, etc., are rendered relatively non-inflammable by immersion in a solution in water or other volatile solvent of

approximately equal amounts of Epsom salts and borax, with or without the addition of other materials such as soda, farina, ammonium sulphite or phosphate, etc. (Reference is directed in pursuance of Sect. 7, Sub-sect. 4, of the Patents and Designs Act, 1907, to Eng. Pat. 1458 of 1900.)—F. W. A.

Bast of the linden or lime-tree and willow for the manufacture of webs ; Treatment of——. A. Waganoff, Petrograd. U.S. Pat. 1,149,876, Aug. 10, 1915. Date of appl., Feb. 6, 1915.

THE bast is boiled in an alkaline liquid and the ends of the separate short bast films are cemented together to form a long film, which is then subdivided into strips or flat threads; alternatively the bast is boiled a second time in a closed vessel containing a 2—3% solution of sodium silicate for 15—30 mins. and the softened bast subdivided into elementary fibrils. The strips, threads, or subdivided fibrils are then spun alone or in combination with other textile fibres and used for the manufacture of webs on looms.—J. F. B.

Acetylcellulose ; Manufacture of solutions of——. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen, Germany. Eng. Pat. 14,042, June 10, 1914.

ACETYLCELLULOSE, of the type which is soluble in acetone, is dissolved in a fully hydrogenated monocyclic ketone, e.g., cyclohexanone, with or without the addition of ethyl acetate or other suitable solvent or diluent.—J. F. B.

Paper-making machine. W. E. Sheehan, Albany, N.Y. U.S. Pat. 1,150,636, Aug. 17, 1915. Date of appl., Apr. 28, 1913.

IN order to prevent the adhesion of the moist paper to the press rolls of the paper-machine, these rolls are perforated and covered with a closely fitting homogeneous fibrous material, and a current of air is forced through the perforations of the rolls so as to form an air cushion between the covering and the web of paper.—J. F. B.

Gas-tight membrane, and method of producing the same. Deutsche Gasglühlicht A.-G. (Auerger.), Berlin. Eng. Pat. 14,230, June 12, 1914. Under Int. Conv., Aug. 6, 1913.

SEE Fr. Pat. 473,421 of 1914; this J., 1915, 545.

Textile fabrics ; Process for ungumming——. J. Meister, Basle, Switzerland. Eng. Pat. 17,941, July 29, 1914. Under Int. Conv., Sept. 27, 1913.

SEE Fr. Pat. 470,128 of 1914; this J., 1915, 24. Reference is directed in pursuance of Sect. 7, Sub-sect. 4, of the Patents and Designs Act, 1907, to Eng. Pat. 2213 of 1914.

Viscose ; Preparation of——for the production of artificial threads and other structures. II. Lange and G. Walther, Crefeld, Germany. Eng. Pat. 12,822, May 25, 1914. Under Int. Conv., June 19, 1913.

SEE Fr. Pat. 473,256 of 1914; this J., 1915, 546.

Pyroxylin bodies ; Formation of——. E. C. R. Marks, London. From E. I. du Pont de Nemours Powder Co., Wilmington, Del., U.S.A. Eng. Pat. 24,033, Dec. 14, 1914.

SEE U.S. Pat. 1,135,026 of 1915; this J., 1915, 606.

Cellulose or half-stuff ; Opening-up treatment of wood and similar crude vegetable fibre for the preparation of——. C. G. Schwalbe, Eberswalde, Germany. Eng. Pat. 18,199, Aug. 1, 1914.

SEE Ger. Pat. 282,050 of 1913; this J., 1915, 656.

Sulphite cellulose; Process of utilising the organic as well as the inorganic constituents of the waste liquor produced by the boiling of—. R. W. Strehlenert, Nol, Sweden, Assignor to A. H. Kiaer and Co., Ltd., Glemminge, Norway. U.S. Pat. 1,140,420, Aug. 10, 1915. Date of appl., Aug. 12, 1912.

SEE Ger. Pat. 266,096 of 1912; this J., 1913, 1104.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

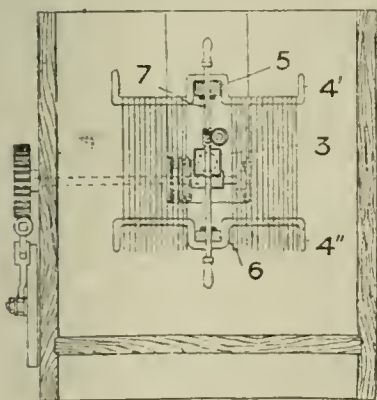
PATENTS.

Dyeing, washing, and similarly treating textile materials. J. R. Foulds, Bingley. Eng. Pat. 14,198, Dec. 17, 1911.

THE flow of liquid in machines used for the treatment of textile materials, is controlled by a four-way valve operated mechanically, by which the liquid is diverted for equal periods in various directions; the device assists the production of level shades in dyeing.—F. W. A.

Skein-yarn; Device for wet-treatment of—. C. Obser and L. Hwass, Crefeld, Germany. Eng. Pat. 14,682, June 18, 1911. Under Int. Conv., June 18, 1913.

AN apparatus for the wet-treatment of hanks of yarn, an interchangeable frame is provided with upper and lower supporting arms (4', 4'') for the hanks,



adjustable relatively to one another; the arms are bent upwards or downwards at right angles at their ends, and are attached to upper and lower bars (5 and 6) respectively, both bars being connected by means of a tension device (7) with a common central bar (3) for operating and rotating the frame.—F. W. A.

Ice colours on artificial silk; Process for producing—. Chem. Fabr. Griesheim-Elektron, Frankfurt, Germany. Eng. Pat. 17,272, July 21, 1914. Under Int. Conv., Feb. 16, 1914.

ARTIFICIAL silk is passed through water at 60° C., impregnated with a solution of an arylide of 2,3-hydroxynaphthoic acid at 30°–40° C., and treated with a diazo, tetrazo, or diazo-azo-compound which does not contain a sulphonie acid group.—F. W. A.

Dyeing and like apparatus. F. Riley, Bury. Eng. Pat. 17,517, July 24, 1914.

TO avoid loss of dye-liquor when suction or pressure is applied in apparatus for dyeing cops, cheeses, etc., in which the direction of flow is reversed at short intervals, the suction pipe is provided with an

intercepting device consisting of a vertical cylindrical chamber, the top of which is connected to the vacuum chamber; a pipe for dye-liquor enters the chamber at the bottom and extends upwards, the open end having a baffle fixed over it or a valve in it, and the lower end being perforated to allow the return of the collected liquor when the flow is reversed.—F. W. A.

Artificial silk and other threads; Apparatus for treating [dyeing, etc.]—. Courtaulds, Ltd., London, and M. Linfoot, Braintree. Eng. Pat. 18,556, Aug. 11, 1914.

THE dyeing, sizing, or other similar treatment of artificial silk or other threads is carried out in an apparatus in which the threads pass from a let-off beam direct to a take-up beam, the treatment being effected by surface contact of the threads with a roller rotating in a bath of the liquor employed. The threads are dried by passing over a heated cell of large surface so shaped that the threads only gradually make contact with it. Provision is made for moving the threads in and out of engagement with the rotating roller and the heated cell simultaneously with the starting and stopping of the take-up beam.—F. Sp.

Dyeing-machine; Circulating—. W. W. Sibson and T. Allsop, Assignors to The Philadelphia Drying Machinery Co., Philadelphia, Pa. U.S. Pat. 1,150,306, Aug. 17, 1915. Date of appl., Nov. 28, 1914.

A PERFORATED plate supported on brackets attached to the cover of the main dyeing chamber, has side and end walls which extend downwards, the side walls supporting perforated bars of V-shaped cross-section, arranged so that the article supported only makes contact with their outer edges.—F. W. A.

Dyeing, bleaching, washing, scouring, and subjecting to like processes hanks of yarn; Machine for—. E. Kruse, Langerfeld, Germany. U.S. Pat. 1,150,685, Aug. 17, 1915. Date of appl., Nov. 13, 1914.

A MACHINE for dyeing, etc., hanks of yarn is provided with a carriage moving over the vat and vertical frames carrying the hanks, the frames engaging holders which are guided in a circular path independently of the direction in which the carriage moves.—F. W. A.

Calico printing; Method of preparing etched steel rollers for—. J. Hug, Mulhouse, Alsace, F. Teissere, Loerrach, Germany, and H. Wutz, Mulhouse, Alsace. Eng. Pat. 3355, Feb. 9, 1914.

PRINTING rollers are coated whilst wet with a sensitised emulsion, and rotated vertically in a current of warm air. A strengthened film carrying the drawing to be reproduced is applied to the surface of the roller after oiling with paraffin oil. After exposing and developing, the roller is burnt in or baked in the usual manner, and then etched in stages; after each stage the roller is cleaned, rolled in with a greasy ink upon a slightly arched elastic table, powdered with asphalt, and baked.—F. W. A.

Finishing of materials dyed with vat colours. R. B. Ransford, London. From L. Cassella und Co., Frankfurt, Germany. Eng. Pat. 17,318, July 21, 1914.

THE bleeding of material dyed with vat colours, noticed on washing in a strongly alkaline bath, is due to the reducing effect of the dextrin, glucose, etc., in the finish. It is prevented by the addition to the finish of sulphates, chlorides, and nitrates of the heavy metals, chromates, bichromates, chlorates, bromates, and certain nitro compounds, e.g., nitrobenzenesulphonic acid or nitrotoluene-sulphonic acid.—F. W. A.

Dyeing skins, hairs, and the like; Process for —. Act.-Ges. f. Anilinfabr., Treptow, Germany. Eng. Pat. 12,644, May 22, 1914. Under Int. Conv., Dec. 20, 1913.

SEE Fr. Pat. 472,702 of 1914; this J., 1915, 489.

Furs; Treatment of — for dyeing. R. B. Ransford, London. From L. Cassella und Co., Frankfurt, Germany. Eng. Pat. 13,470, June 2, 1914.

SEE Ger. Pat. 272,736 of 1913; this J., 1914, 641.

Azo dyestuffs on the fibre: Process for producing —. Act.-Ges. f. Anilinfabr., Treptow, Germany. Eng. Pat. 15,059, June 23, 1914. Under Int. Conv., Dec. 31, 1913.

SEE Fr. Pat. 473,441 of 1914; this J., 1915, 489.

Dye vals. A. Kluge, Brooklyn, N.Y., U.S.A. Eng. Pat. 20,561, Oct. 5, 1914. Under Int. Conv., Oct. 4, 1913.

SEE U.S. Pat. 1,121,023 of 1914; this J., 1915, 76. Reference is directed, in pursuance of Sect. 7, Sub-sect. 4, of the Patents and Designs Act, 1907, to Eng. Pat. 7911 of 1887.

Dyeing or like frames. Klauder-Weldon Dyeing Machine Co., and J. Benosch, Amsterdam, N.Y., U.S.A. Eng. Pat. 24,029, Dec. 14, 1914. Under Int. Conv., Dec. 13, 1913.

SEE U.S. Pat. 1,120,644 and 1,120,645 of 1914; this J., 1915, 75.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Nitrogen monopoly in Germany. Pharm. J., Sept. 11, 1915.

THE "North German General Gazette" states that the production of nitrogen compounds in Germany, particularly sulphate of ammonia and cyanamide, has been considerably increased during the course of the war, and that the sale prices of nitrates have been lower than the cheapest prices in the past ten years. It is now feared that on the conclusion of peace the newly developed German industry may be confronted with such foreign competition that only a German national monopoly would be able to withstand the onslaught of world-united competitors. It is stated that the whole of the producers and exporters of Chilean nitrate are (or were) proposed to be combined in the form of a trust company in London, with a share capital of £2,000,000, and that the export duty on the Chilean produce would be reduced by 50%, and the production raised gradually from 2,500,000 tons per annum to 5,000,000 tons, a guarantee to be given to the State of Chili against any loss by the English and French Governments. In addition, the North-Western Cyanamide Co., which is declared to be in close relations with the English munitions industry, controls 1,000,000 horse-power in Scandinavia, with plant capable of producing annually a tonnage of nitrates equal to that of Chili before the war. It is said that already before the war negotiations were proceeding between this company and its subsidiaries—the English interests in the Chilean industry and American groups which have secured control of comprehensive water powers in America and Canada for the extension of the production of nitrates—with the object of constituting a world-wide trust. It is therefore considered that the most effective counter measure to proposals of the kind set forth lies in the grant to the Federal Council of authorisation to create at any time a monopoly in nitrogenous compounds, which would

place the Council in possession of a ready weapon which would deter even the strongest trust from venturing upon a violent commercial invasion. (See also this J., 1915, 353.)

Potash; The world's supply of —. The Imperial Institute, London, 1915.

THE value of the potash salts imported into the United Kingdom in 1912 and 1913 was as follows:—

	1912.	1913.
	£	£
Indian potassium nitrate	44,244	56,631
Foreign potassium nitrate	172,946	184,335
Other foreign potassium salts	614,077	625,834

About 90% of the total quantity of potash salts produced in Germany is used in agriculture. The cost of production of various potash salts from the Stassfurt deposits (see Emslie, this J., 1909, 393) in 1913 was: kainite 7s. 2d., potassium chloride 61s. 10d., potassium sulphate 89s. 1d., and manure salts 42s. per ton. In 1904 potash deposits were discovered at Niederbrück in Alsace; in 1910, 37,000 tons of crude salts was extracted, and in 1913, 350,341 metric tons, from twelve mines. The deposits cover an area of 7 sq. miles and range in thickness from 6 to 30 ft.; the average depth of the workable deposits is 2100 ft. The sources of potash most likely to prove competitors of the Stassfurt deposits when prices again fall to their normal level are the potash deposits of Spain and India, and the giant seaweeds of the Pacific coast of the United States. The Spanish deposits (see this J., 1915, 869) offer one of the most promising fields for the supply of potash minerals that has been recorded for many years past; near Suria, where most of the prospecting has been done, they resemble the Stassfurt deposits, and it is probable that the bottom of the deposits has not yet been reached. In India potash beds occur in the Mayo salt mine at Khaura, Punjab. The chief potash minerals are langbeinite ($K_2SO_4 \cdot 2MgSO_4$) and sylvite. Average samples from the Pharwala-Sujawal, Buggy, and Nurpur seams contained respectively 8.0, 11.9, and 11.3% K. The deposits have never been worked for potash salts, and, owing to the difference in mineralogical composition, the methods of treatment now employed in Europe will probably not be applicable. The potassium nitrate exported from India is obtained mostly from nitre-earths, i.e., the soils of old village sites. In 1912, the exports amounted to 12,806 tons, value £205,600; in 1913, 15,234 tons, value £237,581; and in 1914, 14,157 tons, value £232,916. There are several plants on the Pacific coast of the United States producing dried seaweed for use as a manure in place of low-grade potash salts. In addition several experimental plants—now amalgamated into one concern—have been working processes for the recovery of potassium salts, iodine, and other by-products. According to an official estimate, 6,000,000 tons of potassium chloride per annum could be obtained from the Pacific coast seaweeds (see Balch, this J., 1910, 150; Cameron, 1912, 227; 1915, 869; also this J., 1912, 1177; 1914, 919). Kelp is prepared at many places on the Irish coast, and seaweed is also utilised for the production of potash salts in Norway and Japan. The exports of kelp from Ireland amounted to 4719 tons, value £18,300, in 1912, and 3939 tons, value £16,631, in 1913. The annual production of potash salts (34–37% K_2O) in Norway is about 1000 tons. Other sources of potash referred to are salt lakes and brines (see this J., 1912, 431; 1914, 1101; Norton, 1915, 869), sea water, wood ashes (see Gimmingham, this J., 1915, 675), hedge clippings (see Umney, this J., 1914, 1046; Russell,

1914, 1216), sunflower stalks, residues from beet sugar manufacture, wool suint, and insoluble potash minerals, such as feldspar, alunite, etc. (see Cushman and Hubbard, this J., 1908, 560; Preuss, 1911, 282; Hart, 1911, 1379; 1915, 902; Ross, 1912, 1077; Cushman and Coggeshall, 1915, 79; Wagaman, 1915, 293; also this J., 1914, 1007). With potash salts at the present high price, it might pay to recover them from the waste liquors obtained in works for the recovery of salt from sea water such as exist in France, Portugal, the United States, and India. Potash is recovered from wool suint in France, Belgium, and Germany. The wool, before being scoured, is treated with cold water, the brown liquor of sp. gr. about 1.12 so obtained, is evaporated in iron pans, and the pasty residue is calcined in a reverberatory furnace or destructively distilled in clay retorts. Potassium chloride and carbonate are recovered from the charred residue by lixiviation. It is estimated that from 5000 to 10,000 tons of potash (K_2O) is produced annually from this source; in the Roubaix district of France alone, potash salts to the value of £100,000 per annum are produced. (See also Phalen, this J., 1914, 1204; Cresswell, 1915, 387).—A. S.

Potash deposits in Chili. S. Salcedo. Eng. and Min. J., 1915, 100, 218.

THE potash salts are found in the Province of Tarapaca, Chili, in Pintados and Bella Vista Lakes, which together have an area of about 100,000 acres. The deposits are only about three miles from the railroad that runs from Iquique to Lagunas. The potash occurs as chloride in a crust at the surface, samples of which vary from 3 to 36% KCl. The density of the bed is about 1.352 and the average thickness 20 cm. The water underlying the crust contains 8 kilos. of potassium chloride per cubic metre; when the salt bed is removed, it is again formed in eight to twelve years. As a result of an examination of the deposits in 1905, they were calculated to contain over 2,000,000 tons of KCl. Analysis of representative samples indicates that the salts present are KCl, 14.15%; NaCl, 51.45%; Na_2SO_4 , 29.39%; Na_2CO_3 , 0.32%; $CaSO_4$, 0.93%. Only a trace of magnesium was found. To produce a commercial product containing up to 90% KCl, successive lixiviations will be necessary.

Bleaching powder; Influence of phosphoric acid on the determination of available chlorine in —. E. Kedesky. Mitt. k. Materialpruf., 1914, 32, 534—535. J. Chem. Soc., 1915, 108, ii., 572.

BLEACHING powder always contains a small quantity of ferric oxide, and this interferes with the iodometric determination of the available chlorine. When the sample is treated with hydrochloric acid and potassium iodide, the ferric oxide is first converted into ferric chloride which reacts with the potassium iodide, liberating iodine, and thus causing the result for available chlorine to be too high. The addition of phosphoric acid or sodium phosphate prevents the action of the ferric salt on the potassium iodide. Hough has shown (this J., 1910, 594) that phosphoric acid prevents the action of ferric halides on permanganate.

Iron in silicates; Determination of ferrous — by titration with bichromate. O. L. Barnebey. J. Amer. Chem. Soc., 1915, 37, 1829—1835.

THE disturbing influence of hydrofluoric acid on the titration of iron with bichromate may be overcome by adding boric acid to the ferrous solution (compare this J., 1915, 737), and, in the method previously given for the analysis of silicates (*loc. cit.*), bichromate may be employed instead of permanganate. Acids reduce the sensitiveness of the ferrixyanide test for ferrous iron, and in titrating

small amounts of iron, therefore, the concentration of free acid should be low (not more than 10 c.c. of concentrated hydrochloric acid, for example, per 200 c.c.). Good results may, however, be obtained in the presence of much free acid by adding ferric chloride to the solution.—F. SODN.

Radioactive constituents of carnotite; Extraction and separation of the —. H. M. Plum. J. Amer. Chem. Soc., 1915, 37, 1797—1816.

AN examination of commercial methods for separating vanadium and uranium from carnotite led to the following modified procedure for recovering these elements and also the long-lived radioactive constituents of the ore. One kilo. of concentrates (from carnotite containing vanadiferous silicates) was boiled for several hours with 2 litres of a solution containing 400 grms. of anhydrous sodium carbonate, the filtered solution was concentrated, to precipitate the uranium as uranyl sodium carbonate, and excess of sodium carbonate recovered from the liquor by evaporation and cooling to 0° C., the remaining solution being treated by known methods to recover the vanadium present. The ore residue was boiled for 8 hrs. with 400 c.c. of hydrochloric acid, diluted with about 1 litre of water, and to the filtered and concentrated solution (containing most of the radium, actinium, polonium, and radio-lead) 50 c.c. of 1% bismuth nitrate solution was added; the mixture was then treated with hydrogen sulphide, the precipitated sulphides were dissolved in nitric acid, and the lead (with the radio-lead) was separated as sulphate; polonium was carried down with the bismuth on adding ammonia. The filtrate from the sulphides (after expelling hydrogen sulphide) was treated with 3—4 c.c. of concentrated sulphuric acid and small amounts of barium chloride, and the radium-barium sulphate precipitate, containing actinium, was converted into chloride and treated, twice successively, with aluminium nitrate and ammonia, to separate the actinium. The residue insoluble in hydrochloric acid was heated for a day with 200 c.c. of nitric acid, diluted with about 1 litre of water, which extracted a further quantity of radium, and the residue from this was finally treated with twice its weight of sulphuric acid, diluted with an equal weight of water, and heated until most of the acid had escaped in fumes. The ionium was found in the solution obtained by treating the resulting mass with water, and was separated by adding cerium nitrate, almost neutralising with ammonia, and precipitating the cerium with a large excess of oxalic acid, the process being repeated to effect a more perfect recovery. Over 90% of the radium, 50% of the polonium, 52% of the actinium, and 61% of the ionium present were extracted and separated.—F. SODN.

Radioactive deposits; Volatilisation of extremely thin —. A. B. Wood. Proc. Roy. Soc., 1915, A91, 543—560. (See also this J., 1914, 1206.)

THE active deposit of thorium B (obtained from radio-thorium) is best collected upon a platinum surface or on quartz; nickel, copper, or brass are far less satisfactory. When heated in a silica tube placed in an electric furnace at 1200° C. for 60 min., 96% of the deposit volatilises; the remainder is removed only with extreme difficulty, probably owing to the penetration of the platinum foil by molecules of the active deposit. The density (thickness) of the active deposit is extremely small, from 1.5×10^{10} to 1.5×10^{11} molecules per sq. cm. of platinum, the number of platinum molecules in a surface layer being about 10^{15} . Concordant results were obtained only when the volatilisation was effected without an electric field, in which case the density is independent of the time of exposure to the emanation.

In an electric field the density can be increased to 100 times the maximum found without the field, but the results were very variable. Measurements of the rate of volatilisation at different temperatures showed that it decreased rapidly with the time of heating, particularly at high temperatures; the initial rate increases very rapidly with small increments of temperature. The rate of volatilisation practically conforms to the law of the rate of emission of ions from a heated metal, with the exception that a new factor, the amount of active deposit, is introduced. Volatilisation is much more rapid at low than at high pressures and it begins at a lower temperature; but even at a pressure of 3 mm. of mercury at 1175° C. it is not complete. The behaviour of thorium B is probably typical of that of all similar constituents of the active deposits of radium, thorium, and actinium.—E. H. T.

Hydrogen sulphide: Oxidation of—by bacteria. H. C. Jacobsen. *Folia mikrobiol.* Holland. Beitr. gesamt. Mikrobiol., 1914, 3. *J. Chem. Soc.*, 1915, 108, ii., 553.

HYDROGEN sulphide is oxidised by the sulphur bacteria and by the thiobacteria described by the author. 1–2 mgrms. of hydrogen sulphide is added to a culture solution placed in an Erlenmeyer flask provided with a rubber stopper carrying a funnel and bent glass tube. After one to two days the odour of hydrogen sulphide has entirely disappeared; in the film of bacteria a large variety of the latter is found, together with numerous minute globules of sulphur, which, however, are not deposited within the cells. When the film of bacteria has been formed, the amount of hydrogen sulphide can be increased, and further oxidation proceeds briskly. The second phase of the process, the oxidation to sulphuric acid, requires a much longer time. The film of bacteria fulfils the function of oxygen-carrier during the oxidation of hydrogen sulphide to sulphur; the bacteria which are chiefly found in the crude cultures belong to the type *Thiobacillus thioparus*. The oxidation of hydrogen sulphide to sulphuric acid proceeds quantitatively, and the substance of the bacteria is formed by reduction of carbon dioxide. In the second phase of the oxidation the thiobacteria are autotrophically nourished.

Selenium and tellurium: Solutions of—in anhydrous sulphuric acid. E. Moles. *J. Chim. Phys.*, 1915, 13, 207–218.

CRYSCOPIC measurements and determinations of electric conductivity seem to confirm the existence of the compound, SeSO_3 , in solutions of selenium in anhydrous sulphuric acid (H_2SO_4). Whilst with crystallised selenium the cryoscopic data indicate the simple molecule, SeSO_3 , the results obtained with red amorphous selenium point to the existence of $(\text{SeSO}_3)_2$. Concordant results could not be obtained with tellurium, owing to chemical action, tellurium dioxide and sulphur dioxide being formed. Selenium and tellurium are only slightly soluble in anhydrous sulphuric acid, and if heat be applied to accelerate solution, chemical action takes place. In the author's experiments the selenium or tellurium was dissolved in fuming sulphuric acid and then the calculated quantity of water or dilute acid to yield H_2SO_4 was added. (See also Littmann, this J., 1906, 693.)—A. S.

Red phosphorus: Preparation of 100 per cent.—. Reduction of halogen phosphide. I. Action of mercury on phosphorus halides. L. Wolf. *Ber.*, 1915, 48, 1272–1280.

THE action of mercury on phosphorus tribromide, under pressure and at medium temperatures, was in accordance with the equation, $2\text{PBr}_3 + 3\text{Hg} =$

$3\text{HgBr}_2 + 2\text{P}$, mercurous bromide being probably formed as an intermediate product; at higher temperatures and under reduced pressure the reaction was reversed. Pure red phosphorus was prepared by heating phosphorus tribromide with mercury in a sealed tube at a temperature finally reaching 170° C., extracting the product with ether, heating *in vacuo* to expel mercuric bromide, heating with a further small quantity of phosphorous bromide (to convert any mercurous into mercuric bromide), again extracting with ether, and volatilising the mercuric salt as before. A dark residue, becoming cinnabar-red on cooling and containing 99.83% P, was obtained. It ignited in the air at about 300° C. and agreed in properties with the red phosphorus prepared by Schenck (this J., 1903, 494; 1904, 17), except that it did not darken with ammonia (either anhydrous or in solution) or piperidine and reacted less readily with caustic potash solution. This difference in behaviour is considered due to the presence of impurity, probably colourless phosphorus, in Schenck's product (see Stock, this J., 1908, 626). Phosphorus trichloride was also attacked by mercury, but mercurous chloride and red phosphorus were the final products.—F. SODN.

Determination of phosphoric acid in vegetable substances, especially crops, and in phosphates. Stutzer and Haupt. See XVI.

Recovery of ammonium molybdate used in phosphate determinations. Prescott. See XXIII.

Application of Stock's reaction to the volumetric determination of aluminium. Kovscharova. See XXIII.

PATENTS.

Waste acid; Denitration of—. C. R. Jahn, Schlebusch, Assignor to Sprengstoff A.-G. Caronit, Hamburg, Germany. U.S. Pat. 1,149,585, Aug. 10, 1915. Date of appl., Oct. 11, 1913.

THE waste acid is distilled and the vapours are passed over the surface of water, whereby organic substances are deposited and a portion of the nitric acid is absorbed. The main unabsorbed portion of the acid is recovered separately.—E. H. T.

[Nitric acid] stills: Apparatus for heating—. F. T. Beers, Barksdale, Wis., Assignor to E. I. du Pont de Nemours Powder Co., Wilmington, Del. U.S. Pat. 1,149,711, Aug. 10, 1915. Date of appl., June 3, 1914.

THE still is provided with a jacket through which a heating medium may be circulated, and the system includes a pump and heating device. The temperature of the still is controlled by a by-pass for the medium around the still.—F. SODN.

Nitric acid; Apparatus and method for producing—. H. D. Rankin, Pittsburgh, Pa., Assignor to Rankin Process Co., Phoenix, Ariz. U.S. Pat. 1,150,786, Aug. 17, 1915. Date of appl., Sept. 19, 1903.

COMPRESSED air is brought into contact with a flame produced by electric discharges in a vessel provided with a head or disc which is simultaneously reciprocated and rotated. Relatively stationary terminal points on the disc are connected by electric conductors to a high tension induction coil, thus establishing independent circuits in addition to the primary field.—E. H. T.

Sulphur burner. A. G. Hinze, Rothschild, Assignor to Valley Iron Works Co., Appleton, Wis. U.S. Pat. 1,149,765, Aug. 10, 1915. Date of appl., May 7, 1914.

A VERTICAL cylindrical combustion chamber, constructed with an outer metal casing and inner

lining of firebrick, is provided with a gas outlet and divided into a number of superposed compartments (each with controlled air inlet) by a series of burner trays or dishes, the edges of which extend loosely between the lines of firebrick, spaced from the inner surface of the casing. The trays have semi-circular lines of perforations near their edges, to allow the overflow of material to the trays beneath and the passage of combustion products. A receptacle for the supply of sulphur, having a conical bottom portion, with valved discharge opening, extends centrally into the upper part of the chamber, so as to receive heat from the combustion products, and discharges its contents into the uppermost tray. The discharge outlet of the chamber may communicate with a supplementary combustion chamber.—F. SODN.

Hydrofluoric acid; Manufacture of —. H. B. Bishop, Assignor to General Chemical Co., New York. U.S. Pat. 1,150,415, Aug. 17, 1915. Date of appl., Aug. 8, 1911.

THE formation of the hard cake of calcium sulphate which is produced in the interaction of calcium fluoride and sulphuric acid, is prevented by continually breaking up the entire mass of the reacting materials.—E. H. T.

Lime; Hydrating —. P. G. Toepfer, Milwaukee. Wis. U.S. Pat. 1,146,372, July 13, 1915. Date of appl., Aug. 21, 1913.

QUICKLIME is treated with water in an inclined revolving cylinder, and the slaked product, which is released intermittently, is dried by exposure to the atmosphere whilst being conveyed to a screen. The apparatus includes a device for precipitating lime powder from the vapour produced in the process.—F. SODN.

Ammonia; Manufacture of — from calcium cyanamide. W. S. Landis, Niagara Falls, N.Y., Assignor to American Cyanamid Co., Nashville, Tenn. U.S. Pat. 1,149,653, Aug. 10, 1915. Date of appl., June 18, 1914.

COMMERCIAL calcium cyanamide is heated in steam at above 120°, preferably above 130° C., in presence of less than 10%, preferably less than 6%, of a salt with an alkaline reaction, which tends to diminish the formation of dicyanodiamide.—E. H. T.

Oxides of nitrogen; Manufacture of —. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen, Germany. Eng. Pat. 13,087, June 5, 1914.

THE oxidation of ammonia is effected by employing as catalyst an oxide of a metal of the iron group (especially iron, manganese, chromium, or uranium), or more than one of such oxides, in separate pieces or lumps, which are preferably heated before use to 600°–800° C., so that no sintering or local fusion may take place in the contact tube. The catalyst may be prepared by breaking up an oxidised melt which has been allowed to solidify, or by heating hydroxides or salts, or it may consist of superficially oxidised spheres of metal. Thin layers of the catalyst should not be employed.—F. SODN.

Oxides of nitrogen from atmospheric air; Method of obtaining —. F. I. du Pont, Wilmington, Del. U.S. Pat. 1,147,150, July 20, 1915. Date of appl., Sept. 28, 1912.

SUCCESSIVE volumes of a mixture of oxygen and nitrogen, e.g., air, are independently compressed within a long, narrow space, and each volume is allowed to expand whilst under the influence of an electric arc which is drawn out between a stationary point and a point moving with the advance portion of the expanding gas, the

current being so adjusted that the gas is heated almost instantaneously to a high temperature, whilst the heat is simultaneously converted into mechanical energy.—F. SODN.

Nitrogen; Fixation of — by means of ferro-aluminium. Soc. Générale des Nitrures, Paris. Eng. Pat. 4287, March 18, 1915. Under Int. Conv., April 4, 1914.

CALCIUM carbide is added to the ferro-aluminium employed in the fixation of nitrogen (see Eng. Pat. 27,030 of 1913; this J., 1914, 549). For example, 20 kilos. of carbide (54% CaC_2) per 100 kilos. of ferro-aluminium (42% Al) is used.—F. SODN.

Nitride; Manufacture of double —. S. Peacock, Chicago, Ill., Assignor to Agricultural Research Corporation, New York. U.S. Pat. 1,147,184, July 20, 1915. Date of appl. Dec. 10, 1912.

BRIQUETTES made from a mixture of quicklime and carbon are heated in the presence of hydrogen and nitrogen, so as to decompose the double nitride of calcium and hydrogen, which is formed, yielding calcium nitride and ammonia.—F. SODN.

Radium emanation; Process and device for enriching or activating liquids or gases with —. E. Schwarz, Vienna. Eng. Pat. 18,023, July 1, 1914. Under Int. Conv., July 30, 1913.

THE radio-active substance, which may be either in the solid or dissolved state, is enclosed in a capsule of celluloid, or similar substance, and this is immersed in the fluid to be activated.—E. H. T.

Soluble salts; Purification of —. J. A. Newby, Westminster, and C. J. Montgomery, Dumfries. Eng. Pat. 18,601, Aug. 12, 1914.

AN impure salt is purified by washing it with a pure, saturated solution of the same salt in presence of a current of minute bubbles of air. The operation is conducted in a tank provided with a mechanical stirrer; the air current is forced in at the bottom and there is an overflow pipe at the top.—E. H. T.

Acid sulphates; Process for recovering products [sulphur dioxide and sulphites] from —. G. Hunnybun, Huntingdon. From F. J. Stanes and G. S. Rogé, Madras, India. Eng. Pat. 18,605, Aug. 12, 1914.

THE acid sulphate is made to interact with heated sulphur in a non-oxidising atmosphere, e.g., the substances may be heated together in a closed retort or muffle. The liberated sulphur dioxide is collected and the residual anhydrous sodium sulphite can be converted into bisulphite by treatment with sulphurous acid.—E. H. T.

Salt; Manufacture of — from brine. J. Todd, Ramsey, Isle of Man. Eng. Pat. 18,701, Aug. 15, 1914.

THE evaporating pan is so constructed that the furnace gases pass from the flues into a chamber at one side of it, thence through pipes extending through the pan to another chamber on the other side, down the flues below it, and finally into the chimney. The brine may be preheated by passing it through pipes, of an oval or flat cross-section, in the furnace or furnace flue.—E. H. T.

Potash and structural materials; Process of making — [from natural cement rock], and products thereof. A. C. Spencer, Washington, D.C. U.S. Pat. 1,146,532, July 13, 1915. Date of appl., Apr. 15, 1911.

A NATURAL cement rock containing potash is disintegrated and heated just below its fusing temperature, so as to expel most of the potash, and the hot plastic residue is compressed into blocks.—F. SODN.

Leucite rock; Treating — for the extraction of alkali and alumina contained therein. E. E. Dougherty, Bloomfield, N.J. U.S. Pat. 1,148,156, July 27, 1915. Date of appl., Oct. 11, 1913.

SUFFICIENT sulphuric acid is added to leucite to combine with the bases present; and the mixture is heated in the presence of hydrochloric acid until most of the water has been expelled and the mass has become pasty; then the heat is increased to drive off the remainder of the water and the hydrochloric acid (which is recovered by passing the vapours through a new charge) and the soluble sulphates are recovered by lixiviation.

—F. SODN.

Phosphorus pentachloride; Process of producing —. S. Peacock, Chicago, Ill., Assignor to Agricultural Research Corporation, New York. U.S. Pat. 1,147,183, July 20, 1915. Date of appl., July 17, 1912. Renewed March 5, 1913.

A PHOSPHATE, such as tricalcium phosphate, and an alkali chloride are heated, under reduced pressure, in an atmosphere free from oxygen, at a temperature sufficient to produce phosphorus pentachloride, the reaction products being drawn off as they are formed.—F. SODN.

Salts of formaldehyde-sulphurous acid with aluminium oxide; Manufacture of —. L. G. Bleckwenn, Hanover, Assignor to Chem. Fabr. von Heyden, A.-G., Radebeul, Germany. U.S. Pat. 1,149,712, Aug. 10, 1915. Date of appl., Jan. 11, 1915.

ALUMINIUM oxide (one mol.) is treated with formaldehyde (one mol.) and sulphurous acid (one mol.). The product is readily soluble in water, gives a precipitate of aluminium hydroxide when treated with sodium carbonate solution, and yields sulphur dioxide with strong acids.—F. SODN.

Air liquefier and separator. J. F. Place, Glen Ridge, N.J., Assignor to American Air-Liquefying Co., New York. U.S. Pat. 1,146,020, July 13, 1915. Date of appl., Jan. 2, 1908.

A PIPE, having a portion coiled so as to form a series of superposed, inverted cone frustums, communicates at one end with a supply of compressed air, and at the other with a distributor which delivers liquid air over the uppermost cone-shaped coil and thence, over similar distributors and coils below, to an insulated low-pressure liquid-air evaporating vessel, a liquid-air pressure-releasing valve being fitted in the pipe between the air supply and the distributor. Each distributor is constructed with radial grooves, so that the liquid air, which is received for separation by the uppermost distributor from an outside source and also from the lower portion of the coiled pipe submerged in the liquid of the low-pressure evaporator, flows uniformly from its periphery on to the upper part of the corresponding helical coil. The apparatus furnishes nitrogen gas and liquid oxygen.—F. SODN.

Nitrogen and carbon dioxide; Process of making —. R. H. Brownlee and R. H. Uhlinger, Assignors to American Nitro-Products Co., Pittsburgh, Pa. U.S. Pat. 1,150,337, Aug. 17, 1915. Date of appl., Aug. 18, 1913.

FUEL is added to the products of combustion of an internal explosion engine, and combination of the mixture is effected by passing it through a mass of highly heated refractory material to produce a maximum amount of carbon dioxide. The resulting gases are passed through an absorbing medium to absorb the carbon dioxide and release free nitrogen.—W. G. C.

Nitric acid of highest concentration; Manufacture of —. Farb. vorm. Meister, Lucius, und Brüning, Höchst, Germany. Eng. Pat. 13,842, June 8, 1914. Under Int. Conv., June 21, 1913.

SEE Fr. Pat. 472,775 of 1914; this J., 1915, 491.

Nitric acid; Manufacture of —. F. Raschig, Ludwigshafen, Germany. Eng. Pat. 3208, Feb. 27, 1915. Under Int. Conv., Feb. 28, 1914.

SEE U.S. Pat. 1,130,104 of 1915; this J., 1915, 423.

Acetic acid from acetylene; Manufacture of —. Chem. Fabr. Griesheim-Elektron, Frankfurt, Germany. Eng. Pat. 14,113, June 11, 1914. Under Int. Conv., June 24, 1913.

SEE Fr. Pat. 473,158 of 1914; this J., 1915, 491.

Ammonia; Producing —. F. Haber, Berlin, C. Bosch, and A. Mittasch, Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen, Germany. U.S. Pat. 1,149,510, Aug. 10, 1915. Date of appl., Jan. 30, 1912.

SEE Fr. Pat. 439,261 of 1912; this J., 1912, 721.

Marine plants; Process of treating — [to recover iodine, etc.]. M. P. P. Gloess, Brest, and L. P. J. and E. R. Darrasse, Paris. Eng. Pat. 9775, April 20, 1914. Under Int. Conv., June 27, 1913.

SEE U.S. Pat. 1,103,283 of 1914; this J., 1914, 920.

Oxides of nitrogen; Production of —. Verein. Chem. Fabriken in Mannheim, Mannheim-Wohlgelegen, Germany. Eng. Pat. 12,600, May 22, 1914. Under Int. Conv., May 28, 1913.

SEE Fr. Pat. 472,567 of 1914; this J., 1915, 492.

Carbonate of magnesia; Preparation of — from minerals containing calcium and magnesium. A. Hambloch, Andernach, Germany, and S. Gelleri, Budapest. Eng. Pat. 17,311, July 21, 1914. Under Int. Conv., Dec. 24, 1913.

SEE Ger. Pat. 280,738 of 1913; this J., 1915, 492.

Calcium hypochlorite; Manufacture of —. Chem. Fabr. Griesheim-Elektron, Frankfurt, Germany. Eng. Pat. 17,859, July 28, 1914. Under Int. Conv., Nov. 11, 1913.

SEE Ger. Pat. 282,746 of 1913; this J., 1915, 715.

Ozone; [Use of chromium-iron alloys for apparatus for the] production, storage, and utilisation of —. Chem. Fabr. Griesheim-Elektron, Frankfurt, Germany. Eng. Pat. 14,448, June 16, 1914. Under Int. Conv., June 16, 1913.

SEE Ger. Pat. 274,872 of 1913; this J., 1914, 790.

Hydrogen; Manufacture of —. K. Schaefer, Charlottenburg, Germany. Eng. Pat. 16,140, July 6, 1914.

SEE U.S. Pat. 1,144,730 of 1914; this J., 1915, 834.

Manufacture of peat fuel and ammonia from crude peat. Eng. Pat. 17,882. See IIA.

Process of recovering alkalis from cement-kilns. U.S. Pat. 1,150,295. See IX.

Electrolytic cell. Method of electrolysis [of alkali and alkaline-earth salts]. U.S. Pat. 1,149,210 and 1,149,211. See XI.

Apparatus for producing ozone and separating gases. U.S. Pat. 1,149,254. See XI.

VIII.—GLASS; CERAMICS.

Glass; Formulae for —. Proc. Institute of Chemistry, 1915, Part III.

SATISFACTORY reports have been received from manufacturers who have tried the formulae suggested by the Glass Research Committee (see this J., 1915, 424). An additional formula is given for a lead glass suitable as an enamel for sealing platinum into soft glass:—Red lead

(Pb₂O₄) 55.3 parts; sand, 38; potassium carbonate, 9; sodium carbonate, 1.7; alumina, 1; calcium carbonate, 1 part. This glass has a very low fusing point and joins satisfactorily to soft glass tubing.

Clay; Rational analysis of —. O. Kallanner and J. Matejka. Sprechsaal, 1914, 47, 423. J. Chem. Soc., 1915, 108, ii., 572.

MOISTURE (*T*) is estimated by drying the clay at 110°–120° C.; the clay is then digested with cold hydrochloric acid (1:1), washed with water, and again dried. The loss in weight corresponds with the amount of acid-soluble substances (*I*). A portion of the dried clay is now used for the estimation of the loss on ignition (*G*), whilst another portion (2 grms.) is heated at 700° C., then digested with 150 c.c. of hydrochloric acid, and the insoluble portion (*R*) collected on a filter and washed with hot water. The filtrate is diluted to 500 c.c., and 100 c.c. of this solution is used for the estimation of the soluble silica, iron oxide, and alumina (*m*₁); the amount of clay-substance (*II*) is found by multiplying the sum of the iron oxide and alumina by 2.533. The insoluble residue (*R*) is treated with hydrofluoric acid and sulphuric acid; the mixture is heated until the sulphuric acid has been expelled, and the dissolved alumina (*m*₂) is estimated by precipitation with ammonia; its weight multiplied by 5.46 gives the quantity of felspar (*III*). If the clay contains an appreciable quantity of mica, potassium is estimated in the filtrates from the aluminium hydroxide precipitates, *m*₁ and *m*₂; let the amounts of K₂O be *n*₁ and *n*₂. The mineral constituents of the clay are then calculated as follows: Clay substance (*II*) = 2.533*m*₁ – 21.505*n*₁; felspar (*III*) = 8.882*n*₂ – 2.728*m*₂; quartz = (*T*) – [(*I*) + (*G*) + (0.861 × *II*) + (0.954 × *IV*)]; mica (*II'*) = 8.49*n*₁ – 4.237*n*₂ + 3.907*m*₂.

PATENTS.

Enamels and the like; Opaquing composition for —. J. Weber, Essen, Germany. U.S. Pat. 1,150,467, Aug. 17, 1915. Date of appl., Jan. 31, 1912. SEE Fr. Pat. 439,609 of 1912; this J., 1912, 723.

Enamels; Opaquing agents for the production of white —. I. Kreidl, Vienna. U.S. Pat. 1,150,772, Aug. 17, 1915. Date of appl., Sept. 4, 1913.

SEE Fr. Pat. 462,587 of 1913; this J., 1914, 314.

IX.—BUILDING MATERIALS.

Iron-Portland cement [slag cement] in comparison with Portland cement; Examination of —. M. Gary and H. Burchartz. Mitt. Königl. Materialprüfungsamt, 1915, 33, 29–34. (See this J., 1909, 1250, and 1912, 818).

With the testing of the 10-year old briquettes this research has been concluded. Tables are given showing the complete series of tests.—T. St.

Portland cements, iron-Portland cements, blast-furnace cements, and other hydraulic cements; The properties of —. H. Burchartz. Mitt. Königl. Materialprüfungsamt, 1915, 33, 31–72.

THE results of tests of the samples of cement completely examined during 1913 are given and discussed. The report contains the following sets of results arranged in tabular form:—(1) results of the physical and mechanical tests of 101 Portland cements, 22 iron-Portland cements, 27 blast-furnace cements, and 20 various cements not included in the previous classes; (2) results of chemical analysis of 27, 18, 4, and 14 samples of the same materials respectively; (3) the mean results of the mechanical tests made on Portland cement

samples for each of the years 1909 to 1913 inclusive; (4) the limit and mean percentages of the various constituents in the four classes of cements; (5) the limit and mean values of the results of mechanical tests made on the samples of the four classes of cements.—T. St.

PATENTS.

Cement, ores, and the like; Method of burning —. E. C. R. Marks, London. From G. Polysius, Dessau, Germany. Eng. Pat. 17,115, July 20, 1914.

HEAT-INTERCHANGING bodies, formed of iron, are fastened to the inner wall of a rotary kiln, parallel to its axis, and projecting towards the centre. They serve to take up heat from the burnt material and transfer it rapidly to the incoming cooling air. The burner nozzle, extending over a considerable section of the cooling zone of the kiln, is supported at one end only and made of thin sheet metal.—W. C. H.

Cements and concretes. E. Longan y Senan, Aytona, Spain. Eng. Pat. 17,756, July 27, 1914.

CEMENTS or hydraulic limes containing free lime are mixed in the finely ground state with granite or diorite which has been heated for at least 2 hours at about 1000° C., and converted into a fine powder. The silica in this product is capable of acting on the free lime, and the setting power of the cement is thereby improved. The heating may be carried out in an inclined gas-heated tube furnace. In making concrete, similar granite or diorite is calcined, broken into small pieces about the size of nuts, moistened, and mixed with the improved cement.—T. St.

Cement; Manufacture of magnesian —. E. Müller and E. Eichert, Frankfort, Germany. Eng. Pat. 17,829, July 28, 1914. Under Int. Conv., Dec. 13, 1913.

BURNT magnesite and dry unburnt clay, preferably a fine-grained clayey marl which easily softens in water, are well mixed in suitable proportions and finely powdered together, the necessary quantity of water being added prior to use. Finely powdered potassium salts may also be added.—W. C. H.

Cement, whitening, Paris white, or the like; Production of coloured —. J. C. Pelton, San Francisco, Cal., U.S.A. Eng. Pat. 18,520, Aug. 10, 1914.

COMMERCIAL iron sulphide is made into a paste with sulphuric acid, and the paste, after dilution with water, is allowed to soak into cement, whitening, Paris white, etc. The soaked product is then dried, reburnt, and reground.—W. C. H.

Cement-kilns; Process of recovering alkalis from —. S. B. Newberry, Baybridge, Ohio. U.S. Pat. 1,150,295, Aug. 17, 1915. Date of appl., March 14, 1913.

FLUE-DUST is separated from the stack-gases of cement-kilns, which are then cooled by contact with heat-absorbing surfaces and washed with aqueous liquid. The washed gases are freed from suspended liquid by passing them through a porous layer, and insoluble matter is separated from the solution of alkali salts thus obtained; the flue-dust and insoluble matter are returned to the kiln, and part of the solution is evaporated, whilst the remainder is returned to the liquid used for washing the gases.—W. C. H.

Cementitious plastic composition; Method of making a —. J. H. Amies, Philadelphia, Pa. U.S. Pat. 1,150,481, Aug. 17, 1915. Date of appl., Dec. 30, 1914.

QUICKLIME in dry, powdery form is mixed with

earthy material, and water is added to slake the lime. When the heat due to the slaking is greatest, hot liquid pitchy material (four parts for each one part of quicklime) is added, and also an additional part of calcium oxide to induce granulation of the mass, to every four parts of which about one part of cement, in the form of a thin mortar, giving an alkaline reaction, is finally added. During the various steps of the process, the mass is kept continuously agitated.—W. C. H.

Road dust; Process for binding—H. F. T. Lindballe, Skaarup, Denmark. Eng. Pat. 17,952, July 29, 1914.

A MIXTURE of hygroscopic salts and substances containing sugar is used, the proportion of the former substantially exceeding that of the latter, for instance, a solution of 100 lb. of sodium chloride and 35 lb. of molasses in 600 lb. of water.—W.C.H.

Fire-proof compositions. W. W. Crawford, Westminster. Eng. Pat. 18,439, Aug. 8, 1914.

ABOUT 82% of finely divided silica is mixed into a stiff paste with about 18% of refuse oil from mineral oil stills, and the mixture heated to 2000° C. in a reducing atmosphere until the mass has "clinkered." The clinker, which contains free carbon, is then ground to a powder, mixed into a thick paste with a concentrated solution of sodium silicate, compressed in moulds, and dried. To produce bricks, etc., capable of withstanding the highest temperatures, about 15% of finely divided tungstic oxide is mixed with the other ingredients.—T. St.

Waterproofing composition [for masonry]; Plastic—A. C. Horn, New York. U.S. Pat. 1,149,519, Aug. 10, 1915. Date of appl., Nov. 10, 1914.

A COMPOSITION which readily adheres to surfaces of masonry and remains plastic for an indefinite period, consists of slightly vulcanised Chinese wood-oil of a "heavy fluent consistency" and a pigment, unaffected by sulphur.—W. C. H.

Process of making potash and structural materials [from natural cement rock]. U.S. Pat. 1,146,532. See VII.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Iron carbides and their catalytic action on the decomposition of carbon monoxide. S. Hilpert and T. Dieckmann. Ber., 1915, 48, 1281—1286.

FERRIC oxide, when heated in the presence of carbon monoxide at 950° C., was reduced to metallic iron, but the metal was not carburised at this temperature (compare Hilpert and OrNSTEIN; this J., 1913, 698). At 850° C., however, iron carbide was formed, and rapid separation of free carbon commenced when the carbon content exceeded 6% (the approximate proportion present in the carbide, Fe_3C). Separation of carbon was not observed during the period of reduction, nor during initial carburisation. The black products containing separated carbon were found to lose their magnetic properties at about 200° C., like iron carbide, and it is considered that the carbides, rather than metallic iron or free carbon, are responsible for the catalytic decomposition of carbon monoxide into carbon dioxide and carbon. It is suggested that triferrous carbide is first formed and converted by carbon monoxide into unstable compounds richer in carbon (e.g., Fe_2C or FeC), from which carbon is liberated, forming triferrous carbide again. The idea of surface action is rejected, since contact poisons, such as

ammonia, have no effect on the reaction. The carbide in the black product behaves like that in tempered steel (Heyn and Bauer; this J., 1906, 987), and it is thought that in both cases unstable carbides are present (see RUFF; this J., 1912, 233).—F. SODN.

Iron; Rusting of—in water softened by the Permutit process, and means for preventing rusting. O. Bauer and E. Wetzel. Mitt. Königl. Materialprüfungsamt, 1915, 33, 1—29.

CORROSION tests were made with plates of cast iron and mild steel in distilled water, tap-water, and tap-water softened by means of Permutit. Rusting (loss in weight) was found to correspond with the amount of dissolved oxygen in the water, and this was greatest, at temperatures above atmospheric, in the softened water. Experiments with added sodium sulphite showed that the reaction between this salt and the dissolved oxygen took place quantitatively, but that at the ordinary temperature the reaction was very slow. At higher temperatures and when traces of copper salts were present, it was considerably accelerated. Tests made with both softened and unsoftened waters to which sodium sulphite had been added, showed that the addition of the salt prevented rusting both at the ordinary temperature and at 211° C. (20 atmospheres pressure).—T. St

Steel production in the United States in 1914. Eng. and Min. J., Aug. 14, 1915.

THE American Iron and Steel Association Bulletin No. 4 gives the production of steel in the United States during 1914 as 23,513,030 long tons, a decrease of 7,784,844 tons from 1913. Of the total, 69·2% was basic (open hearth) steel, and 26·5% was made by the Bessemer process. The production of "electric steel" amounted to 24,000 tons.

Iron and steel production in Canada. Board of Trade J., Aug. 26, 1915.

THE American Iron and Steel Institute gives the following statistics for the production of iron and steel in Canada during 1913 and 1914:—

	1913.	1914.
	Tons of 2240 lb.	Tons of 2240 lb.
Pig iron	1,015,118	705,972
Steel ingots and castings	1,042,503	694,447
Finished rolled iron and steel	967,097	659,519
Forged iron and steel ..	23,405	8,138
Cut nails and wire nails	67,857	51,071

The production of pig iron during the first half of 1915 was 366,825 tons, compared with 442,430 tons in the first half of 1914.

Pig iron production in Germany. Board of Trade J., Aug. 26, 1915.

"STAHL und Eisen" of Aug. 5th states that the production of pig iron of all kinds in Germany during the first half of 1915 amounted to 5,534,337 metric tons, compared with 9,288,196 tons during the first half of 1914.

Antimonial gold ores from the Murchison Range; Treatment of—H. R. Adam. J. Chem. Met., and Min. Soc. S. Africa, 1915, 15, 322—326.

THE Murchison Range (N.E. Transvaal) deposits consist of superficially oxidised stibnite in quartz, the gold being associated chiefly with the latter. Where the antimony is not much above 1%, the gold can be extracted with fair success by the usual methods. The consumption of cyanide is always high, as antimony sulphide dissolves in

alkali, and addition of lime only increases the consumption. Small-scale tests showed that amalgamation, followed by concentration and cyanidation of the tailings, would give an extraction of 70–80%. Experiments made with a view to removing the antimony from higher-grade stibnite ore by volatilisation as trioxide or chloride, or by leaching with alkali, were more or less unsuccessful. Acid flotation tests on a laboratory scale gave the following results:—

Ore.	Float.		Middling and tailing.	
	Percentage of total		Percentage of total	
Size of sieve.	Au dwt.	Sb %.	Au.	Sb.
mesh.				
—60	8.0	16.1	7	87
—30	6.7	28.1	39	89
slime	3.0	19.5	20	54
—60	8.3	3.7	8	80
—60	7.5	7.2	11	63
—50 + 90	20.4	3.5	18	87
—90	20.6	8.3	35	92

—W. R. S.

Gold precipitation on paper cathodes. D. Lay. Eng. and Min. J., 1915, 100, 276–277.

STRIPS of smooth paper, 2–3 in. wide, were dipped in melted beeswax, and then in flake graphite before the wax had solidified. After cooling, more graphite was rubbed on until the surface appeared highly polished. A number of these strips were used side by side with lead cathodes, for the electrodeposition of gold. The coating adhered firmly to the paper cathodes; after 30 days' immersion, they gave a ringing sound when tapped with a piece of metal. The chief advantage claimed for this form of cathode is the purity of the bullion obtained by simple incineration and melting.—W. R. S.

Gold; Dissolved — in slime residue. L. R. Benjamin. J. Chamber of Mines, W. Australia, Sept., 1914. J. Chem., Met., and Min. Soc. S. Africa, 1915, 15, 337–342.

THE proportion of dissolved and undissolved gold in slime residues is best ascertained by filtering and assaying the solution, and calculating the dissolved gold from the proportion of solution to dry slime. The undissolved gold is found by difference, after determining the total gold content in the dried material. In the latter assay, the usual practice of drying the pulp over a fast fire leads to low results, ascribed chiefly to the imperfect removal from the sides of the iron dish, of incrustations containing the gold from the more concentrated solution formed during the later stages of the drying. The error is largely overcome by precipitating the dissolved gold prior to drying, by adding 10 c.c. of 5% cuprous chloride solution per kilo. of pulp. After thorough stirring, the mixture is evaporated as usual. The direct determination of undissolved gold is untrustworthy, as the slime cake cannot be washed absolutely free from soluble gold.—W. R. S.

Canadian nickel production. Eng. and Min. J., Aug. 21, 1915.

THE world's production of fine nickel in 1913 approximated 34,000 tons, of which the Canadian ore contained 24,838 tons; the ore produced by La Société de Nickel of New Caledonia and refined in France contained about 8000 tons and production in Norway amounted to 400 tons, the remainder having been refined in Germany from various metallurgical processes. Practically all of

the ore mined in Ontario was reduced to matte and shipped to the United States and Great Britain to be refined, only a small percentage having been refined in Canada.

The production of nickel in the Sudbury district—which region yields 73% of the world's output of nickel—is closely associated with that of copper, the matte produced containing about 50% Ni and 25% Cu. The details of this production for 1912 and 1913 are:—

	1912.	1913.
	tons.	tons.
Ore raised from mines	737,656	784,697
Ore smelted at mines	725,065	823,403
Bessemer matte produced	41,925	47,150
Nickel content of matte	22,421	24,838
Copper content of matte	11,116	12,938

The largest producer of nickel is the Canadian Copper Co., of Copper Cliff, Ont., its output of matte in 1913 having contained about 22,000 tons of nickel, which was principally shipped to refiners in New Jersey. The Mond Nickel Co., of Coniston, Ont., produced matte containing 2600 tons of fine nickel, this matte being sent to Swansea, Wales, for refining.

Under the metal refining act of 1907, extended in 1912 for a period of five years, a bounty of 6c. per lb. is paid on such metal in cobalt or nickel oxide or metal as is refined in the Province of Ontario. The only company that took advantage of this law during 1913, in respect to nickel, was the Coniagas Reduction Co., Ltd., of St. Catherine's, Ont., the production of that company in the year having been 149,645 lb. of metal.

Nickel; Manufacture of — in Canada. U.S. Comm. Rept. No. 187, Aug. 11, 1915.

THE Canadian Smelting and Refining Co., of Orillia, Ontario, has commenced to smelt and refine nickel from ores mined in the Sudbury district, about 200 miles distant. A small quantity of the metal had been extracted on Aug. 3rd, believed to be the first production of nickel in Canada.

Zinc; Induction period and passivity of —. M. Centnerszwer and J. Drucker. J. Chim. Phys., 1915, 13, 162–195. (See this J., 1914, 753.)

ZINC is rendered passive by heating *in vacuo* or in hydrogen, and the effect seems to extend beyond the surface, for the activation induced by polishing with emery paper is less than in the case of zinc which has not been heated. In presence of ferrous sulphate the induction period is shorter and the maximum speed of solution in acid is greatly increased. Amalgamated zinc is passive and does not dissolve appreciably in *N/1* hydrochloric acid. Active zinc exhibits a slightly higher potential than passive zinc against a normal calomel electrode. Zinc is rendered passive by anodic polarisation and active by cathodic polarisation in *2N* sulphuric acid.—A. S.

Zinc; Displacement of metals from solutions of their salts by —. M. Centnerszwer and J. Drucker. J. Chim. Phys., 1915, 13, 196–206.

EXPERIMENTS with zinc in solutions of copper, cobalt, and nickel salts showed that the induction period is much shorter than in the case of the action of acids on zinc, and in many cases it can be observed only with very dilute solutions. Sackur's observation (Z. Elektrochem., 1904, 10, 841; 1908, 14, 607) that zinc is not capable of displacing copper from solutions of complex copper cyanides and copper thiocyanate, iron from iron sulphate, or nickel and cobalt from their nitrates, is confirmed. This is, however, apparently not due to a specific action of

the anions, for experiments with nickel sulphate solution to which potassium nitrate was added, showed that the presence of NO_3^- ions is without effect on the displacement of nickel by zinc. The displacement of copper from copper sulphate solution by zinc is governed by the speed of diffusion of the dissolved salt from the solution to the surface of the zinc, and hence the reaction velocity is directly proportional to the concentration of copper sulphate. The behaviour of zinc in solutions of metallic salts and in acids is explained as follows:—In the case of metallic salt solutions local galvanic elements are formed shortly after the initial deposition of metal on the zinc. The resistance of these elements is very low, and hence the electrochemical displacement of the metal by zinc proceeds with high velocity, and the speed of the reaction is determined by the rate of diffusion of the dissolved salt. In the case of acids, on the other hand, bubbles of hydrogen are liberated at the surface of the metal, and formation of local galvanic elements takes place only as a result of the presence of impurities in the zinc or by solution of hydrogen in the zinc (compare this J., 1914, 753, and preceding abstract); both of these causes act very slowly and hence the induction period is prolonged.—A. S.

Cold-worked metals; The properties of—Part II. *Methods of measuring small changes of density produced by annealing.* R. G. Parker and T. M. Lowry. Chem. Soc. Trans., 1915, 107, 1160—1168.

THE small changes of density produced by annealing have been measured by the use of a pyknometer or a dilatometer. Silica flasks, 5—7 c.c. in capacity, with a neck 1 mm. in bore, were used as pyknometers, the filling liquid being either ethylene dibromide or carbon tetrachloride. The metals were either annealed in the flasks or, at higher temperatures, in silica test tubes and then transferred to the flasks. With silver-tin dental alloy, Ag_3Sn , the annealing at 100°C . was complete in 2 hours, but a further and larger increase of density was produced at 350°C . Silver-cadmium alloy (about 70% Cd) behaved similarly, but the changes were smaller. The density of copper is reduced by filing, but the density is partly recovered at 100°C . and 400°C ., and there is a still further gain by treatment with dilute nitric acid. With the dilatometer, the difficulty of maintaining a sufficiently constant temperature has been overcome by taking differential observations with two dilatometers, one containing the metal and liquid, and the other liquid alone, paraffin, b.pt. $245^\circ\text{—}280^\circ\text{C}$., fractionated from commercial kerosene, being mostly used. For heating, vapour baths of alcohol, water, aniline, quinoline, and amyl benzoate were used, the use of a dummy dilatometer being equivalent to controlling the temperature within about 0.001°C . An example is given in detail of the changes observed by the use of the dilatometer during the annealing of antimony for 27 hours at 100°C .; the percentage change in volume was -0.0672 , corresponding to an increase of density of $+0.0045$. —B. N.

Zinc production in Canada. Board of Trade J., Sept. 9, 1915.

BOUNTIES on a sliding scale, not exceeding 2 cents (1d.) per lb., will be granted on the production in Canada of zinc from Canadian ores when the standard price in London (England) falls below £33 per ton of 2000 lb. Such zinc must not contain more than 2% of impurities. The bounties will not be payable on zinc produced after the expiration of the war, or after 31st July, 1917, or on zinc contracted for by the Shell Committee at

a price of 8 cents (1d.) or over per lb. The total amount of bounty paid will not exceed 400,000 dol.

Although Canada possesses many deposits containing zinc, the production is not large owing to the difficulty of extraction from the ores. Freight duty and smelters' charges are high. Most of the ore is mined in British Columbia and shipped to the United States for smelting. The quantity and value of zinc ore produced in Canada during the last three years were as follows:—

	Tons of 2000 lb.	Value in dols.
1912	6,415	215,149
1913	7,535	400,000
1914	13,140	310,000

The following statistics show the values of the imports into Canada of zinc and zinc manufactures from the countries mentioned during the two years ended 31st March, 1913 and 1914:—

	Year ended 31st March.	
	1913.	1914.
	dols.	dols.
United Kingdom	151,834	137,342
United States	539,926	449,587
France	1,018	1,239
Germany	26,278	29,763

Mineral production of South Africa. Board of Trade J., Sept. 9, 1915.

THE total value of the mineral output of the Union of South Africa for 1914 was £45,366,224, as compared with £52,924,990 in 1913.

The following table shows the production of the chief minerals:—

	1913.	1914.
	£	£
Gold	37,374,553	35,664,230
Silver*	115,822	102,471
Diamonds	11,389,807	5,487,194
Coal	2,240,458	2,258,896
Coke	15,862	12,377
Copper	507,856	692,355
Tin	436,550	311,391
Asbestos	16,028	20,087
Graphite	1,257	970
Magnesite	1,194	1,451
Lead	1,199	1,396
Salt	77,142	67,648
Lime	118,984	109,041
Flint	3,789	2,508

*Contained in gold bullion and base metal ores.

All diamond mines were closed down at the outbreak of the European war. The output of gold in 1914 represented 38% of the world's production. The total production of gold in the Union of South Africa since 1868, when gold was first discovered, amounts to approximately £436,830,000 up to the end of 1914, and was practically all won in the Transvaal.

Mineral resources of Columbia. U.S. Commerce Rept., Suppl. No. 42B, Aug. 20, 1915.

THE total value of minerals exported from Cartagena in 1914 was \$1,549,164, of which two-thirds went to the United States. The exports of gold from Columbia were valued at \$5,122,224, nearly one-fifth being from Cartagena. The principal gold-bearing areas are Choco, the Department of Antioquia, and the district between the Cauca and Magdalena rivers. Platinum was exported from Cartagena to the extent of 9382 oz., valued

at \$357,519 in 1914, practically all of which went to the United States. There is also a small production of silver, salt, and emeralds. Petroleum deposits exist in the Sinu River district, but at present there are no producing wells. Coal, iron, and copper are found in paying quantities, but inadequate facilities for transportation, lack of capital, and absence of demand account for the fact that they are not being worked.

Minerals in Portugal. U.S. Comm. Rept. No. 192, Aug. 17, 1915.

THE production of tungsten ore in Portugal during 1913 was 753 tons, valued at £113,000. At present there are twelve productive mines, the largest being the Borralha mine, which produced 361 tons of 65% ore. The output of copper in 1913 was 547,516 tons, the mines giving employment to about 5000 people. There was also a small output of tin, lead, iron, and coal. The uranium mines in the Guarda district produced 1266 tons of ore and 186 mgrms. of radium bromide.

Determination of ferrous iron in silicates by titration with bichromate. Barnebey. See VII.

Cause of the red coloration sometimes obtained on decomposing basic slag with sulphuric acid. Ditz. See XVI.

PATENTS.

Steel; Manufacture of—. Rombacher Hüttenwerke, and J. I. Bronn, Rombach, Germany. Eng. Pat. 2385, Jan. 1, 1914. Addition to Eng. Pat. 29,051 of 1912 (this J., 1914, 360, and 1913, 917).

FOR introducing a special element into steel an alloy of the element with refined iron is used. The present modification consists in adding the alloy after it has been allowed to cool, instead of using it in the molten state immediately after preparation.—T. St.

Silicon steel sheets; Manufacture of—. O. Graef, Bismarckhütte, Germany. Eng. Pat. 13,703, June 5, 1914.

SILICON steel sheets, for use in electric dynamos and motors, are annealed before pickling. After the pickling, which is effected in warm dilute acid solution, they are washed in a neutralising solution, and then dried by being passed through heated rollers. This reversion of the final operations is stated to improve the magnetic properties of the sheets, the permeability being increased, and the loss due to hysteresis reduced.—T. St.

Cast-iron; Process of treating [removing oxygen from]—. J. E. Johnson, jun., New York. U.S. Pat. 1,150,201, Aug. 17, 1915. Date of appl., Dec. 8, 1913.

THE molten metal is poured into an electric furnace and heated in a reducing atmosphere to a higher temperature, to cause combination of the oxygen with the other impurities.—W. R. S.

[Tungsten] wire; Manufacture of—. Westinghouse Metallfaden Glühlampenfabrik G. m. b. H., Vienna. Eng. Pat. 12,358, May 19, 1914. Under Int. Conv., May 26, 1913.

ISCOATS of tungsten or other refractory metals are coated, before being reduced to wire, with sulphur, selenium, tellurium, or other suitable material which can be removed subsequently without leaving a residue. Such a coating serves both as a lubricant and as a protector against oxidation. The coating may be applied by exposing the heated metal to the vapours of the elements or to their hydrides; by dipping the metal in a bath of the molten material; by passing the metal

through the flame of a combustible compound, such as the hydride; or by applying the element to the drawing dies, where it melts and coats the wire.—T. St.

Tungsten; Rendering—ductile. C. Trenzen, Cologne, Germany. Eng. Pat. 14,381, June 15, 1914.

TUNGSTEN in the form of crystalline powder is stirred into a solution of alkali nitrite (40 grms. anhydrous salt in 100 c.c.) and heated therein to 127° C. for three or four hours, after which it is washed free from alkali compound and dried on a water bath. The dry powder is compressed into a slightly coherent bar, and consolidated by heating to a high temperature in a vacuum or in an inert gas. The resulting bar is very ductile and can be drawn into fine wire.—T. St.

Tungsten; Manufacture of pure ductile—. Glühfadenfabrik Aarau A.-G., Aarau, Switzerland. Eng. Pat. 23,496, Dec. 3, 1914. Under Int. Conv., Jan. 15, 1914.

PURE tungsten powder is placed in a vertical tube of graphite or hard carbon, and this is surrounded by two concentric cylinders which are heated to bright incandescence by an electric current. The furnace is enclosed above and below by suitable blocks. When the tungsten is melted to a perfectly fluid mass, the cylinders are lifted clear, and this movement is caused automatically to stop the current, and to allow cold compressed air to impinge on the graphite tube from two laterally placed funnels. The tungsten is thereby very rapidly cooled and is thus rendered perfectly malleable and ductile.—T. St.

Filament; Ductile—. O. M. Thowless, Newark, N.J. U.S. Pat. 1,149,701, Aug. 10, 1915. Date of appl., March 20, 1914.

REFRACTORY metal is flashed on a metal core, which is then removed. The tube of refractory metal remaining is reduced to a smaller diameter, and then made to serve as the core for the deposition of more metal. The product is heated and worked until it becomes a substantially solid body, and is finally reduced to a filament.—T. St.

Electroplating wire; Apparatus for—. V. F. Feeny, London. From Fabr. Elektr. Zünder G. m. b. H., Köln-Niehl, Germany. Eng. Pat. 13,699, June 5, 1914.

THE wire is passed through the electroplating bath in the form of a continuous spiral around two vertical rolls, which serve as cathodes to connect the spirals to the battery. To prevent the anode metal from being deposited on the rolls, protective glass walls are provided, perforated and fitted with glass guides to allow the passage of the wire.—W. G. C.

Alkali metals; Electrolytic production of—. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen, Germany. Eng. Pat. 17,763, July 27, 1914.

IN the production of alkali metals by the electrolysis of molten hydroxides, hydroxyl ions are liberated at the anode, and combine together to form water, which reacts with the alkali metal and diminishes the yield. If the alkali which has taken up water is replaced continuously by fresh anhydrous alkali, either by means of a pipe leading to the cell on the cathode side, or by an opening in the lower part of the cell, the yield of alkali metal is increased.—W. G. C.

Sulphides or sulphide ores; Process for treating metallic—. W. M. Hooton, Burton-on-Trent. Eng. Pat. 18,007, July 30, 1914.

IRON pyrites, etc., is heated to 750°–1000° C.,

and treated with steam in a vertical furnace, the process being continuous. Sulphur first distils off in the upper, cooler part of the furnace, and condenses in a channel at the upper end, where, in the molten state, it forms a seal. The lower end of the furnace is closed by a water seal where the treated ore, which is very porous and free from sulphur, is drawn off. Steam is blown into the furnace by a pipe near the bottom, and the gaseous products, hydrogen, hydrogen sulphide, and sulphur dioxide, are drawn off through a pipe situated a little way above. The mixed gases pass over bog iron ore, where reaction between the hydrogen sulphide and sulphur dioxide is initiated. The sulphur thus produced is removed by condensation, the cooled gases being passed over cold bog iron ore to remove any remaining hydrogen sulphide, and then through an alkali solution to remove sulphur dioxide. The residue consists of hydrogen of a high degree of purity.—T. St.

Sulphide ores; Separation of mixed——. Minerals Separation, Ltd., London. Eng. Pat. 8746, June 14, 1915. Under Int. Conv., June 19, 1914.

IN the flotation separation of mixed sulphides (pyrites, galena, and blende), the slime, etc., is agitated with water containing in solution 0.1 to 1.0% of a sulphide of an alkali (sodium sulphide) or of an alkaline earth, with or without a frothing agent. The solution is preferably heated to 130°–140° F. (55°–60° C.). The addition, in certain cases, of about 0.1 to 0.5% of sodium carbonate, and in others, of a small quantity (0.1%) of potassium bichromate, is advantageous.—T. St.

Metals from their ores or other metal-bearing material; Method of reducing——. E. Millington, Borrowash, and Kittel and Co., Ltd., London. Eng. Pat. 20,832, Oct. 10, 1914.

FINELY-DIVIDED metal-bearing ore, magnetically separated iron ore, mill scale, or other metal-bearing material, is mixed with coal, coal dust, charcoal, or other form of carbon, and a flux, the mixture is stamped or pressed into briquettes with the aid of tar or pitch, and coked at 700°–850° C. The briquettes are specially suitable for subsequent treatment in an electric smelting furnace.—A. S.

Slimes and colloidal masses; Treatment of—— and recovery of the metalliferous contents of ores, tailings, middlings, and concentrates. A. A. Lockwood, Merton Park, Surrey. Eng. Pat. 174, Jan. 5, 1915.

THE selective and segregating action of colloidal and greasy substances such as mica, schist, asbestos, shale, colloidal silica, etc., when these are associated with metalliferous particles, is destroyed by passing the concentrate or slime through a mass, preferably moving, of coarsely ground particles, preferably of a silicious nature. The most efficient size of the particles is determined by experiment in each particular case.—T. St.

Furnace; Metallurgical——. G. C. Carson, Denver, Colo. U.S. Pat. 1,149,195, Aug. 10, 1915. Date of appl., Jan. 15, 1907.

A REVERBERATORY furnace has storage bins above its roof, and lateral passages leading from the bins, through which the ore descends into the furnace, forming a lining.—W. R. S.

Alloy; Noble——. E. Haynes, Kokomo, Ind. U.S. Pat. 1,150,113, Aug. 17, 1915. Date of appl., May 10, 1915.

AN alloy of cobalt, chromium, and iron in which the proportions of cobalt and iron exceed 5 and 10% respectively.—W. E. F. P.

Zinc ores; Electric reduction of——. W. McA. Johnson, Assignor to The Continuous Zinc Furnace Co., Hartford, Conn. U.S. Pat. 1,150,271, Aug. 17, 1915. Date of appl., Oct. 17, 1912.

SULPHATES present in the calcined ore are reduced to sulphides, copper is reduced to the metallic form, and iron to a mixture of metallic iron and ferrous oxide; the zinc compounds are then reduced electrically and the zinc is distilled.—W. P. S.

[Zinc] sulphide ores; Method of smelting——. H. L. Doherty, New York. U.S. Pat. 1,150,841, Aug. 17, 1915. Date of appl., Apr. 20, 1911; renewed Jan. 19, 1915.

THE oxidation of zinc sulphide and reduction of the oxide are effected in a single furnace, the heat required for reducing the oxide being obtained by burning the finely divided sulphide while suspended in air, and by the combustion of the waste gases from the retorts.—W. E. F. P.

Ores; Device for treating [leaching]——. J. A. Fleming, Globe, Ariz. U.S. Pat. 1,150,669, Aug. 17, 1915. Date of appl., Oct. 5, 1914.

A REVOLVING drum has an outer casing with hollow trunnions and an inner receptacle with double perforated walls between which a filtering medium is inserted. Coarsely crushed ore is introduced into the inner chamber and treated with a solvent by means of a pipe passing through one of the trunnions. The metal-bearing liquor is drawn through the filter into the outer casing by the aid of a suction pipe passing through the other hollow trunnion.—W. R. S.

Metalliferous materials; Methods of treating—— and recovering solvents used. H. D. Rankin, Grafton, Pa., Assignor to Rankin Process Co., Phoenix, Ariz. U.S. Pat. 1,150,787, Aug. 17, 1915. Date of appl., July 17, 1909.

FINELY divided sulphur-bearing material is heated with nitric acid in a closed vessel under pressure below 125° C.; or it is treated with carbon dioxide at a suitable temperature and pressure, the soluble bicarbonates removed, and the residue treated with nitric acid and an amount of acid-forming material sufficient to cause the displacement of nitric oxide, which is recovered and re-converted into nitric acid.—E. H. T.

Iron; Process and apparatus for smelting and purifying——. G. R. Gehrandt, Chicago, U.S.A. Eng. Pat. 14,437, June 16, 1914.

SEE U.S. Pat. 1,110,540 of 1914; this J., 1914, 1013.

Iron and steel ingots; Treating——. B. Talbot, Middlesbrough. U.S. Pat. 1,150,401, Aug. 17, 1915. Date of appl., May 5, 1915.

SEE Eng. Pat. 2639 of 1915; this J., 1915, 875.

Platinum and osmium; Alloys of——. F. Zimmermann, Newark, N.J., Assignor to Baker and Co., Inc. Re-issue No. 13,961, of Aug. 10, 1915, to U.S. Pat. 1,055,119, Mar. 4, 1913. Date of appl., Aug. 14, 1913.

SEE this J., 1913, 431.

Furnaces; Mechanical ore-roasting and like——. J. Harris, Sheffield. U.S. Pat. 1,149,754, Aug. 10, 1915. Date of appl., Nov. 17, 1911.

SEE Fr. Pat. 436,298 of 1911; this J., 1912, 440.

Refractory metals [e.g., tungsten]; Treatment of——. G. Günz-Zehnder, Aarau, Switzerland. U.S. Pat. 1,150,670, Aug. 17, 1915. Date of appl., Jan. 15, 1915.

SEE Eng. Pat. 23,496 of 1914; preceding.

Method of burning cement, ores, and the like. Eng. Pat. 17,145. See IX.

XI.—ELECTRO-CHEMISTRY.

PATENTS.

Furnace; Electric —. J. G. Marshall, Niagara Falls, N.Y., Assignor to Union Carbide Co., New York. U.S. Pat. 1,149,203, Aug. 10, 1915. Date of appl., Oct. 10, 1914.

THE wall of the furnace hearth is provided with a tapping hole and with a metal block, below the hole, with its upper surface projecting outwards, so that the first portion of the difficultly-fusible product, such as carbide, leaving the furnace, solidifies on the metal block and forms a spout.

—B. N.

Furnace regulator; Electric —. R. H. White, Niagara Falls, N.Y., Assignor to Norton Co., Worcester, Mass. U.S. Pat. 1,149,238, Aug. 10, 1915. Date of appl., Sept. 8, 1914.

ONE electrode of the furnace may be moved by means of a motor, which is controlled by a movable switch comprising a circuit-closing member and a solenoid in a current circuit responsive to variations in position of the electrode, so that by means of the solenoid plunger connected to the circuit-closing member, the latter is counter-balanced in a neutral position. The solenoid is provided with two sets of coils, differing in number of turns, but each sufficient to maintain the circuit-closing member in the neutral position, one set being normally in circuit at a predetermined current strength, and the other set only being brought into circuit at a less current strength; the circuit-closing member controls suitable means for opening and closing the circuits of the coils.

—B. N.

Electrolytic cell. Method of electrolysis [of alkali and alkaline-earth salts]. H. R. Nelson, Elizabeth, N.J. U.S. Pats. (A) 1,149,210 and (B) 1,149,211, Aug. 10, 1915. Date of appl., Aug. 17, 1914.

(A) THE interior of a container, surrounding a U-shaped permeable cathode, is supplied with a gaseous medium, such as dry steam, capable of producing a liquid product with the cathode, and the product is collected in a tilting pan disposed below, but spaced and electrically insulated from the cathode. (B) Solutions of salts of the alkali and alkaline-earth metals are electrolysed, the cathode being transferred to a point out of contact with the electrolyte and treated with a vaporized reacting medium, condensation of the medium within the reaction region being prevented. The liquid cathode product is withdrawn in drops, and collected at a point disconnected electrically from the cathode and the electrolyte.—B. N.

Ozone; [Electrical] apparatus for producing — and separating gases. H. Dumars, Glen Ridge, N.J. U.S. Pat. 1,149,251, Aug. 10, 1915. Date of appl., Aug. 26, 1913.

AIR is cooled below the temperature at which ozone is liquefied, dried, and then passed through an ozoniser. The liquefied ozone and gaseous nitrogen are collected separately, the nitrogen being used for keeping the ozone cool, and for cooling the air.—B. N.

Electrodes; Manufacture of electrolytic —. Schott and Gen., Jena, Germany. Eng. Pat. 16,063, July 6, 1914. Under Int. Conv., July 21, 1913. Addition to Eng. Pat. 17,759 of 1913, dated Aug. 21, 1912.

SEE Ger. Pat. 279,253 of 1913; this J., 1915, 366.

Electrolytic cell. H. C. Jenkins, London. U.S. Pat. 1,150,370, Aug. 17, 1915. Date of appl., Nov. 4, 1914. SEE Eng. Pat. 25,415 of 1913; this J., 1914, 1096.

Apparatus and method for producing nitric acid. U.S. Pat. 1,150,786. See VII.

Electrolytic production of alkali metals. Eng. Pat. 17,763. See X.

Process for purifying and separating the constituents of glue, gelatin, or bodies like glue or containing glue, with aid of the electric current. Eng. Pat. 21,448. See XV.

Process and apparatus for treating sewage or other putrescible matter. Eng. Pat. 18,561. See XIXB.

XII.—FATS; OILS; WAXES.

Palm kernel and palm oil trade of Sierra Leone. Col. Off. Ann. Ser. No. 851.

THE exports of palm kernels from Sierra Leone during 1914 showed a falling off in volume of 13,286 tons, and in value of £361,630, as compared with the preceding year. The total quantity exported amounted to 35,915 tons, and was valued at £559,313. The contraction during the earlier part of the year was due to the reduction of prices in the European market. Upon the outbreak of war there was a temporary dislocation in the kernel trade, but from September onwards there was a steady acceleration in the monthly output. The total quantity of palm oil exported during 1914 was 436,144 gallons, valued at £38,537. Although prices were high during the first seven months of the year, exports of palm oil showed a decrease of 95,077 gallons as compared with the corresponding period of 1913. In August shipments were considerably decreased, and although the trade recovered somewhat towards the end of the year, the figures for the whole of 1914 show a decrease of 180,945 gallons as compared with 1913—an estimated loss of £18,122.

Unsaturated fats and fatty acids; Catalytic hydrogenation of — by means of nickel oxides. E. Erdmann. J. prakt. Chem., 1915, 91, 460—506.

PARALLEL experiments with linseed oil are cited showing that hydrogen acts differently with nickel oxide or pyrophoric nickel as catalyst. Even with only 1% (by vol.) of freshly prepared nickel oxide, cottonseed oil was hydrogenated to a product with an iodine value of 16.8 within 2 hours at 240° C. The velocity of the reaction depends not only on the nature of the catalyst but also on other factors, notably its superficial area. The assertion of Meigen and Bartels (this J., 1912, 323) that reduction of the nickel oxide to metallic nickel is an essential stage in the hydrogenation, is disproved by the physical and chemical properties of the recovered catalyst. The reduction of the nickel oxide observed by Meigen and Bartels is to be attributed to the use of impure oils with reducing properties, or to the use of an excess of catalyst, or to high temperatures and super-hardening of the fat. Inaccurate conclusions may also have been drawn from the use of the nickel carbonyl reaction under conditions in which reduction by carbon monoxide took place. The most satisfactory explanation of the hydrogenation process by means of nickel oxide, is the formation of a hydroxy compound, HNiO.NiOH as an intermediate product, which on further reduction yields a hydride of nickel

oxide, $\text{H}\cdot\text{Ni}\cdot\text{O}\cdot\text{Ni}\cdot\text{H}$, the latter being the actual hydrogen carrier.—C. A. M.

Oils; Hydrogenation of—without pressure in presence of nickel and its compounds as catalysts. W. Siegmund and W. Suida. J. prakt. Chem., 1915, 91, 442—468.

HYDROGENATION of fats takes place much more rapidly with nickelous oxide, nickel carbonate, or nickel formate than with metallic nickel as catalyst. Metallic nickel could not be detected in the catalysts until after the fat had been completely hydrogenated, and it is concluded that a lower oxide of nickel acts as hydrogen-carrier; water also plays a part in the reaction.—C. A. M.

[Hüb] *iodine value; Determination of the—*. A. Pagnello. Giorn. Farm. Chim., 1914, 63, 505—515. J. Chem. Soc., 1915, 108, ii, 571.

The addition of ammonium carbonate to the thiosulphate solution used in the process considerably increases the stability of the solution, and does not interfere with the estimation.

Adaptability of the Röse-Gottlieb method for determining fat and oil in pharmaceutical preparations. Blackman. See XX.

PATENTS.

Oil and glucose from nuts and shells; Method to obtain—. A. H. and P. A. A. Suzmeyan, Manchester. Eng. Pat. 12,621, May 22, 1914.

THE nuts (coconuts, cohune nuts, etc.) are ground and the oil extracted with benzine. The residual shells, fibre, etc., are boiled with mineral acid, the extract filtered, neutralised, and decolorised (with animal charcoal, etc.), and the filtrate evaporated to obtain the glucose.—C. A. M.

Oil from seed, meal, and the like; Apparatus for expressing— and simultaneously producing cattle-feeding cake. C. Benson, jun., Kingston-upon-Hull. Eng. Pat. 18,270, Aug. 7, 1914.

THE seed or meal is introduced into a mould adapted to slide and fit into a mould-box in the press. The mould-box is open at the bottom, and has one end left open for the admission of the mould, while attached to the top is a plate, preferably of aluminium, which is ribbed so as to give the appearance of a "bagged" oil-cake. Pieces of wire gauze are also placed in the mould for the same purpose. One end of the mould is hinged to allow of easy removal of the cake, and the ends and sides are lined with tin, aluminium, or other light-coloured metal, which is pierced with holes for the escape of the oil.—C. A. M.

Unsaturated fatty acids and their esters; Hydrogenation of—. J. Y. Johnson, London. From Badische Anilin und Soda Fabrik, Ludwigshafen, Germany. Eng. Pat. 2,307, Jan. 28, 1914.

UNSATURATED fatty acids or esters are hydrogenated at low temperatures (e.g., 80° C.), under a pressure of at least 30 and preferably over 50 atmos., in the presence of nickel, cobalt, iron, or a mixture of two or all of these, the catalyst being supported in the reaction chamber so that it does not mix with the material under treatment.

—C. A. M.

Fats and oils; Process for splitting—into glycerin and fatty acids. Akt.-Ges. zur Erzeugung. und Anwend. v. Naphta-Sulfosäuren "Kon-takt," and G. Petrow, Petrograd. Eng. Pat. 17,148, July 20, 1914. Addition to Eng. Pat. 27,241, Dec. 5, 1911 (see Fr. Pat. 437,336 of 1911; this J., 1912, 545).

FATS are decomposed by means of sulphonic acids soluble in water, which are prepared by the

sulphonation of paraffin or hydrocarbon oils derived from coal tar, lignite tar, peat tar, or bituminous minerals.—C. A. M.

Emulsions; Manufacture of—and substances for use therein. C. Büchel, Frankfurt, Germany. Eng. Pat. 12,141, May 16, 1914.

SEE Fr. Pat. 472,655 of 1914; this J., 1915, 560.

Process for manufacturing an india-rubber substitute [from vegetable oils]. Eng. Pat. 21,524. See XIV.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Polymerisation of isoprene under the influence of the aluminium-mercury couple. Böeseken and Noorduijn. See XX.

PATENTS.

Paints; Grinding or crushing discs particularly applicable for grinding—. Farbwerk Worms, O. Schifferdecker, Worms, Germany. Eng. Pat. 14,489, June 16, 1914. Under Int. Conv., Dec. 1, 1913.

THE grinding discs, arranged co-axially, are in the form of oval or similar rings, thus insuring mutual contact at all points of their surfaces.—C. A. M.

Pigments and the like; Mills for grinding—. D. E. Reid, Mitcham. Eng. Pat. 18,410, Aug. 7, 1914.

COMPRESSED air is introduced into the hopper, which is provided with an air-tight cover, a pressure gauge, and a blow-off valve. By this means an increased yield of paint is obtained with less friction on the grinding surfaces and with the use of less turpentine.—C. A. M.

Alumina colour takes from 1-amino-4-[hydr]oxy-anthraquinonesulphonic acid; Process for producing—. Farbenfabr. vorm. F. Bayer und Co., Leverkusen, Germany. Eng. Pat. 17,744, July 27, 1914. Under Int. Conv., Aug. 4, 1913. Addition to Eng. Pat. 15,557, July 5, 1913.

SEE Fr. Pat. 464,918 of 1913; this J., 1914, 876.

Oil and oil paint films; Manufacture of—. Oel- und Farbfilm A.-G., Wädenswil, Switzerland. Eng. Pat. 18,889, Aug. 20, 1914. Under Int. Conv., Dec. 9, 1913.

SEE Fr. Pat. 471,158 of 1914; this J., 1915, 186.

[Plastic] *condensation products from formaldehyde and phenol; Process of manufacturing—*. H. Stockhausen, Crefeld, and R. Gruhl, Charlottenburg, Germany. U.S. Pat. 1,150,642, Aug. 17, 1915. Date of appl., Apr. 1, 1913.

SEE Eng. Pat. 14,481 of 1913; this J., 1914, 799.

Process for producing alumina [and barium] colour takes from quinizarinsulphonic acids. Eng. Pat. 17,743. See IV.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Polymerisation of isoprene under the influence of the aluminium-mercury couple. Böeseken and Noorduijn. See XX.

PATENTS.

Rubber; Process of reclaiming and regenerating— from rubber waste. F. V. O'Neill, Boston, Mass., U.S.A. Eng. Pat. 12,271, May 18, 1914.

MOTOR tyres and similar waste rubber articles are immersed whole in refined rosin spirit—the

distillate below 130° C. from commercial rosin spirit—in a digester, provided with thermometer, pressure gauge, steam jacket, drainer bottom, and suitable valve connections. The temperature is raised to 130° C. for 2 hours or more, the pressure in the digester being about 60 lb. The rubber solution is blown out through the drainer bottom into a vessel from which the solvent can subsequently be recovered by steam-distillation, and the rubber obtained in a form in which, after separation from water, it can be used again. Other solvents of rubber, such as toluol, benzene, or naphtha, may be used to dilute the refined rosin spirit.—E. W. L.

Rubber substitute. J. Baier, London, and A. G. M. Weals, Totteridge, Herts. Eng. Pat. 1171, Jan. 15, 1914.

Dry animal tissue, such as sinews, is cut up into small pieces and mixed with an astringent solution, such as a concentrated solution of zinc chloride. 3 oz. of the jelly thus obtained is mixed with 1 lb. of finely powdered tapioca or other starchy material to a uniform mass, which is spread on slabs in thin layers and allowed to dry in warm air for 12–24 hours. A rubber-turpentine dough is then mixed with the mass in such proportion as to give 6–12% of rubber in the finished product. The pasty product may be applied as a dressing to leather, canvas, coconut fibre, etc., and may be cured by heating it at 250° C. until it is sufficiently tough. A saturated solution of resin in methylated spirit may be employed instead of rubber dough, and rubber latex is preferable to either.—E. W. L.

India-rubber substitute [from vegetable oils]; Process for manufacturing an— V. Ottorepitz, Graz, Austria. Eng. Pat. 21,524, Oct. 26, 1914. Under Int. Conv., Oct. 26, 1913.

SULPHUR is heated with a vegetable oil to 130°–160° C., and the resulting dark brown liquid is heated on the water bath with dilute nitric acid for several hours. The yellow product is well washed, and dried at 100°–110° C. Subsequently the material is swollen by an organic solvent such as benzene, dried, and vulcanised by heating with 10% to 20% of sulphur.—F. C. T.

Caoutchouc substance and process of making same. K. Gottlob, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 1,149,577, Aug. 10, 1915. Date of appl., Jan. 6, 1913.

SEE Ger. Pat. 254,672 of 1912; this J., 1913, 372.

Caoutchouc substance and vulcanisation product thereof. F. Hofmann and K. Gottlob, Elberfeld, Germany, Assignors to Synthetic Patents Co., New York. U.S. Pat. 1,149,580, Aug. 10, 1915. Date of appl., July 31, 1914.

SEE Ger. Pat. 280,198 of 1914; this J., 1915, 436.

Plastic compositions or horn substitutes [from yeast residues]. Eng. Pat. 76. See XV.

XV.—LEATHER; BONE; HORN; GLUE.

PATENTS.

Sulphonic acids of aromatic hydrocarbons [tanning agents]; Manufacture of soluble condensation products of— J. Y. Johnson, London. From Badische Anilin u. Soda Fabr., Ludwigshafen, Germany. Eng. Pat. 17,172, July 20, 1914.

SOLUBLE condensation products are obtained by heating sulphonic acids of aromatic hydrocarbons free from hydroxyl groups, or a mixture of such acids, with or without condensing agents, and either

at or below atmospheric pressure. Preferably sulphonic acids of polynuclear hydrocarbons are employed. The products are viscous liquids which precipitate glue and similar colloids from their solutions, and are capable of tanning skins. Their alkali salts are soluble, and neither the acids nor the salts give deep colorations with ferric chloride. *Example.*—100 parts of dry naphthalene-2-sulphonic acid and 50 parts of phosphorus pentoxide are heated at 90°–100° C. until a sample dissolved in water and freed from phosphoric acid shows that the maximum capability of precipitating glue from aqueous solution has been reached. The viscous product is dissolved in water, filtered, neutralised with milk of lime, and filtered again. Sulphuric acid is added to precipitate the calcium as sulphate, which is filtered off, and the filtrate is concentrated *in vacuo*.—F. Sr.

Quebracho tanning substances; Treatment of— H. Franke, Wilsdorf, Austria. Eng. Pat. 17,273, July 21, 1914. Under Int. Conv., July 30, 1913.

HOT quebracho liquors are treated with oxides, hydroxides, or salts of alkaline-earth metals, and are then heated for a considerable time out of contact with air, preferably at 130° C., in an autoclave. Enough acid is afterwards added to neutralise or precipitate the alkaline-earth. This process gives a liquor richer in soluble tannin.—F. C. T.

Impregnating [tanning] process; Electro-osmotic— Ges. für Elektro-Osmose m.b.H., Frankfurt, Germany. Eng. Pat. 21,190, Oct. 19, 1914. Under Int. Conv., Jan. 7, 1914. Eng. Pat. 19,849 of 1914, dated Sept. 19, 1913.

IN the previous patent a method and apparatus were described for tanning (or otherwise impregnating) materials in which the liquid containing the material to be treated is subjected, between diaphragms, to electro-osmosis. It is now found that impure tannin extracts, which cannot be used direct for tanning, may be employed in the process. The apparatus employed differs from that already described solely in the provision of an additional compartment, formed by subdivision of the cathode chamber by means of a positive diaphragm, e.g., leather. All the compartments save the one between this positive diaphragm and the cathodic diaphragm are filled with water, and into the latter the tannin extract is charged. On passage of a current the basic impurities pass to the cathode chamber, and the acid impurities through the positive diaphragm and through the hide into the anode chamber. This is followed by the passage of the tannin into the chamber containing the hide, and through the hide.—E. W. L.

Leather substitute; Process of manufacturing— E. Wagner, Berlin. Eng. Pat. 2633, Feb. 18, 1915. Under Int. Conv., Feb. 26, 1914.

A FABRIC is treated with an albumin solution, and the material is then partially tanned with chromium salts and subsequently completely tanned by dilute formaldehyde or vegetable tannin solutions. Several modifications of the process are described.—F. C. T.

Glue, gelatin, or bodies like glue or containing glue; Process for purifying and separating the constituents of— with aid of the electric current. Ges. für Elektro-Osmose, Frankfurt, Germany. Eng. Pat. 21,448, Oct. 23, 1914. Under Int. Conv., Mar. 2, 1914.

A SOLUTION of glue between indifferent diaphragms is subjected to an electric current which causes the inorganic ions to migrate through the diaphragms, thus freeing the glue from mineral constituents. Albumin-like bodies are converted

into the gel form and may be separated by filtration or centrifugal action. The process, modified by the use of charged intermediate diaphragms of special materials, may be used to separate highly pure glue substance or to remove from the glue bodies of an acid nature.—F. C. T.

Horn substitutes [from yeast residues]; Plastic compositions or —. E. Krause, Steglitz, and H. Blücher, Leipzig, Germany. Eng. Pat. 76, Jan. 1, 1914.

SUBSTITUTES for horn, ebonite, etc., are made by treating with formaldehyde albuminous residues obtained in the manufacture of yeast extracts. The material is then pressed, at temperatures up to 100° C., and at pressures up to several hundred atmospheres, according to the degree of firmness and elasticity required.—F. C. T.

Leather; Manufacture of fibrous material to be used as a substitute for — and for other purposes. Anhydatt-Leder-Werke A.-G., and K. Haring, Hersfeld, Germany. Eng. Pat. 14,868, June 20, 1914. Addition to Eng. Pat. 28,392, Dec. 9, 1912.

SEE Ger. Pat. 276,619 of 1913; this J., 1914, 1006.

Leather; Treatment of — for waterproofing the same and rendering it non-slipping. A. McLennan, Ross, Hereford. U.S. Pat. 1,150,047, Aug. 17, 1915. Date of appl., Aug. 26, 1913.

SEE Eng. Pat. 21,081 of 1912; this J., 1914, 95.

Process and device for the destruction and conversion into valuable products of the dead bodies of animals, animal refuse, fish, and the like. Eng. Pat. 18,360. See XIXB.

XVI.—SOILS; FERTILISERS.

Soils; Analysis of plants and soils to determine the amount of nutritive substances in —. T. Pfeiffer, E. Blanck, W. Simmermacher, and W. Rathmann. Landw. Versuchs-Stat., 1915, 86, 339—391. J. Chem. Soc., 1915, 108, i., 763—764.

THE amount of nitrogen taken up by plants from an unmanured soil is only slightly increased by manuring with an excess of phosphoric acid and potassium. Assimilation of phosphoric acid, on the other hand, is much more influenced by applications of nitrogen and potassium, partly owing to greater root development and partly to increased solubility of the soil phosphates, which will vary with different soils. The same holds good in the case of potassium. Oat plants assimilated only about 10% of the phosphoric acid dissolved by 1% hydrochloric acid, whilst with potassium the results were in much greater agreement. Water saturated with carbon dioxide dissolved much less phosphoric acid than was assimilated by oats in the same soil. In this case, the difference is attributed to the presence of organic acids in the roots, to the dissolving action of manurial salts, and to disturbances in the equilibrium of the soil solution. The potassium fixed by absorption in soils, as estimated by Kellner, cannot be the only source of potassium available to plants. Useful indications of the amounts of nutrients in soils can be obtained by ascertaining the maximum amounts of nutritive substance which give increased yields. Soils which yield crops relatively poor in phosphoric acid, when manured with nitrogen and potassium, sometimes respond only slightly, if at all, to applications of phosphates, whilst a fairly high amount of phosphoric acid in a crop may sometimes be increased by phosphatic manure.

Cyanamide, dicyanodiamide, and calcium cyanamide. J. C. de Ruijtes de Wildt and A. D. *Berkhout. Versl. Landbouwk. Onders. Rykslandbouwprefstat, 1913, No. 13. J. Chem. Soc., 1915, 108, i., 764.

CYANAMIDE (0.5%), when kept for three years in N/50-solutions of sodium, ammonium, and potassium chlorides, was only slightly decomposed; in presence of calcium chloride (N/50) and calcium carbonate, decomposition was more marked. Mineral acid solutions (N/50) containing 0.5 and 1.0% of cyanamide, which were kept for two months, were found to contain urea. The results of pot experiments in which buckwheat grown in humus sand received cyanamide and iron oxide showed that the iron was without effect. Decomposition of calcium cyanamide when stored is shown to be due to atmospheric moisture rather than to carbon dioxide; production of dicyanodiamide is to be expected more than loss as ammonia. Calcium cyanamide may be mixed with potassium sulphate, magnesia, and kainite. The results of manurial experiments with fresh and with stored calcium cyanamide showed that the value of the stored manure was considerably less than that of the fresh.

Basic slag; Cause of the red coloration sometimes obtained on decomposing — with sulphuric acid. H. Ditz. J. prakt. Chem., 1915, 91, 507—520.

THE stable red coloration given by certain kinds of basic slag when decomposed with strong sulphuric acid is due to trivalent manganese, exclusively or predominantly in the form of a manganic-phosphoric acid compound. It can be matched in other kinds of basic slag by the addition of a sufficient quantity of potassium permanganate. The oxidation of the manganous oxide in a slag may, under certain conditions, be promoted by the presence of free lime, which will form a calcium manganite (CaO, MnO₂). By varying the conditions of temperature and oxidation it is possible to obtain, from the slag leaving the converter, a product giving either a green-blue or a red coloration when decomposed with sulphuric acid. It is probable that the proportion of ferrous oxide to manganese in the slag has also an influence on the formation of a compound giving a red coloration.—C. A. M.

Phosphoric acid in vegetable substances, especially crops, and in phosphates; Determination of —. A. Stutzer and W. Haupt. J. Landw., 1915, 63, 46—49. J. Chem. Soc., 1915, 108, ii., 578.

THE vegetable substance, containing about 2 grms. of dry matter, is heated in a Kjeldahl flask with 25 c.c. of sulphuric acid and two drops of mercury until colourless. The solution is then diluted with water, transferred to a conical flask, and treated with solid ammonium carbonate, by which the temperature is lowered. When the carbonate begins to dissolve slowly, an indicator is added, and then a strong solution of ammonium carbonate until the solution is neutral or slightly alkaline. It is then made acid with strong nitric acid, filtered if necessary, and heated until it begins to boil. Molybdic acid (100 c.c.) is added, and the solution filtered after two hours through asbestos in a perforated crucible, which is heated at 130°—140° C. and weighed. The precipitate is washed with dilute nitric acid, followed by alcohol, dried at 130°—140° C., gradually ignited until uniformly bluish-green, and weighed. The factor for calculating the amount of P₂O₅ is 0.03946. The molybdic solution is prepared by dissolving 250 grms. of molybdic acid in 250 c.c. of 24% ammonia, and diluting to 2 litres; it is then slowly added to 4 litres of nitric acid, sp. gr. 1.20. In the case of phosphates the solution, containing hydrochloric or sulphuric acid, is neutralised with ammonia and acidified with nitric acid before precipitation.

Food supplies and the consumption of artificial manures. Chem. Trade J., Sept. 4, 1915.

THE Committee appointed by the Secretary for Scotland on June 23 to consider and report what steps should be taken by legislation or otherwise for maintaining and, if possible, increasing the present production of food in Scotland, on the assumption that the war may be prolonged beyond the harvest of 1916, have issued their report.

The Committee consider that no single factor of production will have a greater and more immediate effect in increasing the home-grown food supplies of this country than artificial manures.

The production of basic slag in the United Kingdom may be put at about 400,000 tons a year, of which about 150,000 tons is normally exported. While the manure is largely and increasingly used as a dressing for roots, it has perhaps given its most valuable results on permanent pasture, of which there are over 20 million acres in the United Kingdom. While it is not suggested that the whole of such grass land can be profitably treated with basic slag, the Committee believe that there are extensive areas that can be greatly benefited by dressing with this manure. Nothing was more notable in the evidence submitted to the Committee than the marked increase in the production of meat as a result of the treatment of suitable grass land by basic slag. The use on grass land in Scotland of that portion of basic slag hitherto exported may be expected to result in a large increase of meat even in 1916, while the land so treated would continuously improve in fertility.

In 1914 there was produced in the United Kingdom 426,414 tons of sulphate of ammonia, of which 314,000 tons was exported. In Scotland the production in 1914 was 123,000 tons, of which over 90,000 tons was sent abroad. The Committee believe that if, in addition to the usual application of nitrate of soda, our exports of sulphate of ammonia were used at home and applied to grain and other crops, they might be expected enormously to raise the produce. Other artificial manures manufactured in this country should also be retained and used on British land.

PATENTS.

Phosphates; Method of treating —. C. N. Meriwether, Clarksville, Tenn. U.S. Pat. 1,149,390, Aug. 10, 1915. Date of appl., Nov. 18, 1913.

PHOSPHATIC material for the manufacture of fertiliser is pulverised and mixed with about 10% of metallic iron and mill scale, lime is added, and the mixture heated in a furnace till it fuses. Soda or potash is added to the molten mass, and the mixture run out, allowed to cool, and pulverised for use.—W. G. C.

Felspar; Process of treating — for use as a fertiliser. C. W. Drury, Kingston, Ontario. U.S. Pat. 1,150,815, Aug. 17, 1915. Date of appl., Dec. 28, 1914.

FELSPAR (50 parts) is fused with calcium oxide (16.8 parts) and ferrous oxide (13.5 parts) at about 1200° C., a mixture of potassium, aluminium, iron, and calcium silicates being formed; the potassium silicate is decomposable by weak acids, and the potash thereby rendered available.—W. G. C.

Process and device for the destruction and conversion into valuable products of the dead bodies of animals, animal refuse, fish, and the like. Eng. Pat. 18,360. See XIXB.

XVII.—SUGARS; STARCHES; GUMS.

Sugar-beet; Basal rot of the —. J. Bodnár. Biochem. Zeits., 1915, 69, 245—256. J. Chem. Soc., 1915, 108, i., 701.

THIS disease appears to be of bacterial origin, and

spreads from the tips of the roots upwards. The diseased roots contain larger amounts of water and acid, less sucrose, and more invert sugar, and a larger amount of inorganic constituents (ash), especially of aluminium, than normal, healthy roots.

Tragacanth. T. von Fellenberg. Mitt. Lebensmittelunters. Hyg., 1914, 5, 256—259. J. Chem. Soc., 1915, 108, i., 705.

ONLY the insoluble portion of tragacanth, not the gum, contains methoxyl groups. The insoluble portion (bassorin) is less readily hydrolysed than pectin, heating with sodium hydroxide being necessary. The product, bassoric acid, is soluble and can be titrated with sodium hydroxide and phenolphthalein; dilute solutions are precipitated by alcohol and some electrolytes.

PATENTS.

[Sugar] solutions; Process of purifying —. W. D. Horne, Yonkers, N.Y. U.S. Pat. 1,150,194, Aug. 17, 1915. Date of appl., Apr. 4, 1907.

SOLUBLE impurities, such as iron salts, are precipitated in presence of a substance which causes the precipitate to agglomerate; e.g., sugar solutions are treated with a soluble phosphate and a soluble sulphide.—J. H. L.

Method to obtain oil and glucose from nuts and shells. Eng. Pat. 12,621. See XII.

XVIII.—FERMENTATION INDUSTRIES.

Malt; Amylase of —. P. Petit. Comptes rend., 1915, 161, 39—41.

IF finely ground malt is extracted for 24 hours at the ordinary temperature with a mixture of acetone and water containing 30—35% of the former by volume, and the filtered extract is kept in the dark, it retains its diastatic activity much better than extracts made with water or dilute alcohol. The diastatic power of one such solution decreased nearly one-half within 48 hours, but afterwards remained constant for several weeks. Exposure to light greatly accelerates the loss of activity, especially if a small quantity of eosin is added to the liquid; at the same time the acidity increases. Dry preparations may be made by precipitating the acetone extracts with a mixture of one part of ether and two parts of acetone, allowing the whole to stand under cover for 24 hours, and then decanting the liquid and drying the precipitate *in vacuo*. Aqueous solutions of such dried preparations are distinctly alkaline to methyl orange, and their activity is increased by addition of a trace of a primary phosphate or sodium chloride, or even by passing a current of carbon dioxide through them. If the precipitate formed by the ether-acetone mixture is dissolved in water immediately, the solution reacts normally with starch paste, but does not give a coloration with guaiacol tincture until it has stood for some time or been aerated; it appears, therefore, that peroxides are formed on simple contact with the air, and that they play no part in the saccharification of starch. The guaiacol reaction is not affected by the presence of formaldehyde. Extracts of malt made with a 13% aqueous formaldehyde solution, or with aqueous acetone containing 0.1% of sodium hydrosulphite, saccharify starch and give a positive reaction with guaiacol.—J. H. L.

Peroxydase; Alleged occurrence of — in brewers' yeast. A. Bach. Arch. Sci. phys. nat., 1915, [iv], 39, 497—507. J. Chem. Soc., 1915, 108, i., 755—756.

HARDEN and Zilva (this J., 1914, 761) have

recorded that fresh English yeast gives the peroxidase colour reaction with hydrogen peroxide and *p*-phenylenediamine. In the author's experiments very variable results were obtained with boiled yeast, and in no single instance could a peroxidase reaction be produced, using guaiacol, pyrogallol, or quinol as indicator. The production of the violet coloration in the experiment of Harden and Zilva is attributed to the presence of acids; the intensity of the coloration increases proportionately to the acidity up to the limit of 1% acid: 2 of phenylenediamine. The formation of colour in an acidified mixture of *p*-phenylenediamine and hydrogen peroxide is accelerated by finely divided hair in the same manner as by yeast. No peroxidase reaction was obtained with pure races of either top or bottom fermentation yeasts, even when they had been grown in a current of air. Yeast extracts, purified by ultrafiltration, contain invertase and maltase, but no peroxidase.

Glucosides of glycerol; Formation of — by α -glucosidase. E. Bourquelot, M. Bridel, and A. Aubry. *Comptes rend.*, 1915, **161**, 41—43. (See also this J., 1915, 159.)

AFTER the prolonged action of an aqueous extract of air-dried bottom-fermentation beer yeast on a solution containing dextrose and glycerol, an impure product was isolated which probably contained the two possible isomeric α -monoglucosides of glycerol. An analogous result had previously been obtained by means of emulsin which contained β -glucosidase (*Comptes rend.*, 1915, **160**, 823).—J. H. L.

α -Glucosidase; Influence of sodium hydroxide on the synthetic and hydrolytic activities of —. E. Bourquelot and A. Aubry. *Comptes rend.*, 1915, **161**, 184—186.

THE experiments were similar to those made with acetic acid (this J., 1915, 728), but a parallel series was also necessary to study the influence of alkali on the optical rotatory power of solutions of dextrose in methyl alcohol. It is concluded that the synthetic and hydrolytic activities of the enzyme are considerably depressed in liquids neutral to phenolphthalein, and are completely arrested in media containing an excess of sodium hydroxide equal to 0.005 gm. per 100 c.c.—J. H. L.

Acetic bacteria; Reducing properties of —. N. L. Söhenen. *Folia mikrobiol. Holländ. Beitr. gesamt. Mikrobiol.*, 1914, **3**. J. Chem. Soc., 1915, **108**, i., 753—754.

THE oxidation of ethyl alcohol to acetic acid, which is characteristic of acetic bacteria, is to a slight extent reversible. Experiments were performed under aerobic conditions at 28°—30° C. in an Erlenmeyer flask with a layer of culture liquid about 2 cm. deep. The latter consisted of a solution in yeast extract of the organic substance whose behaviour was being studied. When methylene-blue is added to a flourishing acetic bacteria culture, it is reduced to the leuco-base. In the anaerobic region beneath the surface, dextrose is oxidised to gluconic acid, but, simultaneously, ethyl alcohol and acetic acid are formed; aldehydes and ketones could not be detected in the liquid. In anaerobic conditions dextrose is decomposed to a slight extent into ethyl alcohol and carbon dioxide. Organic acids and salts are not decomposed by *Acetobacter xylinum* in anaerobic conditions. Gluconic acid and calcium gluconate in yeast extract are converted by acetic bacteria into dihydroxyacetone, carbon dioxide, water, and ethyl alcohol (up to 0.4%). Similar experiments with lactic, malic, pyruvic, and acetic acids or their calcium salts show that ethyl alcohol is produced from them in small quantity by the acetic bacteria.

Esterase; Rapid detection and determination of small amounts of —. A. Bach. *Fermentforschung*, 1915, **1**, 151—154. J. Chem. Soc., 1915, **108**, ii., 603.

THE method is based on the results of experiments on tyrosinase. Neither phenolase nor peroxidase + hydrogen peroxide attacks undecomposed phenolic esters, but produces pigmented substances when even a trace of esterase is present. Guaiacol carbonate is particularly suited for the colorimetric estimation. Fresh fungus juice (from *Lactarius vellereus*), rich in oxydase, oxidises guaiacol carbonate directly, whilst the phenolase precipitated from it by alcohol is without any action; the fresh juice therefore contains an esterase.

Catalase; Chemical nature of —. P. Waentig and W. Gierisch. *Fermentforschung*, 1915, **1**, 165—195. J. Chem. Soc., 1915, **108**, i., 727—728.

AN aqueous extract of bullock's liver was precipitated with alcohol, and the catalase, which can only be completely extracted from the precipitate with great difficulty on account of the adsorptive action of accompanying impurities and alterations in the enzyme itself, was further purified by: (1) Fractional extraction, the middle extracts being the purest; (2) self-purification by long keeping of the extract at low temperatures with preservatives, whereby a considerable portion of the non-enzymes was precipitated; (3) repetition of the precipitation with alcohol, whereby a large portion of the aqueous extractive remained in solution; (4) dialysis, although often accompanied by loss of activity; (5) adsorption in finely divided substances. After purification, catalase proved to be a coagulable protein, precipitated in the cold by mineral acids, but not by acetic acid. Coagulation by heat is preceded by inactivation. The precipitates with alcohol and ammonium sulphate are active reversible gels which only slowly undergo change. The limit concentrations depend on the accompanying impurities. Alkaloidal reagents and bromine water also precipitate catalase. The protein reactions all give a positive result, the biuret test giving a bluish-violet colour. The nitrogen content of the catalase increases with increasing purity to at least 15.45%. Mineral matter is almost absent, although iron and phosphorus are always present, but it is doubtful whether they are integral constituents, as it is certain that catalase is not a nucleo-protein.

Glycerol in wine; Determination of —. F. Wohack. *Z. landw. Vers. Wesen. Oesterr.*, 1914, **17**, 684—697. J. Chem. Soc., 1915, **108**, ii., 589.

THE modification of Zeisel's method described by Klemenc for the estimation of methoxyl and ethoxyl groups (this J., 1913, 770) may be used for the estimation of glycerol in wine. One hundred c.c. of the wine is evaporated to 30 c.c., then diluted to 50 c.c., and 5 c.c. of this solution is used for the estimation. The liberated iodine is dissolved from the decomposition tube by the aid of potassium iodide solution, and then titrated with thiosulphate solution; the small quantity of hydrogen iodide formed is estimated by subsequently titrating the solution with potassium hydroxide solution, using methyl-red as indicator. The phosphorus used in the process should be treated previously with carbon bisulphide, ether, alcohol, and water.

Citric acid in wine; Occurrence and determination of —, and the detection of citric acid in milk, jams, and fruit syrups. R. Kunz. *Arch. Chem. Mikrosk.*, 1914. J. Chem. Soc., 1915, **108**, ii., 595—596.

STAHR'S reaction (compare Wöhlk, this J., 1902, 564) is recommended for the detection of citric

acid; the reaction depends on the formation of a white precipitate of pentabromoacetone when bromine and potassium permanganate act on citric acid. The author prefers to use potassium bromide in place of bromine; 10 c.c. of the solution to be tested is treated with 1 c.c. of sulphuric acid (1:1) and 0.3 c.c. of 37.5% potassium bromide solution; 1 c.c. of 5% permanganate solution is then added, the mixture heated for five minutes at 45° C., and any traces of manganese dioxide are removed by addition of a drop of ferrous sulphate solution containing sulphuric acid. A distinct turbidity is obtained with 1 mgrm. of citric acid. Wines usually give a precipitate with bromine alone, and in this case the test is modified by evaporating 50 c.c. of the wine to 10 c.c., adding 2 c.c. of dilute sulphuric acid, then 10 c.c. or more of saturated bromine water, diluting the mixture to 50 c.c., and filtering it through kieselguhr. The filtrate is then tested as described. Red and white wines examined all yielded a reaction for citric acid, although the quantity present was usually very small. Using a larger quantity of the wine (100 c.c.), the pentabromoacetone formed may be collected, dried over sulphuric acid, then washed with very dilute sulphuric acid, again dried, and weighed.

For the detection of citric acid in milk, the latter is warmed with dilute sulphuric acid, the serum treated with fannin to remove soluble proteins, filtered, and the test applied to the filtrate. Fresh milk appears to contain more citric acid than does old and curdled milk. In the case of jams, a portion of the sample is diluted with water, acidified with a few drops of sulphuric acid, the solution is mixed with about twice its volume of alcohol, and filtered. The filtrate is neutralised with ammonia, evaporated to expel alcohol, again filtered after the addition of dilute sulphuric acid, and the filtrate used for the test. If the filtrate gives a precipitate with bromine, it is treated as described under wine. Fruit juices also require a similar treatment before being tested.

Citric acid in pressed yeast; Occurrence of—.

R. Kunz. Arch. Chem. Mikrosk., 1914. J. Chem. Soc., 1915, 108, ii., 596.

THE citric acid may be isolated as follows: 250 grms. of the yeast is digested with 500 c.c. of cold alcohol for two days, then filtered, the filtrate is treated with a slight excess of ammonia, and boiled under a reflux apparatus for twenty minutes. After cooling, the solution is neutralised with hydrochloric acid, calcium chloride is added, the precipitate collected and boiled with sodium carbonate solution; the resulting sodium citrate is again precipitated as calcium citrate; this is decomposed with sulphuric acid, the calcium sulphate separated, and the citric acid crystallised from the solution. It may be identified by means of Stahr's reaction (see preceding abstract). The quantity of citric acid in pressed yeast varies with the kind of yeast; bottom fermentation yeast is free from the acid.

Methyl alcohol in alcoholic beverages and pharmaceutical tinctures; Detection of—.

G. Franceschi. Giorn. Farm. Chim., 1914, 63, 250—252.

J. Chem. Soc., 1915, 108, ii., 588.

TWENTY c.c. of the liquid to be tested is distilled, and 15 c.c. of distillate is collected and re-distilled so as to give 8 c.c. of distillate, into which is plunged a glowing copper spiral. The solution is now divided into two portions. One portion is treated with 1 drop of 10% sodium nitroprusside solution and 1 drop of piperidine; a blue coloration indicates the presence of methyl alcohol. The other portion is boiled for one minute, a drop of phenol is added, and the solution poured on the surface

of concentrated sulphuric acid; a red zone develops if the sample contained methyl alcohol. In testing tincture of iodine, 10 c.c. of the sample should be diluted with 30 c.c. of water, filtered, the filtrate decolorised by the addition of thio-sulphate solution, and then tested as described.

Rum; Ferments of—.

E. Kayser. Comptes rend., 1915, 161, 181—181. (See also this J., 1915, 505.)

THREE types of yeast are concerned in the production of rum, viz., bottom fermentation yeasts, *Schizosaccharomyces*, and film-yeasts. The author has studied their relative capacities for producing volatile acids under various conditions of fermentation. In experiments with sugared malt extracts, two series of fermentations were carried out with the liquid 15 mm. and 15 cm. deep in the respective series. The production of fixed and volatile acids and the yeast crop by the *Schizosaccharomyces* type was practically identical in both series. The other two types produced much less fixed acid but much larger yeast crops in the shallow than in the deep liquid. The shallow medium proved favourable to the formation of volatile acids by bottom fermentation yeasts, but unfavourable in the case of film yeasts. The volatile acids produced were acetic, butyric, and formic acids. When the mixed acids, in the form of salts, were treated with sulphuric acid and ethyl alcohol, the characteristic odour of rum was observed: the odour was most agreeable in the case of the acids derived from bottom fermentation yeasts, and in the other cases it resembled that of arrack. Acidification of malt extracts with tartaric acid (up to 1.5%) led to increased production of formic acid but diminished production of yeast and butyric acid. In fermentation experiments with bottom yeasts and *Schizosaccharomyces*, using molasses worts treated with equal amounts of combined nitrogen in different forms, it was found that inorganic nitrogen (ammonium sulphate) increased the production of acetic acid, amide nitrogen (asparagin) increased that of formic acid, whilst peptone slightly diminished the amount of butyric acid formed. Both these types of yeast produced relatively more butyric acid at 25° than at 35° C.—J. H. L.

Alcohol; Production of—from wood.

E. Hägglund. J. prakt. Chem., 1915, 91, 358—361.

FOR the commercial production of alcohol from wood the use of very dilute acids for hydrolysis is alone feasible. The best temperature for hydrolysis with dilute sulphuric acid (0.25—1%) is 175° C., and as high a proportion of wood shavings to the dilute acid as 1:3 may be employed without adversely influencing the yield of sugars. Under these conditions the yield of alcohol amounted to 75—85 litres per ton of wood (pine or fir). The use of sulphurous acid or calcium bisulphite for hydrolysis decreased the yield of alcohol to about 40 and 60 litres per ton respectively. Comparative experiments carried out with 70% sulphuric acid indicated that under the most favourable conditions as much as 158 litres of alcohol per ton could be obtained, but the cost of the acid outweighed the advantage of the increased yield, and the commercial production of alcohol from wood using concentrated acids for hydrolysis is economically impossible.—G. F. M.

Alcohol in aqueous mixtures of varying concentration;

Apparent specific volumes of—.

H. T. Brown.

Analyst, 1915, 40, 379—383.

THE apparent specific volume, i.e., the volume occupied by unit weight, of alcohol in all concentrations may be expressed by the formula: $1 - (D - W)/W$, where D is the sp. gr. of the mixture at 15.6°/15.6° C., and W the weight of

alcohol in grms. in 1 c.c. In the case of alcoholic mixtures of low concentration, corresponding with sp. gr. of 0.988 to 0.999, the apparent specific volume of the contained alcohol increases steadily with the dilution, and it follows from this that on progressive dilution within these limits the volume of the mixture must exceed the sum of the initial volumes of the constituents (water and alcohol) and that, under these conditions, there is an expansion of volume, instead of a contraction as is observed when stronger spirits are diluted. The critical point at which dilution ceases to produce contraction and begins to give rise to expansion occurs at a point corresponding very nearly with a sp. gr. of 0.9652. This point would seem to mark the completed formation of a definite alcohol hydrate, during the formation of which continuous contraction takes place, and the expansion which occurs on still further dilution may be regarded as an expression of progressive dissociation of this hydrate. A hydrate having the composition $C_2H_5OH, 8H_2O$ would contain 24.21% of alcohol, whereas dilute alcohol of sp. gr. 0.9652, at the critical point, contains 24.83% of alcohol by weight.—W. P. S.

Oxidation of hydrogen sulphide by bacteria. Jacobsen. See VII.

PATENTS.

Fermenting sugar or materials containing sugar [by Bacillus macerans]; Process for —. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Leverkusen, Germany. Eng. Pat. 14,371, June 15, 1914.

SEE Ger. Pat. 283,107; this J. 1915, 729. Nitrogenous nutritive materials, such as pressed yeast, yeast extract, acrospires, etc., are also added to the mixture.

Beverage; Non-alcoholic —. A. P. Stitzel, Louisville, Ky. U.S. Pat. 1,149,700, Aug. 10, 1915. Date of appl., Dec. 21, 1914.

SPENT beer, i.e., fermented wort from which the alcohol has been removed, is mixed with a flavouring substance, cooled, filtered, and carbonated.—J. H. L.

Hopped beverages; Process of manufacturing —. R. Wahl, Assignor to Lupulytic Process Co., Chicago, Ill. U.S. Pat. 1,149,704, Aug. 10, 1915. Date of appl., Sept. 3, 1914.

THE hops are heated at about 180° F. (82° C.) with about 20 times their weight of a dilute solution of caustic alkali to dissolve the bitter acids. The alkaline extract, still containing the hops, is added to the wort, the acidity of which neutralises the alkali thus introduced. In this way the bitter acids are distributed throughout the wort in a colloidal form.—J. H. L.

Plastic compositions or horn substitutes [from yeast residues]. Eng. Pat. 76. See XV.

Ferment and process for producing and preserving the same. U.S. Pat. 1,149,839. See XIXA.

XIXA.—FOODS.

Milk; Pasteurisation of —. U.S. Comm. Rept. No. 183, Aug. 6, 1915.

A RECENT investigation by the U.S. Department of Agriculture has shown that the process of pasteurising milk in bulk and then bottling whilst hot in hot steamed bottles, eliminates the danger of bottle infection and saves the loss of milk by evaporation over the cooler. Satisfactory

bacterial reduction was obtained by keeping the milk at 145° F. (63° C.) for 30 minutes.

Dutch cheese; Composition of —, and the system of control for whole-milk Dutch cheese. J. J. L. van Rijn. Analyst, 1915, 40, 391—397.

GENUINE Gouda cheese is almost always made from whole milk whilst Edam cheese is made from milk deprived of a small proportion of its cream. Cheeses made from skimmed milk, however, are now prepared in the well-known shapes of these brands, and control stations have been established in Holland for the purpose of analysing and issuing guarantee marks for the genuine cheeses. Cheeses made from whole milk must contain at least 45% of fat, calculated on the dry substance. From the results recorded it is clear that no fixed relation exists between the amount of fat in a milk and that in the cheese prepared from the milk; the ratio of fat to casein in the milk appears to be the determining factor. Milks containing from 2.8 to 3.0% of fat will yield cheeses having as high a percentage of fat as those obtained from milks containing up to 3.7% of fat. Edam cheese is not to be considered as a whole milk cheese, but only as a fat cheese; it is generally agreed, however, that this cheese should contain not less than 40% of fat, calculated on the dry substance.—W. P. S.

Polypeptides, peptones, and proteins; Synthesis of — by means of enzymes. E. Abderhalden. Fermentforschung, 1915, 1, 47—54. J. Chem. Soc., 1915, 108, i., 725.

NUMEROUS experiments with pepsin, trypsin, and erepsin on the synthesis of proteins from their degradation products were unsuccessful, but the treatment of mixtures of amino-acids from definite organs with the juice from the same organ led to the desired result, as after some months there was a decrease in amino-nitrogen which could be explained in no other way, and also the coagulation test showed the presence of protein. The enzymes of the cell exert, therefore, a specific action according to the nature of the cell. Syntheses of proteins from peptones were also effected in a similar way.

Amino-acids; Salting out of — and their separation by means of neutral salts. P. Pfeiffer and F. Wittka. Ber., 1915, 48, 1041—1048.

ON addition of saturated solutions of neutral salts to saturated solutions of amino-acids, glycocoll, tyrosine, and aspartic acid gave no precipitate, alanine was only precipitated by ammonium sulphate, whereas *dl*-leucine and *dl*-phenylalanine were precipitated by sodium and potassium chlorides, potassium oxalate, magnesium and sodium sulphates, sodium and potassium acetates, but best by ammonium sulphate. In these precipitates, the amino-acids are not combined with the salts, but are in the free, crystalline condition. Phenylalanine did not give a precipitate with potassium or aluminium sulphate, ammonium, calcium, barium, magnesium, or aluminium chloride, or with barium bromide. The results give further confirmation of the view that proteins are complexes of amino-acids, the salting out of which can no longer be accepted as a criterion of their colloidal character. Phenylalanine and *l*-leucine may be separated from glycocoll by means of ammonium sulphate. The calcium chloride compounds of glycocoll and *d*-alanine have been separated by the difference in their solubility in aqueous alcohol.—F. W. A.

Determination of phosphoric acid in vegetable substances, especially crops, and in phosphates. Stutzer and Haupt. See XVI.

Occurrence and determination of citric acid in wine, and detection of citric acid in milk, jams, and fruit syrups. Kunz. See XVIII.

PATENTS.

Ferment [for bread making] and process for producing and preserving the same. H. A. Kohman, Pittsburgh, Pa. U.S. Pat. 1,149,839, Aug. 10, 1915. Date of appl., June 21, 1912.

A BREAD leaven, comprising a dried bacterial ferment capable of liberating carbon dioxide and hydrogen and in which the spores have been developed, is prepared from a starchy material, sodium bicarbonate, calcium carbonate, and milk. —W. P. S.

Milk or other fluids; Process of pasteurising —. S. M. Heulings, Haddonfield, N.J. U.S. Pat. 1,150,269, Aug. 17, 1915. Date of appl., Dec. 30, 1913.

MILK is heated at 140°—150° F. (60°—66° C.) until pasteurised, then at a higher temperature for a short time, and rapidly cooled. —W. P. S.

Beverage-producing material and process of making same. H. Barnhard, Davenport, Wash. U.S. Pat. 1,150,733, Aug. 17, 1915. Date of appl., Mar. 27, 1914.

CARROT roots are cleansed and cut into thin slices which are then dried for 20 mins. at 100° F. (38° C.), roasted for 10 mins. at 145° F. (63° C.), and ground to a powder. —W. P. S.

Foodstuff containing free lecithin and process of making same. H. Martin, Vienna. U.S. Pat. 1,150,691, Aug. 17, 1915. Date of appl., Mar. 28, 1914.

SEE Fr. Pat. 470,527 of 1914; this J., 1915, 198.

XIXB.—WATER PURIFICATION; SANITATION.

Phenol; Action of formaldehyde on — in the presence of concentrated sulphuric acid. J. Buraczewski. Chem. Zentr., 1914, ii, 1267. J. Chem. Soc., 1915, 108, i., 674.

WHEN phenol dissolved in concentrated sulphuric acid is shaken with a cold, freshly prepared solution of 40% aqueous formaldehyde in concentrated sulphuric acid, the mass suddenly solidifies. The solid product is green, but paler in colour according to the cooling of the mixture; it is insoluble in organic solvents. The colour changes to pale yellow under the action of alkalis, and in this respect ammonia or potassium cyanide is more active than sodium or potassium hydroxide. If the solution of phenol in sulphuric acid is warmed and then cooled, previous to the addition of formaldehyde, a solid product is not formed. When however, hot solutions of the components are mixed, solidification takes place, and an intensely green mass results; at a higher temperature a black product is obtained. The products have an antiseptic and deodorising action; fresh urine to which a small quantity was added showed no sign of decomposition after a long period.

Chloroamines as antiseptics. H. D. Dakin and J. B. Cohen. Brit. Med. J., 1915, 11, 318.

EXAMINATION of a number of chloroamines has shown that all substances containing the group, :N.Cl, are strongly antiseptic; some will probably be found to have practical value. Compounds of this type are formed *in situ* when wounds are treated with hypochlorous acid, so that a certain antiseptic action may be expected to persist after the free hypochlorite has disappeared. (See also this J., 1915, 919.)

South African sheep dips. Chem. Trade J., Aug. 28, 1915. (See also this J., 1915, 530.)

AN organised protest, headed by the Bradford Chamber of Commerce, was made some time ago

against the use of caustic soda and sulphur sheep dips, to the Agricultural Department of the South African Government, on the ground that the use of such dips had a deleterious effect upon the quality of the wool. The use of these products is, however, still officially recommended by the Union Government, and a Governmental report issued recently deals as follows with the objections raised:—

(1) The South African Government is well aware of the nature of sodium sulphide, and of the fact that it is used in removing wool from dead skins; but it is emphatically denied that the caustic soda-sulphur dip, mixed in accordance with official directions, partakes of the nature of a wool solvent, and as proof it may be stated that some of the best prices obtained for South African wools have been made for fleeces which have been dipped in the lime-sulphur or caustic soda-sulphur solutions. Wool buyers continue to purchase, year by year, at top prices, what the Bradford Chamber calls "dissolved" wool. (2) Wool treated with caustic soda and sulphur in certain proportions will be dissolved, but the Government has made it quite clear that the dipping fluid must be made in proportions which will not damage wool. (3) It is well known that wool is frequently treated with caustic soda or caustic potash in the scouring process, and that if hard water be used for scouring it becomes necessary to soften it artificially by the addition of caustic soda; but the caustic soda or caustic potash would not be used by a manufacturer in proportions which would dissolve the wool. (4) The effect of all alkaline soda salts, when they are used improperly, is to destroy the spinning qualities of the wool, but the manufacturer would find his task an impossible one if he were prohibited from using alkali. The damage caused by the improper use of alkalis is hardly likely to be greater than that caused by the scab mites, for wool from sheep which have suffered from scab is brittle and structureless, and has lost both its spinning and felting qualities. (5) It may be that wool treated with an excess of alkaline matter has a stronger affinity for colouring matters than wool not so treated, but the fact that manufacturers themselves use caustic soda and caustic potash in the course of the manufacture of wool into cloth, is proof conclusive that whilst these substances may be dangerous when applied in a careless manner, they cause no damage to the wool when properly used. Reference to any standard work on the effect of alkalis on wool will show that in some cases caustic soda is used to strengthen the fibre. It all depends on the form in which the solution is made and its degree of alkalinity.

Contributions to the knowledge of para-chloro- and para-bromo-metacresol. Von Walther and Zipper. See 111.

Rusting of iron in water softened by the Permutit process, and means for preventing rusting. Bauer and Wetzel. See X.

PATENTS.

Water; Process for softening —. Oelwerke Stern-Sonneborn A.-G., Cologne, Germany. Eng. Pat. 22,362, Nov. 11, 1914. Under Int. Conv., Nov. 13, 1913.

THE water is treated with sodium phosphate in the proportion of 4 c.c. of 10% solution to 100 c.c. of water, and heated at 70° C. for half an hour, when the hardness is reduced to 1.75 degrees (German). If the mixture is boiled for 5 mins. the hardness is reduced to 1.65 degrees, and after 10 mins. boiling to 1 degree. —J. H. J.

Sewage or other putrescible matter; Process of and apparatus for treating—. C. P. Landreth, Philadelphia, Pa., U.S.A. Eng. Pat. 18,564, Aug. 11, 1914. Under Int. Conv., June 9, 1914.

COARSELY strained sewage is passed to an electrolysing chamber, where it is broken up by paddles and is mixed with sufficient calcium hydroxide to make it distinctly alkaline. The mixture passes between horizontal electrodes of carbon or iron. After electrolysis the sewage passes into a settling tank, where the sludge settles out and a clear sterile liquid is obtained, which runs off from the top of the tank. The sludge is carried by a pump to a press, the liquid leaving which is returned to the sewage well for re-treatment.—J. H. J.

Sewage; Apparatus for purifying—. G. W. and J. F. Naylor, Denby Dale, Yorks. Eng. Pat. 20,579, Oct. 6, 1914. (See also this J., 1915, 814.)

IN the purification of sewage by aeration in a tank with a false bottom of porous material, the false bottom is made of a pliable material, such as filter-cloth, felt, canvas, or perforated metal, supported if desired on wire netting, through which the air supply diffuses into the sewage in the tank. The porous floor may be laid on the air pipes placed horizontally along the bottom of the tank, or on the framework covering each line of pipes and dividing the air space into separate compartments. The floor may be supported also on boxes with porous sides, the air pipes coming through the bottom of the tank and being in a vertical position in the centre of each box.—J. H. J.

Sewage; Apparatus for separating the solid matter from—. C. A. Jennings, Chicago, Ill., Assignor to A. E. Nichols, Philadelphia, Pa. U.S. Pat. 1,149,650, Aug. 10, 1915. Date of appl. Nov. 3, 1913.

SEWAGE is delivered to an inclined screen conveyor the lower end of which is situated in a well. The solid material is discharged from the top of the conveyor into a receptacle by means of a blast of air passing outwards through the screen.—W. P. S.

Destruction and conversion into valuable products of the dead bodies of animals, animal refuse, fish, and the like; Process and device for the—. G. Barker, Birmingham. From F. Fahl, Bremen, Germany. Eng. Pat. 18,360, Aug. 7, 1914.

THE animal refuse is thrown into a cylinder of wire network mounted within a horizontal boiler, and is heated by high-pressure steam until the whole body, including the bones, is decomposed. The fat and glue solution are run off continuously from a discharge socket at one end of the boiler. When the operation is finished, the inner cylinder is set in rotation, and as the material falls off from the side, the water adhering to it escapes through the network. Benzine is introduced, the rotation continued, and then the benzine extract run off. The benzine retained in the material is vaporised by the application of steam heat and the inner cylinder rotated, when the material falls through the wire network on to the side of the boiler, where the drying is completed, and the material conveyed to the discharge socket by the action of scrapers. The material is almost completely freed from fat and can be packed forthwith.—J. H. J.

Antiseptic and disinfecting compound. J. Challis, London. Eng. Pat. 21,000, Oct. 15, 1914.

MIXTURES of acetone with saponified vegetable oils and tar oils are claimed. For instance, carbolic acid or cresylic acid, 5, linseed oil, 5, water, 4 galls., and potassium hydroxide, 12.5 lb., are boiled together until the oils are saponified, and the solution, while hot, is mixed with acetone, 3.75 galls. Alcohol, benzene, naphtha, etc., may also be added. The products are readily soluble in water.—W. P. S.

Water; Method of producing sterile drinking—. J. W. Mackenzie, London. From Sucrofilter- und Wasserreinigungs-Ges., Berlin-Schöneberg, Germany. Eng. Pat. 15,366, June 26, 1914.

SEE Ger. Pat. 281,810 of 1913; this J., 1915, 731.

Apparatus for detecting the presence of injurious gases in mines. Eng. Pat. 11,721. See XXIII.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Alkaloid formation in plants. I. Protein and nicotine content of the tobacco plant during growth. H. Baggesgaard Rasnussen. Biochem. Zeits., 1915, 69, 461—466. J. Chem. Soc., 1915, 108, ii., 759—760.

THE content of total nitrogen alters during the growth of the plant, diminishing with the age. The lower leaves contain less nitrogen than the higher ones. The nitrogen is higher in well-fertilised plants. In the less fertilised plants the protein nitrogen diminishes with the age. The nicotine content (estimated by means of silicotungstic acid; see this J., 1915, 330) increases during the whole period of the growth. The basic nitrogen also increases. There are large variations in the proportions of nicotine to basic nitrogen.

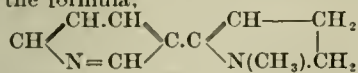
Tobacco resin; Method for the determination of, and its application to various tobaccos. J. von Degrazia. Fachliche Mitt. der österreichischen Tabakregie, 1914, 1—4. J. Chem. Soc., 1915, 108, ii., 603—604. (Compare this J., 1914, 436.)

TWO portions of 60 grms. each of the dry powdered tobacco are extracted in a Soxhlet apparatus with ether, about 100 grms. of ether being used for each portion. One of the ethereal solutions is then washed with water containing a small quantity of acid to remove nicotine, the ether evaporated, the residue dissolved in 90% alcohol, and the solution strongly cooled. After the separated wax has been removed, the alcoholic solution is boiled with the addition of 150 c.c. of 2% potassium hydroxide solution, and the mixture is extracted with ether; the ethereal solution contains the tobacco resin, together with small quantities of ethereal oils. The solution usually has a reddish-brown colour, but in the case of Cserbel tobacco it has a green colour. After the ether has been evaporated, the residue of tobacco resin is weighed. The alkaline solution contains the resin acids and the resin alcohol; the latter is in suspension, and is separated and weighed, whilst the resin acids are separated by extraction with ether in the usual way, the ethereal solution evaporated, the residue weighed, the acids dissolved in alcohol, and the tobaccic acid precipitated by the addition of alcoholic lead acetate solution. The lead salt is separated by filtration, and the filtrate mixed with ten times its volume of water acidified with nitric acid; the β -tobaccic acid which separates in flocks is collected, dissolved in ether, the solution evaporated, and the residue weighed. The γ -tobaccic acid is found by difference. The other portion of the ethereal solution is evaporated, and the residue extracted with alcohol to dissolve the α -tobaccic acid; the alcoholic solution, which contains tannin and nicotine in addition to the acid, is evaporated, the residue heated with very dilute potassium hydroxide solution, cooled, filtered, the filtrate neutralised, and the separated α -acid collected. The following table shows the composition of the resins from various tobaccos expressed as percentages of the latter; the figures indicate that it is possible to differentiate between different kinds of tobacco:—

Kind of tobacco.	Total resin.	Wax.	Resen.	Acids.			Resin alcohol.
				α .	β .	γ .	
Havana	4.65	0.50	2.64	1.44	0.18	0.38	0.01
Brazilian	3.36	0.55	1.97	0.93	0.12	0.32	0.02
Java	4.45	0.55	1.37	0.96	0.27	1.75	0.10
Virginian	7.59	0.77	5.75	0.86	0.43	0.44	0.02
Hungarian	5.15	1.32	3.41	0.83	0.24	0.65	0.02
Cserbel (<i>Nicotiana rustica</i>)	4.57	0.69	3.46	1.04	0.03	0.04	none
Dalmatian	7.86	1.48	5.88	1.22	0.26	0.45	0.05
Turkish	7.00	1.00	3.80	2.02	0.32	0.81	0.07

Tobacco extract; Alkaloids of —. E. Noga. Fachliche Mitt. öst. Tabakregie, 1914. J. Chem. Soc., 1915, 108, i., 711.

RESIDUES from Turkish tobacco were extracted systematically with water and the extract evaporated in a vacuum. By the use of benzene, a small quantity of alkaloid, which was not volatile with steam, was obtained from this extract, and was separated by distillation into four fractions. I. Nicotine, $C_{10}H_{11}N$, colourless, mobile liquid, with a peculiar intense odour resembling that of pyridine, b.pt. 208° C.; sp. gr. at 21°/4° C. 0.9545, $n_D^{20}=1.5105$. It gives the usual alkaloidal reactions. With hydrochloric, sulphuric, and picric acids, mercuric and platinic chlorides, it yields, in part, well-crystallised salts of definite m.pt. II. Nicotine (compare Pictet and Rotschy, this J., 1901, 501). III. Isonicotine, $C_{10}H_{12}N_2$, colourless, viscous, oily liquid, with a rather powerful, very persistent odour. It is optically inactive, and has b.pt. 293° C. (darkening), sp. gr. at 20°/4° C. 1.0984, $n_D^{20}=1.5749$. With hydrochloric, sulphuric, and picric acids, mercuric, platinic, and auric chlorides it yields, in part, well-crystallised salts. It forms a methiodide. It is converted by oxidation into nicotinic acid, gives the pine-shaving reaction, immediately decolorises potassium permanganate, and therefore has the formula,



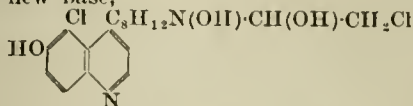
IV. Nicotelline, $C_{11}H_{11}N_2$, m.pt. 148° C., h.pt. above 300° C. (*loc. cit.*).

Quinine; Action of chlorine on —. A. Christensen. Ber. Deut. pharm. Ges., 1915, 25, 256—281. J. Chem. Soc., 1915, 108, i., 711—713.

WHEN a solution of quinine hydrochloride in a mixture of acetic and hydrochloric acids is treated with chlorine (1 mol.) there is produced an additive compound, quinine dichloride, $C_{20}H_{24}O_3N_2Cl_2$, a colourless, amorphous powder, m.pt. 97° C., which dissolves in dilute oxy-acids giving solutions with a blue fluorescence; it forms a dihydrochloride, prisms with $2H_2O$, sparingly soluble nitrate, hexagonal prisms, dihydrobromide perbromide, $C_{20}H_{24}O_3N_2Cl_2 \cdot 2HBr \cdot Br_2$, orange-red, crystalline powder, and iodosulphate,

$4C_{20}H_{24}O_3N_2Cl_2 \cdot 3H_2SO_4 \cdot 2HI \cdot 7$ or $8 H_2O$, which closely resembles the corresponding derivative of quinine. By energetic treatment with alcoholic potassium hydroxide it is converted into dehydroquinine, $C_{20}H_{22}O_3N_2$, m.pt. 181° C. If quinine hydrochloride is treated in solution in cold dilute hydrochloric acid with chlorine (1 mol.) dissolved in water, the product is an additive compound of quinine and hypochlorous acid, $C_{22}H_{24}O_3N_2Cl.OH$, to which the name quinine hydroxychloride is given; this is an amorphous, colourless powder, m.pt. 110° C., which can be isolated as the nitrate by the addition of ammonium nitrate solution. Chlorine (2 mols.) in aqueous solution acts on a cold solution of quinine hydrochloride in dilute hydrochloric acid, giving a base, $C_{19}H_{22}O_3N_2Cl_2$, which separates as the

dihydrochloride on the addition of sodium chloride. The new base,



forms colourless needles with $4H_2O$, m.pt. 172°—173° C.; it forms a triacetyl derivative and a dibenzoyl derivative; when oxidised with nitric acid it gives pyridine-2,3-dicarboxylic acid. The above formula receives confirmation from the formation of a base, $C_{19}H_{22}O_3N_2Cl_2 \cdot 4H_2O$ (dihydrochloride, yellow prisms with $3H_2O$; nitrate, crystalline), when chlorine water is allowed to act on hydrochloroquinine, $C_{20}H_{25}O_3N_2Cl$; the last-named substance does not contain any aliphatic ethylenic linking, so that the new chlorine atom in the product must have entered the quinoline nucleus. Further confirmation of the structure is supplied by the conversion of 6-methoxyquinoline into 5-chloro-6-hydroxyquinoline by the action of chlorine water in hydrochloric acid solution. The product of the action of chlorine (3 mols.) on a solution of quinine hydrochloride in dilute hydrochloric acid is an unstable base, $C_{19}H_{21}O_3N_2Cl_3$, which can be separated from solution as the nitrate, colourless, hexagonal leaflets, whilst the action of chlorine on hydrochloroquinine produces an analogous compound, the difference between these two bases being the replacement of the hydroxyl group in the side-chain of the former by hydrogen in the latter. Both these bases give a green coloration with aqueous ammonia, and also liberate iodine from potassium iodide; it is therefore probable that each contains the grouping $-CO \cdot CCl_2-$ in the quinoline nucleus. Quinine dichloride (see above) also reacts with chlorine (2 mols.), yielding a base, $C_{11}H_{12}O_3N_2Cl_4$, which is separated as the crystalline nitrate; this contains one active chlorine atom capable of displacing iodine from potassium iodide and so probably contains the grouping $-CO \cdot CCl_2-$, which is also present in the products $C_{19}H_{21}O_3N_2Cl_3$ and $C_{19}H_{21}O_3N_2Cl_4$, obtained from quinine and hydrochloroquinine respectively. Although only one chlorine atom is reactive in these compounds, they liberate two equivalents of iodine from potassium iodide, the grouping $-CO \cdot CCl_2-$ undergoing conversion into $-C(OH) : CCl_2-$.

Hydrastine in plants and in extracts of Hydrastis Canadensis by the methods prescribed in the various Pharmacopœias; Determination of —, and a new method for the determination of berberine in extracts. L. David. Pharm. Post., 1915, 48, 1—4. J. Chem. Soc., 1915, 108, ii., 601.

THE author has determined the solubility of hydrastine in various solvents; 1 gm. of the substance is dissolved by 227.27 grms. of ether at 20° C., by 22727.27 grms. of light petroleum (b.pt. 40°—60° C.) at 15° C., by 11627.88 grms. of light petroleum (b.pt. 50°—85° C.) at 15° C., and by 17.91 grms. of benzene at 15° C. Hydrastine is soluble in chloroform. The methods given in the German and Belgian pharmacopœias are the most trustworthy for the estimation of hydrastine; then follows that of the Austrian pharmacopœia, whilst the French, Dutch, Swiss, and U.S.A. methods are untrustworthy, as the hydrastine obtained by their use is very impure. The U.S.A. method may be improved by removing the alcohol before the hydrastine is extracted with ether. In the estimation of hydrastine, alcohol must be removed previously, berberine should be separated by precipitation with potassium iodide or hydrochloric acid, and the ethereal extract must be mixed with light petroleum, and the mixed solution treated with tragacanth. A method proposed for the estimation of berberine in hydrastine extracts

depends on the precipitation of berberine and hydrastine by potassium bismuth iodide, and the separation of the hydrastine by extraction with ethyl acetate. The precipitate is then treated with 10% sodium hydroxide solution, and the berberine extracted with a mixture of equal parts of ether and chloroform.

Alkaloids; New silicotungstic acid method for the determination of—. A. Ferencz and L. Dávid. Pharm. Post., 1914, 47, 559—563. J. Chem. Soc., 1915, 108, ii., 600.

TEN c.c. of a solution containing the alkaloid salt is treated with 5 c.c. of 10% silicotungstic acid solution; the precipitate is collected on a filter, and washed with 10 c.c. of very dilute hydrochloric acid. The precipitate is then transferred to a flask, and shaken for five minutes with 5 c.c. of water and 10 c.c. of 20% sodium hydroxide solution; after the addition of 15 grms. of sodium chloride and 100 c.c. of ether (in the case of nicotine 50 c.c. of a mixture of ether and light petroleum is used), the mixture is shaken for ten minutes, allowed to separate, and one-half of the ethereal solution is drawn off and titrated with *N*/100-hydrochloric acid, using iodococin as indicator.

Toxins and antitoxins. I. Partial synthesis of antitoxins. I. I. Ostromisslenski. J. Russ. Phys. Chem. Soc., 1915, 47, 263—300. J. Chem. Soc., 1915, 108, i., 751.

IN the majority of cases toxins are slightly basic nitrogenous compounds of high molecular weight, and exhibiting colloidal properties. Their salts, unlike those of alkaloids and crystalline poisons, are generally non-poisonous. All antitoxins are globulins, which exhibit the ability to adsorb, in normal conditions, the corresponding toxins, but not other toxins. The interaction of toxins and antitoxins proceeds in three phases: (1) mutual adsorption, or, more generally, physical approximation of the toxin and antitoxin, the poisonous character of the former not being changed; (2) a chemical reaction or neutralisation, the toxin and antitoxin forming a non-poisonous, salt-like compound, resolvable by the action of acid or alkali; (3) profound chemical change of this compound, proceeding either intramolecularly or conditioned by the influence of the molecules of the surrounding medium, the resulting product not being decomposed into its constituents by acid or alkali. The specificity of an antitoxin is determined by the physical conditions of its colloidal particles, such as their surface, magnitude, mass, electrical state, and possibly the configuration of the molecules or the number of the latter in the colloidal particle. Only the physical condition of an antitoxin distinguishes it from normal globulins, which are passive towards all toxins, without exception. The process of the biological neutralisation of a toxin by an antitoxin may be represented chemically as the neutralisation of a weak organic base by a weak organic acid of amphoteric character. In rare cases the combination of the globulin with the toxin is brought about by heat alone. Thus, if staphylolysin, the toxin of pathogenic *Staphylococci*, is heated with rabbit serum at 60° C. for some hours, the globulin undergoes conversion into the antitoxin of staphylolysin. In other cases, the presence of a catalyst is necessary for this reaction. Sodium chloride has been used for this purpose, and with its help one and the same normal horse serum has been converted into the antitoxin of diphtheria and also into that of botulism ("meat-poisoning"), the globulin-toxin compound being decomposed by acidification of the solution. The serum used may be replaced by a solution of the globulin isolated in the ordinary way, by the

globulins of hens' eggs, etc., without affecting the properties of the antitoxins obtained.

Toxins and antitoxins. II. Transformation of protein substances into specific antitoxins. I. I. Ostromisslenski and D. I. Petrov. J. Russ. Phys. Chem. Soc., 1915, 47, 301—307. J. Chem. Soc., 1915, 108, i., 751—752. (Compare preceding abstract.)

THE formation of bacterial toxins during the growth of the organisms in a liquid medium is slow and progressive, the maximum concentration of toxin being reached only after some days or possibly months from the time of inoculation. Experiments with horse serum and with Löffler's bacillus and *Bacillus botulinus* show that in a medium containing a globulin, the molecules of nascent toxin are adsorbed by the globulin, but such adsorption is not complete, part only of the toxin being converted into the corresponding antitoxin, whilst, in spite of the presence of excess of globulin, the rest of the toxin remains free. This limitation of the reaction is doubtless to be explained by the alkaline reaction of the nutrient medium, but neutralisation of the serum prevents the development of both the above organisms.

Toxins and antitoxins. IV. New reaction for characterising toxins. I. I. Ostromisslenski. J. Russ. Phys. Chem. Soc., 1915, 47, 313—317. J. Chem. Soc., 1915, 108, i., 752—753. (Compare preceding abstracts.)

IN order to ascertain if there exists an antitoxin corresponding with a given toxin, or if a particular poison represents a toxin, the following method may be employed. In a mixture of 3 c.c. of the toxin or poison with about 3 c.c. of normal serum, 0.36 gm. of pure sodium chloride is dissolved, the liquid being maintained at 37°—37.5° C. for three to thirty-six hours. In these conditions the globulin of the serum will undergo transformation into the corresponding antitoxin. Consequently, if the antitoxin sought really exists, the mixture should become atoxic after this treatment. With the toxins of tetanus, diphtheria, and botulism, positive results were obtained, but the treatment with normal serum and sodium chloride is without effect on the toxicity of morphine and strychnine.

Fat and oil in certain pharmaceutical preparations; Adaptability of the Röse-Gottlieb method for determining—. C. A. Hackman. Chem. and Drug., 1915, 87, 19.

THE Röse-Gottlieb method (Analyst, 1898, 259; 1908, 389) gives accurate results in determining oil in many preparations (e.g., extract of malt with codliver oil), and is suitable for all emulsions. It is essential that the proportion of water to immiscible solvents should be kept constant. For example, 1 gm. of the extract of malt with codliver oil should be made up to 5 c.c. with warm water. Accurate determinations of cacao butter in chocolate are rapidly obtained by the method. —C. A. M.

Isoprene; Polymerisation of — under the influence of the aluminium-mercury couple. J. Böseken and J. Noorduyn. Rec. Trav. Chim. Pays-Bas, 1915, 34, 265—271.

WHEN isoprene (10 grms.), dissolved in benzene (40 c.c.), was heated for 30 minutes on a water-bath and then allowed to stand for 24 hours, in contact with a catalyst prepared by warming 0.2 gm. of powdered aluminium with a solution of 3 grms. of mercuric chloride in benzene, a small quantity of an amorphous powder separated. This was removed by filtration, the benzene solution was washed and dried, and the benzene distilled off. The residue, when cold, was a pale,

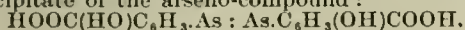
brittle resin, soluble in a number of organic solvents. When carefully dried over phosphorus pentoxide it gave analytical results agreeing with the assumption that it is a polymeric isoprene, although in no way similar to caoutchouc in its physical properties. The insoluble product is impure, but probably consists mainly of a substance of still higher molecular weight, and a higher degree of saturation.—E. W. L.

Terpene series; Autoxidations in the — by the action of light. [Autoxidation of citronellal.] E. Sernagiotto. *Gaz. Chim. Ital.*, 1915, 45, II., 81—86.

CITRONELLAL was exposed to light from June to October in presence of water in flasks filled with oxygen. The reaction products identified were isopulegol, menthone, a compound, $C_{10}H_{16}O$, m.pt. 206° — $207^{\circ}C$., not yet identified, dihydroxy-citronellic acid, acetone, β -methyladipic acid, and fatty acids of composition ranging from formic acid to heptylic acid.—A. S.

Diaminodihydroxyarsenobenzene-o-dicarboxylic acids. Aromatic arsenic compounds. X. P. Karrer. *Ber.*, 1915, 48, 1058—1064.

THE diazo-compound of nitroanthranilic acid (NH_2 : $COOH$: $NO_2=1:2:4$) gives, with sodium arsenite, 2-carboxy-4-nitrophenyl-1-arsinic acid, which gives the corresponding amino-compound on reduction with ferrous oxide. The sulphuric acid solution of this amine is diazotised and boiled to give the phenol, which on warming with hypophosphorous acid gives a yellow, flocculent precipitate of the arseno-compound:



This 2,2'-carboxy-4,4'-arsenophenol is soluble in caustic soda, and unlike arsenophenol is soluble in sodium carbonate and bicarbonate and is not affected by acids. On oxidation it yields the arsenic acid, which crystallises in white needles, and is very soluble in water. Nitration gives 2-carboxy-5-nitro-4-hydroxyphenylarsinic acid, which on reduction by a mixture of hypophosphorous and hydriodic acids gives 5,5'-diamino-4,4'-dihydroxy-2,2'-dicarboxy-arsenobenzene. This is obtained as a yellow compound, readily soluble in caustic soda, sodium carbonate and bicarbonate, and sodium acetate, very slightly soluble in dilute or concentrated hydrochloric acid; with dimethylaminobenzaldehyde a red condensation product is obtained; the amino-group can be readily diazotised. The isomeric 3-dicarboxylic acid of salvarsan has also been prepared. In each case the carboxyl group has a dystherapeutic influence.—F. W. A.

Iodine in organic iodo-derivatives; Detection of — and in mixtures of them with bromo- and chloro-derivatives by means of ammonium bromide. III. I. Guareschi. *Atti R. Accad. Sci. Torino*, 1915, 50, 803—808. *J. Chem. Soc.*, 1915, 108, ii., 573—574. (Compare this *J.*, 1915, 796.)

FOR the detection of iodine in many alkyl iodides, iodobenzene, *o*-, *m*-, and *p*-iodonitrobenzenes, etc., which do not yield iodine when heated alone, the general tests for halogens in organic compounds must be employed. The author finds, however, that ammonium bromide, or in some cases ammonium chloride, serves to demonstrate, in the dry way, the presence of iodine in organic iodo-derivatives, even when these contain nitro-groups or are mixed with large proportions of bromo- or chloro-derivatives or chloro- or bromo-nitro-compounds. Even the most stable iodo-derivatives, when heated in a long, narrow tube with ammonium bromide, give violet iodine vapour and, after cooling, a distinct reaction with starch. This test can be performed more rapidly

and with far smaller amounts of substance than the ordinary tests.

Hæmoglobines; Metallic — particularly that of mercury. R. Robert and David. *Chem. Zentr.*, 1914, ii, 1447. *J. Chem. Soc.*, 1915, 108, i., 732.

ZINC hæmoglobinate, when freshly prepared, is a red substance which is as sensitive to desiccating agents as hæmoglobin itself. It appears to be a complex salt, since it is completely soluble in very dilute ammonium sulphide. Hæmoglobin from the horse combines with 1.011% Zn, which is approximately equivalent to 2 atoms Zn to each atom Fe. Zinc hæmoglobinate is insoluble in water containing small quantities of neutral salts. The copper salt is chemically similar to the zinc salt. Mercury hæmoglobins have been prepared from mercury salts and horse hæmoglobin. The air-dried substances obtained by the use of mercuric sulphate, mercurous nitrate, mercuric acetate, and mercuric chloride contain 1.7%, 7%, about 8%, and 9.5% Hg respectively. The compounds are readily soluble in dilute ammonia or very dilute ammonium sulphide, less readily in ammonium or sodium carbonate. Internally administered, they are relatively well tolerated.

Hexamethylenetetramine; Comparative activity of compounds of —. H. Boruttau. *Chem. Zentr.*, 1914, ii, 1279. *J. Chem. Soc.*, 1915, 108, i., 749.

THE antiseptic action of hexamethylenetetramine towards urine can be greatly increased by combining it with an antiseptic such as salicylic, phthalic, or camphoric acid. The compound with boric acid is only slightly more active than the free base, but, on the other hand, the salts formed with anhydromethylcitric acid or citric acid show greatly enhanced activity. As far as the solution of the uric acid by urine is concerned, an increased action is obtained by combining the base with citric, boric, borocitric, or phthalocitric acid, and, to a less extent, with sulphosalicylic acid. One molecule of the base is used for each molecule of acid.

Calcium salicylate; Some reactions of —. W. O. de Coninck. *Rev. gen. Chim. pure appl.*, 1914, 17, 201. *J. Chem. Soc.*, 1915, 108, i., 681.

SALICYLIC acid is displaced from calcium salicylate by sulphurous acid, sodium bisulphite, potassium bisulphate, alum. chrome alum, iron ammonium alum, potassium hydrogen acetate, and potassium hydrogen propionate. The following substances are without action on calcium salicylate: potassium ferro- and ferri-cyanides, potassium bichromate, potassium trichromate, chromic acid, sodium thiosulphate, and methyl-, ethyl-, and amyl-sulphuric acids. Calcium salicylate differs from calcium *p*-hydroxybenzoate in that it does not set solid with water and does not combine with methyl alcohol.

Organic acids; Comparative volatility, by distillation with steam, of some —. W. O. de Coninck and R. Raynaud. *Rev. gen. Chim. pure appl.*, 1914, 17, 201—202. *J. Chem. Soc.*, 1915, 108, i., 645—646.

FIVE c.c. of the acid (formic, acetic, propionic, butyric, isobutyric) was mixed with 25 c.c. of water and distilled, the distillate being collected in 5 c.c. portions and the amount of acid in each portion estimated. With formic and acetic acids the amount of acid present in each fraction steadily increases as the distillation proceeds; with propionic acid it remains constant, and with butyric and *iso*-butyric acids decreases.

Urea in urine; Determination of —. A. Hahn and J. Saphra. *Deutsch. med. Woch.*, 1914, 40, 430—431. *J. Chem. Soc.*, 1915, 108, ii., 599.

THE method depends on the conversion of the urea

into ammonium carbonate by the action of urease this enzyme may be prepared as a dry product by precipitating it with alcohol from an acid aqueous extract of soya beans. One c.c. of the urine is placed in a 50 c.c. flask, and 10 c.c. of water, a small quantity of the dry enzyme, and 5 drops of toluene are added; a similar mixture, but without the enzyme, is placed in a second flask. The flasks are closed with corks, and, after twenty hours, the contents are titrated with *N*/10-hydrochloric acid, using methyl-orange as indicator. The difference in the number of c.c. of *N*/10-acid required for the two titrations is multiplied by 0.003 to obtain the quantity of urea in 1 c.c. of the urine. (See also Eigenberger; this J., 1915, 450.)

Contributions to the knowledge of para-chloro- and para-bromo-metacresol. Von Walther and Zipper. See III.

Detection of methyl alcohol in alcoholic beverages and pharmaceutical tinctures. Franceschi. See XVIII.

PATENTS.

Magnesium acetylsalicylate; Manufacture of —. Richter Gedeon Vegyészeti Gjára (Chem. Fabr. Gedeon Richter), Budapest. Eng. Pat. 10,946, May 4, 1914. Under Int. Conv., May 9, 1913.

MAGNESIUM acetylsalicylate is made by stirring acetylsalicylic acid (360 grms.) for a considerable time with magnesium oxide (40 grms.), or the hydroxide or carbonate, and water (180 grms.). The magma is stirred with methyl or ethyl alcohol, and from the filtered solution magnesium acetylsalicylate is precipitated by adding ether. It is filtered off, washed with ether-alcohol and dried, and forms a white microcrystalline powder, non-hygroscopic, odourless, almost tasteless, easily soluble in water and methyl alcohol, less soluble in ethyl alcohol, and almost insoluble in ether.—F. Sp.

Pharmaceutical compounds [containing bismuth and iodine]; Manufacture of new —. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Leverkusen, Germany. Eng. Pat. 14,017, June 10, 1914.

ANTI-SEPTIC compounds are obtained by treating gallo-carboxylic acid with bismuth oxy-iodide, or the basic bismuth salt of gallo-carboxylic acid with hydrogen iodide. *Example*: A thin emulsion of 214 parts of gallo-carboxylic acid, bismuth oxy-iodide obtained from 966 parts of bismuth nitrate in the known manner, and water is heated on the water bath until all the gallo-carboxylic acid has disappeared. The product, when filtered off, washed with water and alcohol, and dried, is a reddish brown powder.—F. Sp.

Olefinic terpene alcohols, aldehydes, and terpenic acids; Process for hydrogenising —. C. Paal, Leipzig, Germany. Eng. Pat. 16,180, July 7, 1914. Under Int. Conv., Aug. 6, 1913.

OLEFINIC terpene alcohols, aldehydes, and acids are quantitatively reduced to dihydro- or tetrahydro-derivatives without ring formation or alteration of the carbinol, aldehyde, or carboxyl group, by gaseous hydrogen at ordinary or increased pressure, in the presence of finely divided or colloidal metals of the platinum group, or of their protohydroxides in the non-colloidal state, deposited on finely divided inert substances free from anti-catalytic action, such as magnesium, nickel, cobalt, magnesium oxide, magnesium or calcium carbonate, barium sulphate, kieselguhr, carbon, sawdust, cellulose powder, etc. Quantitative yields of the following products have been obtained by the process:—Dihydrocitra (inact. citronella), b.pt.

79°–81° C. (10 mm.), sp. gr. 0.8535 at 17°/4° C.; dihydrogeraniol (inact. citronellol), b.pt. 99° C. (10 mm.), sp. gr. 0.8488 at 19°/4° C.; dihydrolin-alool, b.pt. 92°–93° C. (15 mm.), sp. gr. 0.8579 at 16°/4° C.; dihydrogeranic acid (inact. citronellic acid), b.pt. 139°–141° C. (9 mm.), sp. gr. 0.9277 at 15°/4° C.; tetrahydrocitra, b.pt. 87°–88° C. (16 mm.), sp. gr. 0.831 at 19°/4° C.; tetrahydrogeraniol, b.pt. 112°–113° C. (18 mm.), sp. gr. 0.8329 at 19°/4° C.; tetrahydrolin-alool, b.pt. 89° C. (15 mm.), sp. gr. 0.8327 at 16°/4° C., $[\alpha]_D^{20} = -0.78^\circ$; tetrahydrogeranic acid, b.pt. 133°–134° C. (10 mm.), sp. gr. 0.899 at 15°/4° C.; dihydrocitronellic acid, b.pt. 133° C. (9 mm.), sp. gr. 0.895 at 15°/4° C., $[\alpha]_D^{20} = +4.58^\circ$.—F. Sp.

Acetic anhydride; Manufacture of —. Bosnische Electricitäts-A.-G., Vienna. Eng. Pat. 23,190, Nov. 27, 1914. Under Int. Conv., Jan. 17, 1914.

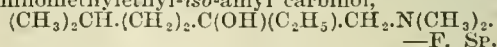
ACETIC anhydride is produced when ethylidene diacetate is heated sufficiently above its boiling point (169° C.), particularly in the presence of catalysts. *Example*: 100 grms. of vaporised ethylidene diacetate is passed through a tube charged with pumice stone at 250° to 300° C., at the rate of 70 grms. per hour for each litre of tube capacity. The condensed product contains 25.3% acetaldehyde, 17.1% acetic acid, 49% acetic anhydride, and 7% unchanged ethylidene diacetate. By fractional distillation 43 grms. of technically pure acetic anhydride is obtained.—F. Sp.

Alkamines, and process of producing same. A. B. Davis, Assignor to Eli Lilly and Co., Indianapolis, Ind. U.S. Pat. 1,150,251, Aug. 17, 1915. Date of appl., May 21, 1914.

ALKAMINES of the general formula $X_1X_2N.CH_2.C(OH)Y.(CH_2)_4.CH_3$, in which X_1, X_2 are alkyl radicals (or hydrogen) and Y a monovalent group capable of being introduced by means of its organic magnesium halides, are produced by treating chloromethyl-*o*-bromopropyl ketone with alkyl magnesium halides, and condensing the resulting tertiary alcohols with substituted amines. Particular claim is made for the compound having the formula: $(CH_3)_2N.CH_2.C(OH)(C_2H_5).(CH_2)_4.CH_3$.—F. Sp.

Alkamine and process of producing same. A. B. Davis, Assignor to Eli Lilly and Co., Indianapolis, Ind. U.S. Pat. 1,150,252, Aug. 17, 1915. Date of appl., May 23, 1914.

ALKAMINES, the esters of which are local anaesthetics, are produced by treating epichlorhydrin with organic magnesium halides, oxidising the resulting secondary alcohols to produce ketones, treating the ketones with organic magnesium halides, and condensing the resulting halogen tertiary alcohols with substituted amines to produce substituted tertiary amino-alcohols. *Example*: Epichlorhydrin is treated with *iso*-butyl magnesium bromide and the chloromethyl-*iso*-amyl carbinol produced is oxidised to chloromethyl-*iso*-amyl ketone. This reacts with ethyl magnesium bromide to form chloromethylethyl-*iso*-amyl carbinol, which is condensed with dimethylamine to form dimethylaminomethylethyl-*iso*-amyl carbinol.



—F. Sp.

Alkamine esters and process of producing same. A. B. Davis, Assignor to Eli Lilly and Co., Indianapolis, Ind. U.S. Pat. 1,150,253, Aug. 17, 1915. Date of appl., May 25, 1914.

DIMETHYLAMINOMETHYLETHYL-*iso*-AMYL carbinol is acetylated to produce esters, of which the benzoyl ester, $(CH_3)_2CH.(CH_2)_2.C(O.CO.C_6H_5)(C_2H_5).CH_2.N(CH_3)_2$, is claimed in particular.—F. Sp.

Esters of alkamines and process of producing same. A. B. Davis, Assignor to Eli Lilly and Co., Indianapolis, Ind. U.S. Pat. 1,150,580, Aug. 17, 1915. Date of appl., May 22, 1914.

COMPOUNDS are claimed containing the following chain of atoms: $N.CH_2.C(O).(CH_2)_4.CH_3$, and, more definitely, alkamino esters of the formula: $X_1X_2N.CH_2.CZ(OY).(CH_2)_4.CH_3$, in which X_1, X_2 are alkyl groups or hydrogen, Y an acid radical, and Z a monovalent group capable of being introduced by the Grignard reaction. Particular claim is made for the compound,

$(CH_3)_2N.CH_2.C(O.CO.C_6H_5)(C_2H_5).(CH_2)_4.CH_3$, made by adding benzoyl chloride to a solution of the amine produced by condensing chloromethyl-ethylamyl carbinol with dimethylamine.—F. Sr.

Therapeutically active substances [from bile]; Manufacture of—R. Nöhring, Dresden, Saxony. Eng. Pat. 12,238, May 18, 1914. Under Int. Conv., June 13, 1913.

SEE Ger. Pat. 280,108 of 1913; this J., 1915, 452.

Metal salts of polymethylene-bis-imino acids. C. Coutelle and A. Moré, Elberfeld, Germany, Assignors to Synthetic Patents Co., New York. U.S. Pat. 1,150,579, Aug. 17, 1915. Date of appl., Oct. 16, 1913.

SEE Ger. Pat. 272,290 of 1912; this J., 1914, 568.

Gallocarboxylic acid compounds [containing iodine and bismuth]. R. Berendes, Elberfeld, Germany, Assignor to Synthetic Patents Co., New York. U.S. Pat. 1,150,654, Aug. 17, 1915. Date of appl., July 17, 1914.

SEE Eng. Pat. 14,017 of 1914; preceding.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

PATENTS.

Sensitised tracing cloth; Production of—R. A. Ritschard and H. Renck, Hamburg, Germany. Eng. Pat. 17,640, July 25, 1914.

ORDINARY tracing cloth is waterproofed by coating one side with an oil varnish or lacquer, and is then coated on the other side with a suitable sensitising solution.—B. V. S.

Photographic films; Manufacture of—Soc. Anon. la Cellophane, Thion-les-Vosges, France. Eng. Pat. 2411, Feb. 15, 1915. Under Int. Conv., Mar. 30, 1914.

A COMPOSITE film having on one side of the sensitised layer a suitable base, such as celluloid or paper, and on the other side a layer of transparent material permeable to developing solutions, etc., e.g., viscose, is used to protect the surface of a cinematograph or other film. The two outer films may be bound together, using the sensitive emulsion as binding material; or a separate sensitised film may be cemented between the two outer films, using any suitable adhesive. In making continuous film, the two, or three, films are brought together over suitably arranged cylinders, the emulsion, or adhesive, applied at the junction, and the composite film then carried over drying drums to the winding spool.—B. V. S.

Preparing etched steel rollers for calico printing. Eng. Pat. 3355. See VI.

XXII.—EXPLOSIVES; MATCHES.

Explosives; Thirty-ninth Annual Report of His Majesty's Inspectors of—for 1914. [Cd. 8029.]

Factories and magazines. There were 33 factories

and 84 magazines under continuing certificate and 105 factories and 371 magazines under licence; 192 visits were paid to factories and 370 to magazines. *Accidents.* The total number of accidents reported was 447, divided as follows: In manufacture, 92, in which 21 persons were killed and 41 injured; in keeping, 3, in which 1 person was killed and 7 were injured; in conveyance, 2; and in use and miscellaneous, 350, in which 44 persons were killed and 375 injured. *Importation.* 134 licences were granted as compared with 178 in 1913. The importation of explosives practically ceased after the outbreak of war. The figures for 1914 and 1913 are:—

	1913.	1914.
Nitroglycerin explosives	lb. 1,576,081	887,862
Non-nitroglycerin explosives ...	lb. 51	4067
Detonators	lb. 149,201	97,136½
Fireworks	lb. 814,482	736,380

Imported and transhipped to other countries:—1914: 451,000 lb. of nitroglycerin explosives and 23,543 lb. of detonators.

Chemical advisers' report. Of 337 samples examined, 43 were rejected, viz., 24 on account of incorrect composition, 16 on account of exudation, and 3 on account of faulty manufacture. An investigation of the effect of addition of diphenylamine to nitrocellulose powders, carried out on behalf of Messrs. Nobel's, showed that above 100° C. the diphenylamine is nitrated to a notable extent at the expense of the nitrocellulose, thus increasing the normal rate of decomposition. This action can be observed also at ordinary temperatures, and it increases with the proportion of diphenylamine present. A powder containing 6% of diphenylamine, for example, evolves a larger quantity of decomposition products at 125° F. (52° C.) than the same powder without such addition, notwithstanding the fact that a considerable quantity of decomposition products is fixed by the diphenylamine. No free acid products are liberated, however, owing to the strong affinity of diphenylamine for nitrous acid, and hence no acceleration of decomposition is produced even when the powder is kept at a high temperature under very drastic conditions. The marked increase in safety produced is demonstrated by the fact that a powder containing 6% of diphenylamine showed no signs of deterioration after 18 weeks at 110° F. (43° C.), whereas the same powder without such addition fumed off after 17 hours at 100° F. (38° C.). The condemnation of explosives containing so-called stabilisers on previous occasions was due to the fact that the additions, whilst lengthening the heat test, did not improve the stability of the powder. Diphenylamine interferes with the heat test but improves the keeping qualities of the powder, and hence its addition has been sanctioned. *Construction of danger buildings.* Experiments made at Shoeburyness by a Committee composed of two representatives of the War Department, two of the Explosives Trade, and the Chief Inspector of Explosives, indicated that it would be difficult to improve on wooden buildings in regard to resistance offered to the effects of an explosion in an adjacent building, ease of repairing, and comparative absence of heavy debris. *Acetylene gas.* According to an Order in Council (No. 22) of June 18, 1914, the gas may be compressed to a pressure of 250 ins. (instead of 100 ins.) of water before being regarded as an explosive. *Use of sodium nitrate in gunpowder.* It has been decided that "gunpowder, ordinarily so-called" may be made either with potassium nitrate or with sodium nitrate. The appendices to the report include a list of explosives at present authorised for manufacture or importation; details of importation of explosives during 1914; a table showing ignitions of firedamp and

coal dust caused by permitted explosives reported during 1914; and a list of the principal explosives used in mines and quarries.—A. S.

Nitro-explosives; Mixtures of —, and nitration of toluene. M. Giua. *Gaz. Chim. Ital.*, 1915, 45, II., 32—44.

AMONG the aromatic nitro-compounds which have recently acquired technical importance as explosives are tetranitromethylaniline, $(\text{NO}_2)_4\text{C}_6\text{H}_2\text{N}(\text{CH}_3)\text{NO}_2$, tetranitroaniline (Eng. Pats. 3224, 4701, 9477, and 11,478 of 1910; this J., 1911, 275), and hexanitrodiphenylamine. The author has determined the solidifying points of various mixtures of α -trinitrotoluene and tetranitromethylaniline, of p -mononitrotoluene and tetranitromethylaniline, and of α -trinitrotoluene and hexanitrodiphenylamine. In the first-mentioned system an addition compound is formed containing 3 mols. of trinitrotoluene to 2 mols. of tetranitromethylaniline, which dissociates on melting; the eutectic temperature is about 64°C . p -Mononitrotoluene and tetranitromethylaniline form an eutectic mixture containing about 25% of the latter and solidifying at about 44°C . The eutectic mixture of α -trinitrotoluene and hexanitrodiphenylamine contains about 11% of the latter and solidifies at 78.2°C . The slight lowering of the solidifying point on adding hexanitrodiphenylamine to trinitrotoluene is attributed to the formation of solid solutions.

The influence of the composition of the nitrating acid in the direct nitration of toluene to the dinitro-derivative is shown in the following table. The liquid product was separated from the solid by draining in a thermostat at $35^\circ\text{--}40^\circ\text{C}$. The yield of solid product includes that dissolved by the nitrating acid and recovered by diluting with water; the melting point is that of the crude solid product.

Composition of nitrating acid, %	Weight of toluene, grms.	Ratio of toluene to acid.	Solid product:		Yield of liquid product, grms.
			Yield, grms.	m.pt. $^\circ\text{C}$.	
15HNO_3	40	1:10	46	62.5	30
$78\text{H}_2\text{SO}_4$		1:15	56.5	50	13
$7\text{H}_2\text{O}$	40	1:10	45	65	30
20HNO_3		1:15	70	54	7
$75\text{H}_2\text{SO}_4$	40	1:10	72	56.5	5
$5\text{H}_2\text{O}$		1:15	64	61	10
20HNO_3	50	1:9	74	63	20
$65\text{H}_2\text{SO}_4$		1:11	69	63	20
$15\text{H}_2\text{O}$	50	1:7	68	62	15
30HNO_3		1:9	63	59.5	22
$65\text{H}_2\text{SO}_4$	50	1:9	89	60	7
$5\text{H}_2\text{O}$		1:10	77	62	15
30HNO_3	50	1:10	745	65.7	200
$55\text{H}_2\text{SO}_4$		1:10			
$15\text{H}_2\text{O}$	50	1:10			
20HNO_3		1:10			
$60\text{H}_2\text{SO}_4$	50	1:10			
$20\text{H}_2\text{O}$		1:10			

—A. S.

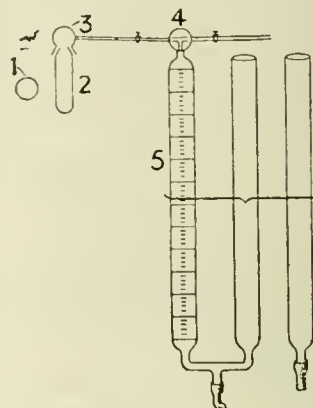
Nitroglycerin. III. Nature of the isomerism of nitroglycerin and sensitiveness of the frozen product to shock. H. Hibbert. *Z. ges. Schiess- u. Sprengstoffw.*, 1914, 9, 305—307, 321—322. *J. Chem. Soc.*, 1915, 108, i., 644.

THE author compares the phenomena observed with the previously described isomerides of nitroglycerin (this J., 1912, 904) with other transformations recorded in the chemical literature, and is led to the conclusion that the solid labile and stable compounds are chemically isomeric. Each isomeride can retain its structure in the liquid state; freshly prepared nitroglycerin is

generally a mixture of a large amount of the liquid labile isomeride and a small quantity of the liquid stable isomeride.

Powders; Apparatus for photolysis of [smokeless] —. M. Guilbaud. *Comptes rend.*, 1915, 161, 212—213.

ACCORDING to Berthelot and Gaudechon (this J., 1912, 47, 204, 303), the ultra-violet rays accelerate the decomposition of smokeless powders, which



takes place slowly under the influence of natural agents like heat, moisture, and atmospheric action.

The apparatus designed by the author consists essentially of a transparent quartz tube, 2,100 mm. long and 15 mm. diam., in which the material to be decomposed is placed. The decomposition tube is closed by a ground glass cap, 3, from which a short, narrow tube, fitted with a three-way stopcock, 4, leads to the measuring burette, 5. About 2 to 2.5 grms. of the nitrocellulose or powder to be tested is placed in the decomposition tube rendered as nearly vacuum as possible (20 mm.). The tube is then exposed to the rays of a mercury vapour lamp, 1, and the quantities of gas evolved during definite periods are noted for construction of the velocity curve of decomposition. The gas collected is then analysed. The decomposition of nitrocellulose and smokeless powders produces five gases, i.e., CO_2 , CO , N_2 , N_2O and NO , in varying proportions.—W. N. B.

Explosives; Volume correction of gases produced by detonation of —. D. Berthelot. *Comptes rend.*, 1915, 161, 209—211.

THEORETICAL considerations as well as observed facts indicate that the conditions of high pressure and temperature prevailing during the detonation of explosives are approximately expressed by the equation, $p(v-b)=RT$. Sarrau (*Comptes rend.*, 1882, 94, 847) found that the volume correction, b , of different gases is approximately $1/1000$ of the specific volume, and subsequently Mallard and Le Chatelier (*Mém. Poudres et Salpêtres*, 1884—89, 2, 144) suggested the use of 0.001 as the value of "b" in calculations of explosive force, and this has been generally accepted.

If b be taken as 0.001, the value of T_c , calculated from Van der Waal's equation, would be 2.2 pc, which the author has found to be not even approximately correct in any of the cases studied by him. If, however, the new equation of state published by the author in 1902 (*Trav. Bureau internat. Poids et Mesures*, 1902, 13) be used, b equals 0.001 when T_c is 3.9 pc, i.e., the volume correction represents $1/1000$ of the specific volume only in the case of gases of which the critical temperature is approximately equal to four times the critical pressure. This condition is fulfilled approximately

by the gases examined by Sarrau and the principal gases produced by explosions. It does not hold good, however, in the case of complex organic compounds, the molecules of which contain a great number of atoms. Thus the ratio, $T_c : p_c$ rises to 8 for alcohol, 12 for benzene, 13 for ether, and 19 for naphthalene.—W. N. B.

Gaseous explosion; Total radiation from a —.
W. M. Thornton. *Phil. Mag.*, 1915, 30, 383—384.

THE conception whereby the lost pressure or suppressed heat of a gaseous explosion is made to depend upon the mechanics of two colliding and cohering spheres also affords an explanation of the energy radiated; the theoretical amounts in the case of two equal colliding spheres are, respectively, 50% and 25% of the heat of combustion, as against the observed amounts of 50% and 22%. The fact that pressure is instantly checked in rising, whilst radiation up to the time of maximum pressure is only 3% of the heat of combustion, suggests that the interchange of energy between rotation and vibration is slower than between translation and rotation. Pressure and radiation are both maintained by the transformation of excess of rotational energy.—J. R.

Velocity of nitration of benzene and some of its derivatives. Wibaut. *See* III.

PATENTS.

Explosives [; Use of hexanitrodiphenyl in] —.
H. Wade, London. From Sprengstoff A.-G. Carbonit, Hamburg, Germany. Eng. Pat. 18,333, Aug. 7, 1914.

HEXANITRODIPHENYL, $C_6H_2(NO_2)_3 \cdot C_6H_2(NO_2)_3$, is prepared by dissolving 1 part of chlorotrinotrobenzene in 3 to 4 parts of solvent (toluene, nitrobenzene) gradually adding powdered copper (about one-fourth of the weight of chlorotrinotrobenzene), expelling the solvent by steam, and recrystallising the product from nitric acid. It is suitable either in crystalline or compressed condition (with or without other nitrohydrocarbons, carbon compounds, or oxygenated compounds) for charging mines, torpedoes, detonators, etc. It is stable, keeps well, and can be handled without danger.—C. A. M.

Explosives [trinitrotoluene]; Manufacture of —.
R. A. Craig, R. Robertson, R. C. Farmer, and G. Rotter, Woolwich. Eng. Pat. 23,181, Nov. 27, 1914.

IN the manufacture of trinitrotoluene, the nitrotoluenes remaining dissolved in the waste acids are recovered by extracting with toluene, or with partly nitrated toluene, or with a mixture of both. The toluene or partly nitrated toluene may be simultaneously nitrated by the nitric acid present in the waste acid. Either of the following methods may be employed:—(a) The waste acid is first diluted with water to 70% strength (reckoned as sulphuric acid) and then agitated with toluene, when a clear solution of the nitrotoluenes is obtained, which is subsequently used for nitration to trinitrotoluene. (b) If it is desired to utilise the residual nitric acid in the waste acids, together with some added nitric acid, for the further nitration of the extracting medium, the waste acid is first fortified with more nitric acid to 75% strength (reckoned as sulphuric acid) and agitated with only a portion of the toluene at 45°C. The acid is then diluted to 70% strength (reckoned as sulphuric acid) and the remainder of the toluene added.

—W. N. B.

Explosive. C. A. Woodbury, Chester, Pa. U.S. Pat. 1,149,487, Aug. 10, 1915. Date of appl., Jan. 14, 1914.

A MIXTURE of nitroglycerin, an aromatic nitro-

compound (such as trinitrotoluene), and a nitrated sugar, with or without another nitrated carbohydrate.—W. N. B.

Denitration of waste acid. U.S. Pat. 1,149,585. *See* VII.

XXIII.—ANALYTICAL PROCESSES.

Ammonium molybdate used in phosphate determinations; Recovery of —. J. A. Prescott. *Analyst*, 1915, 40, 390—391.

THE residues, such as the filtrates from the yellow phosphomolybdate precipitates, solutions of the latter in ammonia, and ignited residues, are evaporated in a large porcelain basin. A syrupy liquid is obtained eventually, from which molybdic acid and phosphomolybdate have separated, mixed with crystals of ammonium sulphate and nitrate. The precipitate is collected, washed with cold water, then dissolved in ammonia and the solution treated with magnesia mixture to precipitate the phosphoric acid. The ammonium magnesium phosphate is filtered off, the filtrate concentrated to a small volume, and the ammonium molybdate allowed to crystallise; the mother liquors are worked up with subsequent quantities of residues. In cases where a blue solution is obtained when the molybdic acid is dissolved in ammonia, a quantity of hydrogen peroxide must be added to oxidise the lower molybdenum oxides.—W. P. S.

Aluminium; Application of Stock's reaction to the volumetric determination of —. T. V. Kovscharova. *J. Russ. Phys. Chem. Soc.*, 1915, 47, 616—624. *J. Chem. Soc.*, 1915, 108, ii., 582—583.

THE author has examined Stock's method for the volumetric estimation of aluminium (this *J.*, 1900, 276). To a definite volume of potash alum solution are added a mixture in equal volumes of 25% potassium iodide and 6% potassium iodate solutions, and an excess of $N/10$ -sodium thiosulphate solution. The liquid is then heated to boiling, and the excess of thiosulphate titrated with $N/10$ -iodine solution. A large number of estimations, carried out under different conditions, shows that trustworthy results are obtained when (1) the excess of sodium thiosulphate solution is small, (2) the solution is as nearly neutral as possible, and (3) the heating on the water-bath is not continued for longer than twenty to thirty minutes.

Determination of toluene in commercial toluols. Northall-Laurie. *See* III.

Influence of phosphoric acid on the determination of available chlorine in bleaching powder. Kedesky. *See* VII.

Determination of ferrous iron in silicates by titration with bichromate. Barnebey. *See* VII.

Rational analysis of clay. Kallauner and Matejka. *See* VIII.

Dissolved gold in slime residue. Benjamin. *See* X.

Determination of the Hübl iodine value. Pagnello. *See* XII.

Analysis of plants and soils to determine the amount of nutritive substances in soils. Pfeiffer and others. *See* XVI.

Determination of phosphoric acid in vegetable substances, especially crops, and in phosphates. Stutzer and Haupt. *See* XVI.

Rapid detection and determination of small amounts of esterases. Bach. *See* XVIII.

Determination of glycerol in wine. Wohack. See XVIII.

Occurrence and determination of citric acid in wine, and detection of citric acid in milk, jams, and fruit syrups. Kunz. See XVIII.

Detection of methyl alcohol in alcoholic beverages and pharmaceutical tinctures. Franceschi. See XVIII.

Determination of tobacco resin, and its application to various tobaccos. Von Degrazia. See XX.

Determination of hydrastine in plants and in extracts of Hydrastis Canadensis, and determination of berberine in extracts. Dávid. See XX.

New silicotungstic acid method for the determination of alkaloids. Ferencz and Dávid. See XX.

Detection of iodine in organic iodo-derivatives, and in mixtures of them with bromo- and chloro-derivatives by means of ammonium bromide. Guareschi. See XX.

Adaptability of the Röse-Gottlieb method for determining fat and oil in pharmaceutical preparations. Hackman. See XX.

Determination of urea in urine. Hahn and Saphra. See XX.

Apparatus for photolysis of [smokeless] powders. Guilbaud. See XXII.

PATENTS.

Injurious gases in mines and like places; Apparatus for detecting the presence of—. Schoeller und Co., Frankfort, Germany. Eng. Pat. 11,721. May 12, 1914. Under Int. Conv., Jan. 12, 1914.

IN apparatus in which a porous diaphragm, forming one wall of a chamber, is distended by the diffusion of gas through it, an impervious cover forms, with the diaphragm, a reservoir which communicates with the atmosphere through tortuous passages, and serves to protect the measuring apparatus from the effect of local surges of gas.—W. F. F.

[Gas] calorimeter. H. L. Doherty, New York. U.S. Pat. 1,150,836, Aug. 17, 1915. Date of appl., Oct. 29, 1909.

THE apparatus consists of two concentric tanks (for containing the gas to be tested) separated by a diaphragm of comparatively high heat conductivity; means for burning the gas; a heat-absorption chamber comprising a tortuous passage for the products of combustion and a separate passage for a cooling liquid; means for supplying the cooling liquid under a constant head and for utilising it to displace the gas in the tanks; and means for regulating the length of tortuous passage traversed by the products of combustion. One of the tanks may be used for containing a gas of known calorific value and the other for the gas under examination, in which case the gases are mixed before passing to the burner of the apparatus.—W. E. F. P.

Process for testing the resistance of cloth to wearing. Eng. Pat. 4820. See V.

XXIV.—MISCELLANEOUS ABSTRACTS.

X-Rays from a Coolidge tube; Maximum frequency of— for different voltages. E. Rutherford, J. Barnes, and H. Richardson. Phil. Mag., 1915, 30, 339—360.

THE frequency and penetrating power of the "end" radiation (i.e., the most penetrating rays

left after the rays of smaller frequency have been almost completely absorbed) from a Coolidge tube reach a maximum at 145,000 volts and are not altered by increasing the voltage to 175,000. The relation between frequency and voltage is expressed by $h\nu = E - ce^2$, where ν is the maximum frequency and E the energy of the electron, c a constant, and h Planck's fundamental unit. The shortest wave-length emitted by the tube is 1.71×10^{-9} cm. or 0.17 A.U.; the absorption coefficient of this radiation in aluminium is 0.39 (cm.)^{-1} and in lead 23 (cm.)^{-1} . The radiation from the Coolidge tube has only about three-tenths of the penetrating power of the γ -rays from radium C; it is more penetrating than one of the main components of the radiation from radium B, but far less penetrating than two other components.—J. R.

X-Rays from a Coolidge tube; Efficiency of production of—. E. Rutherford and J. Barnes. Phil. Mag., 1915, 30, 361—367.

THE efficiency of the production of X-rays, i.e., the ratio of the energy of the generated X-rays to that of the exciting cathode rays, at voltages of 48,000 and 96,000 in a Coolidge tube, under ideal conditions, is given as 1/800 and 1/500, respectively; from this it is deduced that only 1 electron in 200 is efficient in producing radiation.—J. R.

Trade Report.

Prohibited exports. Order in Council, Aug. 12, 1915.

THE export to all destinations of mercury is prohibited.

The heading "Mercury, salts and preparations of (other than nitrate of mercury)," in the list of goods the exportation of which is prohibited to all destinations abroad other than British Possessions and Protectorates, is replaced by the heading "Mercury, compounds and preparations of (other than nitrate of mercury)."

The exportation of caustic soda and sodium is prohibited to all destinations abroad other than British Possessions and Protectorates.

The exportation of the following goods is prohibited to all foreign countries in Europe and on the Mediterranean and Black Seas, other than France, Russia (except through Baltic ports), Italy, Spain, and Portugal:—Acetic acid. Antimony, compounds of, except sulphides and oxides of antimony (the exportation of which is prohibited to all destinations abroad other than British Possessions and Protectorates). Copper, compounds of, except copper nitrate (the exportation of which is prohibited to all destinations), and copper iodide, copper sulphate, and suboxide of copper (the exportation of which is prohibited to all destinations abroad other than British Possessions and Protectorates). Sodium cyanide. Sodium sulphide.

German chemical industry. Chem. and Drug., Sept. 11, 1915.

IN an article on the German chemical industry in the "Frankfurter Zeitung," it is stated that the annual output of chemical products in Germany amounts to 1,800 million marks (£90,000,000), half of which is exported. The effects of the war have been especially keenly felt in this industry, as not only have exports to enemy countries ceased, but the exports to overseas countries were also rendered very difficult, while on the other hand the supply of a number of raw materials was also hindered. The chemical industry quickly adapted

itself, however, to war requirements, and to a great extent substitutes have been found for scarce raw materials, nitrates from the air being especially mentioned. The production of war material has occupied the first place in the industry, peace products being more or less in the background. This applies especially to aniline dyes, but consumers in Germany are not embarrassed on this account, as large stocks are still available, and it has even been possible to export certain quantities of German aniline dyes to neutral countries. The works producing acids are very busy; the production of pharmaceutical products also continues, owing to home demand, and there is no lack of labour in the chemical industry, as men from works that are slack are transferred to busier works, and where war material is produced the men are exempt from army service. Efforts of enemy countries to manufacture products hitherto obtained from Germany were viewed in Germany with calmness, and the possibility of success of British Dyes, Ltd., is regarded as "at present still very distant." On the whole the future is faced with complete confidence by the German chemical industry, owing to the favourable financial position of most works and the amount of the reserves.

Chemical industry in Russia. U.S. Comm. Rept. Suppl. No. 13A, Aug. 12, 1915.

ALMOST immediately after the opening of hostilities all the weak points of Russia's chemical industry made themselves felt. These are the absence of various raw materials, particularly of coal tar and its derivatives, and the lack of production of organic preparations for pharmaceutical, colouring, and dyeing purposes. Some of these preparations were made in Russia but they were prepared from foreign raw or semi-manufactured material, and in inconsiderable quantities.

During 1913 the quantity of raw material, semi-manufactured and manufactured products, imported for the requirements of the textile industry, amounted to about £900,000, including indigo worth £200,000, and alizarin and other synthetic dyeing substances to the value of £500,000; besides, there were imported chemical and pharmaceutical products, not specially named, valued at £760,000. The production of aniline salts ceased at all the works at the end of the year on account of the scarcity of benzol, all of which is imported. The majority of the Russian firms producing acids, which used to work with imported pyrites, are now using raw material from the Ural Mountains; this is principally a question of prices and time of delivery. The Russian soda works are not experiencing any special difficulties excepting the temporary loss of part of their market; prices remained at practically the same level at the end of the year, a slight increase being the result of the war tax on railway freights. The imports of various products used for medicinal purposes during 1913 amounted to £400,000. In this respect the chemical industry of Russia was in a better position to meet the requirements of the country, as there are about 10 industrial concerns, besides the chemical laboratories, that are fairly well equipped. An important drawback proved to be the shortage of raw material, mostly of foreign origin, such as cinchona bark and other substances used for obtaining alkaloids. The stoppage of imports has resulted in the establishment of concerns for the production of chloroform, iodine, phenol and its derivatives, and lanolin, the revival of production of mercury, and the extension of the production of mercurous chloride. Besides, the production of ether, acetanilide, etc., has increased, and concerns have started for the production of some alkaloids.

In spite of the fact that the frontier was closed during the second half of 1914, the total imports

of chemical goods were far in excess of half of the usual annual imports. The usual annual imports of metallic antimony amount to 1640 to 1720 short tons; in 1914 the imports reached 3480 tons. Chile saltpeter was imported to the amount of 59,400 tons, against 47,800 tons during 1913. The imports of copper sulphate increased from 700 to 920 tons. The imports of intermediate products for the manufacture of dyestuffs reached the usual annual amount. On the other hand the imports of pharmaceutical and chemical goods decreased by almost 50%. Less considerable decreases are noted in the imports of indigo, alizarin, and other colours, the first being reduced by 33%, the second by 41%. There was a decrease of 62% in the imports of phosphates.

Italian chemical industry. Chem. Trade J., Aug. 21 and Sept. 4, 1915.

THE Italian chemical industry properly so-called absorbs a capital of about 170 million lire, 65 millions of which are employed in the fertiliser industry, 40 millions in electro-chemical industries and 60 millions in the industry in general and particularly in the pharmaceutical branch. The chemical industry of Italy utilises 87,000 H.P., 65,000 H.P. of which are electric, employs about 12,000 workpeople, and reaches an annual production which may be reckoned at 180 million lire. More than a third of this sum is represented by chemical manures (superphosphates, sulphate of ammonia, cyanamide); then follow copper sulphate, 30 millions; electro-chemical products (calcium carbide, caustic soda, chlorine, hypochlorites, chlorates, nitric and hydrochloric acids, hydrogen), 15 millions; tartaric and citric acids, 12 millions; mineral acids (sulphuric, hydrochloric, and nitric), 7 millions; lastly, the general chemical, boric acid, liquid carbonic acid, oxygen, hydrogen peroxide, mercury salts, carbon bisulphide, metallic salts. Pure chemical products are made in Italy to a value of about 15 million lire.

The importation of chemical products annually exceeds 100 millions, divided for 1914 among these groups as follows: 30 millions for fertilising materials (chloride and sulphate of potash, nitrate of soda, sulphate of ammonia, basic slag, chemical fertilisers in general); 18 millions for copper sulphate. Most of the products manufactured in Italy are of a crude nature and low in price, such as mineral acids, fertilisers, etc., so that the cost of freight is sufficient to protect them against eventual foreign competition. The manufacture of fine chemicals is only in the primordial state in Italy.

It has often been said that the chemical industry can never prosper in the peninsula on account of the lack of coal. In normal times the difference in the price of Cardiff coal at English and Italian ports is about 7s. or 8s. per ton, so that, for a factory operating on the coast, the difference is not prohibitive and, independently of tariff protection, is in part neutralised by the freight of the same article imported. In fact, the chemical process for which the greatest quantity of coal is necessary is the concentration of caustic soda of 38° B. to 97—98% NaOH, which requires a ton of coal for each ton of concentrated product—that is to say, less than it costs in normal times to transport a ton of caustic soda of 97—98% from Liverpool to Milan.

The concentration of liquids in vacuum apparatus with the most recently introduced improvements—for example, in the Prache-Bouillon apparatus—requires for each litre of water evaporated 20 grms. of coal. Moreover, the Solvay installation at Castiglione demonstrates amply that the lack of coal is not an insurmountable obstacle to the establishment of a concern in which coal is of the

greatest importance. The greatest weakness lies in the irrational method of using heat: steam generators, old and unsuitable; insulation and distribution inefficient; absence almost everywhere of any deep study of the thermo-chemistry of reactions; and slow application of the most modern improvements. In very few chemical concerns is thermal economy rigorously observed.

The Italian soil contains scarcely any economic minerals in large quantities besides sulphur, zinc, lead, and mercury, and potash salts are not known, while the copper ores are of slight importance.

The principal problem awaiting solution is to produce in the country the products necessary for making fertilisers, fungicides, and insecticides. The fixation of atmospheric nitrogen is a matter of prime importance. The cost of a unit of nitrogen in sodium nitrate has averaged in recent years, 1 lire 50 at Genoa. To compete with this in the oxidation of nitrogen it would be necessary to supply electrical energy at 30—40 l. per kilowatt-year, whereas the average cost at present is nearly 110 lire. The fixation of nitrogen in the form of cyanamide offers better prospects, 500 kilos. of nitrogen being obtainable with a consumption of 1 kw.-year. The Soc. des Produits Azotés is said to be in a position to produce 180,000 quintals of calcium cyanamide this year, corresponding to 235,000 quintals of sodium nitrate. To satisfy the domestic requirements in imported nitrogen, estimated at 11 or 12 million units, at least 150,000 kw. annually would be necessary, i.e., 225,000 H.P., or one fourth of the total hydro-electric energy at present available in Italy.

Books Received.

GLYCERINE. By S. W. KOPPE. Translated from the German Second Edition by W. H. Simmons. Scott, Greenwood and Son, 8, Broadway, Ludgate, London, E.C. 250 pages, 7½ × 5 in. Price 7s. 6d.

THE first portion of this book deals with the commercial methods for the preparation of glycerin. A short account is given of the derivatives of glycerin, attention being chiefly directed to glycerophosphoric acid and the chlorohydrins. Following this is a brief but comprehensive account of the various methods of hydrolysis of fats. A passing mention is made of the synthetic preparation of glycerin from acetone: the subject might with advantage have been treated in more detail, as a good deal of work has been done in Germany on the synthesis of glycerin from aliphatic hydrocarbons, although this has not yet reached commercial importance. A large section devoted to the preparation of nitroglycerin, including the preparation and properties of mono-, di-, and tri-nitroglycerins, as also of "tetranitroglycerin" (or, more correctly, tetranitrodiglycerol), adequately covers the ground, a description of the modern methods of nitrating glycerin being given, accompanied by illustrations of the plant required. This is quite the best section of the book, being written in an extremely lucid manner, with a sureness of touch which shows that the author has an intimate knowledge of the minutiae of dynamite manufacture. A printer's error may be noted in the graphic formula given for tetranitrodiglycerol, where the glyceryl radicle is given twice as C_3H_5 instead of C_3H_5 . The author gives the composition of various forms of dynamite and blasting powders, chiefly of German and American origin.

A section occupying about seventy pages is devoted to the various applications of glycerin in

the arts and crafts. A large amount of information is here collected, showing the uses of glycerin from the preparation of copying inks to its employment as an inhibitor of fermentation in wine, and the formulæ for a number of soaps and toilet preparations are given.

The chemical analysis and valuation of the various glycerins is worthy of more attention than is here given to it. The author gives two methods for determining the value of a glycerin for dynamite making by the nitration of the glycerin in the laboratory. It must be pointed out that he reduces the amount of glycerin used for each test to the lowest possible point, i.e., 15 grms., in one case even to 10 grms. More reliable results are obtained when using larger quantities, say 50 grms., as the separation of the waste acids when using a smaller quantity is very erratic and gives slight indication of what will take place on a large scale. The statement on p. 217 that the mixed acids for nitrating should consist of "37% of sulphuric acid having a specific gravity of 1.5 and 63% of nitric acid of the specific gravity 1.485" requires correction.

The only method given for the determination of the glycerol is the bichromate method, which the author uses in an obsolete form. It is noteworthy that the author adds the sulphuric acid to his stock bichromate solution instead of employing the far safer method of adding it to each test. He also uses 74.86 grms. of bichromate in a litre of water, whereas the amount based on the modern atomic weights is 74.564 grms. If the bichromate method is to be relied upon, it should be used in the form given to it by the International Standard Methods.

The acetin method is contemptuously dismissed in a few words with the entirely unsupported statement that polyglycerols are acetylated on boiling with acetic anhydride. Although the author points out the danger of contamination with organic impurities, he gives no method for their estimation or for the determination of the salt in crude soap-lye glycerin.

It must be said that the work is of more interest to the pharmacist and technologist than to the analytical chemist. The book is neatly got up and the style is clear, although the somewhat too literal translation of the German idiom is occasionally irritating to the reader.

G. H. WARBURTON.

MINES AND QUARRIES: GENERAL REPORT, WITH STATISTICS, FOR 1914, BY THE CHIEF INSPECTOR OF MINES. PART I. DIVISIONAL STATISTICS. [Cd. 8035.] Wyman and Sons, Fetter Lane, London, E.C. Price 7d.

THIS return contains statistics of the number of persons employed, the output of minerals, and the accidents at mines and quarries in the United Kingdom, arranged according to the inspection districts. The total output of the undermentioned minerals in the United Kingdom in 1914 as compared with 1913 was as follows:—

	1913.	1914.
	tons.	tons.
Coal	287,430,473	265,664,393
Iron ore	15,997,328	14,745,828
Clays and shale	13,892,807	13,124,361
Limestone (other than chalk) ..	12,740,664	12,180,015
Igneous rock	7,098,493	7,135,243
Chalk	1,858,126	4,291,170
Sandstone	3,977,303	3,464,528

THIRTY-NINTH ANNUAL REPORT OF HIS MAJESTY'S INSPECTORS OF EXPLOSIVES, 1914. [Cd. 8029]. Wyman and Sons, Fetter Lane, London, E.C. Price 1s. 2d. (See p. 983).

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Communication.

VULCANISATION EXPERIMENTS ON PLANTATION PARA RUBBER. THE CAUSE OF VARIABILITY.

BY B. J. EATON, F.I.C., AND J. GRANTHAM, B.A.

Department of Agriculture, Federated Malay States.

During the last two or three years much has been written and many statements made concerning variability in plantation Para rubber. The opinions expressed generally by manufacturers are to the effect that variation is considerable, even in the case of "First latex" rubber, when compared with "Fine hard Para" as the highest or first grade of wild Para rubber. On the other hand, the leading rubber technologists and chemists have maintained stoutly that the best grades of plantation Para rubber—especially sheet—are superior to Fine hard Para. Both opinions may be taken as correct, as we shall show, and are not necessarily contradictory. Unfortunately neither the statements made by manufacturers nor the published results of experiments carried out by rubber chemists, have indicated the nature of this variation, still less have any published results enabled us to attribute this variation to any definite cause.

It has been assumed generally that variation refers to differences in the mechanical properties of the vulcanised material, i.e., strength, elasticity, etc. In our experience this is only true to a limited extent among "First latex" rubbers, and represents only a part and by no means the principal part of such variation, as our experiments will show.

Our experiments have so far been confined almost entirely to "First latex" rubbers, but results obtained from a few samples of lower grades indicate that among these there is a much larger variation in mechanical properties.

The experiments described in this paper give the first results obtained in the experimental vulcanising and testing laboratory at the Agricultural Department, F.M.S., apart from tests carried out on a number of estate samples, which at this early stage have little value from a research point of view, except that they show that considerable variation occurs among estate rubbers from first latex.

Experiments at the F.M.S. Testing Laboratory.

In each case the mixing used consisted of 90 parts of raw rubber and 10 parts of sulphur, i.e., 10% of sulphur calculated on the mixture. A mixture consisting of 450 grms. of rubber and 50 grms. of sulphur was found to be sufficient generally for each experiment.

The rubber was rendered somewhat plastic on the hot mixing rolls and the sulphur sprinkled on by means of a small tin with perforations in the cover, and the mixing carried on till the mass was homogeneous and sufficiently plastic to run well on the calender. Such a mixture takes about 20 to 25 minutes to complete.

A few rubbers were found to require longer mixing and hotter rolls to render the mixture sufficiently plastic to calender. Low-grade rubbers, on the other hand, require much cooler rolls.

Experiments on the effect of working on the mixing rolls have been carried out, and it was found that unless excessively overworked or overheated, the differences between different mixes of the same rubber were not great.

The mixing was calendered to such a thickness that three layers of the calendered sheet gave a suitable thickness (just over 5 mm.) for making vulcanised slabs 5 mm. thick. Calendered sheets of this thickness, when properly prepared, did not develop any faults such as air bubbles.

The moulds eventually adopted for vulcanising the samples, after numerous trials of various types had been made, were constructed as follows:—A rectangular steel frame, exactly 5 mm. thick, was divided by means of two cross pieces into four rectangular compartments of equal size, each compartment being sufficiently large for a slab of vulcanised material, from which two rings could be cut by means of the Schopper cutting press employed for cutting the test pieces. In this way four samples of different rubbers could be vulcanised in the same frame, or by removing one or both of the cross pieces, slabs large enough for 4 or 8 rings of the same material could be vulcanised. The outer side of each compartment was provided with a small opening made by a half-cut, to allow the excess of rubber to spue out. Each compartment held about 40 grms. of the mixing, and an amount slightly in excess of this was carefully weighed out by cutting the folded calendered sheet. The frames are placed between two outer plates, $\frac{3}{4}$ inch thick, slightly larger in area than the frame and bolted together by means of $\frac{1}{2}$ -inch bolts in slots, for ease in fixing and removing.

The outer plates were heated in the steam autoclave, before the rubber was placed in the frames, so that the rubber was softened and could be more easily pressed in the frames. Between the surface of the rubber and the outer plates a layer of tracing cloth was used to prevent the rubber adhering to the mould and to prevent faults, such as "lakes," which were found to be formed when the rubber was in direct contact with the mould. It was found possible by these methods to prepare slabs with a maximum variation in thickness of $\pm 2\%$.

In the earlier experiments a temperature of 135°C. was employed for vulcanisation, the apparatus used being a steam autoclave provided with a steam casing, the temperature being controlled by means of an accurate thermometer and a pressure gauge. Some samples were found to take five hours or longer to vulcanise correctly at this temperature, and as this was considered to be too long for the large number of experiments to be conducted on each sample, the temperature adopted subsequently and employed in all the experiments described in this paper was 140°C.

A series of cures was carried out on each sample, in which the time varied from about 1 to 3 hours. So far, no samples, at this particular temperature (140°C.), have been found to cure under one hour and only one or two in slightly over 3 hours. Although, at first, each sample was vulcanised at 1, $1\frac{1}{2}$, $1\frac{3}{4}$, 2, $2\frac{1}{2}$, $2\frac{3}{4}$, and 3 hours, it has now been found that many of these times, after one preliminary cure, may be omitted, since the correct rate of cure can be predicted approximately from the results obtained from the preliminary cure, and it is then only necessary to carry out one or two cures in the neighbourhood of this optimum time, in order to obtain the maximum mechanical properties at this cure.

All the tests described in this paper were made on the Schopper testing machine, which was provided with an autographic apparatus, so that the behaviour of the rubber throughout the whole test is recorded by means of a curve.

Test rings were prepared from the vulcanised slabs by means of the Schopper cutting press. The thickness and width of each ring was ascertained and the load per sq. mm. calculated from

the cross sectional area, the ring being considered as equivalent to two strips, *i.e.*, a ring 4 mm. \times 5 mm. being considered to have a cross sectional area of 40 sq. mm.

The load at breaking point was found to increase with the time of cure to a certain point and then to collapse, the rubber becoming very brittle at an overcure. The elongation decreases continually and fairly regularly with the time of cure until an overcure is reached, when it falls rapidly. The maximum load is often only obtained when the rubber is obviously overcured, *i.e.*, it has become somewhat brittle and the extension is low. It is therefore somewhat difficult to fix the exact maximum point or point of optimum cure from the figures at breaking point.

In our experiments we have always taken as the optimum that point at which the product of the breaking load per unit cross section and the elongation is a maximum. Nearly every sample has a sharply marked maximum product, and any gain in load due to extra curing is outweighed by a correspondingly greater fall in the extension and *vice versa*.

An interpretation of results based on the values of the load and extension at breaking point is in many respects unsatisfactory. This is due to the fact that even from a single slab of vulcanised rubber of uniform thickness it is impossible to obtain a number of test rings giving a really satisfactory uniformity in the figures. The error in the load figures is greater than in those of the extension, especially in the neighbourhood of the optimum cure, owing to the fact that as the breaking point is approached the load is increasing at a very much more rapid rate than the extension. Our results are in most cases based on the maximum figures obtained from two test rings at each particular time of cure. The difference between the two loads may reach 10%; it is usually very much less, and very seldom exceeds this figure unless the ring is obviously defective. The figures thus obtained from a series of cures at $\frac{1}{4}$ -hour intervals show a regularly increasing load to a maximum and a falling extension, and it is only very occasionally that a result is out of place. When this does occur an additional cure at the particular time will usually result in restoring the regularity of the series.

TABLE I.

A. Sample cured for $2\frac{1}{2}$ hours. Six test rings from one slab.

No.	Thickness (mm.).	Breaking load (kilos.).	Final extension. Initial=100.
1	5.15	44.5	1013
2	5.15	49.2	1030
3	5.05	47.0	1025
4	5.00	50.2	1035
5	5.10	51.5	1039
6	5.15	44.0	1011

B. Sample cured $1\frac{1}{2}$ hours; 1, 2, 3, 4 from one slab, 5, 6, 7 from a second slab.

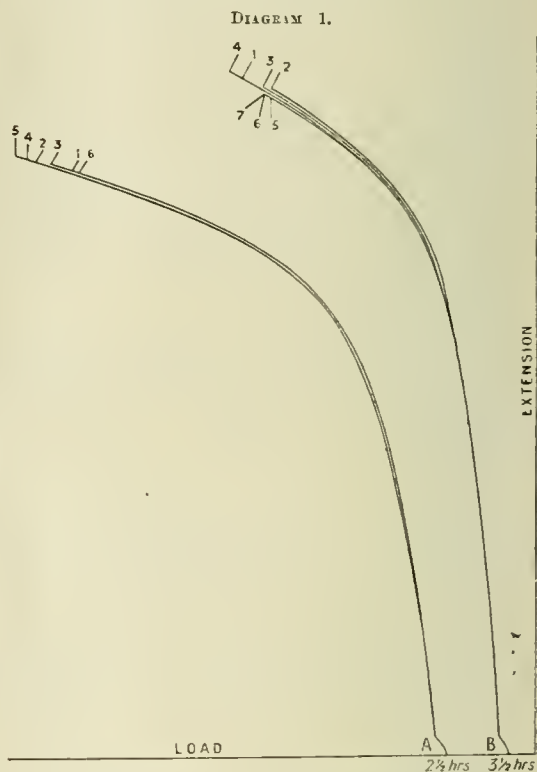
1	5.05	29.8	1160
2	5.00	26.3	1143
3	5.05	26.3	1145
4	5.05	21.5	1166
5	5.15	26.0	1130
6	5.15	27.0	1135
7	5.15	27.0	1135

The product of the load and extension thus obtained has been plotted against the time of cure. The point at which this curve reaches its maximum shows the optimum time of cure. Many of the curves exhibit irregularities, which may be attributed to the failure of the rubber to give the maximum figures attainable at a given time of cure. It was found, however, that although considerable

variation occurred in the breaking point figures, yet the shape of the curve obtained was remarkably constant. This is well shown in the experiments given in Table I.

In the above table the width of the ring cut by means of Schopper cutting press was in each case 3.75 mm. and was constant. The load per unit cross section (sq. mm.) in all the tables given was therefore calculated on a ring 3.75 mm. wide, and having the thickness of the slabs vulcanised (5 mm. approx.) which, as stated elsewhere, did not vary more than $\pm 2\%$.

It will be seen that in the case of A the load varies from 44 kilos. up to 51.5, a difference calculated on the latter of over 14%. The extension varies from 1011 to 1039, a difference of 2.8%. In the case of B the load varies from 26 to 31.5, a difference of 18%. The extension varies from 1166 to 1130, a difference of about 3%.



An examination of the curves in Diagram I, will show, however, that all the A curves and all the B curves are almost identical. The curve can therefore be taken as constant for any particular cure of any particular sample.

If now a series of cures is carried out on a given mixing, a regular series of curves is obtained of regularly increasing initial inclination with increase in time of cure, and a definite relation connects all the curves of the series. Typical cases of these series are seen in Diagram 2 *et sequentes*. It will also be noticed that the curves eventually become parallel. In the case of undercures the curve often breaks off too soon for this to be apparent. The initial portion of each curve is approximately a straight line and represents a rapid increase of extension with a slow but proportional increase in load. The inclination of this part of the curve bears a definite relation to the state of cure. The medial portion of the curve represents a continuously varying ratio between the rate of increase of the extension and the rate of increase of the load. The final portion again approximates to a straight

line and represents a rapid increase in load with a slow but proportional increase in extension. The inclination of this part is constant for a series of curves from one mixing and is independent of the state of cure.

On an examination of the series of curves made while carrying out the experiments which are to be described in this paper, it was seen that the inclination for the final portion of the curve was a constant not only for a given series but for the whole of the experimental samples tested. Also, for a given inclination, the medial part of the curve was constant. As a consequence it was evident that all the curves were of the same type. All the samples (except S, an estate sample, and 31, a smoke-coagulated sample) were coagulated in a similar manner from latex from the same trees. The subsequent treatment varied in every way. Apparently, therefore, latex from certain trees coagulated in the same way will always give the same type of curve. Further, sample 31, Table V, which was smoke-coagulated, gave the same type. The samples of Fine Hard Para did the same. The noticeable feature in the results was that the series when compared show great variations in the initial inclination of the curves at any given time of cure, i.e., the state of cure at a given temperature was variable. Some rubbers therefore cured more quickly than others. If it is desired to determine which of two rubbers cures the more rapidly it is only necessary, the curves being the same type, to cure them at the same time and plot the curves together. The more rapidly curing rubber would give the lower and more inclined curve. Thus in the course of investigations on the rate of cure, the type of curve being constant, it becomes possible to dispense with end point figures altogether.

Theoretically one would expect that rubbers giving the same type of curve would give curves of identical shape at the cure giving their maximum mechanical properties. That this is not so practically is shown in Table XI. later on, where the optimum results obtained in the experiments are collected and discussed.

Experimental results.

The experimental results to be described in this paper are derived from samples of rubber prepared by us at the Agricultural Department factory, and include also a number of estate samples and samples of Fine Hard Para for comparison. All the experimental samples, unless otherwise stated, were prepared from latex of sp. gr. 0.9910 coagulated by 3 oz. of 5% acetic acid per gallon.

Our conclusions as to the cause of this variation are based on our own samples, the complete history of which was known. The mode of preparation of the estate samples was usually unknown and several variables may have been introduced. Our experimental samples, however, have shown us one very important cause of variation in respect to rate of cure, and we have reason to believe that the variation in all samples is due to the same ultimate cause, although differences in method of coagulation and preparation and other factors contribute to this cause. This factor is of considerable importance to the manufacturer, and capable probably of being controlled and applied to good purpose. Many results, which were at first difficult to understand, have now become capable of explanation and support the theory which we shall enunciate here.

In carrying out the vulcanisation of a number of samples of smoked sheet and plain crepes prepared in the Agricultural Department Factory from latex which was reduced to a standard sp. gr. of about 0.9910 corresponding to 15% or 1.5 lb. of dry rubber per gallon, the optimum results from tests on the vulcanised samples were obtained by

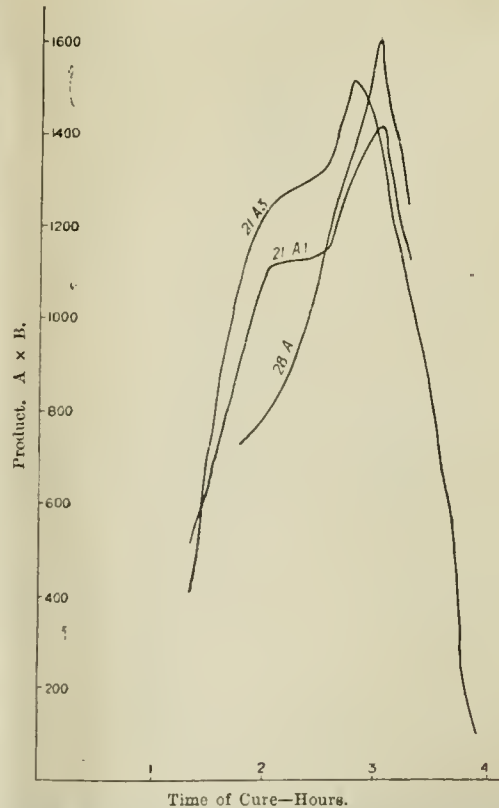
curing the samples at about 2½ to 3 hours. The results for a few samples are given in Table II.

TABLE II.
Smoked sheet and plain crepe.

Reference No.	Time of cure.	Load (kilos.) per sq. mm.	Elongation at break, (Orig. length=100).	Product.
	Hrs. min.	(a).	(b).	a × b.
Plain crepe	1 20	0.45	1168	525
21 A 1.	2 00	0.9	1127	1014
	2 30	1.1	1020	1122
	2 45	1.35	1002	1352
	3 00	1.45	980	1421
	3 15	1.25	910	1137
Plain crepe	1 20	0.35	1116	390
21 A 3.	2 00	1.15	1089	1252
	2 30	1.3	1034	1344
	2 45	1.5	1016	1524
	3 00	1.45	961	1393
	3 15	1.2	893	1071
	4 00	0.25	373	93
Smoked sheet ..	1 45	0.64	1069	684
28 A.	2 00	0.75	1056	792
	2 15	0.88	1046	920
	2 30	1.1	1020	1122
	2 45	1.35	1010	1363
	3 00	1.60	1009	1614
	3 15	1.33	946	1258

The above results are the maxima obtained from 2 to 4 test rings at each time and are typical of the majority of our smoked sheets and plain crepes.

DIAGRAM 2a.



The results have been confirmed by numerous experiments. The maximum product figures are plotted against the time of cure in Diagram 2a.

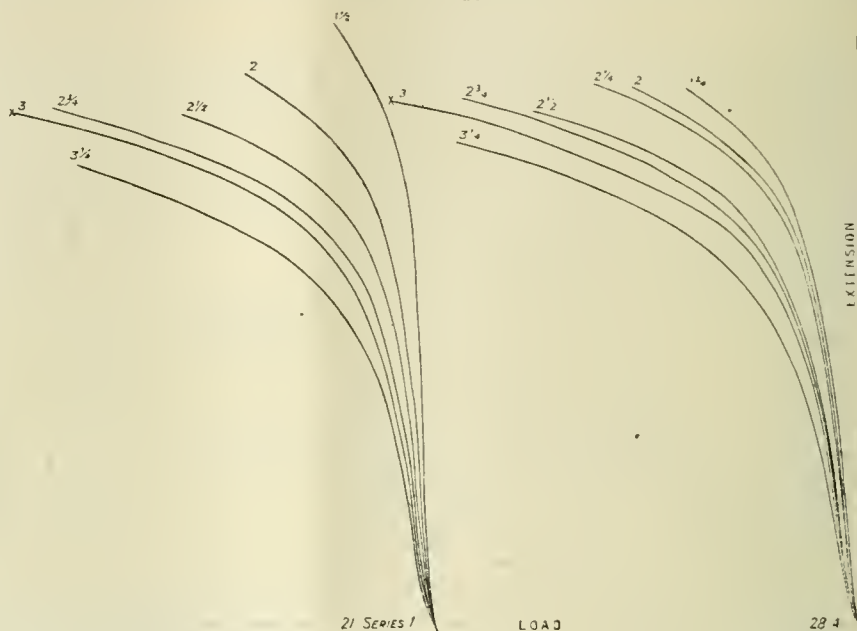
The series of curves showing the progressing state of cure with increase in time of cure are shown in Diagram 2b. The similarity in type is evident.

It was difficult from the results obtained in our earlier work on the above and similar samples to attribute a difference in time of cure of about $\frac{1}{2}$ hour to any particular factor.

Subsequently a sample of "Byrne cured slab" was received for examination and this was found to cure in the remarkably rapid time, under similar conditions as to the temperature and mixing, of $1\frac{1}{2}$ hours, a difference sufficient to demonstrate the influence of some very important cause of variation. The results obtained are given in Table III. and Diagram 3.

had been kindly lent to us by the Byrne Curing Syndicate for experiments on this process and for

DIAGRAM 2b.



is obtained. By putting a little tension on the sheets when wrapping them round the stick, the sheets adhere, and the solid cylinder, when cut open, is seen to consist of alternate light and dark layers—the light layers representing the interior of the sheets and the dark layers the surfaces. This rubber, like slab and Fine Hard Para, never completely dries in the original form and has to be creped and dried before vulcanising.

The results of the tests on the vulcanised samples are given in Table IV., the sample A being the ordinary form of loaf and sample B pressed block from similar sheets.

TABLE IV.

Type.	Refer. No.	Time of cure.	Load (kilos.) per sq. mm.	Elongation at break. (Orig. length = 100.)	Product.
"Loaf"	34 A.	Hrs. min.	(a).	(b).	a × b.
		1 45	0.98	1090	1068
		2 15	1.26	1028	1295
		2 30	1.35	1015	1373
		2 45	1.44	999	1438
		3 00	0.25	572	143
Pressed sheet	34 B.	1 45	1.12	1078	1207
		2 30	1.3	1026	1323
		2 45	1.45	986	1430

The optimum cure in the above table is seen to be at 2½ hours, which is the same as the smoked sheet in Table II. and quite different to the slab. The series curves are also similar to those in Diagram 2b both in type and time of cure.

The results point to the fact that the rapidity of cure in the case of Byrne cured slab in Tables III. and IIIA. is not due to the Byrne fumes.

Another sample of rubber prepared by coagulating latex in thin layers in shallow trays in a smoke house, and superimposing further layers daily for a period of about one week, was also found to vulcanise rapidly. (This method of coagulation has been described by one of us in papers presented to the International Congress of Tropical Agriculture, London, 1914, and the International Rubber Congress, Batavia, 1914, etc.)

The optimum times of cure of this experiment are given in Table V.

TABLE V.

Reference No.	Optimum time of cure.	Load (kilos.) per sq. mm.	Elongation at break. (Orig. length = 100.)	Product.
31 D.	Hrs. min.	(a).	(b).	a × b.
	1 30	1.26	1093	1377
31 E.	1 30	1.30	1108	1451

Unfortunately the quantity of the samples was insufficient to allow of a cure being done for 1½ hours, but the above results clearly show that the rubber is a very rapidly curing one.

The results given by this experiment confirm the idea that the rapidity of cure was not due to any intrinsic properties of the "Byrne" fumes, and suggested that it was connected with the slab form in which the rubber was prepared.

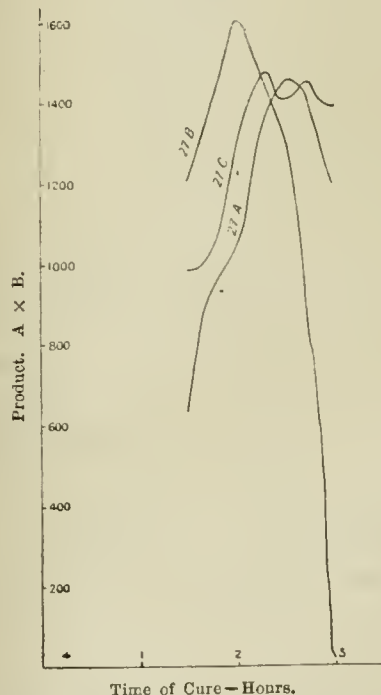
Another experiment was a comparison between smoked and unsmoked sheet, in which it was noticed that the smoked sheet vulcanised more slowly than the plain sheet, the former having its optimum cure about 3 hours and the latter at 2½ hours.

A second and more elaborate experiment, in which comparison was being made between smoked sheet, unsmoked sheet, and plain crepe, was also

in progress. Here again the smoked sheet and the crepe were slower curing than the unsmoked sheet; the results were identical for batches of rubber prepared on seven different days, but the relation between the smoked sheet and crepe varied, sometimes one and sometimes the other being the more rapid curing. The differences are more apparent when examining the curves showing the behaviour of the rubber throughout the test, the curves for the unsmoked sheet invariably being lower and more inclined than the other two.

The results of the first day's batch of rubber are given in Table VI. and Diagrams 4a and 4b. Diagram 4b shows the different rates of cure of A, B, and C, curves of each at particular times of cure being plotted against one another. A, B, C, were always vulcanised together in the same mould at each time of cure.

DIAGRAM 4a.

TABLE VI.
Optimum times of cure.

Type of Rubber.	Ref. No.	Optimum time of cure.	Load (kilos.) per sq. mm.	Elongation at break. (Orig. length = 100.)	Product.
Smoked sheet	27 Ser.	Hrs. min.	(a).	(b).	a × b.
	1 A.	2 30	1.40	1041	1457
Plain crepe	27 Ser.	2 15	1.4	1046	1464
	1 C.	2 30	1.40	996	1394
		2 45	1.5	972	1438
Plain sheet	27 Ser.	2 00	1.59	1021	1613

In the case of the plain crepe results we have a difficulty in deciding which time shall be considered the optimum. This is a rubber which gives excellent results at all times between 2½ and 3 hours. It is quite clear, however, from the curves—Diagram 4b—that the unsmoked sheet cures more rapidly than either the crepe or the smoked sheet, and even from the figures alone it is

seen that it attains its maximum load in a shorter time, viz. 2 hours as compared with 2½ hours in the case of the smoked sheet and crepe. Also the collapse in load and extension denoting a marked overcure is reached by the unsmoked sheet at 3 hours, whereas this has not been reached by the smoked sheet and crepe.

DIAGRAM 4b.
27 A,B,C.

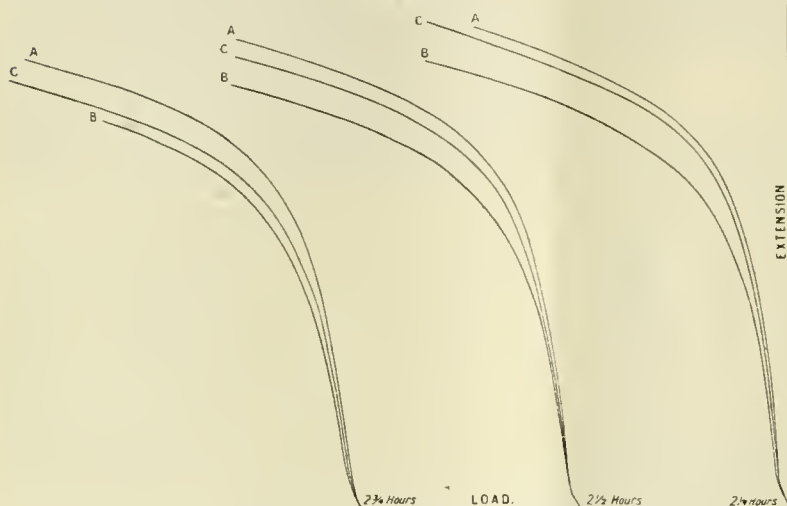


TABLE VII.

	37. Series 6.				37. Series 7.			37. Series 8.		
	Time of cure.	Load (kilos.) per sq. mm.	Elongation at break.	Product.	Load (kilos.) per sq. mm.	Elongation at break.	Product.	Load (kilos.) per sq. mm.	Elongation at break.	Product.
Smoked sheet A.	Hrs. min. 2 45 3 00	(a). 1.22 1.44	(b). 972 953	a × b. 1185 1372	(a). 1.41 1.32	(b). 977 910	a × b. 1370 1201	(a). 1.42 1.48	(b). 970 932	a × b. 1377 1379
Smoked sheet A I, creped when dry ..	2 45 3 00	1.26 1.38	985 954	1241 1314	1.32 1.42	966 925	1275 1313	1.46 1.33	973 926	1420 1222
Smoked slab B.	1 30 1 45	1.28 1.46	1052 1013	1346 1478	1.38 1.36	1053 995	1453 1353	1.41 1.45	1035 968	1459 1403
Unsmoked sheet C.	2 30 2 45	1.12 1.35	966 965	1081 1302	1.35 1.28	976 945	1317 1209	1.46 1.50	965 936	1408 1404
Unsmoked sheet creped when dry, CI	2 45 3 00	1.45 1.3	990 909	1435 1180	1.48 1.35	985 905	1458 1248	1.52 1.27	947 869	1439 1104
Unsmoked slab D.	1 15 1 30	1.48 1.42	1029 970	1522 1377	1.24 1.55	999 1000	1238 1550	1.38 1.51	1024 1006	1423 1519

These results indicate that smoking increases the time of cure. We now had the following facts concerning the variation in rate of cure:—

(1) Slab rubber smoked with Byrne fumes or rubber coagulated by smoke by superimposing layers of latex, cures much more rapidly than plain crepe or smoked sheet.

(2) Unsmoked sheet cures more rapidly than smoked sheet or plain crepe.

In continuation of the first idea connected with the slab form of rubber, the following series of samples were prepared in each case from the same latex. Latex was coagulated in bulk in a wooden box divided by means of movable partitions, so that each section of the coagulum received identical treatment in respect to coagulation. The coagulum from each section was removed on the following morning and treated subsequently as follows:—(1) Two slabs about ½ inch thick were made by rolling the coagulum lightly with a hand

roller. (2) Two sheets of ordinary average thickness were prepared from two other sections of the box, by rolling out on an ordinary sheeting machine. One of the slabs from (1) was allowed to air-dry and the other placed in the smoke house, and similar treatment was accorded the two sheets. The rubbers were allowed to remain in the drying

house and smoke house respectively till the sheets from (2) were dry.

The slabs had to be creped subsequently before vulcanising; the sheets were also divided into two, and half was mixed direct and half creped before mixing so that the following series of samples were obtained.

(1) Smoked slab creped, (2) air-dried slab creped, (3) smoked sheet, (4) ditto creped when dry, (5) plain sheet, (6) ditto creped when dry.

The vulcanised samples were tested and entirely confirmed the theory to be enunciated later, which had been indicated by the previous samples of slab and other rapidly vulcanising rubber. The results given below show the optimum times of cure:—

In Table VII. given above the results obtained from 3 days' rubber are given. The experiment was actually carried out for a period of 8 days, but as all the results were similar the inclusion of all the figures for the whole period would merely be an unnecessary duplication of results.

The optimum time of cure, though not actually the same for each kind of rubber on the eight different days, was always relatively in the same order, viz., A and A1, C and C1, B, D. Curves drawn from these results show that the rubbers placed in the order of rapidity of cure, beginning with the slowest, are (1) smoked sheet creped before mixing, (2) smoked sheet mixed direct, (3) unsmoked sheet creped before mixing, (4) unsmoked sheet mixed direct, (5) smoked slab, (6) unsmoked slab. The difference is in every case well marked between the sheet rubber, the smoked slab, and the unsmoked slab.

One abnormal result occurred in one day's rubber in which the curves for the unsmoked sheet at times were coincident with those of the smoked sheet and at times were very slightly above. This difference was not apparent in the figures. On examining the sheets the cause of this abnormality became apparent. The sheet on this day, and particularly the unsmoked, was very thin and a rubber was thus obtained, which retained a minimum amount of serum. In view of the theory given later it will be seen that this fact tends to eliminate the difference between smoked and unsmoked rubber.

Apart from this single case the results were uniform for the eight days.

The conclusions drawn from this experiment were:—(1) Slab cures more rapidly than sheet. (2) The effect of smoking is to retard vulcanisation. This effect is more marked in the case of the slab than in that of the sheet. (3) Creeping of dry sheet previous to mixing has a very slight effect in decreasing the rate of cure. These results confirmed in every way those of the previous experiments.

A further experiment was undertaken in order to determine the effect of the varying grades of thickness in the prepared rubber. Four specimens of rubber were prepared from bulked latex, each being the rubber from $\frac{1}{2}$ gallon. A. Thick slab. B. Thin slab. C. Thick sheet. D. Thin sheet. These samples were unsmoked. The optimum results are given in Table VIII. below and Diagram 5.

TABLE VIII.

Reference No.	Optimum time of cure.	Load (kilos.) per sq. mm.	Elongation at break. (Orig. length = 100.)	Product.
	Hrs. min.	(a).	(b).	a x b.
46 A 1. Slab 15 mm. thick	1 15	1.45	991	1436
46 B 1. Slab 6.4 mm. thick	1 30	1.49	1025	1527
46 C 1. Sheet 3.5 to 4 mm. thick	2 30	1.52	969	1473
46 D 1. Sheet 3 mm. thick	3 00	1.27	942	1196

The increase in the rate of cure with increasing thickness of the sample is very well marked.

Cause of variation.

It will be observed from the tables given that the rapidly curing samples are those prepared in slab form or by smoke coagulation of latex in shallow pans. It is also seen that rapidity of cure increases with increasing thickness of sheet and slab. Now the only difference between the samples is the amount of serum or mother liquor remaining in them after preparation. Slab has only a small proportion of serum pressed out by hand rolling compared with the amount pressed out in rolling thin sheets. In the smoke-coagulated rubber also, a large proportion of the serum remains in the prepared rubber.

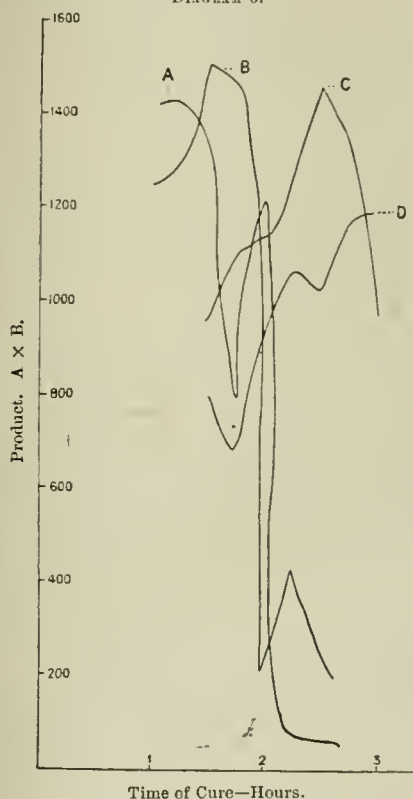
Two alternative explanations of these facts suggest themselves:—(1) That the latex contains, in addition to the caoutchouc, some constituent which influences the rate of cure of the rubber, this substance not being precipitated by ordinary coagulation. Consequently the greater the quantity of the serum remaining in the rubber, the greater will be the quantity of this substance present in the raw rubber. If this be the case, the effect of smoking is apparently to destroy the substance. (2) It may be, however, that this substance does not exist as such in the latex but

is formed subsequently from some constituent of the latex. In this case the retention of the serum in the rubber would appear to encourage the formation of the catalytic substance.

By the ordinary methods of chemical analysis of raw rubber, which are somewhat crude, the non-caoutchouc substances present in latex are classified as proteins or organic nitrogenous substances, resins, carbohydrates, and mineral salts.

In the first place the protein is calculated from the total nitrogen content on the assumption that all the nitrogen is present in this form, which may be quite erroneous.

DIAGRAM 5.



Whether the rate of cure is influenced by the proteins, as such, or by any of the other constituents enumerated above, remains to be investigated.

It is already known that certain organic amines and certain basic organic nitrogenous compounds, e.g., piperidine, have a remarkable influence in accelerating the rate of cure or vulcanisation of rubber, and a number of substances containing such compounds have been patented and are on the market.

Beadle and Stevens have also shown the influence of the albuminous substances on vulcanisation, but the experiments, as published, were not carried sufficiently far.

It is possible then, and this upholds the second of the two explanations which we have just enunciated, that decomposition of the proteins of the latex takes place, with formation of amine substances, which accelerate the rate of cure, and the greater the amount of serum left in the rubber the more favourable the conditions for this decomposition. This view is confirmed by the slow curing which we have observed in the case of rubbers prepared from latex treated with preservatives (*vide* estate samples, Table XA)

and also by the lengthened cure consequent upon smoking, which also acts as a preservative. Further experiments on this point are being carried out.

It may be, however, that the problem is much more subtle and that a substance is present, produced by the action of an enzyme, which is not revealed by the ordinary methods of chemical analysis.

Whichever of the two theories proves to be correct, we have finally in the raw rubber some substance of a catalytic nature capable of profoundly modifying the vulcanising properties of the rubber. This explains the difficulty of vulcanising synthetic rubber and instances another case, analogous to that of steel, in which absolute purity is unnecessary and undesirable.

It is hoped that the experiments now in progress will elucidate the exact nature of this substance. It would appear not to be easily destroyed by heat, since both in the mixing and subsequent vulcanisation process the rubber is subjected to a considerable temperature. During washing and rolling of freshly coagulated rubber this substance is either removed or its formation prevented by the removal of something essential to its formation. In this connection the slow vulcanisation of some excessively thin crepes (Table XB, 2E and F) will be noted.

Once however the serum has been allowed to evaporate from the rubber, as in the case of sheets and slabs, subsequent crepeing has very little effect.

It would appear that the action of smoke in destroying or preventing the formation of the substance is more complete in the case of sheet than of slab, the former being smoked throughout while the latter is only affected near the surface, since smoked slab cures more rapidly than smoked sheet. On the other hand, the difference between smoked and unsmoked rubber is much more marked in the case of slab than of sheet, presumably because of the greater amount or potentially greater amount of the catalyst present. Experiments on the effect of smoking on rubbers of different thickness are in progress.

With regard to the rubber prepared by smoking layers of latex in shallow trays, this again is only subjected to the action of smoke on or near the surface of each layer. Thick unsmoked or air-dried slab gives the most rapidly curing rubber we have prepared, on account of the large amount of serum which remains in the rubber and the absence of smoking.

In the case of Fine Hard Para the action of smoke is well seen. This rubber, containing as it does all the constituents of the latex, might have been expected to cure rapidly. It is, however, prepared in such a manner that the smoke exerts its maximum effect, and Fine Hard Para is relatively slow curing.

Fine Hard Para.

Although, up to the present, only five samples of Fine Hard Para have been vulcanised and tested (four of these samples were kindly sent to us by the Planters' Stores and Agency, Ltd., Kuala Lumpur, and by Messrs. Thompson Bros. of Mincing Lane), these have shown much more uniformity in respect to rate of cure, when considered as the first grade of wild rubber, than first grade plantation Para rubbers. It should be noted, however, that while there is only one class of Fine Hard Para, prepared by one method, there are numerous classes of first grade plantation Para rubber.

The results of tests on vulcanised specimens of Fine Hard Para are given in Table IX.

TABLE IX.
Fine Hard Para.

Reference No.	Optimum time of cure.	Load (kilos.) per sq. mm.	Final length. (Orig. length = 100.)	Product.
	Hrs. min.	(a).	(b).	a × b.
23	2 30	1.25	1058	1322
24	2 30	1.36	1027	1396
25	2 45	1.52	1034	1571
29	2 45	1.34	1044	1399
16	2 30	1.14	994	1133

Sample 16 was a very old sample which had been at the Agricultural Department since 1906 or 1907. As will be seen, the time of cure is fairly constant at 2½ to 2¾ hours. Further samples have been received and will be tested. As regards the mechanical properties, Nos. 23, 24, and 29 are fairly good, though below most of our own experimental samples. No. 25 is very good, but again not equal to our best experimental samples. These results are in accordance with the views of manufacturers on its uniformity and with the statements of rubber technologists to the effect that the mechanical properties of some plantation Para rubbers after vulcanisation are superior. Uniformity in rate of cure is relatively of much greater importance to the manufacturer.

Possibly, however, the time which had elapsed between preparation and vulcanisation was the cause of this slight inferiority. This is confirmed by the inferior mechanical results of No. 16, which is a very old sample. Experiments on the effect of keeping raw rubber are in progress, as most of our experimental samples were vulcanised and tested soon after preparation. On the other hand, some samples which have been kept for over a year have given good results. The load-extension curves are of the same type as those of our experimental samples.

Estate samples.

To illustrate variation among estate samples: Tables XA and XB are included. Although we believe that the ultimate cause of variation in

TABLE XA.

Ref. No.	Type of rubber.	Optimum time of cure.	Load (kilos.) per sq. mm.	Final length. (Orig. length = 100.)	Product.
		Hrs. min.	(a).	(b).	a × b.
Estate No. 1 B.	Lump crepe	2 45	1.31	994	1303
C.	No. 1 blanket crepe	2 45	1.11	1019	1131
D.	Smoked sheet ... (bisulphite)	2 45	1.23	997	1229
E.	Smoked sheet ... (formalin)	3 15	1.26	961	1210
F.	Smoked sheet ... (bisulphite)	3 00	1.00	1035	1035
G.	Smoked sheet ...	2 45	1.14	965	1100
H.	Smoked sheet ...	2 45	1.4	950	1330
J.	Smoked sheet ...	2 45	1.44	949	1366
K.	Smoked sheet ... (new coagulant)	2 45	1.44	949	1366
L.	No. 1 latex crepe	3 00	0.9	973	875
M.	No. 1 lump crepe	2 00	1.24	1003	1243
N.	No. 2 crepe	2 30	1.2	919	1102
R.	No. 2 crepe	2 15	0.83	952	837
T.	No. 2 crepe	2 45	1.1	914	1005
P.	No. 3 bark scrap crepe (nat. dried)	3 00	1.17	883	1033
S.	No. 4 bark scrap crepe (nat. dried)	2 30	0.78	910	709
Q.	No. 4 bark scrap crepe (nat. dried)	3 00	0.93	883	821
O.	No. 4 earth scrap	2 45	0.62	915	567

rate of cure is the same in all cases, *i.e.*, it is dependent on the proportion of the catalyst in the rubber, the amount of this substance may depend on several factors connected with the mode of preparation, *e.g.*, dilution of latex, washing of rubber, thickness of rubber, smoking, rapidity of drying, presence of preservatives, amount of coagulant, etc., and the exact factor causing the variation in the estate samples is unknown, as the mode of preparation and coagulation was not known by us.

Samples B, C, D, E, F, Q, R, S, and T were left for over a year before testing and the remainder, G, H, J, K, L, M, N, O, and P, for about six months. The smoked sheets G, H, and J were coagulated with acetic acid and prepared similarly, the latex being from different fields; K was coagulated by means of a new coagulant.

TABLE XB.

Ref. No.	Type of rubber.	Optimum time of cure.	Load (kilos.) per sq. mm.	Final length. (Orig. length = 100.)	Product.
Estate No. 2 B.	Smoked sheet ...	Hrs. min.	(a).	(b).	a × b.
C.	Smoked sheet ...	2 00	1.5	954	1431
D.	Smoked sheet ...	1 45	1.32	982	1296
E.	Smoked sheet ...	2 15	1.49	983	1464
F.	Thin crepe	3 15	1.3	940	1222
F.	Thin crepe	3 00	1.47	987	1450

Sample 2B had been smoked for 16 days and 2C for 20 days. Sample 2D was allowed to stand overnight after coagulation and smoked for 16 days. The thin crepes 2 E and F had dried in 14 and 20 days respectively.

A number of other estate samples have been examined, but since they do not give times of cure beyond the limits given in Tables Xa and Xb, nor show any other abnormalities, their publication serves no purpose.

Notes on samples from Estate No. 1:—All the first quality samples were of good appearance. It will be noticed that among the "first latex" samples, the optimum time of cure, with four exceptions, is 2½ hours.

Two of the smoked sheets which gave longer cures were treated with formalin and sodium bisulphite respectively. As we have remarked before, the use of such agents appears to retard the rate of cure. The mechanical properties of the first latex samples from Estate No. 1 are all low in comparison with our experimental samples. This may be due to the length of time during which the samples had been kept, although, as we have stated before, all samples do not deteriorate on keeping to the same extent.

With regard to the lower grades, it is at once apparent that not only does the time of cure vary, but the mechanical properties at the optimum cure are also very inferior and variable.

Estate No. 2. In the case of samples from this estate we have an instance of considerable variation in rate of cure, *viz.*, from 1½ to 3 hours, although the mechanical properties at optimum cure do not exhibit marked differences. In this case we have not sufficient knowledge of the methods of preparation and origin of the rubber to be able to give the exact factor which has influenced the rate of cure. This is probably a typical example of the variability of which manufacturers complain, and shows that this occurs among rubbers from the same estate as well as among rubbers from different estates.

Remarks on results.

The product of the breaking load in kilos. and the final length of the samples is proportional,

as can be seen, to the breaking load of the specimen per square millimetre calculated on the cross section at breaking point, since this cross section is inversely proportional to the elongation of the sample. It can be seen, however, that the optimum cure figure is by no means essential as the sole proof as to difference in cure, since similar conclusions can be drawn from all the figures taken collectively, and more especially from the curves showing the behaviour of the rubber throughout the test at all intermediate loads and elongations.

By plotting the product figures against time the curves obtained also give an excellent idea of the differences in cure.

It will be seen on reference to Table XI. below that to obtain maximum mechanical properties in the vulcanised rubbers (taking the optimum cure), it was necessary to vulcanise the samples for periods varying from about 1 to 3½ hours.

TABLE XI.

No.	Description.	Optimum time of cure.	Load (kilos.) per sq. mm.	Elongation at break. (Orig. length = 100.)	Product.
VIII A.	Byrne slab	Hrs. min.	(a).	(b).	a × b.
37 Ser.6 B	Smoked slab	1 15	1.46	1070	1563
38 A	Byrne slab	1 15	1.48	1029	1522
31 D	Byrne slab	1 30	1.43	978	1398
37 Ser.6 B	Smoke coag. slab ..	1 30	1.26	1093	1377
27 B	Smoked slab	1 45	1.46	1013	1478
27 A	Unsmoked sheet ...	2 00	1.59	1021	1613
21 A3	Smoked sheet	2 30	1.40	1041	1457
37 Ser.6 C	Crepe	2 45	1.50	1016	1524
34 A	Unsmoked sheet ...	2 45	1.35	965	1302
25	Byrne loaf	2 45	1.44	999	1438
29	Fine hard Para ...	2 45	1.52	1034	1571
16	Fine hard Para ...	2 45	1.34	1044	1399
21 Ai	Fine hard Para ...	2 45	1.14	999	1133
28 A	Crepe	3 00	1.45	980	1421
37 Ser.6 A	Smoked sheet ...	3 00	1.60	1009	1614
37 Ser.6 A	Smoked sheet ...	3 00	1.44	953	1372

As the tables show, there are differences in mechanical properties in the case of some "first latex" rubbers, as well as differences in rate of cure, but the former are not so marked and are by no means of such vital importance to the manufacturer as the vulcanising capacity of the rubber. We are therefore dealing with two factors, one which influences the rate of cure of the rubber which, as we have shown, is due to the presence of variable quantities of some unknown catalyst in the raw rubber, and the other which influences the mechanical properties. The latter is probably connected with a decomposition of the caoutchouc molecule, oxidation products, resins, etc.

The "optimum" curves (the optimum being decided by the maximum product of load and extension obtained) are all of the same type, their end inclination being the same and no intersections occurring. Also, with the exception perhaps of 31 D, the smoke coagulated sample, and 37 A, which gave a very irregular product curve, they are fairly close together. As mentioned before, it might have been that these optimum curves would coincide. Two causes can be advanced to explain their lack of uniformity: (1) The difficulty of ensuring that the maximum mechanical properties are attained at any particular time of cure without testing a very large number of rings; and (2) the slight inaccuracy in optimum time of cure obtained, caused by not curing samples at smaller intervals than a quarter of an hour. In this connection Dr. Schidrowitz has definitely stated (International Rubber Congress, London, 1914; see this Journal, 1915, 842), that the theoretical optimum curve does give the maximum mechanical result. With rubbers giving the same type of curve, therefore,

the curve indicating the maximum mechanical properties should always be the same. As yet, however, Dr. Schidrowitz has given us no figures in support of this statement.

The problem of uniformity.

We have shown, in the results given here, that lack of uniformity in rubber refers principally to non-uniformity in vulcanisation, and it is only necessary to see the vulcanised specimens which have been prepared, to realise the manufacturers' dilemma when purchasing different lots of plantation rubber, since the appearance of the raw rubber, its mechanical properties as indicated by hand stretching and other crude tests applied on the market, colour, etc., give absolutely no indication of this particular difference in behaviour on vulcanisation.

If some of these rapidly curing samples, which should save the manufacturer a considerable amount in steam and heating costs, and in time and labour in the supervision of the steam autoclaves, presses, etc., were placed on the market at the present time, they would probably fetch from 2d. to 3d. less than the market price of samples of smoked sheet and pale crepe having a pretty appearance, in spite of the fact that it would be to the manufacturers' advantage to pay perhaps 1d. to 2d. above the market value of average first qualities for them. If we can combine appearance with real value, so much the better, but if not the former will have to go, sooner or later, except for special purposes.

It is possible that the substance which causes this variation in rate of cure may be present in varying proportion in different latices, or may be formed in different proportions subsequently, in which case the problem of attaining uniformity becomes more difficult to solve. If, on the other hand, as appears more probable, the greater variation in the amount of this substance is brought about principally by artificial causes, such as different treatment in machining, washing, and coagulation methods, it may and probably will be easier to introduce greater uniformity.

The differences hitherto ascribed to excessive machining of raw rubber are probably almost invariably due to the over-washing or tightness in rolling, by which crepes and sheets of different thicknesses are produced containing variable properties of serum. There is probably a limit beyond which little or no further effect occurs; this is probably represented in the thin crepes curing at 3½ hours, but may be brought about by methods other than washing.

If uniformity is unattainable by present factory methods, and it will certainly be very difficult among rubbers from different estates, although not so difficult among the rubbers from any particular estate, only two methods of dealing with the problem remain. (1) The issue of certificates showing the rate of cure of a shipment of rubber, under certain conditions (the manufacturer after a short time would be able to correlate his works practice with the figures supplied), or (2) a method of preparation of rubber similar to that suggested by one of us, viz., a method in which a block, ball, or slab of rubber is prepared from latex day by day for a period of a week or longer, in order to average any variations.

We do not pretend in this paper to have solved the whole problem, but we do maintain that this discovery is a considerable advance towards the attainment of the object in view, since it shows one, if not the only cause, of a variation of vital importance to the manufacturer. It remains to investigate the various contributory causes or factors which affect this, as we believe, ultimate cause. These contributory factors may be numerous, and

may be both artificial and natural. Having ascertained the cause, the application of a remedy is certainly less obscure.

Summary of results.

The results so far obtained may be summarised as follows:—

(1) Considerable variation occurs in plantation Para rubbers, even in the case of "first latex" rubbers, both among rubbers from the same estate and from different estates.

(2) This variation is connected principally with the behaviour of the rubber on vulcanisation, i.e., its rate of cure, and not in respect to its strength, elasticity, and general mechanical properties, especially in the case of properly prepared "first latex" samples.

(3) If the rate of cure be known or ascertained under specific conditions, vulcanised rubber having similar mechanical properties can be made from all good samples of "first latex" rubbers.

(4) A difference in mechanical properties does exist, even among so-called first quality rubbers, but these differences are greater between high and low grade plantation rubbers; some rubbers never attain the maximum mechanical properties reached by others, whatever period of cure is adopted. These differences, in the case of "first latex" rubbers, however, are not so important to the manufacturer as the differences in rate of cure, and are not of the same order. Indeed, the remarkable uniformity in type of curve points to the fact that the variation of mechanical properties in our samples, at any rate, is of an accidental nature, for at points below the breaking point the mechanical properties are the same.

(5) The rate of cure is due to the presence of some non-caoutchouc substance in the latex, possibly protein or some other organic constituent, or to some degradation product derived from these substances, which acts as a catalyst, and accelerates the rate of cure.

(6) This substance may be already present in the latex, and its amount in the raw rubber determined by the mode of preparation and coagulation, or it may be subsequently formed in the latex by decomposition and taken up by the rubber in variable quantity, according to mode of preparation, or alternatively, it may be formed in the coagulum in variable quantity, depending on the amount of serum (or moisture) left in the coagulum or the presence of preservatives which hinder or prevent its formation. The alternative theories await investigation.

(7) Smoking, removal of excessive serum in the washing and machining processes, and preservatives are among the artificial factors which either hinder the formation of this substance or, if it already exists in the prepared rubber, partially destroy it.

(8) The catalytic substance is probably not affected greatly by heat, since, in the process of mixing and vulcanisation the rubber is subjected to relatively high temperature. Whether heat destroys it or prevents its formation in the latex or freshly coagulated rubber awaits investigation.

(9) The rate of cure of a rubber under specific conditions is not indicated in any way by the apparent mechanical or any other apparent properties of the raw material, hence the worthlessness of the present methods of valuation of rubber.

(10) *Cæteris paribus*, a manufacturer probably prefers a rapidly curing rubber, since it represents economy in heat, labour, and time costs, and secondly, a rubber which cures rapidly is said to have better keeping qualities after vulcanisation.

(11) Uniformity between "first latex" rubbers from different estates will probably be very difficult of attainment with present methods, owing to the

number of factors involved, but should not be so difficult among such rubbers from the same estate.

(12) Two alternatives are suggested: (1) the issue of certificates giving correct rate of cure and mechanical properties at this cure; (2) the attainment of more uniformity by the method suggested in this paper and elsewhere, in which rubber from latex collected during a series of days forms part of one ball or block, which may be described as the method of averages.

We have to acknowledge our indebtedness to Prof. W. R. Dunstan, F.R.S., Director of the Imperial Institute, and Mr. R. G. Pelly, Senior

Assistant Chemist of the Scientific and Technical Department, Imperial Institute, under whom Mr. Grantham received preliminary instruction in technique, for the idea of the frame moulds used and described, which were found to be more convenient than moulds previously used, also in connection with the use of tracing cloth between the rubber and the moulds, which is an adaptation of a method employed by Mr. Pelly.

Our thanks are also due to Prof. van Iterson and Mr. Fol. of the Government Rubber Testing Station, Delft, Holland, who were good enough to allow one of us (B.J.E.) to work at the Testing Station in 1912.

Journal and Patent Literature.

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I.—GENERAL; PLANT; MACHINERY.

Chain grates [for boiler furnaces]. F. Seufert. *Feuerungstechn.*, 1914, 2, 289—294. *Chem.-Zeit.*, 1915, 39, Rep., 307.

A HIGH boiler efficiency, frequently exceeding 80%, can be obtained by the use of a chain grate, with or without an economiser. Within certain limits the most varied kinds of coal can be burned, and a high output (up to 30 kilos. of steam or more per sq. m. per hour), combined with high efficiency, can be attained, not only with boilers with two fire-tubes, but also with modern inclined-tube boilers (Garbe system, etc.).—A. S.

Fuel economy by proper arrangement of steam pipes. M. Guillaume. *Feuerungstechn.*, 1914, 2, 233—237, 252—259. *Chem.-Zeit.*, 1915, 39, Rep., 307—308.

THE results of experiments made at the Berlin Electricity Works show that in modern power installations, where pipes of relatively small diameter are used in order to attain a higher steam velocity and hence minimise loss of heat, the use of ordinary stop-valves is precluded on account of the excessive loss of pressure; for high steam velocities only slide-valves should be employed. In certain circumstances the loss of pressure due to right-angle bends may be greater than that due to valves. As far as possible, change of direction should be effected by smooth curved bends.—A. S.

[Corrosion due to the] *lubrication of Diesel engines and air compressors*. H. Moore. *Engineer*, Aug 20, 1915.

THE corrosion of copper cooling coils in the air compressors attached to Diesel engines has been traced to the formation of organic acids by the oxidation of lubricating oils when subjected to the action of compressed air at high temperatures. Mineral oils form aliphatic acids and unsaturated compounds. The iodine value gives an indication of the extent to which lubricating oils are liable to oxidation in this manner. The acid liquor obtained reacted with all samples of metals and alloys with which it was tested; mild steel and ordinary brass were much affected, whereas aluminium was least attacked, copper and phosphor bronze coming next to aluminium.

—F. W. A.

Gas-producer for steam raising. Mills. See IIA.

Condensers for evaporating apparatus. Kerr and others. See XVII.

PATENTS.

Drying, mixing, and agitating machines [for tarred macadam]. J. E. Hobbs, Coulsden, Surrey. Eng. Pats. (A) 18,354 and (B) 18,355, Aug. 7, 1914.

(A) THE supply of gaseous heating medium to the apparatus is controlled by a valve, which is actuated by a sliding bar, the position of which is varied by the greater or less expansion of the mixing apparatus. (B) The heating medium is circulated first through a rotary drying drum and then around a rotary mixing drum. Both drums are surrounded by an outer casing, and means are provided for charging the drying drum, transferring the material when dried from the drying to the mixing drum, and discharging the mixed material from the latter.—W. H. C.

Vacuum; Centrifugal apparatus for producing a—. J. H. Storm, jun., and S. G. Van Welderen, Baron Rengers, Amersfoort, Holland. Eng. Pat. 21,508, Oct. 26, 1914. Under Int. Conv., Jan. 29, 1914.

A DRUM having peripheral outlet ports and an axial air inlet connected with the chamber in which a vacuum is to be produced, is mounted on a vertical shaft and rotated at high speed. The drum has no exterior casing, so that the displacement of air takes place by velocity alone. Increased efficiency is obtained by making the upper and lower ends of the cylinder project horizontally beyond the cylindrical wall to prevent the flow of air over the edges of the drum. Vanes may also be placed in front of the ports, on the outer side of the drum, at an inclination to the circumference.—W. H. C.

Heating or cooling liquids or gases; Apparatus for—. D. Horsburgh, Manchester. Eng. Pat. 23,517, Dec. 4, 1914.

TWO or more cylinders or plates, having spiral grooves formed on both faces, the convolutions on one face being between the convolutions on the other face, are placed together so that the grooves on the outer face of the inner cylinder or plate form one continuous passage with the grooves on the inner face of the outer cylinder or plate. The grooves on the inner surface of the inner cylinder

or plate and on the outer face of the outer cylinder or plate are closed by plane cylinders or plates and form further continuous passages. The liquid or gas to be heated or cooled is passed through one set of grooves and the heating or cooling agent through the other.—W. H. C.

Furnaces. W. N. Best. Brooklyn, N.Y. U.S. Pat. 1,140,732, May 25, 1915. Date of appl. Feb. 5, 1914.

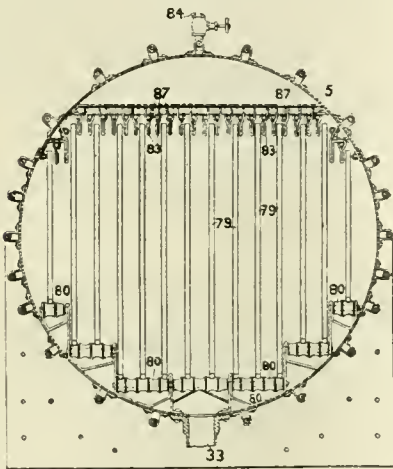
To ensure perfect combustion, the walls on each side of the furnace, above the level of the fuel bed, are provided with air inlets, through which air is drawn by means of jets of steam or compressed air. The width of the inlet openings on each side of the furnace can be adjusted by a pair of horizontal bars. The bars are connected by links and operated by a lever, so that the distance between them, and consequently the width of opening of the air inlets, can be varied.—W. H. C.

Sizing or classifying comminuted materials ; Process of and apparatus for —. H. M. Sutton, W. L. and E. G. Steele, Dallas, Tex. U.S. Pat. 1,141,852, June 1, 1915. Date of appl., July 21, 1913.

THE mixed material is fed continuously on to the roughened surface of an endless belt, which moves in a horizontal direction and is inclined transversely. The speed of the belt and the angle of inclination are so adjusted that the deviation of the particles from a horizontal path is proportional to the size and independent of the specific gravity of the particles. The different sized particles are discharged at different points. A cone may be used instead of a belt.—W. H. C.

Filter. W. P. Lass, Treadwell, Alaska. U.S. Pat. 1,144,854, June 29, 1915. Date of appl., Sept. 30, 1912.

VERTICAL filter leaves, 79, are supported upon the rollers, 80, between the brackets, 83, within the drum, 5. The mixture to be filtered is introduced



under pressure through the pipe, 33, air escaping through 84. When 84 is closed, the pressure forces the liquid through the filtering medium and it is discharged from the interior of the leaves by a pipe not shown. When a sufficient thickness of cake has been formed on the leaves, the remaining liquid is forced out by compressed air introduced through 84. The cakes are washed by solutions introduced through 33, and finally are discharged by forcing compressed air or steam into the interior of the filter leaves and by water sprayed on to the exterior of the leaves from the pipes, 87. —W. H. C.

Filter-press. J. Johnson, Brooklyn, N.Y. U.S. Pat. 1,151,186, Aug. 24, 1915. Date of appl., Nov. 7, 1913.

THE material is forced by a conical screw conveyor into a conical perforated casing, the interior surface of which is covered with filtering material. The conveyor is movable longitudinally with respect to the casing; during filtration a considerable space is left between the periphery of the conveyor blades and the interior surface of the casing, but when a cake of sufficient thickness has formed, the conveyor is moved inwards and its blades act as scrapers to remove the cake.—W. H. C.

Evaporating apparatus ; Vacuum —. E. A. Newhall, Assignor to S. Bent, Philadelphia, Pa. U.S. Pat. 1,149,939, Aug. 10, 1915. Date of appl., May 7, 1914.

VALVED pipes, for condensed water, lead from the bottom of each effect of a multiple effect evaporator, and are connected respectively with the bottom of the next effect in the series, the pipe from the last effect being connected with a suction device. The steam-box of each effect is connected with a steam-trap, provided with a pipe for the removal of air. The condensed water from each steam-trap passes through a pipe discharging into one of the valved pipes mentioned above, on the suction side of the valve.—W. H. C.

Evaporator. M. J. Kermer, Chicago, Ill. U.S. Pat. 1,150,605, Aug. 17, 1915. Date of appl., Dec. 6, 1913.

ONE or more horizontal steam chambers extend through the lower part of a vacuum chamber, from end to end, near to, but not touching the bottom, and have headers at opposite ends for the introduction of steam and the removal of condensed water. Horizontal tubes pass through the steam chambers. The liquid to be evaporated is passed through the tubes and is then delivered, together with the vapour formed, into the vacuum chamber, so that the liquid surrounds the lower part of the steam chamber and the vapour the upper part, and both are heated thereby.—W. H. C.

Separating liquid mixtures into two components ; Apparatus for —. K. Kubierschky, Eisenach, Germany. U.S. Pat. 1,151,801, Aug. 31, 1915. Date of appl., May 13, 1914.

SEE Fr. Pat. 472,560 of 1914 ; this J., 1915, 480.

Recovering the waste heat of smelters and kindred plants. U.S. Pat. 1,151,831. See X.

II A.—FUEL ; GAS ; MINERAL OILS AND WAXES.

Gaseous combustion. Fuel economy and the proper utilisation of coal. W. A. Bone, Brit. Assoc., Manchester, Sept., 1915. J. Gas Lighting, 1915, 131, 576—582.

FOR the ignition of an explosive mixture the temperature of its constituents should be raised, at least locally, to a degree at which the chemical action becomes autogenous, or self propelling; this degree, or range of temperature, is the ignition point. Dixon and Coward (this J., 1909, 301) showed that certain qualifications to this are necessary where the mechanism of the combustion is simple, e.g., with hydrogen and carbon monoxide the temperature of ignition occurs within a very narrow range and is the same for oxygen and air, but where the combustion is very complex, as in the case of hydrocarbons, the ignition range is fairly wide and is lower in oxygen than in air. From the fact that the current energy required for spark ignition is about 56 times greater with alternating than with continuous current, it is

deduced that the igniting effect is not simply thermal but is partly ionic. Incandescent surfaces emit streams of electrons travelling with high velocities, and it appeared probable that the rapidity of the combination in the explosion wave might be due to the molecules in the act of combining sending out electrons which precede the explosion wave and ionise the gas, but Dixon by means of a transverse magnetic field has caused the ions to revolve in small circles, and no appreciable effect was observed in the character or velocity of the flame with any gas mixture at any stage of the explosion. The uniform movement of the flame in gaseous explosions, or the propagation of the flame from layer to layer by conduction, is only obtained in tubes sufficiently narrow to suppress convection currents, though wide enough to prevent appreciable cooling of the flame, and the ignition must be within 1–2 cm. of the end of the tube or vibration is set up from the beginning. With weak mixtures of inflammable gases and air, just below the lower limit of inflammability there is indefinite upward slow propagation of the flame together with incompleteness of combustion, and it is thought from this that a gaseous mixture should not be termed inflammable at a given temperature and pressure unless it will propagate flame indefinitely. By exploding mixtures of methane and oxygen in steel bombs at an initial pressure of 12·7 atmospheres it is found that a considerable proportion of the original oxygen appears as steam. This is explained by the "hydroxylation" theory whereby $\text{CH}_4 + \text{O}_2$ changes to $\text{CH}_2(\text{OH})_2$ which is decomposed to CO , H_2 , and H_2O .

Of the 189 million tons of coal consumed in the United Kingdom in 1913, about 20 million tons was carbonised in gas-works, 13·5 million tons in by-product coke ovens, and 6·5 million tons in beehive coke ovens. There are at present 8297 by-product ovens in this country, of which 6678 are fitted with benzol recovery arrangements. The following table gives an estimate of the yields of the various by-products obtainable in such installations, expressed in percentages on dry coal carbonised:—

District.	Ammonium sulphate.	Tar.	Benzol and toluol as finished products.
Durham	0·0 to 1·45	2·5 to 4·5	0·6 to 1·0
Yorkshire	1·3 to 1·5	3·5 to 5·0	0·9 to 1·1
Derbyshire	1·3 to 1·6	3·5 to 5·0	0·9 to 1·1
Scotland	1·4 to 1·6	3·5 to 5·0	0·9 to 1·1
South Wales	0·0 to 1·1	2·0 to 3·5	0·6 to 0·75

The expansion in production of ammonium sulphate during ten years is shown by the following figures:—

Year.	By-product coke-oven plants.	Gas-works.
	tons.	tons.
1903	17,435	149,459
1908	64,227	165,213
1913	133,816	182,180

The author closed his address with a plea for more adequate scientific control of fuel, suggesting a central organisation for the supervision of fuel consumption on the lines of existing alkali works inspection.—W. G. C.

Coal ash; Fusibility of — in mixtures of hydrogen and water vapour. A. C. Fieldner and A. L. Feild. Amer. Soc. Testing Materials, June 22, 1915. J. Ind. Eng. Chem., 1915, 7, 742–747. (See also this J., 1915, 704.)

DETERMINATIONS of the fusibility of cones of coal ash in mixtures of hydrogen and steam of varying composition showed that a minimum softening temperature is obtained in mixtures containing 30 to 70% of steam, in which the iron is mainly

reduced to the ferrous state and the formation of readily fusible ferrous silicate thus promoted. Analyses of clinker slags from two different boiler furnaces and one experimental furnace showed that the conditions in fuel beds favour the formation of clinkers containing iron principally in the ferrous state, and it is therefore concluded that the best indication of the temperature of clinker formation from a coal ash under furnace conditions will be obtained by determining its softening temperature in a mixture of equal parts of hydrogen and steam.—A. S.

Coal and coal dust; Carbonising mixtures of —. D. T. R. van Lennep. Het Gas, 1915. J. Gas Lighting, 1915, 131, 520.

By carbonising a mixture of gas coal, 80%, and fine coal dust, 20%, in a horizontal retort for 4 hrs. 48 mins., 11,550 cub. ft. of gas, having a calorific value of 554 B.Th.U. per cub. ft., was produced per metric ton. The yields of gas from the dust and coal when carbonised separately under the same conditions were 8050 and 11,326 cub. ft. per metric ton, respectively, the corresponding calorific values being 464 and 578 B.Th.U. per cub. ft.; the coke obtained from the mixture was of good quality. The gas coal used contained moisture 12·00, other volatile matter 9·98, fixed carbon 70·83, and ash 7·19%; and in addition to the gas—which had sp. gr. 0·20 and contained CO_2 3·1, C_2H_4 0·2, CO 4·1, H_2 70·9, CH_4 17·3 and N_2 4·4%—yielded 4·2 kilos. of tar and 3·4 kilos. of ammonium sulphate per metric ton of dried material. The importance of thoroughly incorporating the components of the mixture before carbonisation is urged, the quality of the coke produced depending mainly on the uniform distribution of the dust among the fragments of coal.

—W. E. F. P.

Benzol recovery from town's gas supply. W. R. Herring. J. Gas Lighting, 1915, 131, 569.

EXPERIMENTS are described with a rotary washer 4 ft. 6 in. long and 2 ft. 6 in. diameter, of the Holmes type, using a light grade coal tar scrubbing oil of sp. gr. 0·9862, the flow of oil being 25 gallons per 10,000 cub. ft. of gas, and the amount of gas 500 cub. ft. per hour. Using unbenzolis oil a 16·11 candle gas (No. 2 metropolitan burner) was reduced to a 10·51 candle gas—a loss of 34·7% luminous value. Its calorific value, originally 585·3 B.Th.U. gross, was reduced to 559·1 B.Th.U. a loss of 4·5%. With wash oil benzolised with 5% benzol, 16·08 candle-gas was reduced to 15·06 candles, or a loss of 6·34%, and the calorific value of 579·4 B.Th.U. was reduced to 576 B.Th.U., or a loss of 0·58%. The loss of calorific value when using unbenzolis oil is so small that the author advocates the abolition of the luminous flame test and the establishment instead of a calorific value of 500 B.Th.U. gross.—W. G. C.

Gas-producer for steam raising. E. C. Mills. Brit. Assoc., Manchester, Sept., 1915.

THE producer is a movable structure, mounted on rollers, immediately opposite the furnace front. The ordinary boiler-grate is removed, and the heating effected by the combustion of the gas furnished by the producer. The air needed for this combustion is drawn through a jacket surrounding the producer, and thus intercepts the radiant heat which would otherwise be lost. Where this system is applied to Lancashire and Cornish boilers, fire-brick baffles or obstructors are provided at intervals along the flue. These are made to pivot, so that they can be turned "edgewise" to let a workman pass when the flues are being cleaned. In comparative trials of the plant as applied to a Cornish boiler (unprovided with an economiser) the steam raised per pound of fuel was in

creased 50% when the ordinary coal-firing was replaced by the Mills system. With coal-firing the steam raised had been 6.99 lb. per pound of fuel burnt, whilst with the Mills producer this figure was increased to 11.2 lb. per pound of fuel. The draught required to work the producer and to burn the gas was provided by a fan on the induced-draught principle. Where economisers are fitted, this fan is placed between the boiler and the economiser, but the latter can be dispensed with when the Mills system is used, and the money thus saved will more than cover the cost of the producer. As fitted to a Lancashire boiler (having economisers, but in a very bad condition), the steam raised varied in different trials from 10.23 lb. up to 11.47 lb. per pound of fuel. Parallel tests on a coal-fired boiler showed that the Mills plant gave a saving of 18% of the fuel, and there was an entire absence of smoke. The complete plant is estimated to cost £260.

resins represent the first transformation product of petroleum, from which they are produced by oxidation and polymerisation or condensation. They are readily converted into asphaltenes by intramolecular transference of oxygen or by addition of oxygen. Both classes of products are composed of polycyclic compounds, which contain variable quantities of oxygen and sulphur, and in some cases have a double bond structure. The primary parent substances of the asphaltic compounds are the terpene-like constituents of petroleum oil. The solid hydrocarbons of petroleum oil are crystalline (like paraffin wax from lignite) or amorphous (ceresin). It has commonly been accepted that ceresin consists of higher homologues of the same series as paraffin wax, but the following results obtained with an Indian paraffin wax and a low-grade ceresin of the same m.pt., indicated that these products did not belong to the same series:—

	M.pt. ° C.	Solid.pt. ° C.	Sp. gr. (water at 4° C.=1).		Viscosity, Engler (water at 20° C.=1).	Refracto- meter reading at 90° C.	Mean molec. weight.	Precipitation value (Marcuss- Schlüter; this J., 1907, 401). %
			15° C.	60° C.				
Indian paraffin wax .	56.5—60.5	59.2	0.885	0.781	1.51	1.5	330	5.5
Galician ceresin	57.5—60.1	59.0	0.917	0.798	1.85	10.9	420	31.0

Petroleum; Analytical distillation of—, II. W. F. Rittman and E. W. Dean. *J. Ind. Eng. Chem.*, 1915, 7, 754—760. (See also this J., 1915, 412.)

COMPARATIVE tests with a large number of different types of still-heads showed that the Glinzky, the Young and Thomas, the 12-bulb pear, the Le Bel-Henninger, the Golodetz, the 6-inch Hempel, the rod and disc, and the evaporator still-heads are of practically equal efficiency so far as the lower-boiling fractions (up to about 175° C.) are concerned, but several of them fail for higher-boiling fractions. The Hempel column appears to be the best, particularly when cost, ease of manipulation and cleaning, etc., are taken into account. With a moderate rate of distillation (2—2.5 c.c. per minute) the results obtained are not affected much by wide variations in the height and diameter of the column; and using columns of equal dimensions, the size, shape, and material of the distilling flask have no appreciable influence; glass beads are as efficient as aluminium beads, but the latter are preferred on account of mechanical advantages and less risk of flooding. The most satisfactory form is considered to be a 300 c.c. spherical distilling flask with a Hempel column 1 in. diam. and 6 in. high up to the outlet tube, made in one piece, and with a 5 in. column of aluminium beads. The column has no constriction at the lower end, the beads being supported on a suitable device, e.g., a copper wire spiral. 200 c.c. of oil is distilled; with 100 c.c. the results are somewhat low for the higher fractions. With the Pennsylvania crude oil used in the tests, there was no appreciable cracking on distilling up to 325° C.—A. S.

Petroleum oil; Solid constituents of—, J. Marcuss. *Chem.-Zeit.*, 1915, 39, 581—582, 613—616.

THE solid oxygenated constituents of petroleum oil consist of "petroleum resin" and "asphaltene." The latter may be precipitated from the oil by petroleum spirit of low b.pt. The residual oil is then mixed with fullers' earth, the hydrocarbons extracted with petroleum spirit, and the petroleum resin subsequently extracted from the fullers' earth by means of chloroform. These

On distilling ceresin not only is there a transformation of amorphous material into crystalline paraffin wax, but there is also a disruption of the molecule, with the formation of considerable quantities of liquid hydrocarbons. From this and other reactions, described in detail, the conclusion is drawn that the ceresin examined consisted, in the main, of iso-paraffins, and not of naphthenes. When oxidised with permanganate in pyridine solution it did not yield any acids. In addition to iso-paraffins, all ceresins appear to contain small quantities of normal paraffins, which become concentrated in the more readily soluble portions. Solid compounds such as petrocene, plicene, etc., have been separated from petroleum distillates of high b.pt., but these are probably products formed in the distillation and are not original constituents of the petroleum oil. —C. A. M.

Petroleum oils; Improvement of high-boiling—, and the manufacture of gasoline as a by-product therefrom, by the action of aluminium chloride. A. M. McAfee. *Amer. Inst. Chem. Eng.*, Aug. 25, 1915. *J. Ind. Eng. Chem.*, 1915, 7, 737—741.

IN the cracking of petroleum by heat it is difficult to obtain uniform results, and unsaturated products difficult to deal with satisfactorily are always formed, whilst carbonaceous matter separates in the form of a hard deposit on the walls of the apparatus. A further disadvantage is the great danger to the operators and to the plant at the high temperatures and pressures usually employed. The author's process, which is working successfully on a commercial scale, consists in distilling the oil, previously freed from water and light products, with anhydrous aluminium chloride in a still fitted with a stirrer. Distillation is usually effected at 500—550° F. (260—288° C.) and occupies 24—48 hours. The vapours from the still pass, on their way to the final condenser, through two air-cooled condensers connected in series, in which high-boiling oils and any volatilised aluminium chloride are condensed and returned to the still; the temperature at the inlet to the final, water-cooled condenser should not exceed 350° F. (177° C.). The condensed products are

colourless and saturated and do not need refining with sulphuric acid; in practice they are washed with alkali and water to remove hydrogen sulphide. The high-boiling oil is pumped out of the still and treated as usual for the recovery of paraffin wax and lubricating oil. The residue of aluminium chloride emmeshed in a mass of granular coke is heated to redness in an atmosphere of chlorine and the vaporised aluminium chloride is condensed. The detailed results obtained by the process with Texas, Louisiana (Caddo), and Oklahoma crude oils are tabulated; the net results as compared with the ordinary distillation process are summarised in the following table:—

	Texas oil.		Caddo oil.		Oklahoma oil.	
	AlCl ₃ process.	Usual process.	AlCl ₃ process.	Usual process.	AlCl ₃ process.	Usual process.
Gasoline	17.75	—	42.32	18.00	34.82	12.50
Gas naphtha	13.03	0.10	—	—	—	—
Solvent oil	—	—	16.67	12.00	—	—
Kerosene	8.66	4.30	3.93	35.00	29.47	41.00
Gas oil	17.15	52.00	8.11	21.00	5.36	35.00
Lubricating oil	25.58	25.50	—	—	—	—
Residual oil	—	12.00	13.10	11.00	14.07	9.00
Loss	17.83	6.10	15.87	3.00	16.28	2.50

See also U.S. Pats. 1,099,096, 1,127,465, and 1,144,304; this J., 1914, 783; 1915, 268, 833. —A. S.

Petroleum lamp oils; Examination of —. R. Jungkunz. Chem.-Zeit., 1915, 39, 641—642.

ACCORDING to Swiss State regulations, safety oils must have a flash-point of at least 38° C., and ordinary lamp oils one of at least 23° C. The presence of a trace of alcohol will lower considerably the flash-point of a normal lamp oil. For example, the addition of 0.1% by vol. of alcohol lowered the flash-point from 41° C. to 34° C. In the fractional distillation it is recommended that the following determinations should be made:—(1) Initial b.pt. (2) Amount of distillate from initial b.pt. to 300° C. (3) Heavy oils (above 300° C.). Practical burning tests are suitably made with a Kosmos normal lamp holding 1 litre and having a burner 14 mm. in width. The flame is regulated after 5 minutes and the test continued for at least 4 hours. Less regulation of the flame is required with American than with European lamp oils. The following results were obtained with 30 samples of American lamp oils:—Initial b.pt., 110° to 120° C.; flash-point, 23.3° to 30.3° C.; light oils (up to 150° C.) 13.0 to 26.0%; main fraction (150° to 300° C.) 65.0 to 80.0%; and heavy oils, 4.0 to 13.0%. —C. A. M.

Gasoline; Quantity of — necessary to produce explosive mixtures in sewers. G. A. Burrell and H. T. Boyd. J. Ind. Eng. Chem., 1915, 7, 750—754.

EXPERIMENTS were made in a 2700 ft. length of a Pittsburgh sewer, 8 ft. 3 in. wide and 8 ft. 6 in. high, the depth of the sewage being about 8 in. and the rate of flow 6.45 linear ft. per second; the temperature of the sewage was 21° C. and that of the sewer air immediately above 20.3° C. The gasoline used had a density of 67.5° B. (sp. gr. 0.71) and on distillation yielded 65.5% up to 120° C. and 97.5% up to 160° C. When 55 galls. of gasoline was run in, all at once, an explosive mixture was formed but persisted for a few minutes only at any particular point in the sewer, the gasoline vapour rapidly disappearing; the explosive mixture was observed only close to the surface of the sewage and did not extend very far into the

upper part of the sewer. When 55 galls. of gasoline was introduced at the rate of 5 galls. per min., the greatest proportion of gasoline vapour found in the air 2 ft. above the sewage was 0.7% (low explosive limit, about 1.5%) and the vapour disappeared in 18—30 mins. When the velocity of the sewage was considerably diminished—a condition which would obtain with a completely submerged sewer outlet—dangerous atmospheres existed in the sewer five hours after the gasoline was introduced. —A. S.

[Corrosion due to the] lubrication of Diesel engines and air compressors. Moore. See I.

Method of collecting and determining [suspended particles in] smoke and industrial gases. Gautier. See XIXB.

PATENTS.

Raw peat and the like; Process of drying —. H. Bruue and H. Horst, Dortmund, Assignors to Nasspress-Ges. m. b. H., Wiesbaden, Germany. U.S. Pat. 1,143,497, June 15, 1915. Date of appl., Apr. 8, 1915.

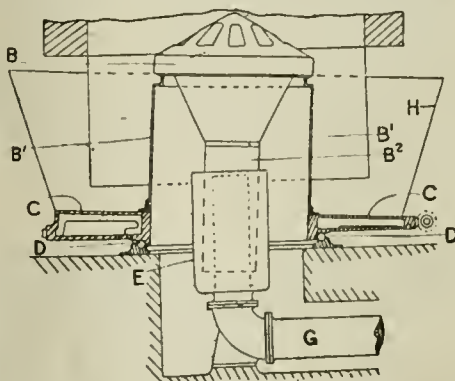
Raw peat or similar fibrous material is cut into small pieces without crushing the fibres, and delivered on to a layer of comminuted dry peat or the like on a travelling band. The mixture in a loosely mixed condition is pressed to remove the moisture, which is effected more readily than with an intimate mixture. —W. F. F.

Coal gas; Apparatus for manufacturing —. H. Bruce, Assignor to Bartlett-Hayward Co., Baltimore, Md. U.S. Pat. 1,144,977, June 29, 1915. Date of appl., Jan. 7, 1914.

HORIZONTAL retorts are arranged in vertical rows, each mouthpiece being independently connected to a vertical standpipe, and also, by a screwed rod and nut, with the mouthpieces above and below. The lower end of the standpipe dips into a tar seal. The standpipe is supported so that it can be adjusted vertically and is connected at its upper end by a slip joint with a pipe leading to a hydraulic main. —W. F. F.

[Producer] gas generators; Grates of —. R. and J. Dempster, Ltd., and G. F. H. Beard, Manchester. Eng. Pat. 9413, June 28, 1915.

THE inclined plane, c, which is rotatable on ball bearings, d, about a vertical axis, carries the cylinder, B¹, and grate, B, and also the ash-pan, H.



The inner part, B², of the grate forms a water-seal, E, with the pipe, G. Discharge of spent material from the generator is facilitated by the eccentric rotation of the grate. —W. F. F.

Producer gas; Process of generating steam accessory to the production of—. H. Foersterling, Perth Amboy, N.J., Assignor to Roessler and Hasslach Chemical Co., New York. U.S. Pat. 1,151,676, Aug. 31, 1915. Date of appl., Apr. 6, 1907.

CURRENTS of air and steam are supplied to the fuel bed of the producer, and the gas leaving the producer is passed through a series of boilers, giving up its heat to water which flows through the boilers in the opposite direction to the gas. The water is preheated in a jacket surrounding the producer, and high-pressure steam is generated in excess of that required for the producer, in the boiler nearest to it.—W. F. F.

Shale retorts [gas producers.] and the like. A. C. Thomson, Mid Calder, Midlothian. Eng. Pat. 6784, May 6, 1915.

AN oscillating horizontal blade is arranged just below the bottom of a vertical retort or gas producer to break up the clinker. The broken clinker falls on to a table which deflects it into a hopper below. Openings may be provided in the wall of the hopper and in the deflecting table for the insertion of a poker into the retort. All the oscillating blades of a series of parallel retorts may be operated by a single bar.—W. F. F.

Cracked mineral oils such as cracked petroleum; Process for refining—. P. M. Justice, London. From Allgem. Ges. für Chem. Ind. m. b. H., Berlin. Eng. Pat. 3572, Feb. 11, 1914.

IN order to eliminate constituents causing resinification or yielding deposits, cracked mineral oils or fractions thereof are treated with salts of heavy metals having a condensing action (e.g., zinc chloride, ferric chloride, tin chloride, copper sulphate), with or without heating; the deposit is separated and the oil distilled if necessary.

—C. A. M.

Oils suitable for cracking; Production of—. from coal and lignite. W. A. Hall, New York. Eng. Pat. 16,857, July 15, 1914.

BITUMINOUS coal or lignite is mixed with 10–20% of coke, charcoal, peat, or the like, both in granulated form, and heated gradually in a retort to 500° C. by external heat only, until volatile matter ceases to be evolved. The condensed distillate is an oil practically free from water, pitch, and oils boiling between 110° and 170° C. It yields about 10% distilling below 110° C., and is suitable for cracking to yield motor spirit.—W. F. F.

Fuel for internal combustion engines; Process for producing— and the fuel so produced. T. Franke, Bedford Park, Middlesex. Eng. Pat. 18,226, Aug. 1, 1914.

THE fuel consists of a mixture of 2 parts of unrefined "carbinols" (e.g., fusel oil and the lower alcohols) produced from raw peat, and 1 part of refined or unrefined benzol. The benzol may be increased up to 50%, and the substances are preferably mixed as vapours during their distillation. (See also Eng. Pat. 28,072 of 1913; this J., 1915, 860.)—W. F. F.

Liquid fuel; Production of— suitable for use in automobile engines. W. Higgins and C. H. Preston, London. Eng. Pat. 23,876, Dec. 10, 1914.

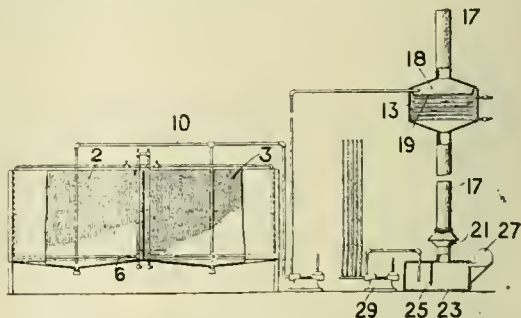
SHALE oil, crude benzol, crude naphtha, paraffin, or coal tar oil, or a mixture of two or more of these, is heated in a converter under pressure, to such a temperature that the least volatile constituent is vaporised. The vapour is passed alone or together with hydrogen through a catalytic medium such as a mixture of nickel oxide and pumice stone, and condensed in contact with the medium.—W. F. F.

Mending tanks containing liquid hydrocarbons; Composition suitable for— and for similar purposes, and means for applying the same. A. G. Hopkins, Kidderminster. Eng. Pat. 19,437, Sept. 4, 1914.

A PATCH of suitable fabric is coated with a mixture of sodium silicate 1 lb., molasses 4 oz., glycerin 1 oz., and sufficient precipitated chalk to form a plastic mixture, and the patch then applied to the tank.—W. F. F.

[Mineral] oils; Apparatus for [neutralising, clarifying, and] drying—. W. P. Bending, Palo Alto, Cal. U.S. Pat. 1,144,522, June 29, 1915. Date of appl., Sept. 30, 1914.

OIL which has been subjected to acid treatment is passed in series through the chambers, 2 and 3, heated by the steam pipes, 6, where it is neutralised



and washed. The oil then passes by the pipe, 10, to a trough, 18, with discharge slot, 19, in a steam-heated chamber, 13, from which it passes by the stand-pipe, 17, to the receiver, 23. Air flows through the stand-pipe from the adjustable ventilator, 21, or from the fan, 27, the baffle, 25, forming a liquid seal. A pump, 29, draws off the oil.—W. F. F.

Hydrocarbon oil; Process of distilling—. C. W. Turner, New York. U.S. Pat. 1,151,422, Aug. 24, 1915. Date of appl., Oct. 26, 1913.

THE oil is heated to cause separation and deposition of heavy hydrocarbons or asphaltum and tarry matter, and the lighter oil is vaporised and subjected, together with steam, alternately to pressure and heat and to expansion and cooling. The lighter constituents are thereby cracked and the heavier constituents deposited. The light products formed by cracking are separated into portions of different specific gravity by fractional condensation.—W. F. F.

Peat; Method of removing water from—. T. Rigby, Dumfries, Assignor to Wetcarbonizing, Ltd., London. U.S. Pat. 1,151,825, Aug. 31, 1915. Date of appl., Oct. 27, 1913.

SEE Eng. Pat. 24,639 of 1912; this J., 1913, 1150.

Producer gas; Process and apparatus for manufacturing—. E. Fleischer, Dresden, Germany. Eng. Pat. 10,408, Apr. 27, 1914. Under Int. Conv., Sept. 19, 1913.

SEE Fr. Pat. 471,341 of 1914; this J., 1915, 414.

Gas purifiers; Apparatus for treating spent material from—. L. C. Bonneau, St. Denis, and V. E. Hasenfratz, Levallois-Perret, France. Eng. Pat. 10,780, May 1, 1914.

SEE Addition of April 3, 1914, to Fr. Pat. 468,535 of 1913; this J., 1915, 283.

II.B.—DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Gas [lighting]; German hygiene applied to —.
W. J. A. Butterfield. *J. Gas Lighting*, 1915, 131, 568—569, 637—638.

THE statements made by von Grüber in his lecture on Gas and Hygiene (this J., 1914, 1149) are criticised. The rooms chosen for his experiments appear to have been practically devoid of natural ventilation, so that the comparisons between the ventilating action of gas and electricity are questionable. The method of determining the extent of ventilation throughout the tests is not stated, but the results are contrary to general experience. No oxygen content of the air is given, although it is of greater significance than carbon dioxide determinations. The figures given by von Grüber show that gas lighting has a very destructive action on micro-organisms and is superior to electric lighting in this respect. The methods used to demonstrate that gas lighting has no destructive action on odiferous matter are inconclusive. It is thought that a series of investigations of the same subject should be made in this country, and suggestions are given for a research under English conditions.—W. G. C.

Examination of petroleum lamp oils. Jungkuz. See IIA.

Manufacture of fibre, paper, and charcoal from hop-vines. Reinke. See V.

The physical photometer in theory and practice. Coblenz. See XXIII.

PATENTS.

[Wood distillation;] Recovery of volatile products from gases [derived from —] J. J. E. Johnson, jun., Ashland, Wis. U.S. Pat. 1,151,597, Aug. 31, 1915. Date of appl., Jan. 8, 1912.

To recover products such as wood alcohol, the gases are subjected to preliminary scrubbing and cooling and then passed over surfaces cooled by the ammonia compression system; the gases are scrubbed by refrigerated liquor passing over the surfaces in the opposite direction. The liquor is then led through a regenerator and rectifier to raise its temperature and separate the desired products, and afterwards passed through the regenerator in the opposite direction to lower its temperature and thence back to the refrigerator and scrubber.—W. F. F.

Carbons for arc lamps; Process of and means for manufacturing —. Comp. des Charbons Fabius Henrion, Paris. Eng. Pat. 450, Jan. 11, 1915. Under Int. Conv., Jan. 13, 1914.

METAL cores for arc lamp carbons are fixed in position by a thin cement, such as potassium silicate, dextrin, glucose, fish glue, starch or flour paste, or sugar syrup. The metal wire is fed between rollers into a horizontal bore in a block, where it is cut into the required lengths by a knife, operated by a handle. The wire is coated with cement by means of a brush. A stuffing-box prevents the cement from flowing into the bore, and the coated wire passes immediately into the bore in the carbon which is in alignment with the bore in the block.—W. F. F.

Neon tubes. [Electric incandescence lamps.] G. Claude, Boulogne, France. Eng. Pat. 8312, June 4, 1915. Under Int. Conv., July 16, 1914.

A NEON tube is mounted in series in the same high pressure circuit with a mercury and neon tube of the same shape and diameter but double the length, or two of the latter tubes may be used

as a frame to a single neon tube, or a single neon and mercury tube of half the diameter may be employed in place of the two larger tubes. The excessive redness of the light supplied by the neon tube is thus corrected by the bluish light produced by the mercury vapour. The tubes may be combined in a high pressure transformer circuit, with an apparatus operated by the working current to replace automatically the red neon tube by a self-induction coil during the time of lighting up.—B. N.

Animal charcoal; Process of making —. R. Adler, Assignor to Naaml. Vennootschap Algemeene Uitvinding Exploit. Maatschappij, Amsterdam, Netherlands. U.S. Pat. 1,151,553, Aug. 31, 1915. Date of appl., Oct. 2, 1913.

SEE Eng. Pat. 3436 of 1913; this J., 1913, 1151.

III.—TAR AND TAR PRODUCTS.

Picric acid; Specific reaction of —. G. Rodillon. *J. Pharm. Chim.*, 1915, 12, 177—179.

TRACES of picric acid may be detected by adding to a few c.c. of the suspected liquid hydrochloric acid and a few fragments of zinc, decanting after a few seconds into another tube, stirring in a few drops of hydrogen peroxide, and adding ammonia solution to a depth of about two cm. so that the two layers do not mix. Two coloured rings are formed at the interface, a violet-blue in the alkaline layer and a violet-red in the acid layer. The former is specific for picric acid. On mixing the layers the liquid, if still acid, develops a violet-blue colour resembling methylene blue. To detect picric acid in urine, 250 c.c. is extracted three times with 50 c.c. of petroleum spirit or ether, the combined extract is evaporated to dryness, dissolved in a little water, and treated as above. Foodstuffs should be extracted with successive quantities of warm water until 250 c.c. of extract is obtained, which is treated like urine.—F. Sp.

Methoxyl in creosote; Determination of —. J. Sureda and Gonzalez. *Ann. Soc. Esp. Fis. Quim.*, 1915, 13, 158—160. *Bull. Soc. Chim.*, 1915, 18, 496.

A MIXTURE of 0.2 grm. of creosote and 10 c.c. of hydriodic acid, sp. gr. 1.7, is heated in presence of red phosphorus in a current of carbon dioxide, and the methyl iodide collected in an alcoholic solution of silver nitrate. The precipitate of $\text{AgI} \cdot 2\text{AgNO}_3$ is decomposed by water and the silver iodide weighed. The results are expressed as guaiacol. Six samples of beech wood creosote examined by this method gave "methoxyl indices" of 12.5 to 13.4%.

Benzol recovery from town's gas supply. Herring. See IIA.

IV.—COLOURING MATTERS AND DYES.

Methylene Blue and its use in analytical chemistry. F. W. Atack. *J. Soc. Dyers and Col.*, 1915, 31, 183—188, 203—208.

A NUMBER of new salts of Methylene Blue, including the perchlorate, permanganate, bichromate, and persulphate, have been prepared. Leuco Methylene Blue has been prepared by a new method, the zinc-free Methylene Blue hydrochloride being converted into the free base by means of moist silver oxide, and the base reduced with an excess of phenylhydrazine. The

product is free from chlorine, which was not the case with the product obtained by the method of Landauer ("Studien ueber das Methylenblau," Inaug.-Diss., München, 1909). The reaction between phenylhydrazine and Methylene Blue hydrochloride: $C_{16}H_{15}N_3SCl + H_2N.NH.C_6H_5 = C_{16}H_{15}N_3S + C_6H_6 + N_2 + HCl$, is not quantitative, as stated by Landauer, and gives a product, of indefinite m.pt., containing hydrochloric acid, formed in the reaction. Apparatus is described for carrying out the experiments in an indifferent atmosphere. The product obtained by the new method was recrystallised from benzene, giving deep yellow crystals of an addition compound (m.pt. 95°—96° C.) containing 1 mol. of benzene, which yielded, on heating, a product (m.pt. 159°—160° C.) considered to be pure leuco Methylene Blue. Leuco Methylene Blue is a strong base of which the salts are not hydrolysed in solution; thus all attempts failed to extract the leuco-compound from the solution obtained by the addition of stannous or titanous chloride solution to Methylene Blue hydrochloride solution. The pure compound is not oxidised on exposure to pure air, but oxidises rapidly in presence of hydrochloric acid or ammonia gas. It is soluble in warm alcohol, ether, and acetone to colourless solutions, and in benzene, toluene, chloroform, carbon tetrachloride, and carbon bisulphide to deep red solutions. Neutral oxidising agents do not affect the leuco-dyestuff until the solution is acidified, when the original dyestuff is produced.

The applications of Methylene Blue in analysis depend on the following processes: (1) certain reducing agents are detected by the manner in which they reduce Methylene Blue solution to the colourless solution of the leuco-dyestuff, e.g., less than 0.002 mgrm. of molybdenum may be detected after reduction by zinc and hydrochloric acid to the molybdenous condition; (2) certain oxidising agents cause the formation of Methylene Blue when added to the leuco-dyestuff solution obtained as in (1), e.g., chlorates, nitrites, nitroso-compounds, quinones, etc.; and (3) neutral salts of certain inorganic acids (e.g., perchlorates, etc.; see above) give characteristic precipitates with Methylene Blue (hydrochloride) solution. Ferrous chloride does not reduce Methylene Blue in hydrochloric acid solution, and hence Methylene Blue may be used to detect the presence in steel of the "rarer" metals, all of which in their lower states of oxidation reduce Methylene Blue to its colourless leuco-compound. The behaviour of this leuco Methylene Blue hydrochloride solution towards various oxidising agents has been found to differ. Molecular oxygen is not absorbed readily by the solution of the leuco-compound, but traces of oxygen in carbon dioxide, etc., may be detected by passing the gas into a solution prepared by adding several drops of a dilute solution of a nitrite and reducing with titanous chloride the Methylene Blue formed, when the nitric oxide in solution acts as catalyst, leading to the rapid absorption of the oxygen. Of the various methods which have been described by the author (this J., 1913, 163) for the standardisation of Methylene Blue solution, the chlorate-titanous chloride method is preferred; this gives results which agree exactly with those obtained by means of pure potassium bromate and bichromate; it has been found that the iron content of the ferrous ammonium sulphate frequently used as standard is sometimes as much as 1% too low. Methods involving the use of standard Methylene Blue are outlined for the estimation of: (1) perchlorates, by precipitation as Methylene Blue perchlorate; (2) stannous salts (Attack, *loc. cit.*), molybdenum, etc., by titration with the dyestuff solution; (3) chlorates, bromates, chromates, vanadates, ferric salts (Attack, this J.,

1913, 382), nitrites, and hence potassium by precipitation as dipotassium sodium cobaltinitrite, dissolved oxygen, quinones, and azo- and nitroso-compounds, by addition of the oxidising agent to leuco Methylene Blue solution (prepared by reduction of the standard dyestuff solution with titanous chloride), and estimation of the Methylene Blue formed by means of titanous chloride; and (4) of aromatic oximes and 1,2-diketones, e.g., titanous chloride reduces benzil quantitatively to benzoin, and the excess of titanous chloride may be ascertained by titration with standard Methylene Blue. As the Methylene Blue solution generally used is N/50, containing 4 grms. of the zinc-free hydrochloride per litre, and a satisfactory end-point is obtained with even N/500 Methylene Blue and titanous chloride, methods involving the use of this dyestuff are particularly suited to the estimation of small amounts of substances; many of the estimations may be carried out colorimetrically.—F. W. A.

Epithelising action of aminoazobenzene derivatives. Martinotti. See XX.

PATENTS.

Monoazo dyestuff for wool; Manufacture of a —. Act.-Ges. f. Anilinfabr., Berlin. Eng. Pat. 5183, Apr. 6, 1915. Under Int.Conv., May 7, 1914.

6-ACETAMINO-3-DIAZO-1-METHOXYBENZENE-4-SULPHONIC acid is combined with 2-amino-8-naphthol-6-sulphonic acid in acetic acid solution. The diazo-compound may be obtained by acylating 2-aminoanisole-4-sulphonic acid, nitrating, eliminating the acetyl group, reducing, and monoacetylating the diaminoanisolesulphonic acid in aqueous solution by means of acetic anhydride. The monoazo-dyestuff obtained dyes wool from an acid bath a level, pure bluish red shade of good fastness to light.—F. W. A.

β-Amino-alizarin; Manufacture of new heterocyclic compounds [dyestuffs] derived from—. O. Imray. London. From Farb. vorm. Meister, Lucius, und Brüning, Höchst, Germany. Eng. Pat. 12,819, May 25, 1914.

SEE Fr. Pat. 472,100 of 1914; this J., 1915, 417.

Dyestuffs of the triphenylmethane series and process of making same. A. Stock and F. Heim. Assignors to Farb. vorm. Meister, Lucius, und Brüning, Höchst, Germany. Re-issue No. 13,969, Aug. 24, 1915 (date of appl., July 8, 1915), of U.S. Pat. 1,065,405, June 24, 1913.

SEE Eng. Pat. 12,378 of 1912; this J., 1912, 809.

Val dyestuffs and process of making same. K. Thiess, Assignor to Farb. vorm. Meister, Lucius, und Brüning, Höchst, Germany. U.S. Pat. 1,151,628, Aug. 31, 1915. Date of appl., Feb. 12, 1914.

SEE Eng. Pat. 3682 of 1914; this J., 1914, 743.

V.—FIBRES ; TEXTILES ; CELLULOSE ; PAPER.

Wool and silk; Action of solutions of Glauber's salt on —. N. Bland and M. Fort. J. Soc. Dyers and Col., 1915, 31, 178—180.

THE amount and character of wool substance stripped by sodium sulphate have been examined; the wool substance stripped does not contain so much nitrogen as the wool fibre, the more acidic constituent of wool apparently being removed by sodium sulphate. This would be expected from the view previously advanced (this J., 1913, 359) that the basicity of the wool would cause the

formation of caustic soda on the surface of the fibre. The colour of wool after repeated treatment with sodium sulphate is better than after similar treatment with water, due to the acid state of the wool suppressing the browning of the basic constituents. Analogous results were obtained with silk on treatment with sodium sulphate.—F. W. A.

Hop-vines; Manufacture of fibre, paper, and charcoal from —. O. Reinke. Chem.-Zeit., 1915, 39, 597.

THE fibre cannot be satisfactorily isolated by simple treatment with caustic soda; better results are afforded by steeping in a 0.5% solution of a mineral acid or by steaming under a pressure of about 7 lb. per sq. in. Long exposure to the weather also promotes the separation of the fibres from the incrusting matters, and perhaps the best treatment is an artificial retting by piling in warm, moist stacks. A yield of 20% of fibre of good quality is thus obtained. The residual wood, when digested with 6% caustic soda lye under 45 lb. pressure, gives an excellent papermaking fibre. Similarly the roots also yield a fine, long-fibred, white material. The wood of the hop-vine is hollow and may be subjected, after drying, to destructive distillation; when carbonised at 330° C., a very fine red and brown charcoal has been obtained. The production of hop-cones in Germany for brewing purposes amounts to 50,000 tons and the density of the crop is about 8000 plants per hectare (about 2½ acres).—J. F. B.

Sizing [paper]; Notes on —. Lew. Papierfabr., 1914, 963, 975, 988, 999. Chem.-Zeit., 1915, 39, Rep., 281.

IN studying the possible interactions between the cellulose fibre and aluminium sulphate or free sulphuric acid, known weights of several different half-stuffs were steeped in dilute sulphuric acid for 4 hours, adopting conditions of concentration and quantities comparable with those existing in the process of engine-sizing. The free and total sulphuric acid were then determined in the liquid drained from the pulp. In all cases there was a slight increase in total sulphuric acid, showing that nothing is absorbed by the fibre but rather that sulphates are extracted from it. In the experiment with straw cellulose, the sulphuric acid was completely neutralised; in the case of cotton-wool almost the whole of the acid added remained free. The influence of the fibre on the acid component of the sizing mixture would therefore appear to be confined entirely to its ash constituents, particularly the calcium salts. The reaction between aluminium sulphate and calcium carbonate was studied in the absence of fibre. The double decomposition proceeds to a considerable extent, so that more than 2SO₄ of the molecule Al₂(SO₄)₃ enters into combination with the calcium. Dialysis experiments through parchment paper were performed with calcium carbonate on one side of the membrane and aluminium sulphate on the other. At the end of the experiment, no soluble aluminium salt was found in the calcium carbonate compartment, all that had penetrated being precipitated. A study of the reactions between aluminium sulphate and cellulose fibres showed that considerable proportions of alumina are absorbed by the fibre, but little or no sulphuric acid; the alumina so deposited has no sizing action but is regarded merely as a loading material. Practical tests in the paper mill have shown that a large portion of the aluminium sulphate may be replaced by sulphuric acid in the engine-sizing of fine papers.—J. F. B.

Filler-papers; The toughening action of nitric acid upon —. C. Beadle. Chem. News, 1915, 112, 143–144.

For some purposes the method described by

Rankin (this J., 1915, 830) appears too complicated; for use with the filter-pump it is sufficient merely to toughen the apex of the filter by pouring a few drops of nitric acid, sp. gr. 1.42, into the point of the cone, held in a dry funnel, rotating it at a slight angle and washing out the acid first with tap water and finally with distilled water. The rate of filtration of cold water through a filter treated in the above manner is double that through the original paper, but the passage of boiling water is only 95% of the original rate; when the same filter is subsequently used with cold water, the rate is no faster than with the original paper. On the other hand, if the entire paper be toughened by complete immersion in nitric acid, sp. gr. 1.42, washed, pressed, and used without drying, the rate of filtration is considerably reduced, being only 20% of that of the untreated paper.—J. F. B.

Accidents and injuries to health of workpeople in the German chemical industry in 1914. Grossmann. See XIXB.

PATENTS.

Cellulose; Process and apparatus for manufacturing —. E. C. R. Marks, London. From A/S. Cellulosepatenter, Jølgen, Norway. Eng. Pat. 4278, Mar. 18, 1915.

A CENTRAL heater is employed for heating the digesting liquid of several digesters, each of which is connected with the heater in turn and the liquid circulated until the required temperature has been attained, the digestion being then allowed to proceed without further heating. The heater is constructed in sections so that one may be cut off for repair without affecting the work of the whole. The water condensed in the heater is continuously returned to the steam-boiler.—J. F. B.

Liquids [paper pulp]; Apparatus for straining —. J. D. Law, Markinch. Fife, and A. Walmsley-Wood, Bury, Lancs. Eng. Pat. 586, Jan. 14, 1915.

IN a cylindrical strainer in which a reciprocating diaphragm envelops the submerged portion of the drum, this diaphragm, when in the mid-way position of its path of travel, approaches nearer to the two sides of the drum than it does to the bottom, thus enclosing a space which is crescent-shaped in cross-section. The walls of the diaphragm are preferably corrugated longitudinally, with perforations along the inner lines, and are "bellied" outwards towards the middle.—J. F. B.

Paper-making machines; Suction-roll for — and process for making paper. R. J. Marx, London. Eng. Pat. 3708, Mar. 8, 1915.

A ROTARY suction roll is placed under one or more of the wet-press felts at a point between that at which the moist web of paper is transferred to the felt and the wet-press operating on it. The perforated shell of the suction roll is rotated only by the tension of the felt passing over it, and moisture is withdrawn through the suction roll both from the felt and from the paper lying on it. The apparatus may be used on machines having only a single (non-suction) couch roll or the usual two-roll couch press.—J. F. B.

Paper; Manufacture of —. G. Schenck, jun., Millinocket, Me., U.S.A. Eng. Pat. 8838, June 15, 1915. Under Int. Conv., Mar. 18, 1915.

IN high-speed paper machines, in order to prevent the moist web of paper from sticking to the stripping-doctors of the drying cylinders and to deflect it in the direction of the next cylinder, the blades of the doctors on the first few cylinders are perforated, along a portion or the whole of their length, by holes connected with a supply of compressed air, so that the issuing jets of air blow

the paper outwards away from the doctor and in the desired direction. *e.g.*, upwards.—J. F. B.

Artificial silk; Art of making——. B. Loewe, Paris. U.S. Pat. 1,151,487, Aug. 24, 1915. Date of appl., Aug. 29, 1911.

SEE Addition of Aug. 31, 1910, to Fr. Pat. 403,242 of 1908; this J., 1911, 415.

Half-stuff, paper-pulp, or paper; Production of——. W. A. R. M. McRae, Assignor to N. Malcolmson, London. U.S. Pat. 1,151,490, Aug. 24, 1915. Date of appl., Mar. 25, 1912.

SEE Eng. Pat. 26,043 of 1911; this J., 1912, 769.

Machines for manufacture of rubber-coated fibrous material. Eng. Pat. 19,142. See XIV.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Cellulose; Action of some oxidising [bleaching] agents on——. H. Moore. J. Soc. Dyers and Col., 1915, 31, 180—183.

THE action of bleach (calcium or sodium hypochlorite) of varying concentration on cotton yarn has been investigated. Methylene Blue being employed to estimate the amount of oxycellulose formed. The effect of moderate additions of acid was to decrease the amount of oxycellulose formed and not increase it, as might have been expected; on addition of alkali to the bleach, a minimum amount of oxycellulose is formed at a certain concentration of caustic soda. Permanganate solutions gave similar results to bleach.—F. W. A.

Weighting of silk as a chemical reaction. F. Fichter. Naturfors. Ges. Basel, June 16, 1915. Chem.-Zeit., 1915, 39, 636.

THE weighting of silk by means of stannic chloride is due to the formation and progressive hydrolysis of an addition compound of the tin salt with the silk fibroin (this J., 1914, 689). In the subsequent treatment with phosphate, the silk fibre plays no part, the sole reaction being between the stannic acid and phosphoric acid or sodium phosphate.—A. S.

Action of solutions of Glauber's salt on wool and silk. Bland and Fort. See V.

PATENTS.

Dyeing apparatus. J. T. Wood, Assignor to Franklin Process Co., Providence, R.I. U.S. Pat. 1,151,916, Aug. 31, 1915. Date of appl., Feb. 24, 1914.

IN a dyeing apparatus each perforated, vertical standpipe holding the cops carries a sliding flange fitted with a locking-device for keeping it pressed against the end cop.—F. W. A.

Dyeing; Beam for use in——. J. T. Wood, Assignor to Franklin Process Co., Providence, R.I., U.S. Pat. 1,151,917, Aug. 31, 1915. Date of appl., Feb. 6, 1915.

A TUBULAR ribbed cylinder, with perforated walls, carries end-heads provided with hubs which slide on the cylinder. The position of the end-heads is maintained by springs, and means are provided for moving the heads towards each other against the action of the springs, so that material wound on the cylinder may be compressed.—F. W. A.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Formic acid; Determination of—— in the presence of acetic acid. R. Lauffmann. Chem.-Zeit., 1915, 39, 575.

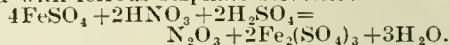
A METHOD described recently by Heermann (Chem.-Zeit., 1915, 124) depends on the fact that formic acid is capable of expelling acetic acid from acetates. A mixture of sodium formate and sodium acetate is dried at 125° C. and weighed, then treated with formic acid, evaporated, the residue again dried at 125° C., and weighed, the quantity of acetic acid being calculated from the loss in weight, and the amount of formic acid present originally being ascertained indirectly. Investigation of this method showed that it yields results which are only approximately correct. Solutions containing about 1% of formic and acetic acids together, the quantity of formic acid varying from 0.3 to 0.7%, were neutralised and evaporated, and the residues dried and weighed. The latter were then twice evaporated with the addition of formic acid, followed by four evaporations with the addition of water. The quantity of formic acid found was about 0.02% too high, whilst that of the acetic acid was too low.—W. P. S.

Alkali salts; Hydrolysis of—— and reaction to litmus. F. Fichter. Naturfors. Ges. Basel, June 16, 1915. Chem.-Zeit., 1915, 39, 636.

THE widely held view that the alkalinity of solutions of alkali salts of weak acids increases with increasing dilution is not correct, for although the degree of hydrolysis increases with the dilution, the rate of increase is lower, so that the absolute concentration of hydroxyl ions decreases with increasing dilution, until finally alkalinity can no longer be detected with sensitive litmus paper. With sodium carbonate solution alkalinity can be detected down to N/512, and with potassium cyanide down to N/256, but with sodium nitrite only down to N/8, with sodium benzoate down to N/4, and with Rochelle salt not distinctly even at N/2. Statements as to the reaction to litmus paper of salts of weak acids should therefore always be accompanied by precise data as to the concentration of the solution.—A. S.

Nitrates; Titration of—— with ferrous salts. F. C. Bowman and W. W. Scott. J. Ind. Eng. Chem., 1915, 7, 766—769.

NITRATES dissolved in concentrated sulphuric acid are reduced only to nitrogen trioxide when titrated cold with ferrous sulphate solution:



Slight reduction of the nitrogen trioxide to nitric oxide occurs, and the end point of the titration is denoted by a pinkish brown colour, due to a compound of ferrous sulphate and nitric oxide. The ferrous sulphate solution is prepared by dissolving 176.5 grms. of the crystallised salt in 400 c.c. of water, adding 500 c.c. of sulphuric acid (1:1), and diluting to 1 litre; it is standardised by means of bichromate or nitric acid. The solution of the sample (containing 0.3—0.6 gm. HNO_3) is delivered from a 10 c.c. pipette to the bottom of a beaker containing 100 c.c. of concentrated sulphuric acid and standing in a large porcelain dish containing cold water. The ferrous sulphate solution is run in slowly, with constant stirring, until the solution becomes faint brown or pink, then the pipette is rinsed by drawing the solution into it and allowing it to drain, and the titration is completed; 0.2 c.c. of the ferrous sulphate solution is required to effect the colour change and this amount is deducted from the volume used. The temperature should be kept below 60° C., preferably below 40° C., and the water content of

the solution should not exceed 25% at the end of the titration. Results accurate to within 1/300 of the quantity of nitric acid present can be obtained; the method is not suitable for very small quantities. Chlorates, bromates, iodates, chlorides, bromides, and iodides interfere, but the method is useful for the determination of nitrates in presence of nitrites and ammonium salts, and of nitric acid in fuming sulphuric acid and in mixed acids used for nitrating. Nitrates may also be titrated accurately with ferrous sulphate in arsenic acid or phosphoric acid solution, in which cases the nitrate is reduced to nitric oxide.—A. S.

Thorianite in Madagascar. Chem. and Drug., Sept. 25, 1915.

The discovery of good crystals of thorianite in South-Eastern Madagascar is reported. A preliminary analysis of a sample gave the following figures:—Thoria, 93.02%; uranium oxide, 4.73; ferric oxide, 0.29; lead oxide, 1.80%.

Tungsten: Critical study of the compounds of —. V. K. Kantschev. J. Russ. Phys. Chem. Soc., 1914, 46, 729–742. Bull. Soc. Chim., 1915, 18, 409–410. (See also this J., 1915, 819.)

TUNGSTIC acid forms three series of salts: normal tungstates, $R_2WO_4 \cdot xH_2O$; paratungstates, $3R_2O \cdot 7WO_3 \cdot xH_2O$ or $5R_2O \cdot 12WO_3 \cdot xH_2O$; and metatungstates, $R_2O \cdot 4WO_3 \cdot xH_2O$. The author finds that previously described di- and tri-tungstates of sodium, barium, and calcium do not exist, a repetition of the experiments of Lefort (Ann. Chim. Phys., [5], 15, 325) giving sodium paratungstate or mixtures of that salt with the metatungstate. The tungstates of chromium cannot be obtained pure if violet chromium salts be used for their preparation. The compound obtained by Lefort by the action of sodium tungstate on chrome alum has in reality the composition $Cr_2O_3 \cdot 7WO_3 \cdot 16H_2O$. Other chromium salts described by Lefort are merely mixtures of para- or metatungstates of sodium coloured green by mechanically retained chromium compounds. The mixture obtained by warming paratungstic acid with trivalent chromium compounds contains complex tungstochromates.—G. F. M.

Beryllium nitride. F. Fichter and E. Brunner. Z. anorg. Chem., 1915. Pharm. J., 1915, 95, 397.

If powdered beryllium is heated at 900° – 1100° C. in presence of nitrogen, the nitride is formed. It can also be obtained by heating at 1000° – 1100° in ammonia or a mixture of hydrogen and nitrogen. Beryllium nitride, Be_3N_2 , is a white powder which melts at 2200° C. in an atmosphere of nitrogen, and dissociates at 2240° C. When boiled with water a slow development of ammonia takes place. With dilute acids the following reaction occurs: $Be_3N_2 + 8HX = 3BeX_2 + 2NH_3X$. No compound of beryllium containing both nitrogen and hydrogen could be made.

Sicilian sulphur industry. U.S. Comm. Rept., Aug. 18, 1915.

THE production of sulphur in Sicily for 1914 was 334,974 metric tons, a decrease of 11,000 tons from the production of 1913. Exports during 1914 amounted to 338,308 as against 414,716 tons in 1913. The production, exports, and stocks of sulphur on hand for the last five years are shown in the accompanying table, in metric tons:—

	1910.	1911.	1912.	1913.	1914.
Production	397,808	376,171	357,547	345,074	334,974
Export	393,987	453,826	447,292	414,716	338,308
Stock on hand .	640,711	551,422	450,917	376,356	369,001

The principal countries to which sulphur was exported were Italy, 89,611 tons, and France, 61,871 tons. The decline in exports is attributed to American competition and to increased use of iron pyrites, as well as to the war. The increased cost of extraction at the mines induced the producers to petition the Government syndicate that controls the sale of the sulphur (Consorzio Obbligatorio per l'Industria Solifera Siciliano) to advance prices, which request was granted in July, 1914. Prices were increased about 2s. per ton for crude sulphur, and a further advance of 2s. 6d. per ton was reported early in 1915.

Ionic diffusion in permulit. Schulze. See XIXB.

Accidents and injuries to health of workpeople in the German chemical industry in 1914. Grossmann. See XIXB.

PATENTS.

Sulphuric acid; Process of making —. H. Howard, Brookline, Mass. U.S. Pat. 1,151,103, Aug. 24, 1915. Date of appl., June 26, 1914.

SODIUM nitrate and sulphuric acid, in the approximate ratio of 2 mols. to 1 mol., and preferably in intimate admixture, are fed continuously to a reaction vessel in which the mixture is stirred and heated. The residual sodium sulphate is discharged continuously, and the evolved oxides of nitrogen are mixed with gases containing sulphur dioxide.—F. SODN.

Sulphuric acid; Method and apparatus for producing —. G. Schliebs, Cologne, Germany. U.S. Pat. 1,151,294, Aug. 24, 1915. Date of appl., May 22, 1914.

THE acid vapours or reacting gases are passed through a succession of series of towers, with a separator interposed between adjacent series, and a portion of the uncondensed gases is returned from each separator, through a conduit furnished with draught-producing means, to the preceding series of towers.—F. SODN.

Nitric acid; Manufacture of —. C. Claessen, Berlin. Eng. Pat. 6102, Apr. 23, 1915.

To effect a quiet and uniform distillation of nitric acid from a mixture of nitrate and sulphuric or other acid, the nitrate is used in the form of briquettes or cubes of about 2–3 cm. edge, preferably with the addition of 5–10% of sulphuric acid, or of about 10% of ground bisulphate.—E. H. T.

Lactic acid; Manufacture of pure —. M. Landau, Berlin. Eng. Pat. 7998, May 29, 1915.

COMMERCIAL lactic acid is decolorised by prolonged boiling with animal charcoal, or other insoluble decoloriser, in a vessel fitted with a reflux condenser, a current of inert gas being continuously passed through. The liquid is concentrated to 90–95% by distilling off the water, preferably *in vacuo*, and about $1\frac{1}{2}$ times its weight of alcohol is then added to precipitate dextrin or other organic matter. After standing for 24 hours the liquid is filtered and the alcohol distilled off.—E. H. T.

Zinc carbonate; Production of pure — in a closed cycle. E. Hunebelle, Paris. Eng. Pat. 14,226, June 12, 1914. Under Int. Conv., June 12, 1913.

AN impure compound of zinc, or zinc-waste, is dissolved in hydrochloric acid containing a little free chlorine, lead is precipitated with magnesium sulphate and other metals with calcium carbonate. The zinc chloride liquor is treated with magnesium carbonate and the zinc carbonate filtered

off and washed. Magnesium is recovered from the filtrate by evaporation and by calcining the hydrated chloride at gradually rising temperatures (up to 550°–600° C.), air and steam being injected from 250° C. The oxide so obtained is re-converted into carbonate, and the hydrogen chloride and chlorine evolved are collected and also used again.—E. H. T.

Radioactive balls; Production of —. H. Farjas. Paris. Eng. Pat. 18,808, Aug. 18, 1914. Under Int. Conv., Nov. 10, 1913. Addition to Eng. Pat. 14,530 of 1913, dated July 1, 1912. (See Fr. Pat. 456,990 of 1912; this J., 1913, 1028.)

THE solid, non-porous balls which are coated with radioactive material and used to activate large quantities of fluids, are so constructed that they present a plain, smooth surface without cavities or other irregularities.—E. H. T.

Lead arsenate; Method of manufacturing —. E. O. Barstow, Midland, Michigan, Assignor to Cleveland Trust Co., Cleveland, Ohio. U.S. Pat. 1,141,920, June 8, 1915. Date of appl., June 10, 1911.

A SOLUTION containing arsenic and hydrochloric acids, such as is obtained by oxidising arsenious oxide with chlorine, is stirred with the necessary amount of an oxy-compound of lead (monoxide, carbonate, etc.) in order to precipitate the hydrochloric acid as lead chloride. The clear liquid is decanted and stirred persistently with a further quantity of the lead compound, so that some of the arsenic is precipitated as lead arsenate. This is filtered off, the filtrate is neutralised with sodium carbonate, and the remaining arsenic precipitated with lead chloride. The method is also applicable to the manufacture of the arsenates of zinc, iron, and barium.—E. H. T.

Monoalkali-metal phosphate; Manufacture of —. E. H. Strickler, Assignor to General Chemical Co., New York. U.S. Pats. (A) 1,150,899 and (B) 1,150,900, Aug. 24, 1915. Dates of appl., March 22 and 23, 1912.

(A) AN alkali phosphate, such as sodium phosphate, is treated with an acid, such as sulphuric acid, to produce a monoalkali phosphate and a salt of the added acid, which is separated in the solid form by concentrating the solution. (B) A trialkali phosphate is treated with sufficient acid (e.g., sulphuric acid) to produce free phosphoric acid and a salt of the acid added, the solution is concentrated to precipitate the salt formed, and the phosphoric acid, thus separated, is treated with alkali phosphate, so as to give monoalkali phosphate. Alkali sulphate, obtained as a by-product, is converted into bisulphate and heated with phosphate material and carbonaceous matter to produce trialkali phosphate.—F. SODN.

Effervescent compound. E. H. Strickler, Assignor to General Chemical Co., New York. U.S. Pat. 1,150,901, Aug. 24, 1915. Date of appl., July 25, 1912.

SODIUM bicarbonate or other suitable alkali compound is stabilised by means of an efflorescent salt, such as di-sodium phosphate.—F. SODN.

Felspar, leucite, etc.; Treatment of —. F. A. Rody and H. M. Burkey, Newark, N.J. U.S. Pat. 1,151,498, Aug. 24, 1915. Date of appl., Oct. 11, 1913.

THE alkalis and alumina in felspar and other silicates are recovered by heating them to a sintering temperature with added alkali and the oxide of an alkaline earth (calcium oxide). The ratio of alumina to total alkali in the mixture must be at least as great as 1:3, and is preferably 1:2. A soluble alkali aluminate of higher basicity than the mono-salt, and a mono-calcium silicate (or ortho-silicate) are formed.—E. H. T.

Felspar, leucite, etc.; Treatment of —. F. A. Rody, Newark, N.J. U.S. Pat. 1,151,533, Aug. 24, 1915. Date of appl., Oct. 11, 1913.

THE alkalis and alumina in felspar and other silicates are recovered in a soluble form by heating the mineral to a sintering temperature with the oxide of an alkaline earth (calcium oxide) in proportion to form an ortho-silicate. The product is crushed, boiled with water, and the calcium salt is filtered off from the resulting alkali aluminate solution. Instead of the oxide, a solution of a calcium salt may be mixed with the silicate, and this mixture preheated to form the oxide, the temperature required being below that at which silicate and oxide interact.—E. H. T.

Hydrogen peroxide; Process of preparing a solution of —, with a high content of ozone and oxygen. A. Wolff, Berlin. U.S. Pat. 1,152,066, Aug. 31, 1915. Date of appl., Feb. 25, 1915.

A CHEMICALLY pure solution of hydrogen peroxide, containing at least 3% of H₂O₂, is mixed with about 0.7–0.8% of sodium chloride, then saturated with oxygen at about 0°–2° C., and sprayed through a chamber containing compressed ozone.—E. H. T.

Hydrogen; Process of making —. A. Messerschmitt, Stolberg, Germany. U.S. Pat. 1,152,196, Aug. 31, 1915. Date of appl., June 10, 1913.

HYDROGEN is produced by passing alternately currents of reducing gas and steam through pervious, ferruginous matter, contained in a chamber which receives heat from two combustion chambers; e.g., the reaction space may be in the form of an annular chamber between inner and outer, concentric combustion chambers. The mass is also partly heated by the combustion of some of the reducing gas within it. The reducing gas is mixed with a little air, then passed through the first combustion chamber, on to the heated mass, and finally completely burnt in the second chamber to which sufficient air is admitted.—E. H. T.

Sodium carbonate; Apparatus for producing —. M. Spazier, Los Angeles, Cal., U.S.A. Eng. Pat. 19,245, Aug. 29, 1914.

SEE U.S. Pat. 1,127,691 of 1915; this J., 1915, 282.

Radioactive liquids and gases; Apparatus for producing —. H. Farjas, Paris. Eng. Pat. 18,807, Aug. 18, 1914. Under Int. Conv., Aug. 20, 1913. Addition to Eng. Pat. 14,530 of 1913, dated July 1, 1912.

SEE Addition of Aug. 20, 1913, to Fr. Pat. 456,990 of 1912; this J., 1915, 552.

Radiothorium; Process of obtaining — and solutions therefrom containing thorium-X. B. Keetman, Assignor to Deutsche Gasglühlicht A.-G. (Auerger), Berlin. U.S. Pat. 1,151,187, Aug. 24, 1915. Date of appl., Mar. 14, 1913.

SEE Ger. Pat. 269,692 of 1912; this J., 1914, 312.

Ammonium sulphate; Process of manufacturing or obtaining —. G. N. Vis, Cuise-Lamotte, France. U.S. Pats. 1,152,244 and 1,152,245, Aug. 31, 1915. Dates of appl., June 7, 1911, and Jan. 27, 1913.

SEE Fr. Pat. 427,065 of 1910, and Addition thereto, and Eng. Pat. 2002 of 1913; this J., 1911, 1057, 1160; 1913, 534.

Hydrogen; Process and apparatus for making —. A. Messerschmitt, Stolberg, Germany. U.S. Pat. 1,152,197, Aug. 31, 1915. Date of appl., June 12, 1913.

SEE Ger. Pat. 263,391 of 1912; this J., 1913, 944.

Process and apparatus for making mono-ammonium phosphate. U.S. Pats. 1,142,068 and 1,151,074. See XVI.

VIII.—GLASS; CERAMICS.

Physiological action of quinquivalent antimony (sodium metantimonate). Rewald. See XIXB.

PATENT.

Glass-furnace. V. H. Gregory, Chiswick, Assignor to Pilkington Bros., Ltd., St. Helens, U.S. Pat. 1,151,942, Aug. 31, 1915. Date of appl., Feb. 20, 1912.

See Fr. Pat. 411,183 of 1912; this J., 1912, 817.

IX.—BUILDING MATERIALS.

Cement; Apparatus for determining the fineness of —. U. S. Bureau of Standards. U.S. Comm. Rept. No. 208, Sept. 4, 1915.

THE apparatus consists of a vertical brass pipe, about 3 in. in diameter and 5 ft. long, at the lower end of which is attached a glass bulb in which the cement to be tested is placed. Air at constant pressure is blown into the cement through a glass tube or nozzle in the side of the bulb, and passes through the vertical pipe, carrying with it the cement dust, which is caught in a flannel hood at the top. The air flow in the pipe is very uniform, and in a short time all the dust will be removed from the cement, leaving a granular residue in the glass bulb. Different grades are obtained by using different-sized nozzles, and thus a number of separations can be made in the very fine portion of the cement. With the aid of the microscope the size of the largest particles in any given separation can be readily determined, and in this manner the apparatus is standardised without reference to the size of the nozzles and other parts of the apparatus or the air pressure used. It is found that the cement "flour" (the portion which contains no perceptible grit when rubbed between the fingers) consists of particles less than 0.0007 inch in diameter. The apparatus may also be used for separating and grading any hard-grained materials, such as ground quartz, emery, and other abrasives, and in a modified form for separating other powders, such as pigments, plasters, and clays.

PATENTS.

Gypsum plaster and retarder therefor. E. Duryee, Los Angeles, Cal. U.S. Pat. 1,151,095, Aug. 24, 1915. Date of appl., Dec. 29, 1913.

THE water-soluble extract of bean straw is mixed, as a retarding agent, with the mortar and water of gypsum plaster.—W. C. H.

Wood; Method of preserving —. H. S. Loud, New York. U.S. Pat. 1,151,204, Aug. 24, 1915. Date of appl., May 5, 1915.

WOOD is confined in an evacuated vessel, and a preservative liquid is admitted to form a covering film which is mixed with air and driven into the pores by means of increasing air pressure. After the material has been submerged in the liquid, the inflow is cut off, and the excess drawn off under reduced pressure. (See U.S. Pat. 1,147,635; this J., 1915, 907).—W. C. H.

Porous bodies with liquid preservative; Method of treating —. H. S. Loud, New York. U.S. Pat. 1,151,205, Aug. 24, 1915. Date of appl., June 8, 1915.

Porous bodies, under normal or reduced air pressure, are intermittently covered with a flowing film of liquid and then surrounded with air under increasing pressure, which is afterwards reduced and the surplus liquid drawn off. (See also preceding abstract.)—W. C. H.

Drying, mixing, and agitating machines [for tarred & macadam]. Eng. Pats. 18,354 and 18,355. See I.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Electric furnace; Large — for pig iron. Helfenstein-Engelhardt, Montan. Rundschr., 1915, 7, 110. Chem.-Zeit., 1915, 39, Rep., 315.

THE furnace is of rectangular cross section, since this shape is better adapted than the usual round form for electrodes to convey large currents, either single or three-phase. It has a permanent cover, with openings for the escape of the gas and for charging. The first furnace of this kind was erected in 1913 in Domnarfvet by Helfenstein. Its estimated capacity was 10,000—12,000 horse power, but in practice only 6000 to 8000 h.p. was used. The average output was 65 tons in 24 hours, with a consumption of 2000 kilowatt-hours, 300—400 kilos. of wood charcoal, and 70 kilos. of electrode material per ton of pig iron. The installation costs are smaller than in other furnaces, whilst the heating value of the furnace gases is greater. The starting is also more rapid, and up to 70% of unbriquetted fine ore can be used.

—W. G. C.

Iron; Influence of oxygen on some properties of pure —. W. Austin. Iron and Steel Inst., Sept., 1915. [Advance proof.] 5 pages.

By melting pure iron and iron oxide in a Girod furnace, "alloys" were prepared containing up to 0.288% O., as determined by reduction in hydrogen at 1080° C. and weighing the water produced. The melts were quite fluid, and after casting were forged and rolled without difficulty except at about 900° C. The oxide had no appreciable influence on the m.p. of pure iron, but the 900° C. critical point was lowered. As the proportion of oxide increased the density of the alloys decreased and their hardness increased. The alloys resisted atmospheric corrosion well, but were less resistant than mild steel and wrought iron to dilute acids and sea-water, respectively. From micrographic and other evidence it is concluded that the oxide in the alloys is present in mechanical admixture, but the possibility of it being soluble in molten iron and rejected on solidification, is not precluded.—W. E. F. P.

Cementite; Magnetic transformation of —, with a note on the magnetic aspects of the A3 transformation in pure iron. K. Honda and H. Takagi. Iron and Steel Inst., Sept., 1915. [Advance proof.] 15 pages. (See also this J., 1915, 615.)

THE specimens studied included 5 samples of white and one of grey pig iron containing from 2.8 to 4.15% C, and samples rich in cementite cut from the outside and inside portions of a chilled car wheel. From the data obtained it is concluded that the magnetic transformation of cementite begins at 220° C. on cooling and ends at the same temperature on heating, the change occurring gradually (over a range of 50°—80° C.), as in the case of iron and other ferromagnetic materials. From this result and the fact that almost the same critical temperature was observed in a series of steels (0.14—1.5% C) previously investigated by the authors, it is considered probable that cementite is the only form in which carbides exist in steel at ordinary temperatures. By investigating samples of pure iron magnetically between 800° and 980° C., curves were obtained in which the A3 transformation was well defined, the actual temperatures obtained with two specimens being 911° and 908° C. for the Ac3 and 898° and 889° C. for the Ar3 points, respectively; as against 916° and 915° C. for Ac3 and 895° and 885° C. for Ar3 by thermal analysis of the same specimens. The authors' view that the inflexion

of the curve in the vicinity of 930°C. is an effect of the A3 transformation and not due to the occurrence of an independent phase (δ -iron of Weiss) was confirmed, and data obtained unfavorable to the theory of magnetons advocated by Weiss.

—W. E. F. P.

Cast iron; Sulphur in malleable —. R. H. Smith. Iron and Steel Inst., Sept., 1915. [Advance proof.] 12 pages.

TESTS made with a white iron containing S 0.39% showed that whatever annealing mixture was used there was no reduction or redistribution of sulphur during annealing, the only result being the balling-up of the iron sulphide into small globules. When air was allowed to enter the annealing boxes the sulphur tended to segregate into the unoxidised portions. The effect of sulphur on the mechanical properties of malleable cast iron was studied on a series of bars prepared from an American washed iron containing combined carbon about 3% and only traces of impurities, with sulphur rising from 0.01 to 0.34%. The transverse strength was little influenced by the addition of sulphur, the tensile strength increased, while the elongation and deflection decreased. The most marked effect observed was in the bending tests, which were very unsatisfactory when the sulphur was much above 0.15%.—T. Sr.

Iron; Note on the carburisation of — at low temperatures in blast-furnace gases. T. H. Byrom. Iron and Steel Inst., Sept., 1915. [Advance proof.] 7 pages.

A SOFT steel sheet was found to have become highly carburised in the central portion after being exposed to blast-furnace gases at below 500°C. for several years, the iron apparently becoming converted into a mixture of Fe_3C and Fe_2C . Tests made with thin strips of pure electro-deposited iron showed that carburisation did not take place at 400°C. , but was active at 550° – 650°C. , and they indicated that the action was due to carbon monoxide alone. Large quantities of ferrous sulphide were also found as a dust on some of the strips, formed, it is supposed, by the action of sulphur vapour in the blast-furnace gases.—T. Sr.

Iron and steel; Phosphorus in —. W. H. Hatfield. Iron and Steel Inst., Sept., 1915. [Advance proof.] 13 pages.

A SERIES of white irons was prepared with C 2.9, Si 0.77, S 0.04, Mn 0.26% (these constituents practically uniform), and P increasing from 0.046 to 0.835%. The samples as cast and after heat-treatment were tested mechanically, and studied microscopically after etching with picric acid and with Stead's copper reagent (this J., 1915, 616). With regard to the latter reagent it was found that factors (such as scratching) other than local high phosphorus may prevent local deposition. The results observed are discussed with reference to the views expressed by previous investigators, and it is considered that, while the question of the distribution and condition of phosphide in steels is still unsettled, local high phosphorus is associated with the areas richer in pearlite rather than with those where the ferrite predominates. The results showed that in such irons as those investigated phosphorus may be present up to 0.20% without unduly modifying the physical properties of the heat-treated material, and that free phosphide does not become microscopically observable until the phosphorus reaches 0.25%.—T. St.

Iron and steel; The occurrence and influence of nitrogen on —. N. Tschischewski. Iron and Steel Inst., Sept., 1915. [Advance proof.] 51 pages.

Determination of nitrogen. The sample is dis-

solved in hydrochloric acid, the solution distilled with lime, the ammonia absorbed in N/100 sulphuric acid, and the excess of acid titrated with N/100 sodium hydroxide solution using methyl orange as indicator. The addition of zinc after the ordinary distillation of the ammonia is unnecessary. Allowance must be made for the alkalis dissolved from the glass during distillation.

Iron and nitrogen. Pure iron does not combine with dry nitrogen but it forms a nitride, Fe_3N_2 , when heated in an atmosphere of ammonia. The nitride dissociates however at 450°C. and therefore nitrogen in steels must be due to the presence of other elements. *Influence of carbon on the combination of nitrogen with iron.* Tests made with white pig iron containing C 3.9% showed a maximum of combined nitrogen at 600°C. , the amount dropping to a negligible quantity at 900°C. Carbon has thus no influence on the nitrogen content in the manufacture of steel. *Manganese and nitrogen.* When manganese is heated in an atmosphere of ammonia a maximum absorption of nitrogen, corresponding to the compound MnN , takes place at 600° – 800°C. When this material is dissolved in acid, ammonia is formed in amount corresponding to the compound Mn_3N_2 , the rest of the nitrogen being evolved as such. When manganese is heated in an atmosphere of nitrogen, maximum absorption takes place at about 1000°C. , corresponding in amount to the compound Mn_3N_2 . Manganese nitride is dissolved by molten iron, and as ferromanganese often contains considerable quantities of nitrogen, its addition to steel may mean therefore the addition of nitrogen as well. *Influence of silicon on the combination of iron and nitrogen.* Heated in a current of nitrogen at 1500° – 1550°C. silicon is converted into the nitride Si_3N_4 , a very stable body, undecomposed by dilute acids other than hydrofluoric. This nitride dissolves in molten iron, and therefore ferrosilicon additions to steel may be the means of introducing nitrogen. Owing to the resistance of silicon nitride to dilute acids, the ordinary nitrogen determination gives low results. The error is insignificant in the analysis of steels, but becomes of importance in a pig iron containing much silicon. Silicon nitride may be estimated by melting it with a mixture of lead chromate, lead dioxide, and lead monoxide, and measuring the evolved nitrogen. *Influence of aluminium on the presence of nitrogen in steel.* Aluminium forms a nitride, AlN , which is undissociated at 1750°C. and is soluble in iron. As one part of the action of aluminium in reducing blowholes is to combine with nitrogen dissolved in the molten steel, the addition of aluminium may result in the production of bad quality metal. *The metallography of iron nitride.* Iron nitride forms on heating with iron a solid solution which decomposes on cooling into "ferrite" and needle-like crystals of iron nitride. This "ferrite" appears to be a solid solution containing 0.05–0.1% of nitrogen. The presence of nitrogen in steel-works materials in amount below 0.02% would therefore not be revealed by microscopic examination. Rapid cooling yields a structure representing the eutectic of the nitride, Fe_{12}N , in iron. Iron containing nitrogen can be tempered, like carbon steel. Quenching from 750°C. in cold water renders the material extremely hard and brittle. *Influence of nitrogen on the mechanical properties of steel.* Nitrogen-containing iron wire (0.63 mm. diameter) suitable for mechanical tests and with the nitrogen uniformly distributed, was obtained by heating first at 900°C. in an atmosphere of ammonia, and then for a longer period at 1100°C. in nitrogen. After cooling, the wires were straightened and again heated. The structure of the samples with less than 0.15% N was uniform, but with greater amounts the surfaces were rough and cracked. With 0.3% N the wire broke without bending;

with 0.4% N it broke like a glass rod. The results of the mechanical tests are plotted and show that nitrogen increases the ultimate stress and the elastic limit but decreases the elongation. In the tests described the elongation fell from 19.6% with 0.0038% N to 3.5% with 0.131% N. The influence of nitrogen is thus very prejudicial, causing cold-shortness.—T. St.

Steels; Influence of heat treatment on the specific resistance and chemical constitution of carbon — E. D. Campbell. Iron and Steel Inst., Sept., 1915. [Advance proof.] 13 pages.

A SERIES of 8 crucible and basic open hearth carbon steels, in bars about 15 cm. long and 6 mm. square in cross-section, and containing from 0.04 to 2.71% C (with normal amounts of Mn and impurities) were quenched from 892° and 1103° C., respectively, in a large volume of iced water, after which they were polished, their cross-sections accurately measured, and the specific electrical resistance of each determined to within 0.2 microhm of the absolute value. The bars were then reheated to 105°, 195°, 400°, 492°, 600°, 700°, and 800° C., respectively, for 2 hrs. and allowed to cool in the furnace over-night, the specific resistance being determined after each heat treatment and drillings taken for comparative determinations of carbon by the colorimetric process. In addition to being lowered by tempering, the specific resistance increased with the temperature of quenching, and, with hypoeutectoid steel, was greater after reheating to 800° C. and slowly cooling than after reheating to 600° or 700° C. A close relationship was found to exist between specific resistance and the concentration of carbides in solid solution (as indicated by the results for "colour carbon"). An explanation of this relationship is suggested based on the analogy between solid solutions in iron and ordinary aqueous solutions, the chief difference being that in a metallic solution the conductivity is due practically entirely to the solvent and undissociated solutes; the "ionoids," or products of ionic dissociation, which are electrically active tend, like ions, to acquire energy in the form of electric charges, but on account of the nature of the solvent this energy is transformed and dissipated in the form of heat.—W. E. F. P.

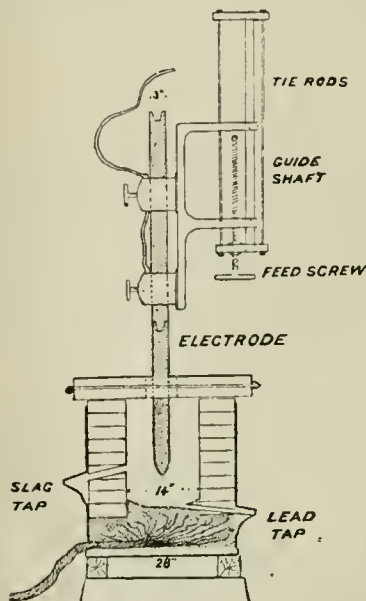
Steel; The effect of chromium and tungsten upon the hardening and tempering of high-speed tool — C. A. Edwards and H. Kikkawa. Iron and Steel Inst., Sept., 1915. [Advance proof.] 25 pages.

SPECIMENS of two series of steels containing (1) C about 0.65%, Cr about 6.15%, and W rising from nil to 12.5%, and (2) C about 0.65%, W about 19%, and Cr rising from nil to 6.24%, were hardened by quenching in an air-blast from 1350° C., and then tempered by heating for one hour at the desired temperature and allowing to cool on an asbestos pad in the air. Each specimen was tempered successively at intervals of about 50° C. from 207° C. to 1048° C. After quenching and after each tempering a Brinell hardness test was made and the specimen examined microscopically. The results are plotted to show the changes of hardness with the different annealing temperatures. In general, the quenched steels first became softer, and then harder again, until after heating at about 614° C. they were much harder than in the air-hardened state; softening followed, the completely annealed state being reached at about 800°–900° C.; with higher temperatures the steels again became harder, though this property of self-hardening was entirely absent in the pure tungsten steel. Contrary to a widely-held view, it is chromium and not tungsten which imparts to steel the property of self-hardening by cooling in air from high temperatures. In fact, tungsten

steel containing W 18% and C 0.63% can be air-hardened only by rapid air-quenching from above 1050° C. Besides being the cause, in conjunction with carbon, of the great hardness of hardened high-speed steels, chromium also materially lowers the temperature at which hardening can be effected. The action of tungsten, in the absence of chromium, is to raise the temperature at which tempering or annealing begins; in the presence of chromium it increases the intensity of the secondary hardening which is brought about by the low heat treatment, and raises the tempering temperature. The maximum effect is obtained, however, only when the tungsten is in solution, and with modern high-speed steels this is not complete below 1350° C. When such steels are hardened at say 1050° C. the tungsten is undissolved and remains inactive, with the result that the tempering properties approximate to those of a pure chromium steel, softening taking place at a lower temperature and little or no secondary hardening being developed. The microscopic examinations showed that with the secondary hardening the austenitic crystals of the quenched steel become converted into martensite; during the annealing stage the martensitic structure is destroyed, and then, during the self-hardening stage, is formed again. Specific gravity determinations made on the tempered steels showed changes closely in line with the hardness changes, increase of hardness being accompanied by an increase in volume. The authors point out that the heat treatment which gives maximum hardness is practically identical with that found in practice to give the best cutting efficiency, and they believe that it may be possible to replace almost completely the elaborate and costly standard cutting tests, by tempering experiments made in conjunction with hardness tests, in determining the relative merits of high-speed cutting tools. In any case such experiments would serve to indicate the best temperature for the second or low heat treatment.—T. St.

Gold refining with an electric furnace. W. P. Lass. Amer. Inst. Min. Eng., Sept. 1915. Met. and Chem. Eng., 1915, 13, 566–567.

THE electric furnace (see fig.) employed at the Alaska-Treadwell cyanide plant, for treating the



by-products from the Tavener refining process, consists of a steel casing (portion of an old drum)

into the base of which a cable composed of bare copper wires is inserted, the wires being spread fan-wise over the bottom and enclosed in a mixture of powdered graphite (old crucibles) with 10% of cement; the sides of the furnace are lined with fire-brick, the heating chamber being 20 in. high and 14 in. in diameter. The upper electrode, of graphite or carbon 3 in. in diameter, consists of sections 40 in. long and capable of being joined without shutting down the furnace; it is raised or lowered by means of a screw feed and projects into the furnace through an opening 6 in. in diameter in the centre of the cover through which the charge is also fed. The furnace gases escape through a second opening in the cover and are then conducted to a 4 in. pipe connected with a ventilating fan. The furnace is operated on the lighting circuit through a 50-kilowatt transformer, 60 cycles, 110 volts; and a water rheostat is also employed to regulate the current at starting or when the furnace contains a bath of metal. The material charged consists of a mixture of litharge 20, old reverberatory hearths (containing 60% CaO) 20, coke 2, scrap iron 3, and refinery by-products 100 parts by weight, the latter containing SiO_2 40.1, Fe 16.0, CaO 16.1, Cu 5.9, Pb 3.0, Zn 5.7, Al_2O_3 2.0, S 3.6, moisture 4.0%, and gold to the value of \$1096.60 (£228 9s. 2d.) per ton. The mixture is added in lots of about 160 lb. each, and when one charge attains quiet fusion (average time 2 hrs. 10 mins.), it is allowed to settle for 15 mins. with the current turned off, after which the slag is tapped and another charge added. For a melt of 8507 lb. in 53 charges, the total running time is 128 hrs. 40 mins. and the total power used 4440 kilowatt-hours. The only item of cost for fluxing is the coke, since the lime is derived from the old reverberatory hearths, the litharge from cupels used in bullion refining, and the iron from mill scrap. Both graphite and carbon electrodes are used, the former costing \$2.95 (12s. 3½d.), and the latter \$1.20 (5s.) each; one graphite electrode is consumed per 24 hrs. Power costs less than 1 c. (½d.) per kilowatt-hour, and the total labour required is only half of one man's time when melting 1 ton per 24 hrs. The advantages of electric over blast furnace smelting are:—saving in mechanical loss of gold in fine dust; production of lower grade slag free from shots of metal; precise regulation of the melting temperature; and benefit to the general health of the operators.—W. E. F. P.

Mercury from amalgamation tailings; Recovery of—E. B. Thornhill. Min. and Eng. World, 1915, 43, 329—330.

In the amalgamation of high-grade silver ores in strong cyanide solution, the tailings contain considerable amounts of mercury, chiefly as sulphide. This can be satisfactorily recovered by leaching the filter-cake with a solution containing 4% of sodium sulphide and 1% of sodium hydroxide. The mercury is precipitated by adding aluminium in the form of foundry waste, and then agitating. After decantation the liquid mercury is recovered by straining through canvas, and the solid residue is retorted.—W. R. S.

Platinum production in the United States. U.S. Geol. Survey, 1914.

THE placer miners of California and Oregon obtained 570 oz. (troy) of crude platinum in 1914, as compared with 483 oz. in 1913. The greatest increase in production was in Oregon. From this crude platinum 525 oz. of metallic platinum was extracted, valued at \$23,625. The Boss gold-copper-platinum mine, near Goodsprings, Nev., produced 110 oz. of platinum. Besides the platinum obtained from sands and platinum ore, 2906 oz. of this metal was obtained from raw material, of both domestic and foreign origin, by smelters and

refiners of gold and copper bullion and mattes. The secondary platinum industry handled 40,826 oz. of platinum, obtained from refining scrap metals and sweepings of the jewellery and dental trades.

The following table shows the estimated production of platinum in 1913 and 1914:—

Country.	1913.	1914.
	oz.	oz.
Russia, crude	250,000	241,200
Canada, crude	50	30
New South Wales and Tasmania, crude ..	1,275	1,248
Colombia, crude	15,000	17,500
United States domestic, crude	483	570
United States refined, platinum from foreign and domestic matte and bullion	1,100	2,905
Borneo, Sumatra, and others	200	(a)

a No basis for estimates.

[Copper.] *Concentrator slimes tailings; Roasting and leaching*—L. Addicks. Amer. Inst. Min. Eng., Sept., 1915. Met. and Chem. Eng., 1915, 13, 531—535.

DETAILS are given of experiments made by J. Douglas, at Douglas, Ariz., on the ore of the Burro Mountain Copper Co., consisting of pyrites and chalcocite very finely disseminated through a silicious gangue, and containing Cu 2.35, Fe 1.5, S 3.0, Al_2O_3 13.0, CaO 0.5, K_2O 4.0, and SiO_2 70.0% and Ag 0.05 oz. per ton. Direct leaching of the finely divided ore was tried but discarded in favour of rough concentration—by which a product suitable for roasting and the preparation of sulphuric acid for leaching was readily obtained—followed by treatment of the tailings. The latter consisted of sand and slime in about equal proportions, the sand containing about 0.3% Cu and being too poor for treatment, and the slime about 1% Cu. The large scale tests were made on the slime. After the water content of the slime had been reduced from 50 to 30% by settling, the product was exposed to air in shallow pans until only 10% of moisture remained and then delivered to a rotary drier heated by fuel oil, of which about ½ gall. was required for each 1% of water expelled per ton of material. The dried slime, still containing 1% of moisture, was then passed through disintegrating rolls to a six-hearth MacDougall roaster, in the third hearth of which fuel oil was burned to maintain a maximum temperature of about 950° F. (510° C.) in the furnace, the consumption of oil being about 3½ galls. per ton, on the basis of 100 tons roasted per day. The hot product from the roaster was delivered into a long, inclined, rectangular trough containing dilute sulphuric acid of about 3½% strength, and passed thence, after agitation, to the first of a series of seven Dorr thickeners, in the first four of which the extraction was completed, whilst the last three were used for washing; the copper was subsequently recovered from the solution by electrolysis and from the wash-liquor by precipitation on iron. The dried slime contained 0.84% Cu as received and 0.74% after roasting, the copper content of the final tailings being about 0.2%. Over 90% of the extraction was found to occur in the sloping trough. In one run extending over 12 days, during which 388 tons of dried slime was treated, sulphates corresponding to 10 lb. Cu, 4.3 lb. Fe, and 16.2 lb. Al_2O_3 per ton of slime leached were accumulated in the solutions, and the acid consumed was 49 lb. Particulars of mechanical and other details are also given, together with diagrams illustrating the various stages in the progress of the tests.

—W. E. F. P.

Copper slags; Metal loss in—F. E. Lathe. Eng. and Min. J., 1915, 100, 215—217, 263—268, and 305—308.

THE important literature on the subject is reviewed

and diagrams are given showing the variation of copper in slags with composition and with the copper contents of corresponding mattes. The experience of various authors is quoted as indicating that the copper in slags is not entirely in the form of suspended particles of matte, but is also present in the oxidised condition. Investigations at the works of the Granby Consolidated Mining, Smelting and Power Co., Ltd., Grand Forks, B.C., showed that by deepening the blast-furnaces and employing a series of settlers for the slag, the copper content of the latter was materially reduced. The presence of copper sulphide in slag was found not to preclude that of copper oxide; on the contrary, 50–75% of the copper in the slags under discussion was present in the oxidised form. Serious loss of copper from the presence of dissolved cuprous sulphide in slag is regarded as not proved. Loss from suspended matte particles may be reduced by settling, and slag losses generally decreased by careful study of conditions. Of the means suggested for reducing the loss of oxidised copper in slags, the proposal to provide the reverberatory furnace, near the skimming end, with a wall sufficiently high to keep back the main body of matte but low enough to allow the slag to flow over it, and to add pyrites to the slag thus separated, is regarded as the most promising for reverberatory practice.—W. E. F. P.

Brasses containing small percentages of tin; The constitution of —. O. F. Hudson and R. M. Jones. Inst. of Metals, Sept., 1915. [Advance proof.] 13 pages.

THE constitution of ternary brasses containing Cu 50–70% and Sn 0–5% was investigated at temperatures below the 460° C. critical point. The cooling curves showed that tin has no marked effect on the temperature at which the inversion of the β -constituent occurs; the critical point was found to vary between 450° and 466° C., but the variation did not seem to bear any relation to that of the amount of tin. Microscopic examination disclosed the colours of the constituents, β' appearing bright yellow, α reddish yellow, and δ (or γ) clear light blue. Equilibrium was practically attained after 24 hours' annealing, but in many cases a much shorter annealing appears sufficient. The photomicrographs prove that the commercially useful tin brasses have the same constitution as the corresponding copper-zinc alloys, with tin held in solid solution. A diagram is given showing the limits within which the ternary alloy consists of three phases, α , β' , and δ , in equilibrium.—W. R. S.

Brasses; Structural changes in industrial —. D. Meneghini. Inst. of Metals, Sept., 1915. [Advance proof.] 8 pages.

THE brass parts of certain incandescence gas-burners used in street-lighting became brittle and often broke after 2 or 3 months' use, while other burners of the same brass, which had been in use for several years, showed no defect. The metal contained Cu 64.5 and Zn 35%. Both the altered and normal parts were found to consist of a solid solution of pure α , only a few very fragile samples showing traces of β or of γ . Determination of hardness before and after annealing proved that the metal was much harder near the cracks; after annealing the hardness always decreased, but the decrease varied considerably in the same piece of alloy. It is suggested that partial annealing, due to reheating of the burner parts during use, may be followed by electrolytic action between the cold-worked and partially annealed parts of the same piece in contact with an electrolyte, such as sulphur dioxide condensed from the burner gases during wet weather.—W. R. S.

Copper in presence of tin; The iodide method applied to the determination of —. R. W. Coltman. J. Ind. Eng. Chem., 1915, 7, 764–766.

A QUANTITY of a copper-tin alloy containing not more than 0.25 grm. Cu and 0.1 grm. Sn is boiled with 15 c.c. of nitric acid (2:1) till completely decomposed, a volume of dilute sulphuric acid equivalent to 3 c.c. of the concentrated acid is added, and the solution is evaporated over a direct flame until a crystalline mass of stannic and cupric sulphates separates. After cooling, the residue is treated with 25 c.c. of water, and the solution evaporated till fumes appear. The cooled residue is dissolved by addition of 50 c.c. of cold water, a further 25 c.c. of water and 10 c.c. of 40% potassium iodide solution are added, and the liberated iodine is titrated with thiosulphate.—A. S.

Corrosion; The micro-chemistry of —. Part IV. Gun-metal. C. H. Desch and H. Hyman. Inst. of Metals, Sept., 1915. [Advance proof.] 11 pages. (See also this J., 1915, 258.)

Two alloys containing copper, tin, and zinc approximately in the proportions 88:10:2 and 84:14:2 were tested, with and without preliminary thermal treatment, in the corrosion apparatus previously used. At 1.3 volts the eutectoid was still unattacked, while the α -regions were deeply pitted. The critical voltage, above which the eutectoid is attacked, was always in the neighbourhood of 1.4 volts. The corrosion of the α -constituent was found to be uniform; where β was present, the action on α was only slightly more rapid than on β . The weight of metal removed by corrosion was much less than that of the brasses under similar conditions, a white adherent film of basic tin salt being formed; a pure α -alloy was corroded more rapidly than one containing the eutectoid.—W. R. S.

Copper-rich kalcoids; Notes on the —. S. L. Hoyt and P. H. M. P. Brinton. Inst. of Metals, Sept., 1915. [Advance proof.] 11 pages. (See also this J., 1913, 1112.)

THE heat effects produced at 520° and 590° C. in copper-zinc-tin alloys rich in copper were found to be separate and distinct. Chill cast specimens are unsuitable for use in locating the eutectoid line by microscopic means, the microstructure normal to that composition being only produced after reheating, annealing, and cooling to the ordinary temperature. The questions whether the grey or blue constituent, formed by adding tin to the brasses, is the γ constituent of the Cu-Zn alloys or δ of the Cu-Sn series, or both; and whether it is identical with the light grey constituent of the eutectoid of the copper-rich kalcoids, are also discussed.—W. E. F. P.

Cu₂S—Ni₃S₂; The equilibrium diagram of the system —. C. R. Hayward. Trans. Amer. Inst. Min. Eng., 1915, 48, 141–152.

HEATING and cooling curves of mixtures of Ni₃S₂ (the stable sulphide) and Cu₂S show that the system is eutectiferous between 2.5 and 90% Ni₃S₂. Outside this range there is a series of solid solutions. The eutectic contains 77% Ni₃S₂ and solidifies at 728° C. The melting point of Ni₃S₂ is 794° C., and that of Cu₂S, 1130° C. The molten mattes do not separate into layers and there is no evidence of chemical compounds of the two sulphides. Microphotographs of the different mattes confirm the thermal results.—T. St

Alloys for high-speed superheated steam turbine blading; Specifications for —. W. B. Parker. Inst. of Metals, Sept., 1915. [Advance proof.] 47 pages.

MATERIAL used in blading high-speed turbines

driven by superheated steam should satisfy the following requirements: It should be in a physically stable condition, free from internal stresses, non-corroding in damp steam, and resisting steam erosion. The proportionality limit (*i.e.*, the point at which the elongation ceases to be proportional to the load) should be at least 16 tons per sq. in., and should remain constant within 10% over the whole range of 100°–400° C. The maximum stress should be at least twice the proportionality limit, and remain constant over the same range of temperature. The greater the natural hardness of the metal in the soft or annealed condition the better: 30° by Shore's scleroscope would be desirable. The thermal expansion should preferably be low, with a constant coefficient between 100° and 500° C. Ductility is not of special importance, while low specific gravity would be an advantage. Definitions are given of the terms used in describing the physical properties of alloys, together with a list of non-ferrous alloys used, or formerly used, in the manufacture of blades. Brass is too soft and anneals readily in superheated steam. Pure copper is also unsuitable, while pure nickel free from carbon is difficult to obtain. Cobalt has not been sufficiently investigated. Pure Monel metal (copper-nickel) may be used for stationary blades under certain conditions. Aluminium-bronze anneals readily, like brass. Copper-aluminium-manganese and copper-aluminium-nickel alloys, rich in copper, may repay further investigation. The most useful alloy up to the present is pure phosphor-bronze; alloy steels are being used chiefly for want of a better non-ferrous material, in spite of their common tendency to rust.—W. R. S.

Metallic crystal twinning [in tin and zinc] by direct mechanical strain. C. A. Edwards. Inst. of Metals, Sept., 1915. [Advance proof.] 16 pages.

THE evidence adduced by Carpenter and the author (J. Iron and Steel Inst., 1914, 89, No. 1) that twinning is produced at ordinary temperatures in tin, zinc, and cadmium is regarded as inconclusive by Rosenhain, who considers that, as tin undergoes spontaneous annealing at ordinary temperatures, the twinning, if present, is due to recrystallisation of the metal occurring simultaneously with the straining. The nature of the acicular markings formed by strain on the surfaces of tin and zinc has now been investigated, and the evidence adduced is regarded as undoubtedly confirming the author's original contention. The appearance or non-appearance of twin markings was found to coincide with the application of compressional or tensional strain, respectively, and the author is of opinion that no broad twin markings would be formed if pure tensional strain could be applied to tin crystals. The strained specimens were polished before examination so as to obtain a perfectly plane surface and eliminate possible markings due to superficial inequalities produced by slip. Much difficulty was experienced in devising means free from objection as regards possible alteration of an appreciable thickness of the metal by grinding, etc., the method finally adopted consisting in immersing the strained specimens in strong acid until the desired result was attained, then polishing the surface on chamois leather and etching as usual. Rose (Trans. Faraday Soc., May, 1915, 77) found that although marked softening occurred in tin kept at 14° C. for 1½ hrs., no change occurred in metal kept at 0° C. for 30 mins. If the twin crystals produced by straining tin are in any way connected with annealing, they should, therefore, not be formed if the straining is conducted below 0° C., but large numbers of twin crystals, visible to the naked eye, were produced by straining tin kept at the temperature of liquid air. In con-

sidering the mechanism of the change and the relation of mechanical twinning to the hardness of metals generally, existing views are compared and summarised, and it is concluded that the available evidence indicates that crystal twinning involves internal movement of a kind productive of amorphous layers.—W. E. F. P.

Metal castings; Detection of internal blowholes in — by means of X-rays. C. H. Tonamy. Inst. of Metals, Sept. 1915. [Advance proof.] 4 pages.

THE specimen is placed on a photographic plate under an X-ray tube; the position of blowholes will be indicated by spots on the radiograph. By taking radiographs in two directions at right angles to one another, it is stated that the depth of the blowholes beneath the surface can be determined.—W. R. S.

Mineral industry in Spain. U. S. Comm. Rept. Suppl., No. 15d., Sept. 2, 1915.

IN 1914 there were 2,471,044 acres of mining lands being worked, and the present annual output of mineral ore is capable of being doubled. The district of Huelva is rich in copper, Ciudad Real in mercury, and Cordoba in anthracite. The Province of Viscaya produces 30% of the coal, Murcia 5%, and Almeria 2%. Coal is also mined in Oviedo and Leon, salt in Alicante and Cadiz, lead in Ciudad Real and Cordoba, zinc in Santander and Murcia, lignite in Teruel, silver in Guadalajara, manganese in Oviedo, asphalt in Alava, and antimony in Leon. During the last 10 years the production of coke, iron, and steel has doubled, while that of silver has increased 50%, mercury 30%, and pig iron 300%.

The production of the mining-metallurgical industries in Spain during 1913 represented a total value of over £20,000,000, more than half of which represents the metals extracted at smelting and other works. There was an increase in the output of iron ore and iron pyrites, soft coal, lead ore, anthracite, sulphur, and common salt and a falling off in copper ore, argentiferous lead, lignite, and zinc. The production of iron ore in 1913 (the latest available figures) was 9,861,668 metric tons, an increase of 728,661 tons over 1912; that of iron pyrites, 926,913 tons, an increase of 505,843 tons; bituminous coal, 3,783,214 tons, an increase of 157,548 tons; lead ore, 279,078 tons, or 88,916 tons more than 1912; anthracite, 232,517 tons; sulphur, 62,653 tons, an increase of 20,309 tons; and common salt, 26,238 tons. Copper ore showed a decrease of 1,097,464 tons, as compared with 2,268,691 tons in 1912; silver-bearing lead ore, a falling off of 70,250 tons from 93,850 in the preceding year, and zinc ore, 3480 tons less than that of 1912, which was 5,251 tons.

In the list of minerals mined in Spain during the year 1913 uranium ore appears for the first time, the quantity being given as 1 metric ton. This mineral is found near the Portuguese frontier.

The copper district of Spain extends over an area of 52,660 acres, of which only 8073 acres are productive. The greater part, 6548 acres, of the district exploited is in the Province of Huelva, where there are 53 copper mines, including 11 containing pyrites as well. The older method of smelting has been largely replaced by the sulphur process. Low grade ore, formerly neglected, is now being largely and successfully worked. Spain's output of copper in 1914 amounted to 36,515 metric tons. The total area of the Spanish mercury district is 489,679 acres, of which 485,585 acres are productive, containing 24 mines. The mines of Almaden in 1913 produced 1223 metric tons. The great quantities of mercury employed in the preparation of fulminate for cartridges has increased the demand for this metal since the war.

The greater part of the iron ore of Spain is mined in the Provinces of Viscaya, Santander, and Guipuzcoa, and the trade is accordingly centred in the neighbourhood of Bilbao. In the Province of Viscaya there are 120 productive iron mines, with a superficial area of 6430 acres. A number of new blast furnaces have been constructed recently.

Mineral exports of Chile. Eng. and Min. J., Sept. 11, 1915.

THE mineral exports of Chile during 1914 are reported by the Boletín de la Sociedad Nacional de Minería as follows: Gold bars, 14,704 kilos.; silver bars, 4,843,272 kilos.; auriferous silver bars, 221.85 kilos.; gold and silver precipitate, 667.1 kilos.; copper bars, 25,790,515 metric tons; copper matte, 15,987 metric tons; cement copper, 10 metric tons; gold ore, 32,742 metric tons; gold-silver ore, 369,328 metric tons; gold-copper ore, 1,764,831 metric tons; silver-copper ore, 493,302 metric tons; silver-lead ore, 13,155 metric tons; gold-silver-copper ore, 710,818 metric tons; copper ore, 68,892,545 metric tons; copper-zinc ore, 8 metric tons; molybdenum ore, 2,704 metric tons; lead ore, 105,251 metric tons; iron ore, 63,505.6 metric tons; coal, 266,972 metric tons; nitrate, 1,846,783 metric tons; perchlorate, 55.43 metric tons; borate, 34,203.6 metric tons; iodine, 188,952 metric tons. The total fine copper contained in the exports was 45,682 metric tons, this figure being the greatest ever reached, due to the increased production of the Braden Copper Co. The nitrates and borates suffered a loss, owing to the closing of the European market, the exportations of the last half of the year being only about one-half of those of the first half-year.

[Corrosion due to the] lubrication of Diesel engines and air compressors. Moore. See I.

Anodic potentials of silver. Reedy. See XI.

PATENTS.

Steel alloys; Manufacture of—. Soc. Anon. des Acieries et Forges de Firminy, Firminy, France. Eng. Pat. 3427, Mar. 3, 1915. Under Int. Conv., Mar. 28, 1914.

FROM 1 to 6% of copper is added to chromium-nickel steels containing 1–4% Cr and less than 3.5% Ni, the total quantity of copper and nickel being from 3.5 to 8%. Great hardness may be imparted to the steels, even to pieces of tolerably large section, by moderately energetic tempering or by cooling in air after heating to 800° C., and they may be very easily softened by the usual process for annealing carbon steels.—A. S.

Steel; Process of treating—. C. H. A. F. L. Ross, Balnagown Castle, Scotland. U.S. Pat. 1,151,049, Aug. 24, 1915. Date of appl., July 27, 1914.

STEEL is subjected to a bath of molten metal at about 1400° F. (760° C.), to which heat equivalent to more than 125 British thermal units per pound of steel is imparted in less than 10 mins. The steel is then immediately quenched in a bath containing sal ammoniac, alum, and common salt, at below 130° F. (56° C.), and reheated to about 1000° F. (538° C.). The steel next receives during 8 mins. heat equivalent to less than 125 British thermal units per pound and is afterwards immediately quenched at below 120° F. (49° C.).—T. St.

Blast-furnace construction. L. L. Knox, Avalon, Pa., Assignor to Knox Pressed and Welded Steel Co., Pittsburgh, Pa. U.S. Pat. 1,151,192, Aug. 24, 1915. Date of appl., April 19, 1913.

THE masonry wall above the bosh is at least partially encased by a water-cooled jacket made

up of a number of separately removable box-like members which have connections to allow of water being circulated. The inner walls of the hollow units are sufficiently flexible to yield to the expansion movements of the masonry wall.—T. St.

Metal; Process of recovering— from ore. H. Wade, London. From New Metals-Process Co., Chicago, U.S.A. Eng. Pat. 17,324, July 21, 1914.

A MIXTURE of ore with several times its volume of coke or charcoal, mainly in large pieces, is preheated to about 2000° F. (1090° C.) and then fed into a deoxidising chamber, in the lower part of which a temperature of about 3500° F. (1930° C.) is maintained by burning a quantity of raw fuel with a regulated supply of air. The reduced metal is obtained in the form of fused globules or lumps, which are separated from the unburnt charcoal or coke, the latter, with any adhering particles of metal, being used with a fresh charge of ore. The process is carried out in the furnace described in Eng. Pat. 17,323 of 1914 (this J., 1915, 910) and is suitable for oxide or carbonate ores of iron, copper, manganese, lead, and zinc.—A. S.

Sulphide ores; Separation of metallic—. Minerals Separation and De Bavy's Processes Australia Proprietary, Ltd., Melbourne, Australia. Eng. Pats. (A) 19,373 and (B) 19,374, Sept. 2, 1914. Under Int. Conv., Sept. 3 and 4, 1913.

(A) MIXED lead-zinc sulphide ore, especially slime, is violently agitated in water, with addition of a quantity of sulphuric acid less than that required to separate both lead and zinc sulphides by flotation, and with or without addition of a frothing agent such as eucalyptus oil. The float concentrate consists mainly of lead sulphide, and the tailings may be subjected subsequently to a further froth flotation treatment to separate the zinc sulphide. Instead of adding the acid during the flotation treatment, the ore may be submitted to a preliminary digestion with an acid solution. (B) The ore is violently agitated in water, with addition of a predetermined quantity of a frothing agent such as eucalyptus oil, namely the quantity required to effect separation of the lead sulphide. The tailings may be subjected subsequently to further treatment, with addition of more of the frothing agent, to separate the zinc sulphide. Instead of water, a neutral or alkaline solution of salts, or mineralised water obtained from underground workings, may be used as specified in Eng. Pat. 11,939 of 1913 (this J., 1914, 698).—A. S.

Ore separating machines. H. H. Thompson, Aldridge, Staffs., and A. E. Davies, Hockley Heath, Warwick. Eng. Pat. 21,119, Oct. 17, 1914.

THE separator comprises a disc armature rotating adjacent to the ore carrier, *c.g.*, an endless band, and to stationary magnet pole pieces, the arrangement being such that the armature is influenced by at least two pole pieces and two distinct regions of magnetic influence are produced on opposite sides of the disc. Any magnetic particles which fail to be attracted when passing the first region are separated when they reach the second region of influence. When treating materials of different degrees of magnetic permeability, the armature may be disposed at an angle to the ore carrier, so that the magnetic fields at the opposite sides are of different strengths, or one or more additional armatures may be provided. Means are provided for varying the distance of the armatures from the ore carrier and from the pole pieces.—A. S.

Ore-separating process. A. J. Moxham, Wilmington, Del. U.S. Pat. 1,151,117, Aug. 24, 1915. Date of appl., April 6, 1912; renewed Jan. 22, 1915.

THE separate particles of mixed solids of different

specific gravities are coated with a material so that the specific gravities are reduced to such an extent that the constituents can be separated by immersion in a liquid having a specific gravity intermediate between the reduced specific gravities of the solids.—T. SR.

Electric heating for metal working [welding]. The British Thomson-Houston Co., Ltd., London. From General Electric Co., Schenectady, N.Y., U.S.A. Eng. Pat. 19,942, Sept. 18, 1914.

IN working or welding metals, such as copper, by the electric resistance method, the portion of the work being heated is subjected to a jet of cooling liquid, e.g., water, which is continued after the heating current is cut off. In this way oxidation and deleterious alteration of structure of the metal are prevented.—A. S.

Zinc tailings; Process of treating—A. C. Spencer, Washington, D.C. U.S. Pat. 1,150,897, Aug. 24, 1915. Date of appl., Apr. 22, 1909.

PULVERISED ores containing calcareous gangue, especially tailings from ores of the franklinite-willemite type, are calcined under oxidising conditions, at a temperature sufficient to overburn the lime produced, and the overburnt lime is separated from the accompanying heavy minerals.—F. SODN.

Alloy and process of producing the same. J. L. Brown, Assignor to E. R. Cooper, Baltimore, Md. U.S. Pat. 1,151,160, Aug. 24, 1915. Date of appl., Jan. 22, 1912.

THE alloy contains 60 to 90% zirconium, the rest being mainly iron. It is substantially free from oxides and metalloids, and is malleable and ductile.—T. SR.

*Cuprous sulphide; Recovery of—*from ores. R. F. Bacon, Pittsburgh, Pa., Assignor to Metals Research Co., New York. U.S. Pats. (A) 1,151,234 and (B) 1,151,235, Aug. 24, 1915. Date of appl., Jan. 24, 1914.

(A) THE ore is leached by a suitable solvent and the copper precipitated from the liquor by hydrogen sulphide, whereby the solvent is regenerated. The cupric sulphide, is reduced to cuprous sulphide by subjecting it, with or without an added quantity of free sulphur equivalent to one-half of the sulphur in the cupric sulphide, to the action of a hydrocarbon, the hydrogen sulphide given off being used to precipitate a fresh quantity of copper. (B) Cupric sulphide, is reduced to cuprous sulphide by means of a boiling hydrocarbon in a reducing atmosphere.—W. R. S.

*Cuprous sulphide; Recovery of—*from ores and the like. Metals Research Co., New York, and R. F. Bacon, Pittsburgh. U.S.A. Eng. Pat. 143, Jan. 4, 1915. Under Int. Conv., Jan. 24, 1914.

SEE U.S. Pat. 1,150,234 of 1915; preceding. Reduction of the cupric to cuprous sulphide is effected at a temperature not above 500°C. with an excess of hydrocarbon, and the residual hydrocarbon is subsequently recovered by distillation.

Copper; Metallurgy of—R. F. Bacon, Pittsburgh, Pa., Assignor to Metals Research Co., New York. U.S. Pat. 1,151,236, Aug. 24, 1915. Date of appl., Mar. 20, 1915. (See also preceding abstracts.)

A CYCLE of operations for recovering copper from solutions consists in producing hydrogen sulphide from hydrocarbons and sulphur, and precipitating the copper as sulphide, with simultaneous regeneration of the solvent, by means of a part of the hydrogen sulphide; from the other part sulphur is regenerated by interaction with sulphur dioxide produced by roasting the copper sulphide.—W. R. S.

Copper and its alloys: Alloys or compounds for improving—C. Vickers, Niagara Falls, N.Y., Assignor to The Titanium Alloy Manufacturing Co., New York. U.S. Pat. 1,151,744, Aug. 31, 1915. Date of appl., Jan. 8, 1913.

AN alloy of copper, titanium, and magnesium, in proportions decreasing in the order given.—A. S.

Tempering metals; Method and apparatus for—J. A. Dyblie, Joliet, Ill. U.S. Pat. 1,151,675, Aug. 31, 1915. Date of appl., Sept. 21, 1914.

THE apparatus consists of an inner tank containing oil, surrounded by water in an outer tank. The water is passed through coils placed in the oil tank on its way to the outer tank, and oil is withdrawn from the hotter portion of the oil tank, forced by a pump through coils immersed in the water in the outer tank, and back to the cooler part of the oil tank.—A. S.

Waste heat of smelters and kindred plants; Recovering the—C. Semmler, Wiesbaden, Germany. U.S. Pat. 1,151,831, Aug. 31, 1915. Date of appl., Dec. 9, 1913.

A LIQUID heat-absorbing medium flows from the lower part of a heat-accumulator and is forced by a pump into a number of heat-yielding devices receiving heat from independent sources. The liquid flows back to the upper part of the heat-accumulator through a separate conduit provided, near the heat-accumulator, with a check-valve to prevent vaporisation of the heated liquid whilst passing through the conduit.—A. S.

Manganese steel; Heat treatment of—Poldihütte Tiegelgussstahlfabrik, Vienna. Eng. Pat. 12,011, May 15, 1914. Under Int. Conv., May 7, 1913. SEE Fr. Pat. 472,185 of 1914; this J., 1915, 430.

Steel; Treatment of—A. Hethey, London. Eng. Pat. 17,285, July 21, 1914. Under Int. Conv., July 21, 1913.

SEE U.S. Pat. 1,089,410 of 1914; this J., 1914, 424.

Ores; Magnetic separation of—B. Schwerin, Frankfurt, Germany. Eng. Pat. 19,313, Sept. 1, 1914. SEE U.S. Pat. 1,063,893 of 1913; this J., 1913, 757.

Sulphide ores; Separation of mixed—H. Lavers, Surrey Hills, Victoria, Assignor to Minerals Separation American Syndicate (1913), Ltd., London. U.S. Pat. 1,142,821, June 15, 1915. Date of appl., May 28, 1914.

SEE Eng. Pat. 16,302 of 1913 and Fr. Pat. 469,677 of 1914; this J., 1914, 869; 1915, 35.

Metals; Electric deposition of—by fusion. A. P. Strohmenger, Assignor to Slaughter and Co., Ltd., London. Re-issue No. 13,970, Aug. 24, 1915 (date of appl., Mar. 23, 1915), of U.S. Pat. 1,073,543, Sept. 16, 1913.

SEE this J., 1913, 981.

Zinc; Arrangement for preventing the formation of smoke [fume] in the production of—A. Roitzheim, Duisburg-Rohrort, Germany. U.S. Pat. 1,152,050, Aug. 31, 1915. Date of appl., Apr. 1, 1913.

SEE Fr. Pat. 455,726 of 1913; this J., 1913, 949.

Galvanising bath. N. K. Turnbull, Manchester. U.S. Pat. 1,151,629, Aug. 31, 1915. Date of appl., Feb. 17, 1915.

SEE Eng. Pat. 5089 of 1914; this J., 1915, 431.

Foil, bronze foil, and metal foil; Manufacture of coloured—C. and H. Sturm, München-Gladbach, Germany. U.S. Pat. 1,152,060, Aug. 31, 1915. Date of appl., May 6, 1914.

SEE Eng. Pat. 9384 of 1914; this J., 1914, 869.

XI.—ELECTRO-CHEMISTRY.

Silver; Anodic potentials of—. J. H. Reedy. Amer. J. Sci., 1915, 40, 281—298.

THE potential difference which must exist between a metal and a solution before a definite action can commence is termed the "reaction potential," and is best determined by the third-electrode method, in which no current flows in the subsidiary circuit, thus insuring a constant potential for the reference electrode. The cell containing the electrolyte is subjected to a gradually increasing voltage, and a curve is plotted with the electrode potentials as abscissae and the corresponding current strengths as ordinates. For polarisable silver electrodes, where the products of the reaction are soluble, the point of greatest curvature on the graph may be taken as the reaction potential. A large number of electrolytes show the same reaction potential (0.521 volt) with silver anodes, regardless of their concentration, and this value is interpreted as the solution potential of silver. Reaction potentials below 0.521 volt appear in cases where the ions give up their electric charges very readily and are deposited on the silver anode; these deposition potentials, except in the neighbourhood of the solution potential of silver, are logarithmic functions of the dilution, and are higher than for electrodes of bright silver. Certain electrolytes show two reaction potentials, the lower one due to the deposition of the anion, the other (0.521 volt) due to the solution of the silver. With the exception of copper and mercury, the presence of cations of other metals has no effect on the reaction potentials of silver. In the case of the cations of copper and mercury the solution potentials are abnormally high, possibly owing to the formation of solid solutions with silver, and consequent lowering of its electrolytic solution pressure.—W. G. C.

PATENTS.

Electrical charge of a diaphragm for processes depending on electro-osmosis; Method of influencing the—. Ges. für Elektro-Osmose m.b. H., Frankfurt, Germany. Eng. Pat. 21,189, Oct. 19, 1914. Under Int. Conv., Nov. 6, 1913.

THE working charge of a diaphragm may be altered as required during the working process, by causing it to adsorb a suitable material, or by eliminating previous adsorptions from it.—B. N.

Treatment of materials for impregnating [tanning] them electro-osmotically. Eng. Pat. 19,849. See XV.

XII.—FATS; OILS; WAXES.

PATENTS.

Liquids [e.g., oils] from seeds and the like; Apparatus for the extraction of—. A. F. Craig and Co., and F. Morfitt, Paisley. Eng. Pat. 21,360, Oct. 22, 1914.

PRESSES are arranged at equidistance round a carriage which rotates horizontally and conveys press-boxes in rotation beneath each press. The carriage consists, preferably, of upper and lower ring frames, each with an upper and a lower flange; the lower flange of the lower frame rotates on rollers or the like in a channel secured to the lower part of the press-frames.—C. A. M.

Cottonseed drier. A. B. Carr, Atlanta, Ga. Assignor to The Procter and Gamble Co., Cincinnati, Ohio. U.S. Pat. 1,150,996, Aug. 24, 1915. Date of appl., Jan. 5, 1914.

THE seed is dried in vertical racks each formed by a series of mutually inclined plates. A feed roller

with pockets in its periphery rotates between the two bottom plates of each rack; one of these plates, which is pivoted, is held normally against the roller, but is free to swing outwards to allow for the action of the latter.—C. A. M.

Oils or fats; Process of hydrogenating—. W. D. Richardson, Assignor to Swift and Co., Chicago, Ill. U.S. Pat. 1,151,045, Aug. 24, 1915. Date of appl., Nov. 11, 1912.

THE fat is mixed with nickel or other catalytic metal which has been electrically disintegrated in an organic liquid, the mixture hydrogenated, and the nickel separated from the product.—C. A. M.

Oils; Treatment of mineral and vegetable—. J. J. Hood and A. Gordon Salamon, London, Assignors to The Oil Refining Improvements Co., Ltd., Glasgow. U.S. Pat. 1,151,523, Aug. 24, 1915. Date of appl., May 12, 1910.

SEE Eng. Pats. 16,617 and 24,209 of 1908; this J., 1909, 1081.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Pontianak (Jelutong) rubber resin. C. Ellis and A. A. Wells. J. Ind. Eng. Chem., 1915, 7, 747—750. (See also this J., 1912, 35.)

A SAMPLE of crude Pontianak rubber resin melted at 126° C. and contained about 95% of unsaponifiable matter. When heated above its melting point (e.g. to 204°—316° C.), acetic acid and other volatile products were evolved and the product subsequently melted at about 77°—78° C. The melting point was lowered still further by heating at 343° C. under a reflux condenser, and finally a plastic mass was obtained, whilst at higher temperatures destructive distillation took place. The iodine value of the resin was increased by heating and the product was somewhat more soluble in organic solvents than the original resin. In general the best solvent is benzol; in many cases resin is deposited from the solutions on standing. In some cases the solutions give frosted films and in others clear films when dried on glass. Films prepared from solutions composed of equal parts of the plastic resin and heavy benzene were scarcely affected by 5% caustic soda solution.—A. S.

PATENT.

Pigment and making the same. R. Just, Ludwigshafen, and F. Eckhard, Mannheim, Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen, Germany. U.S. Pat. 1,150,863, Aug. 24, 1915. Date of appl., Oct. 22, 1912.

SEE Ger. Pat. 260,428 of 1912; this J., 1913, 705.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Rubber producers in the temperate zone; Possible—. C. P. Fox. Rubber Industry, London, 1914, 395—398.

AMONG rubber-producing plants suitable for various sections of the temperate zone the following are enumerated:—*Atractylis gummifera*, S. Europe; *Eucommia ulmoides* ("Chinese Rubber Tree"), N. China; *Asclepias cornuti* (Milkweed), U.S.A.; *Apocynum cannabinum* (Indian hemp), U.S.A.; *Soucheus* (Sow Thistle); *Lactuca Canadensis* and *L. virosa* (Wild lettuce); *Parthenium argentatum* (Guayule); *Actinella Richardsonii* (Pingue), New Mexico and S. Colorado; a *Parthenium* (Mariola); "Nevada Greasewood"; a *Composita* ("Strockles Rubber Bush"); an *Euphorbia* (Candelilla);

Ficus elastica and *F. aurca*, S. Florida; *Bumelia lanuginosa* (Texas "Stretchberry"); *Euphorbia triangulifolia* (Hedge Spurge), yielding "Cuban Rubber." Of the above only the Guayule and the Pingue have so far been found to contain enough rubber to ensure profitable working. The remainder may be improved by careful selection and cultivation.—E. W. L.

Pontianac (Jelutong) rubber resin. Ellis and Wells. See XIII.

PATENTS.

Caoutchouc; Manufacture of synthetic—. A. Heinemann, London. Eng. Pat. 15,572, June 29, 1914. Addition to Eng. Pat. 18,506, Aug. 12, 1912 (this J., 1913, 1022).

METHYL acetate may be used in place of ethyl acetate as an addition to isoprene or polymerised isoprene for the purpose of precipitating the real caoutchouc whilst retaining in solution other caoutchouc-like substances.—E. W. L.

Rubber-coated fibrous materials; Machines for the manufacture of—. J. W. H. Dew and The Azulay Syndicate, Ltd., London. Eng. Pat. 19,142, Aug. 27, 1914.

AFTER being coated in the usual way, the material is carried through a drying chamber on a belt or band conveyor in contact with heating pipes, so that the solvent is removed readily and the material dried thoroughly. The dried material is wound on a bobbin driven from the belt-conveyor spindle. The machine is specially suited for very thin strips of material.—R. G. P.

Latex; Treatment [coagulation] of—. S. C. Davidson, Belfast. Eng. Pat. 22,138, Nov. 6, 1914.

A SOLUTION of 1 part of sodium thiosulphate in 16 parts of "alkalised cresol" (see this J., 1914, 758) is stirred into *Hevea* latex in the proportion of from 1 to 5%. Usually the solution is diluted considerably, with hot or cold water, before addition to the latex. The latex is allowed to stand for about 24 hours and then coagulated by means of a 1–2% solution of sulphuric acid, added in quantity about equal to that of the original latex. Other acids, such as acetic, trichloroacetic, and hydrochloric, may also be used. The sulphur dioxide evolved on addition of the coagulant has a preservative and sterilising action on the rubber. (Reference is directed, in pursuance of Sect. 7, Sub-sect. 4, of the Patents and Designs Act, 1907, to Eng. Pats. 25,256 of 1911, and 16,352 of 1912; this J., 1913, 98, 876.)—E. W. L.

Rubber latex; Process of treating and handling—. S. Milne, Edinburgh. Eng. Pat. 24,680, Dec. 28, 1914.

RUBBER latex is rendered suitable for storage or shipment by the evaporation of water in quantity insufficient to cause coagulation. The concentrated latex is suitable subsequently for various manufacturing purposes after the addition of water. The latex is evaporated either in open vessels or *in vacuo*, and the concentrated latex may be heated or treated with preservatives to prevent decay; it is stored in air-tight containers.—R. G. P.

Compositions of matter [rubber substitutes, etc.]; Process of manufacturing—. W. Plinatus, Paris. Eng. Pat. 12,143, May 24, 1913.

SEE Fr. Pat. 465,047 of 1913; this J., 1914, 558.

Elastic substances; Manufacture of—. F. W. Herbold, Assignor to W. E. Reeser, Amsterdam, Netherlands. U.S. Pat. 1,151,948, Aug. 31, 1915. Date of appl., Dec. 16, 1912.

SEE Eng. Pat. 25,912 of 1912; this J., 1913, 615.

XV.—LEATHER; BONE; HORN; GLUE.

Tanning materials; Extraction of— and *determination of water-soluble matter in leather.* E. Nihoul. Collegium (London), 1915, 233–236.

THE use of pressure in extraction is condemned both on theoretical and practical grounds. Samples of leathers were extracted by the Procter and Koch methods, the figures showing that soluble matter is much more quickly extracted without the use of pressure, and that non-tannins are more easily extracted than tannins. To obtain correct results it is necessary to use more than 1 litre of water, or to allow a longer time for the litre of water to percolate through the material than recommended by Paessler, or to heat gently during the operation in order to facilitate the solution of the difficultly soluble tannins; in no case is the use of increased pressure permissible. It is recommended that the height of the column of material to be extracted, in the extraction vessel, should be $1\frac{1}{2}$ times its diameter, and that Procter's extraction apparatus should be connected with a constant-feed device so as to render its operation continuous.—F. C. T.

Tanning industry of the Philippines. J. Roy. Soc Arts, 1915, 63, 921.

AN effort is being made to stimulate and develop the leather industry in the Philippine Islands. About 18,000 skins are tanned annually in the islands. The leather produced is manufactured into slippers and shoes of the lower grades. The value put upon this annual output of the tanneries is about £30,000. The 125 tanneries are scattered through various provinces. The tanning is poorly done and the skins are poorly selected. The Bureau of Science recommends that four months be devoted to the tanning process. The process proposed is to immerse the skins first in a solution containing about 0.5% of tannin and pass them gradually to baths of stronger solutions, the last solutions containing 10 to 15% of tannin. The present practice is generally to immerse the skins in a strong solution at first and allow them to remain only four or six weeks. The result is preserved skins rather than leather.

The Philippines are rich in tanning materials, which, properly employed, would make locally produced leather not only of the highest class, but also cheaper than that produced elsewhere. The mangroves, which abound in different parts of the islands, and the camachile tree (*Pithecolobium dulce*) which grows in great abundance in the Philippines, furnish a large percentage of tannin. The fresh bark of these contains often 15 to 25% tannin, but as a rule no more than 10% is utilised. The cost of 100 kilos. of camachile bark is 24s.; about 40 to 50 kilos. of bark is needed to tan a hide that in finished form should be worth £3, but because of its poor quality the leather turned out is worth only about £2.

Investigation of the present system reveals great wastage. In one tannery 1,500,000 lb. of bark was used, but it was found that only 40% of the tannin was utilised. Again, a poor quality of lime is used for depilation, insufficient care is exercised in the washing process, and the tanned product is dried too rapidly.

PATENTS.

Treatment of materials for impregnating [tanning] them electro-osmotically. Ges. f. Elektro-Osmose, Frankfurt, Germany. Eng. Pat. 19,849, Sept. 16, 1914. Under Int. Conv., Sept. 19, 1913.

HIDE is tanned by electro-osmosis by utilising the material to be treated as a partition, without fitting it tightly to the walls, to divide the space

between suitable diaphragms, the latter being so selected that the active constituents cannot migrate through them, whereas substances affecting the osmotic action unfavourably pass through and are separated from the liquid. Constituents which hinder or delay the process, are removed from the hides or skins electro-osmotically by desorption, before the actual tanning. During treatment, the hides or skins are caused to acquire automatically a potential suitable for the tanning substances used; with tannin, this must be of an electropositive character, and with chromium compounds electronegative.—B. N.

Tanning process. W. S. Shaw, Boyne City, Mich. U.S. Pat. 1,149,298, Aug. 10, 1915. Date of appl., Sept. 10, 1914.

HIDES are immersed in a tanning solution (which may be weak at first and increased in strength subsequently), and the liquid is caused to boil under reduced pressure at a temperature (not higher than 75° F.) sufficiently low not to injure the hides. When the hides are partially tanned, the air pressure and temperature are gradually increased until the tanning is completed. (Compare Eng. Pat. 26,040 of 1909 and U.S. Pat. 1,065,168; this J., 1910, 1216; 1913, 761.)

—E. W. L.

Leather-board; Process for producing stock for leather-board, and —. A. L. Clapp, Braintree, Mass., Assignor to Hide-It Leather Co., Boston, Mass. U.S. Pat. 1,152,294, Aug. 31, 1915. Date of appl., Dec. 13, 1910.

STOCK for leather-board is prepared by mixing a colloidal substance with an inherently-water-repelling substance, emulsifying the mixture with an alkali, precipitating with a "salt-of-alum," and distributing the non-alkaline precipitate through a mass of fibrous leather pulp having an acid reaction.—R. G. P.

XVI.—SOILS; FERTILISERS.

Mechanical analysis [of soils]; Effect of changes in the viscosity of water on the results of the — at varying temperatures. G. W. Robinson, J. Agric. Sci., 1915, 7, 142—143.

WHEN samples of a mixture of ignited silt and fine sand were separated by sedimentation at different temperatures, it was found that the weight of sand deposited increased with the temperature, owing to the alteration in viscosity of the water used. It is therefore recommended that the operation should be performed at a constant temperature, e.g., 12°—14° C.—E. H. T.

Soil; Effect of grinding the — on its reaction [time requirement] by the Veitch method. P. E. Brown and H. W. Johnson, J. Ind. Eng. Chem., 1915, 7, 776—777.

WHEN acid soils are ground before being tested by the Veitch method (this J., 1901, 762), the acidity diminishes and frequently the reaction becomes basic, probably owing to hydrolysis of silicates. The effect produced by grinding depends upon the amount of sand present and is greater in coarse sandy soils than in fine sands.—A. S.

Humus; Effect of removing the soluble — on the productiveness of a soil. W. Weir, J. Agric. Sci., 1915, 7, 246—253.

THE soluble humus in an allotment soil and in a typical loam field soil was removed by extraction with 2% caustic soda solution, after the bases had been extracted previously with N/5 hydrochloric acid. By this treatment the nitrogen contents of the soils were reduced by 43.6 and

41.2% respectively. Both extracted and untreated soils were then used in pot culture experiments, chalk being added to replace the carbonates removed by the acid treatment, and 1 grm. of mono-potassium phosphate being given to each pot (capacity 10 kilos.); in each case the soil was mixed with sand. Wheat grown on the extracted soils gave a heavier crop and contained more nitrogen than that grown on the untreated soils. Mustard was then grown in the same soils, but with the exception of the untreated field soil, the crops were a failure. With rye, as a third crop, the results were similar to those obtained with the wheat. Mustard was then grown again and with better results, except for the extracted field soil, which was a complete failure; the extracted allotment soil gave a slightly better crop than the untreated. In five out of the eight crops, more nitrogen was taken up from the extracted than from the untreated soils. In another series wheat was grown on the same soils but from which about 5% less nitrogen had been removed. The yields were poor; the untreated allotment soil did better than the extracted, but the reverse was the case with the field soil, although in both cases the plants growing in the extracted soils had a more healthy appearance. The addition of 0.5% of untreated soil to the extracted soils in order to replace the bacterial flora did not influence the results. The removal of soluble humus caused the ammonia to increase and the nitrates to diminish. It is concluded that the absence of soluble humus did not diminish the productivity of the soils used.—E. H. T.

Potash; its distribution, commercial sources, and agricultural value. A. Smetham, J. Royal Lancashire Agric. Soc., 1915. [Reprint.]

AFTER reviewing briefly the present commercial sources and possible new sources of potash salts (compare Cresswell, this J., 1915, 387; also 1915, 958), the author shows that, so far as can be estimated, there is upwards of 9,000,000 tons of "available" potash (K_2O) in the top nine inches of the cultivated soil of the United Kingdom, and hence, if it were not for the special needs of certain soils and the requirements of particular crops, the quantity of potash imported from Germany (32,000 tons) could be regarded as negligible. It is estimated that the stocks and gains of potash (K_2O) in the United Kingdom in 1913 were:—Available potash in soils, 9,000,000; potash in crops, 1,000,000; in imported seeds and oil cakes, 25,000; in imported corn, etc., 31,000; imported from Germany, 32,000; total, 10,091,000 tons. The losses are estimated as:—Potash in crops from arable land, 80,000; in produce (meat, milk, etc.) from permanent grass land, 22,400; total, 102,400 tons. It would appear, therefore, that the temporary suppression of the German imports should have but little effect upon the agricultural production of the country as a whole. For those soils and crops which benefit most by a free supply of potash, the following measures are recommended as affording a more economical method of meeting the present deficiency of potash fertilisers than attempts to procure the necessary supplies from seaweed, hedge clippings, etc. (1) Deeper and better cultivation, to render available the potash in the subsoil. (2) Purchase of feeding stuffs: the annual average loss of potash from arable land in the crops sold is less than 9 lb. per acre, and this amount could be replaced by the purchase of 4 cwt. of decorticated cottonseed cake. (3) Conservation of farm manure. (4) Use of sodium nitrate: apart from its value as a nitrogenous fertiliser it tends to increase the amount of available potash. (5) Liming the soil. (6) Liberal use of other artificial fertilisers in order to induce greater root development and thus

permit of a greater absorption of the available potash of the soil. (See also Russell, this J., 1915, 915.)—A. S.

Manures; Influence of—on crop and soil of permanent meadow. C. Crowther and A. G. Ruston. J. Agric. Sci., 1915, 7, 197—218.

EXPERIMENTAL work on a light loam soil in a district of medium rainfall showed that it was more economical to dung the land biennially than annually, especially if artificial fertilisers (including sodium nitrate) were applied in the intervening year; and that the biennial dressing of dung was better than the application of a complete artificial manure. Owing to the lack of lime in the soil, hay grew much better with sodium nitrate than with ammonium sulphate, the continued application of which proved very detrimental. The persistent manurings caused changes in the botanical nature and the chemical composition of the herbage, in the power of the soil to provide plant food, and in the bacterial activity. The hay grown on dunged soil had apparently a better food value than that grown on land dressed with artificial fertilisers. As the rate of ammonia production is a better indication of the soil's activity than the total output over a long period, it is recommended that ammonia determinations be made at short intervals, *e.g.*, every 12 hours.—E. H. T.

Bacterised peat as fertiliser. W. B. Bottomley. Brit. Assoc., 1915.

EXPERIMENTS with auximones from bacterised peat (this J., 1915, 881) at Kew Gardens and in the Lea Valley have given some remarkable results. Plants apparently dying have been restored to normal and more than normal growth. Four potato sets, weighing a few ounces in all, placed in a small box of moss litter, and watered once a week with the extract from bacterised peat, produced 3 lb. of potatoes in eight weeks. Forty runner-bean plants yielded a bushel and a half of beans weekly. The best twelve of a number of radishes grown with ordinary manure weighed 3½ oz., whilst the second best dozen of others treated with bacterised peat weighed 5½ oz. One tomato plant had 16 lb. of fruit upon it at one time. At the experimental station in the Lea Valley eighteen cucumber plants treated with a complete manure of well-rotted dung and bone meal yielded 4 cwt. 1 qr. 8 lb. of fruit. Eighteen others, grown in nine parts of ordinary soil mixed with one of bacterised peat, gave 5 cwt. 3 qr. of fruit, of which 71 lb. was sent to market before a single cucumber was ready from the other crop. The bacterised peat can be produced for a few pounds a ton, and will probably be put on the market within the next few months. (See also this J., 1913, 878, 919, 920; 1914, 366, 975.)

PATENTS.

Mono-ammonium phosphate; Process of, and apparatus for, making—. F. S. Washburn, Nashville, Tenn. U.S. Pats. 1,142,068, June 8, 1915, and 1,151,074, Aug. 24, 1915. Dates of appl., Aug. 3, 1914 and Apr. 8, 1915.

FINELY ground phosphatic rock is treated with a slight excess of sulphuric acid, and the crude phosphoric acid solution is passed through a filter-press into a heating tank, and thence into two successive towers packed with bricks. In the first tower the acid is subjected to the action of ammonia and steam so that principally di-ammonium phosphate is formed, the waste heat being utilised in the heating tank. Into the second tower, which serves to collect the ammonia escaping from the first, a large amount of phosphoric acid is passed. The solution is then led into an adjusting tank where sufficient phosphoric acid is added to convert

any di- into mono-ammonium phosphate; methyl orange is used as indicator and phosphoric acid is added until the solution is slightly acid. The solution is evaporated in a multiple effect apparatus until it contains 10% of water, and is discharged at a temperature of about 112° C. into highly exhausted receivers, whereby a granular product sufficiently dry (3—4% H₂O) for mixing with most fertilisers is obtained. The salt can then be completely dried in an ordinary dryer without any danger of adhesion to the side walls.—E. H. T.

Fertiliser material and process of producing the same. F. S. Washburn, Nashville, Tenn. U.S. Pat. 1,151,633, Aug. 31, 1915. Date of appl., Apr. 16, 1915.

A SOLUTION of mono-ammonium phosphate is evaporated in the manner described in the preceding abstract, so that the phosphate is obtained as a porous, dry, granular mass, somewhat resembling pumice stone.—E. H. T.

Alkali compounds useful for fertilising; Process of obtaining—. T. L. Willson and M. M. Haff; Ottawa, Assignors to Southern Investment Co. of Canada, Montreal, Canada. U.S. Pat. 1,144,405, June 29, 1915. Date of appl., Dec. 18, 1911.

A MINERAL containing an alkali—*e.g.*, a potash mineral, or a potassium magnesium mineral—is heated to fusion with a compound of an alkaline earth, such as calcium phosphate. The fused product is pulverised, suspended in water, and sulphur dioxide passed through, the potash and phosphoric acid being recovered by evaporation of the resulting solution.—E. H. T.

Seeds; Treatment of— [before sowing]. C. E. de Wolf, London, and H. E. Fry, Godmanstone, Dorset. Eng. Pat. 21,888, Nov. 2, 1914.

To render seeds (particularly cereal and cotton seeds) more productive and to protect them from insects and birds, they are steeped in a solution or suspension of an organic or chemical manure (including in this term zinc salts and mineral acids) and a salt of iron, or of sodium chloride, nitrolim, nitrate of lime, nitric acid, or nitrous acid, to which a salt of iron may be added, and afterwards are sprayed with petroleum or benzoline. Good results are obtained, for example, by steeping wheat seeds for 4 hours, or seeds of barley, oats, or maize for 6 hours, in a liquid containing 10% of sodium chloride and 2% of ferric chloride, or 15% of sodium nitrate and 1% of ferric chloride, or 15% of nitrate of lime alone, and afterwards spraying them in a thin layer with about 1 quart of petroleum or benzoline per bushel. After 12—18 hours the seeds are ready for sowing.—J. H. L.

XVII.—SUGARS; STARCHES; GUMS.

Beetroot; Influence of stripping the leaves of the — upon its weight and composition. H. Pellet. Bull. Assoc. Chim. Sucr., 1915, 32, 174—179.

EXPERIMENTS recently made at the Rovigo (Italy) experimental station by Murerati, Mezzadrolì, and Zapparoli, show that stripping the leaves of the beetroot, even repeatedly, has practically no influence upon the weight of the beet. On the other hand the composition of the root is adversely affected. A single stripping diminishes the sucrose content by about 9%, while several strippings may cause a loss of 35% of the sucrose. At the same time there is a considerable diminution in the purity of the juice, largely owing to the increase of reducing sugars.—J. P. O.

Beetroot; Relation between the sucrose content and the weight of the —. H. Pellet. Bull. Assoc. Chim. Sucr., 1915, 32, 179—182.

RECENT work of Murerati, Mezzadrolì, and

Zapparoli has shown that there is no relationship between the sucrose content and the weight of the sugar beet. Moreover, the author's own experiments indicate that beets having the same sucrose content but possessing such extreme differences of weight as 50, 150, 300, 500, 800, and 1200 grms. may be grown on the same field from the same seed.—J. P. O.

Beetroot ; Presence of reducing sugars in the stalk of the —. H. Colin. Bull. Assoc. Chim. Sucr., 1915, 32, 156—158. (See also this J., 1914, 1217.)

STALKS of freshly pulled beetroots divided into minute particles, were boiled in 95% alcohol in presence of sodium carbonate for some minutes, then pounded in a mortar, and the alcoholic extraction continued. After mixing together, the extracts were concentrated *in vacuo*, defecated with normal lead acetate, the excess of lead removed with sulphuric acid, and the excess of acid neutralised with sodium carbonate. This clarified liquid was examined polarimetrically, or by the copper reduction method, preferably using Bertrand's permanganate modification (this J., 1907, 60). Operating in this way, the author has arrived at the following conclusions: (1) In the stalks of beetroot plants of the first year, reducing sugars may constantly be found, the amount increasing as the root develops. (2) The reducing sugars are less concentrated in the middle than elsewhere in the stalk. (3) During the period of rest, the proportion of reducing sugars to sucrose increases somewhat, though almost all the sugar remains in the state of sucrose. (4) In the second year the amount of the reducing sugars is always greater than in the first. It remains undecided whether the reducing sugars originate from the hydrolysis of sucrose, or whether they remain after the polymerisation of invert sugar in the tissues of the stalk.—J. P. O.

Sucrose ; Elaboration of — in the beetroot. H. Pellet. Bull. Assoc. Chim. Sucr., 1915, 32, 159—165.

IN the leaves of the beet the quantity of sucrose present is often very small, and cannot account for the formation of all the sucrose in the root. As a rule the amount of sucrose disappearing from the leaves in the night is slight, though there is an appreciable diminution in the amount of reducing sugars; but during the day (and especially in the morning) there is a very large diminution of reducing sugars, and the sum of the reducing sugars and sucrose then disappearing is approximately equal to the increase of sucrose in the root. With Colin the author is of the opinion that in studying the nature of the carbohydrates passing from the leaves to the root, it is the leaf-stalk (close to the neck) that must be examined. The leaf-stalk always contains a greater proportion of reducing sugars than sucrose, and hence it would appear that both reducing sugars and sucrose pass into the root, where the former polymerise.—J. P. O.

Sucrose ; Determination of — by double polarisation methods. H. Pellet. Bull. Assoc. Chim. Sucr., 1915, 32, 169—173.

SAILLARD's so-called "neutral double polarisation method" (this J., 1913, 836) is considered by the author to be too complicated for routine work. In place of it, and also of Stanek's new process, in which both direct and inversion readings are made in the presence of exactly the same amount of potassium chloride and of citric acid, clarification being effected by bromine in place of lead acetate (this J., 1914, 705), the double polarisation method involving the use of sulphurous acid for the direct reading is recommended. As Ogilvie and later the author have shown (this J., 1912, 1195), this procedure gives readings identical with those

found with hydrochloric acid and urea, but is much more convenient, and applicable to solutions of every degree of purity. In the case of doubtful results, the invertase method should be used.

—J. P. O.

Double polarisation method [of sucrose determination] ; Degree of accuracy attainable in establishing constants for the — using acid or invertase. H. Pellet. Intern. Sugar J., 1915, 17, 421—423.

A HIGH degree of accuracy in the determination of the constant to be used for calculating the percentage of sucrose in the double polarisation method, using acid or invertase, is impossible. With a 1% solution, for example, with the small and permissible error of ± 0.05 in the inversion reading, when using the 200 mm. observation tube and a polarimeter having a normal weight of 26.00 grms. per 100 c.c., the constant will vary between 139.8 and 142.3, a difference of 2.5; while when employing instruments having normal weights of 16.29 and 20.0 grms. the differences may be 1.6 and 2.0 respectively. With a 5% solution and using the 200 mm. tube, the same error may produce differences of 0.5, 0.4, or 0.3 when employing saccharimeters having normal weights of 26.00, 20.00 or 16.29 grms. respectively. If the error of ± 0.05 be assumed to occur in making the direct reading also, the differences will be increased. It is therefore desirable to use a 400 mm. observation tube, preferably one that is water-jacketed, and provided with a central tubulure, and to employ it for the direct as well as for the inversion readings.—J. P. O.

Sucrose ; Determination of — in beet molasses by the double polarisation method, using invertase as hydrolyst. E. Saillard. Circ. hebdomadaire. Fabr. Sucre France, 1915, 27, No. 1371, 4.

COMMENTING upon the invertase process of double polarisation for the determination of sucrose in beet molasses, used by Ogilvie (this J., 1911, 62; 1912, 244), the author suggests that it may give inexact results on account of the commencement of alcoholic fermentation. It is preferable, he claims, to use an aqueous solution of the enzyme rather than to add yeast directly to the sugar solution.—J. P. O.

Sucrose ; Determination of — in molasses by means of invertase. H. Pellet. Intern. Sugar J., 1915, 17, 367—369.

IN reply to Saillard (preceding abstract), the author points out that alcoholic fermentation cannot take place in Ogilvie's invertase process, owing to the nature of the yeast used and also to the fact that the liquid is warmed to 55° C. before addition of the yeast. This temperature must be maintained throughout the hydrolysis, particularly when using certain bottom-fermentation yeasts, some of which very readily induce alcoholic fermentation at low temperatures. In determining the constants used in the calculation of the results of the double polarisation method, it is most important to adhere to the exact conditions of the actual analysis, even to the extent of subjecting the pure solution then used to the operations followed for the clarification of the product under examination.

—J. P. O.

Centrifugal clarification ; Experiments on the continuous — of [sugar] refinery liquors. J. Hamill. Intern. Sugar J., 1915, 17, 419—420.

A CENTRIFUGAL machine (see Eng. Pat. 6333 of 1913; this J., 1914, 407) has been used in a sugar-house in Greenock for the clarification of blow-up liquors of 65°—70° Brix, the object being to obviate filtration through Taylor bags, as is customarily done. It is claimed (i) that satisfactory results were obtained, even with a liquor from which it was impossible to separate the insoluble

matters by settling; (ii) that the machine worked continuously; and (iii) that no attendance was required to remove the collected mud, this being discharged automatically by the valves while the machine was running in regular operation. It is considered that the machine could be used in the raw sugar factory for the treatment of limed juices, the lengthy process of settling in tanks now in vogue thus being avoided.—J. P. O.

Condensers for [sugar house] evaporating apparatus.

E. W. Kerr, J. F. Gunther, and W. A. Rolston. Bull. 149, Agric. Exp. Stat. Louisiana State Univ. and A. and M. Coll. Met. and Chem. Eng., 1915, 18, 551—557.

THE general principles of condensers for evaporating apparatus are considered, various types described, and the results of comparative tests given. Most sugar-house condensers are of the barometric jet type in which the vapour mixes directly with the cooling water. The amount of cooling water, in pounds, required for condensing one pound of vapour (W) is calculated from the formula, $W = \frac{H - (t_2 - 32)}{t_2 - t_1}$, where H is the total heat of steam at the pressure corresponding to the vacuum, and t_1 and t_2 the initial and final temperatures of the cooling water, respectively. The value of t_2 must be a maximum to ensure a given vacuum with a minimum of cooling water; and the chief factor in maintaining the vacuum must be the condenser, not the vacuum pump. For a given amount of air handled, the vacuum pump displacement should be less with a counter-current than with a parallel-current condenser, the air being withdrawn at a lower temperature in the former than in the latter; the difference in the volume of air, due to this cause, may amount to 10% or more. On other theoretical grounds also, the separation of vapour from incondensable gas should be more complete, and the general efficiency greater, in counter-current than in parallel-current condensers. In the comparative tests made, the conditions of temperature and pressure were determined at different points and the weight of cooling water required per lb. of vapour condensed calculated in each case. On the basis of temperature alone, neither type showed any marked advantage over the other; the results of the pressure observations were mainly of value as indicating the necessity for careful design and liberal dimensions so as to secure steadiness of action. On the basis of cooling water required, the counter-current type was superior to the parallel-current type of condenser; in one series of tests, 43% more water was required in the latter than in the former, under standard conditions.

—W. E. F. P.

Sugar production in Spain. U.S. Comm. Rept. Suppl., No. 15D, Sept. 2, 1915.

THE production of beet and cane sugar in Spain during 1914 amounted to 147,770 metric tons, compared with 162,000 tons in 1913. Beet sugar fell off from 148,769 to 140,394 tons, and cane sugar from 13,231 to 7,376 tons. Export statistics show that 141,857 tons left the country during 1914. Of the 45 sugar factories in Spain, 26 were active during the sugar campaign of 1914, or 5 less than in the preceding year.

Honey-diastase; Properties and mode of action of —. F. Gothe. Z. Unters. Nahr. Genussm., 1914, 28, 286. Chem.-Zeit., 1915, 39, Rep., 280.

THE diastatic activity of honey is expressed in terms of c.c. of 1% starch solution converted by 1 gm. of honey in one hour under the following conditions:—10 grms. of honey is dissolved, neutralised with sodium carbonate and made up

to 100 c.c. Portions of this solution: 10, 7.7, 6.0, 4.6, 3.6, 2.8, 1.7, 1.3, and 1.0 c.c. respectively, are measured out into wide test-tubes with 0.5 c.c. of N/50 acetic acid, 0.5 c.c. of N/10 sodium chloride solution, and 5 c.c. of 1% starch solution and then all made up with water to 16 c.c. Two other tubes contain 10 c.c. of honey solution and 2.5 and 1 c.c. of starch respectively, with the other ingredients as above. All the tubes are placed simultaneously in a water-bath at 45°—50° C. in which they are heated for exactly one hour, then rapidly cooled in ice-water. One drop of N/10 iodine solution is added to each tube and the diastatic value thus established. The starch solution should be prepared from Merck's soluble starch, boiled with water for half an hour, diluted to 1%, and filtered cold through paper; it should be not more than 2 days old and clear or only slightly opalescent. Tests showed that, as a rule, the most aromatic honeys possess the highest diastatic values; honeys from sugar-fed bees are weak. Artificial honeys and over-heated samples show no, or only a very feeble, diastatic activity. When undiluted honey is heated for one hour at 65° C. a slight decrease in diastatic activity is observed; at 85°—90° C. it is destroyed. Honey which has been heated to such a degree cannot be regarded as a normal natural product.—J. F. B.

PATENT.

Sugar-bearing bodies; Process of treating —.

G. H. Benjamin. New York. U.S. Pat. 1,140,353, May 25, 1915. Date of appl., May 21, 1912.

SUGAR cane, as harvested, is cut into pieces about 0.5 in. in length, the juice which escapes being collected in a pan containing calcium phosphate. The cut cane is incorporated with a mixture of 75% calcium phosphate and 25% diatomaceous earth; the juice collected in the calcium phosphate is also added. The proportion of the mixture of calcium phosphate and diatomaceous earth used may vary according to the condition of the cane; 25% of the weight of the cane is usually a suitable quantity. The mass is then pressed into receptacles for shipment; if the mass is soft, it may be dried by means of a current of hot air before being packed. The product may be stored for long periods without appreciable loss of sugar. To extract the sugar the mass is treated with hot water and steam, the woody portion of the cane is separated, the solution then pumped into settling tanks, filtered through charcoal, and introduced into vacuum pans. Beetroots may be treated similarly.—W. P. S.

XVIII.—FERMENTATION INDUSTRIES.

Malt; The acid ratio of —. A new basis for malt valuation. C. A. Nowak. U.S. Master Brewers' Assoc. Brewers' J., 1915, 51, 509—512.

A NEW factor is proposed for the valuation of malts, based on the ratio between acidity values determined under specified conditions in the cold-water extract. The infusion is made with 50 grms. of finely ground malt in three times its weight of distilled water at the ordinary temperature. The mixture is shaken for 30 mins., then filtered into a dry flask, the first two portions of 10 c.c. being returned to the filter. Exactly 45 mins. after the first contact of the malt and water, 20 c.c. of the clear filtrate is mixed with 20 c.c. of water and 0.5 c.c. of standard phenolphthalein and titrated with N/10 caustic soda. The result represents the "natural" acidity. The "formol" acidity due to amino-acids is then determined by a modification of Soerensen's method (this J., 1908, 135), by adding to the titrated liquid 10 c.c.

of standard formaldehyde solution and again titrating with $N/10$ caustic soda. The acid ratio is then calculated by dividing the amino acidity by the natural acidity and multiplying by 100. The standard phenolphthalein consists of a 0.5% solution in 50% alcohol with the addition of sufficient $N/10$ caustic soda to produce a faint pink colour. The standard formaldehyde consists of the commercial 40% solution to which is added 5% by vol. of the above phenolphthalein and $N/10$ caustic soda to produce a faint pink colour. The balance of the filtered infusion is allowed to remain at the ordinary temperature for a given time, e.g., 16 hours, when the acid ratio is again determined; the increase is a measure of the proteolytic strength of the malt. In interpreting the significance of the various acid values, consideration must first be paid to data accumulated from experience with malts from various types of barley. Good malts [from most American barleys] will show a natural acidity of 0.31% as lactic acid. Generally a high acidity for the type in question connotes a high yield of extract with clear-running worts. Malts from Western barleys are exceptions, having low acidities ranging from 0.19 to 0.27% as lactic acid; excessively high dried malts frequently show high natural acidity with low yield of extract. For brewing stable bottled beers, malts should have a high natural acidity and an acid ratio of 110 or over, with proper regard to variations due to type, growth, and kilning.—J. F. B.

Yeast and attenuation. M. H. Daly. *Brewers' J.*, 1915, 51, 508.

THE problem in brewing ales of low original gravity is to allow them to attenuate sufficiently low to prevent "fretting," but not so low as to give the impression of thinness or lack of body. Having established a suitable degree of attenuation, it is not always easy to prevent successive attenuations from gradually becoming lower, owing to the fact that certain yeasts tend to acquire greater attenuative strength when continuously cultivated in saccharine worts of low gravity. Much depends on the suitable blending of the various ingredients of the wort, so as to maintain a sufficient supply of yeast nutrients whilst affording a maximum of fullness and condition in the finished beer. Thus a proportion of well-modified, lightly fired malt is used for the benefit of the yeast, together with a well flavoured grain yielding an extract conducing to fullness and checking the attenuative energy. The attenuating properties of yeast are not dependent only on its variety or type characteristics, but are also determined by the composition of the wort in which it has been continuously reproduced. The complexity of the nitrogenous components of the wort plays a part comparable with that of the carbohydrates, and the palate-fullness depends on the nature of the substances left unfermented rather than on the actual degree of attenuation. The degradation of the proteins and the carbohydrates proceeds more or less on parallel lines and both have a similar effect on attenuation, but for different reasons; while the simpler carbohydrates are directly fermentable, the simpler protein matters stimulate the attenuative activity of the yeast.—J. F. B.

Beer; The enzymes of—A. Bau. *Woch. für Brau. Brewers' J.*, 1915, 51, 516–518.

WELL-ATTENUATED bottom-fermentation beer of Pilsen type, carefully filtered and practically free from yeast cells and other organisms, was tested for the presence of various active enzymes by digestion of boiled and unboiled samples with the respective suitable substrata under optimum conditions. Positive results were obtained showing the presence of invertase (inversion of sucrose

and raffinose), melibiase (inversion of melibiose) and amygdalase. The presence of the last-named enzyme was proved by digesting 20 c.c. of the boiled and unboiled beer, each with 2 grms. of amygdalin, at 31°C. for 4 days, in presence of thymol, and determining the difference in cupric-reducing power of the samples after digestion. This difference, being corrected by the amount of reducing sugar produced by the inversion of the small quantity of sucrose introduced with the amygdalin, showed that 12.28% of the glucoside had been decomposed by the enzyme in the beer. Other experiments on similar lines showed negative results for the enzymes: maltase, trehalase (probably), emulsin, carboxylase, lipase, endoptyase, catalase, oxydase, reductase, and the lactic ferment.—J. F. B.

Madeira wine and its substitutes; Preparation, composition, and analysis of—A. Kickton and R. Mordfield. *Z. Unters. Nahr. Genussm.*, 1914, 28, 325. *Chem.-Zeit.*, 1915, 39, Rep., 294.

ACCORDING to a German-Portuguese agreement, the term "Madeira wine" is applied only to the wine which is produced in the Funchal district of Madeira. In the preparation of the wine a quantity of alcohol and of still must or boiled caramelised must is added to the fermented liquor; sugar is not added. The wine is then stored for many months in a warm cellar or shipped for a voyage through the tropics; finally, a further quantity of alcohol is added to bring the alcohol content of the wine up to at least 17% by vol. Madeira wine as imported into Germany contains, on an average:—alcohol, 13.5 to 16 grms.; total solids, 6 to 8 grms.; sugar-free extractives, 2 to 2.8 grms.; total acid, 0.5 to 0.7 gm. per 100 c.c. The quantity of levulose in the wine is smaller than that of dextrose and constitutes from 44 to 50% of the total invert sugar present. Spanish and Grecian wines sold as substitutes for Madeira wine usually differ considerably in composition from the latter.—W. P. S.

Wine; Colorimetric determination of pentoses and methylpentoses in—F. Schaffer. *Jahresversamml. schweiz. Vereins anal. Chem.*, Zürich, June 5, 1915. *Chem.-Zeit.*, 1915, 39, 564. (See also this J., 1915, 193.)

THE following method is much more expeditious than that of Tollens, but requires strict adherence to the procedure described. Wines containing more than 3% of sugar must first be fermented. One hundred c.c. of the sample is evaporated to $\frac{1}{4}$ of its volume, made up to 50 c.c., and heated under a reflux condenser for 2 hours with 22 c.c. of hydrochloric acid of sp. gr. 1.10. The liquid is next diluted to 100 c.c., and 92–93 c.c. is rapidly distilled (cork connections should not be used) and made up to 100 c.c. Five c.c. is transferred to a wide test-tube containing at least 0.2 gm. of resorcinol. 10 c.c. of hydrochloric acid of sp. gr. 1.19 is added, and after a rubber stopper carrying a vertical tube of 6 mms. diameter has been inserted, the test-tube is heated for 10 mins. in boiling water. The liquid is then quickly cooled and compared with a standard solution which may be prepared by operating as above with a solution of arabinose of known titre or with a wine of known content of pentoses and methylpentoses, or a solution of "Paper Red E" (Soc. Chem. Ind. Basle) may be employed (0.01% solution diluted 7.5-fold before use; this corresponds in colour to a 0.01% solution of pentose). The apparent pentose-content thus found must be corrected as described below for the influence of methylpentoses (rhamnose). To determine the latter, 5 c.c. of distillate (see above) is transferred to the test-tube, which contains sufficient pure vanillin to cover the tip of a knife-blade; 10 c.c. of hydrochloric

acid is added and the tube is heated as before, but only for 5 mins. The liquid is quickly cooled without agitation and compared with a standard, which may consist of a 0.01% solution of Merck's Indigocarmin sicc. Pulv. diluted 5.5-fold before use and treated if necessary with a trace of Chinese ink. The content of methylpentoses of the wine so found, multiplied by 0.6, must be subtracted from the apparent pentose content obtained by using resorcinol, to arrive at the true pentose-content. In 200 natural wines ("Naturweine") examined, the ratio of arabinose to rhamnose was never less than 2:1, whilst in "mare" wines, yeast wines and raisin wines it frequently ranged between 0.5:1 and 1:1.—J. H. L.

Wines; Determination of ammonia in —. W. I. Baragiola and C. Godet. Jahresversamml. schweiz. Vereins anal. Chem., Zürich. June 5, 1915. Chem.-Zeit., 1915, 39, 564.

AMMONIA can be completely expelled from wines by distillation with magnesia *in vacuo*, without risk of formation of further quantities during the operation. To separate the ammonia from other volatile bases in the distillate, it is precipitated as magnesium ammonium phosphate, filtered off, and again liberated by distillation with caustic alkali. Precipitation of the ammonia as platinum-chloride does not furnish a satisfactory means of separation from other bases. Quantities of ammonia up to 150 mgrms. per litre, or even more, were found in wines of good quality from Eastern Switzerland, but the average amount appears to be lower in years of good vintage than in poorer years. Apple wine and perry are usually nearly free from ammonia.—J. H. L.

Magnesium salts; Stimulating action of — on lactic fermentation. C. Richet. Comptes rend., 1915, 161, 264–265.

MAGNESIUM salts accelerate lactic fermentation more than salts of other metals (see this J., 1892, 770); the optimum concentration for magnesium chloride is about 12.5 grms. of $MgCl_2 \cdot 6H_2O$ per litre. This is almost identical with the optimum recently observed by Delbet (Comptes rend., 1915, 161, 268) for the remarkable stimulation of phagocytes by magnesium chloride. It is probable that this salt, at the concentration mentioned, has a favourable influence on living cells generally.—J. H. L.

Higher alcohols; Separation of — from ethyl alcohol. J. Trambies. Kir. Magyar Természettudományi társulat, Budapest, May 25, 1915. Chem.-Zeit., 1915, 39, 636.

IN the separation of higher alcohols from aqueous ethyl alcohol by extraction with carbon tetrachloride, if the usual procedure be followed the amyl alcohol is completely extracted but only about 50% of the isobutyl alcohol. The author has obtained a complete separation of the latter by a modified method of working based on the law of distribution of a substance between two solvents.—A. S.

Manufacture of fibre, paper, and charcoal from hop-vines. Reinke. Sec V.

PATENTS.

Carbon dioxide [from fermentation]; Process and apparatus for cleaning —. G. M. Clark, London. From Nathan Institut A.-G., Zürich, Switzerland. Eng. Pat. 12,165, May 16, 1914.

To remove all impurities, including esters, from fermentation gas, it is washed successively with water and potassium permanganate solution, then dried, and washed with strong sulphuric acid. The washing apparatus comprises an outer cylin-

dric vessel containing the liquid (water, permanganate solution or sulphuric acid), and an inner bell which carries the entering gas to the bottom of the liquid. The bottom edge of the bell is notched to break up the gas into small bubbles, and as these rise they encounter inclined perforated flanges which project downwards, one above another, from the outer wall of the bell. The hygroscopic substance used for drying the gas before treatment with sulphuric acid, is regenerated from time to time by means of a current of hot carbon dioxide. After the acid treatment the gas is passed over a mixture of pumice and crystallised sodium carbonate or through a solution of the latter to remove traces of acid.—J. H. L.

Beer and the like; Process and apparatus for chilling and carbonating —. H. F. Stanley, and The Farringdon Works and H. Pontifex and Sons, Ltd., London. Eng. Pat. 21,249, Oct. 20, 1914.

A BRINE tank is divided into two compartments through which the brine is circulated by a propeller disposed in an opening in the lower part of the partition at one end; at the other end the partition is provided with a weir at the top. Cooling coils connected with a refrigerating apparatus are placed in one of the compartments, and the beer is passed through coils in the other compartment, then through a carbonator, and is collected in a receiver at the bottom of the tank. Carbon dioxide may be admitted to the beer as it flows through the cooling coils and a quantity of the gas may also be introduced into the receiver. The cooling coils consist of lengths of tinned copper tubing connected by removable U-shaped end pieces.—W. P. S.

Wine; Process for making a fermented but non-alcoholic —. M. E. Dönitz, Dresden, Germany. U.S. Pat. 1,152,154, Aug. 31, 1915. Date of appl., Nov. 16, 1914.

THE alcohol is expelled by distillation from an alcoholic grape or fruit wine, and the residue is diluted with water, pasteurised if necessary, and matured by addition of a wine yeast and storage at a temperature which permits the yeast to develop. After separation from the deposited yeast, the liquid may be treated with sugar, carbonated, and pasteurised.—J. H. L.

Alcohol and other spirits; Extractor for —. C. Tuckfield and W. G. de F. Garland, East Molesey, Surrey. Eng. Pat. 19,845, Sept. 16, 1914.

THE apparatus is designed to separate alcohol, petrol, or other spirits from their solutions or mixtures, without distillation. It is stated that alcohol separates and rises very quickly when solutions or mixtures containing it are heated in a closed vessel above their atmospheric boiling point so that ebullition is impossible. The apparatus comprises a heat exchanger, a sorting cylinder, and a collecting drum, all of which are vacuum-jacketed to avoid loss of heat.—J. H. L.

Stable alimentary extract made from yeast. Eng. Pat. 9425. See XIXA.

XIXA.—FOODS.

Maize flour in admixture with wheat flour; Determination of —. A. von Sigmond and J. Trambies. Kir. Magyar Természettudományi társulat, Budapest, May 25, 1915. Chem.-Zeit., 1915, 39, 636.

UNGELATINISED maize starch is dissolved to a much smaller extent than wheat starch when warmed with malt extract. The following results

were obtained by warming 20 grms. of wheat flour or maize flour, or of a mixture of the two with 200 c.c. of malt extract and 200 c.c. of water for 2 hours at 65° C., with constant stirring, and then determining the concentration of the solution by means of the Zeiss immersion refractometer, the results being corrected by deducting the value given by the malt extract alone.

Composition of flour.		Refractometer reading.	
Wheat.	Maize.	I.	II.
100	0	16.6	16.6
50	50	13.1	13.6
40	60	13.4 (?)	12.9
30	70	12.8	12.8
20	80	12.1	11.9
10	90	9.9	9.5 (?)
0	100	9.7	9.6

—A. S.

Bread; [Production of] better — by means of lactic acid. A. Wahl. J. Ind. Eng. Chem., 1915, 7, 773—775.

JESSEN-HANSEN (this J., 1912, 405) has shown that there is a definite relation between the baking quality of a flour and the hydrogen ion concentration of its aqueous extract. The author has found that by addition of bacterial lactic acid to the dough, a larger loaf of improved flavour, texture, colour, and general appearance is obtained. The development of undesirable organisms is checked by the lactic acid, basic phosphates are converted into acid phosphates, and proteins are partly converted into soluble peptones and amino-compounds, rendering the bread more easily digestible. Milk, whey, buttermilk and similar milk products containing added or developed lactic acid, or commercial lactic acid, may be used, but it is preferable to use lactic acid produced by propagating *Bac. Delbrücki* in a bran mash, as thereby the nutritive extractive substances of the bran become incorporated with the dough. If the lactic acid liquor (1—2% acid) be employed in conjunction with crushed wheat or rye malt flour, the peptase and diastase of the latter are dissolved and effect a partial digestion of the dough during dough fermentation, thus increasing the available supply of yeast food.—A. S.

Milk and cream; Removal of garlic flavour from —. S. H. Ayers and W. T. Johnson, jun. U.S. Dept. Agric., Farmers Bull. No. 608, Aug. 6, 1914. 4 pages.

THE method consists in forcing a current of air through the milk or cream at a temperature of at least 145° F. (63° C.). The apparatus comprises a round, open, tinned tank holding about 4 gallons, surrounded by a water jacket. About 3 inches above it is a smaller tank the base of which contains perforations about 0.3 inch diameter and about 0.5 inch apart. The inlet pipe for air is near the bottom of the lower of the two vessels and a pump connects them. The milk is heated gradually to 145° F. in the lower tank by means of hot water in the jacket, and at the same time stirred mechanically. Air is then blown in under pressure, and the milk is pumped up to the higher tank, from which it descends again in fine streams to the lower one. This operation is repeated until the garlic flavour disappears. The time required varies considerably (from 5 to 60 minutes), cream requiring a slightly longer treatment than milk. The volume of air required is about 0.2 cub. ft. per gallon of milk per minute.—E. H. T.

Meat extract in soup tablets; Determination of the quantity of —. T. Sudendorf and O. Lahrmann. Z. Unters. Nahr. Genussm., 1914, 29, 1. Chem.-Zeit., 1915, 39, Rep., 293.

TEN grms. of the sample is dissolved in water, the solution diluted to 100 c.c., filtered, and 20 c.c. of the filtrate is mixed with 10 c.c. of *N/1* hydrochloric acid and the mixture evaporated to dryness. The brown-black residue is treated with water, neutralised with *N/2* alkali solution, using litmus as indicator, then diluted to about 75 c.c., and 1% permanganate solution containing 2.5% of sodium chloride is added, drop by drop, until a slight excess is present. The excess of permanganate is destroyed by the addition of 3% hydrogen peroxide solution containing 1% of glacial acetic acid, the mixture heated for 10 minutes on a water-bath, filtered, and the filter washed with hot water. The filtrate is evaporated to a small volume, transferred to a 50 c.c. flask, diluted to about 20 c.c., 10 c.c. of 10% sodium hydroxide solution and 20 c.c. of saturated picric acid solution are added, the mixture is diluted to 50 c.c. after the lapse of 5 minutes, and the coloration obtained compared that of *N/2* potassium bichromate solution; a layer of the latter 8 mm. in depth corresponds with the coloration given by 10 mgrms. of creatinine. The quantity of meat extract present is calculated from the amount of creatinine found. (See this J., 1907, 709.)—W. P. S.

Specific reaction of picric acid. Rodillon. See III.

PATENT.

Yeast; Stable alimentary extract made from — and method of manufacturing the same. G. Gerard, London. Eng. Pat. 9425, June 28, 1915.

FROM 100 to 150 kilos. of dry yeast is mixed with 20 to 30 kilos. of powdered gum arabic and 30 to 45 kilos. of an alkali phosphate, e.g., crystallised disodium hydrogen phosphate; liquefaction takes place in less than 1 hour, and, with intervals for fermentation, further quantities of dry yeast are introduced from time to time until 1000 kilos. has been added and liquefied; this takes from 1½ to 3 days. The mixture is then diluted with its own weight of water, passed through a sieve, heated to 100°—125° C., and coagulated substances are separated; after the addition of about 1 to 1.25% of its weight of salt, the mixture is again heated, and filtered. The solution is evaporated to one-half its volume, then boiled for several hours with the addition of charcoal, cooled, filtered, mixed with from 10 to 20% of its weight of salt, and concentrated under reduced pressure.—W.P.S.

XIXB.—WATER PURIFICATION; SANITATION.

Phosphoric acid [in water]; Nephelometric determination of traces of —. H. Serger. Chem.-Zeit., 1915, 39, 613.

FROM 100 to 300 c.c. of water containing phosphoric acid is evaporated to dryness, the residue dissolved in 2.5 c.c. of nitric acid, the solution filtered, and the filter washed with 25 c.c. of nitric acid. Five c.c. of such a solution is mixed with 25 c.c. of molybdic reagent and 20 c.c. of strong nitric acid, and the mixture heated on the water bath at 70° C. Standard phosphoric acid solution (*N/500*) is added to a similarly heated mixture of molybdic reagent and nitric acid, the contents of the two glasses stirred, and the turbidity of the original liquid matched. The molybdic reagent is prepared by diluting 750 c.c. of nitric acid with an equal volume of water, and dissolving 600 grms. of ammonium sulphate therein. A hot freshly-prepared solution of 225 grms. of ammonium molybdate is added to this solution, and the whole made up to 3000 c.c. For matching the turbidity

beakers 8 cm. high and 4 cm. in diameter are suitable. By this method quantities of 91 to 196 mgrms. of P_2O_5 in 100,000 parts of water were rapidly and accurately determined.—C. A. M.

Temporary hardness; Determination of— in very hard waters. H. G. Bennett. Collegium (London), 1915, 237.

100 c.c. of the water is titrated boiling, with standard acid, using methyl red as indicator. The colour change is as sharp as with alizarin, and the process is quicker than Winkler's boric acid method (this J., 1915, 278).—F. C. T.

Permutit; Ionic diffusion in—. G. Schulze. Z. physik. Chem., 1915, 89, 168. Engineering, 1915, 100, 318.

WHEN natrolite and permutit were added to a solution of silver nitrate, 93% of the sodium was replaced by silver. Similar experiments with solutions of ammonia, ammonium nitrate, mercuric chloride and nitrate, cadmium iodide, etc., indicated that the rate of diffusion depended upon the concentration of the metallic ion in the salt solution, and not directly upon the salt concentration. There was little diffusion in the case of ammonia, but considerable diffusion in the case of ammonium nitrate. The electrolytic conductivity of the permutit could not be determined directly owing to its high porosity. To measure it a solution of sodium nitrate was poured over the powdered permutit, and the conductivities of the solution above the permutit and of the permutit itself were determined; this operation was repeated several times, after adding more and more permutit to the liquid. In this way a conductivity of 6.53×10^{-4} reciprocal ohm was observed for sodium permutit, and of 4.48×10^{-4} for silver permutit. The permutit contained about 30% by volume of pores. Diffusion and conductivity experiments indicated approximately the same porosity; it was concluded that permutit has about nine times the active surface of the solid material.

Putrescibility or oxygen demand [of sewage and sewage effluents]; Comparison of methods for determining—. F. E. Hale and T. W. Melia. J. Ind. Eng. Chem., 1915, 7, 760—764.

THE authors made comparative determinations by the dilution method (Jackson and Horton, this J., 1909, 740), the English excess oxygen dilution method (compare this J., 1912, 1197; 1913, 265), and Lederer's nitrate method (this J., 1915, 731). The first-mentioned method, using "methylene green" or "methylene blue," is considered to be the only reliable method for determining the oxygen required to prevent putrescibility. It is better to incubate for five days at 37° C. than for ten days at 20° C., and ground glass stoppers for the bottles are preferable to any other type. There is appreciable loss of oxygen by the English method, probably owing to accumulation below the stopper. The English method gives results nearly twice as high as those obtained by the dilution method, but the discrepancy practically disappears if a correction found by means of a blank determination be applied to the results given by the English method. The nitrate method gives low results if it be assumed, as stated by Lederer, that the nitrate yields 2.5 atoms of oxygen for each atom of nitrogen, but the figures agree with those obtained by the dilution method if a ratio of 4 atoms of oxygen to 1 of nitrogen be used.—A. S.

Smoke filter. Method of collecting and determining [suspended particles in] smoke and industrial gases. L. A. Gantier. Bull. Soc. Chim., 1915, 17, 273—278.

AN apparatus for the filtration of gases containing

solid particles in fine suspension, consists essentially of an iron tube provided with slits, which is placed 4 or 5 metres above the fire or other source of smoke or fumes. Inside this is sealed a nickel-plated tube through which the fumes are drawn and are led by a tin connection to a scrubber consisting of two glass spheres connected by a narrow orifice. The lower sphere of 60 c.c. capacity contains five or six glass balls and 25 c.c. of water. It is kept cool by immersion in water, and the larger particles are retained in this and the upper sphere, which contains a single glass ball. Connected with this sphere is the filter proper, which consists of very flat cones of platinum foil, the edges of which are tightly held together by a suitable mounting. Between the cones is placed the filtering septum, consisting of three pieces of accurately counterpoised filter paper of equal weight. The interior of the cones can be kept at 100° C., to avoid condensation of water vapour, by means of a metal rod attached to the mounting and heated at the other end by a gas burner. Beyond the filter is a gas meter and an aspirator or water pump, whereby a known volume of gas can be drawn from the flue through the filters. When sufficient gas has passed, the filter is opened, and the contents of the scrubber filtered through it; it is then dried at 100° C. In a properly conducted operation the third filter should have retained its original weight.—G. F. M.

Garbage reduction plant; Investigation of the nature, and elimination, of the odours and dust from a—. H. W. Mahr and A. C. Kraft. J. Ind. Eng. Chem., 1915, 7, 778—785.

THE vapours from the digesters in which the garbage is digested with water and live steam contain alcohol, acetic acid, volatile oils, and sulphur compounds, and the odour is due chiefly to the two last-named. They can be deodorised by treatment with a hypochlorite solution, or by heating to 1100°—1200° F. (590°—650° C.) and then treating with water to remove sulphur dioxide. Direct heat dryers are used in large establishments for drying the digested garbage and the residue left after extracting the grease, and these produce considerable quantities of dust. The gases from the dryers can be freed from dust and odour practically completely by efficient scrubbing with water. It is recommended that the floors in garbage-treating works should be of concrete with a frequently renewed coat of tar or asphalt.—A. S.

Sterilising instruments; Use of glycerin for—. G. Seiffert and A. Spiegl. Zentr. Bakt., 1914, [1], 74, 518. Chem.-Zeit., 1915, 39, Rep., 306.

THE authors use bacteria enclosed in an envelope of albumin for testing the efficacy of disinfectants. Tuberculous pus obtained from a slaughter-house, free from micro-organisms, and preferably after being heated for $\frac{1}{2}$ hour at 56° C. to eliminate, as far as possible, the bactericidal action of leucocytes, is mixed in the proportion of 1:10 with a broth culture of the bacteria under examination. Sterilised strips of wire gauze, 5 cm. by 1 cm., are immersed in the mixture until the meshes are filled, and are then dried in an exsiccator and treated as in the known silk thread method. All the micro-organisms examined, viz., *B. coli*, *Paratyphus B.*, *Bac. pyocyaneus*, *V. Metschnikoff*, *Bac. diphtheriae*, *Staphylococcus albus*, *Streptococcus brevis*, *Bac. anthracis*, and *Bac. subtilis*, were killed in 1 min. by heating with glycerin at 120° C. Sterilisation by heating with glycerin is specially suitable for porcelain filters, rubber tubing, and surgical instruments; the latter are not injured and do not rust even when kept in the hot glycerin for 1 hour.—A. S.

Picric acid as an antiseptic. H. L. Tidy. *Lancet*, 1915, 604. *Pharm. J.*, 1915, 95, 397.

PICRIC acid in 2 to 3% alcoholic solution has been used successfully for sterilising the skin before operation. The Rideal-Walker carbolic acid coefficient of picric acid is 6 for *B. typhosus*.

Dipping and spraying fluids containing a soap basis: Determination of the wetting power of —.
Theory of wetting. W. F. Cooper and W. H. Nuttall. *J. Agric. Sci.*, 1915, 7, 219—239.

THE efficiency of a dipping or spraying fluid is not solely dependent upon the amount of toxic substance present, the wetting power being usually of equal importance. For a liquid to wet a solid, the condition $T_2 > T_1 + T_{12}$ must be satisfied, where T_1 is the surface tension of the liquid, T_2 that of the solid, and T_{12} that between the two. Since T_1 and T_{12} are experimentally indeterminate, the above expression cannot be applied practically. The determining factor in the wetting power is the interfacial tension, T_{12} , since T_1 may be high if T_{12} is low. Two other factors of importance are the solvent power of the liquid and the surface concentration or adsorption. Owing to the latter a superficial viscosity comes into play, which acts by preventing rupture and running together to form drops. The surface tension of a liquid is by itself an unreliable index of its wetting power. Equally unreliable is the method of determining the wetting power by finding the weight of the liquid which adheres to a strip of material, not easily wetted, after immersion in it. Theoretical and practical considerations also condemn the determination of foaming power as a criterion of wetting power. It has not been found possible to devise a method of comparing accurately the wetting powers of liquids which contain saponin, gelatin, and other substances which show a high surface concentration, but one has been worked out for fluids containing a soap basis. A thick non-acid paraffin oil (liquid vaseline) of determined surface tension, was taken as a standard to represent the greasy surface of a hide or waxy leaf, and the comparative wetting power of any two dips or sprays, diluted with water to the strength used in practice, was found by determining their surface tensions and their interfacial tensions towards the oil. The values were then substituted in the formula $T_2 > T_1 + T_{12}$. Experiments showed, however, that T_{12} alone (being least affected by surface concentration) was a better index of the wetting power than the expression $T_2 - (T_1 + T_{12})$, and the method accordingly developed into a determination of the interfacial tension between a standard oil and the liquid under examination. The interfacial tension was measured by Donnan's drop-pipette method (*Z. physik. Chem.*, 31, 42—49) in which the oil is run from a pipette through the aqueous liquid, and the number of drops formed from a given volume of oil is counted. For comparative values, the interfacial tension may be taken as inversely proportional to the number of drops; and since the tension varies inversely as the wetting power, the latter varies directly with the drop number.

—E. H. T.

Accidents and injuries to health of workpeople in the German chemical industry in 1914. H. Grossmann. *Chem.-Zeit.*, 1915, 39, 604—605.

ACCORDING to the Official Report of the Inspectors, visits were paid to 4800 out of a total of 15,014 factories; the work of inspecting ceased entirely immediately after the outbreak of war, but was resumed, in part, towards the end of the year. The total number of cases of injury to health notified, the number of cases sufficiently serious to warrant compensation, and the number of deaths were respectively 13,279, 1781, and 168 in 1914;

15,310, 1967, and 113 in 1913; and 14,578, 1893, and 134 in 1912. The distribution of the cases receiving compensation among the different branches of chemical industry was as follows, the figures in brackets indicating the number of deaths:—Salines, 8 (2); heavy chemicals, 304 (26); other chemical, pharmaceutical, and photographic products, 251 (14); colours, except tar colours, 78 (6); lead pencils, crayons, chalks, 4 (1); aniline and aniline colours, 236 (29); other tar products, 30 (2); explosives, 118 (35); matches etc., 20 (2); disinfecting, etc., installations, 6; artificial manures, 125 (12); wood charcoal, wood tar, and lampblack, etc., 27 (3); rosin and pitch, 2; tallow and tallow candles, 90 (5); stearine and wax candles, 9; coal tar, mineral oil, paraffin candles, petroleum refining, 31 (21); tar distillation, greases for leather and for lubricating, 15; essential oils and perfumes, 8; resins, varnishes, etc., 67 (8); roofing felt and roofing pulp boards, 52 (8); rubber and gutta-percha goods, 182 (8); impregnating installations, except those in which chiefly wood is treated, 29 (1); artificial mineral waters, 64 (3).

A serious explosion in a vacuum evaporating plant occurred in the following circumstances. When the liquid had attained the desired concentration, the valve in the suction pipe leading from the evaporator to a central condensing apparatus was closed, but in order to prevent the concentrated liquor from solidifying, the supply of steam to the heating coil by intention was not cut off completely. There was some delay in running off the liquid and the pressure inside the evaporator rose slowly until an explosion occurred. To prevent similar accidents the evaporator is now provided with an opening covered by a plate which normally is held closed by the vacuum, but opens automatically as soon as atmospheric pressure is attained. In a factory where artificial silk is made by the viscose process, many of the workers suffered from painful eye troubles, sometimes accompanied by temporary blindness; in all cases they recovered completely in a few days. It was found that the viscose was contaminated by small quantities of sulphides and the injuries were caused by hydrogen sulphide liberated when the artificial silk filaments were squirted into dilute sulphuric acid. The quantity of hydrogen sulphide was too small to be detected by its odour, but the trouble has been overcome by providing means for a more frequent renewal of the air of the work-room and the use of test-papers to check the purity of the air. Attention is directed to the need of caution in dealing with what are supposed to be empty receptacles. On attempting to cut off, by means of the oxy-hydrogen flame, the bottom of an old sulphuric acid tank from which the sludge had not been rinsed out, an explosion occurred by which the tank was shattered and two workmen received severe injuries.—A. S.

Antimony (sodium metantimonate): Physiological action of quinquivalent —. B. Rewald. *Therapie d. Gegenw.*, 1914, 16, 357. *Chem.-Zeit.*, 1915, 39, Rep., 286.

THE salt is not injurious to health; daily doses of 30 grms. given to dogs and rabbits, and of 0.01 grm. to men, did not produce any harmful effect, neither was the health of children affected when they were given food prepared in vessels enamelled with a mixture containing sodium metantimonate.—W. P. S.

Quantity of gasoline vapour necessary to produce explosive mixtures in sewers. Burrell and Boyd. *See* 11A.

German hygiene applied to gas [lighting]. Butterfield. *See* 11B.

PATENTS.

Water; Treatment of—for softening, sterilising, and like purposes. [Revivifying the filtering material.] H. J. Magrath, London. Eng. Pat. 18,867, Aug. 20, 1914.

IX apparatus where water is purified by passing it through a bed of natural or artificial zeolites, the latter are revived by cutting off the main water supply and causing a portion of the water to flow into a small tank containing sodium chloride; the solution thus obtained is passed through the layer of zeolites, which is afterwards washed by fresh water. The main valve on the water supply pipe is connected with additional valves adapted to control the supply and outflow of the sodium chloride solution, the connection being such that one handle closes the main valve and opens the auxiliary valves and *vice versa*.—W. P. S.

Sterilising liquids by means of ultra-violet rays; Apparatus for—, V. Henri, A. Helbronner, and M. von Recklinghausen, Paris, Assignors to The R.U.V. Co., Inc., New York. U.S. Pat. 1,151,267, Aug. 24, 1915. Date of appl. June 7, 1910.

SEE Eng. Pat. 25,509 of 1909; this J. 1910, 1470.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Cantharidin; Chemical nature of—, P. W. Danckwortt. Arch. Pharm., 1914, 252, 632. Chem.-Zeit., 1915, 39, Rep., 305.

THE potassium salt of cantharidic acid, the dibasic acid of which cantharidin is the anhydride, is stable only in absence of water. A tolerably stable, crystalline brucine salt is formed when 1 mol. of cantharidin is heated on the water-bath with 2 mols. of brucine and water for about 4 hours under a reflux condenser.—A. S.

"Leeithin"; Determination of—in small amounts of blood, W. R. Bloor. J. Biol. Chem., 1915, 22, 133—144.

A NEW method is described which is applicable to the determination of phosphoric acid (phosphatides) in various organic materials, especially in small quantities (2—3 c.c.) of blood. The phosphatides are extracted from blood or serum with warm alcohol-ether, and after destruction of organic matter by digestion with sulphuric and nitric acids, the phosphoric acid is precipitated as silver salt (or silver ammonium salt) in the presence of ammonium salts, and the amount of the precipitate is estimated by means of a nephelometer.

—J. H. L.

Menthol and some of its derivatives, N. J. Kouranov. J. Russ. Phys. Chem. Soc., 1914, 46, 815—845. Bull. Soc. Chim., 1915, 18, 430—433.

THE product of the action of hydrogen chloride or phosphoric chloride on menthol is a mixture of isomerides from which a stable chloride was isolated by boiling with alcoholic potassium hydroxide, or better, with aniline. It boils at 109°—110° C. at 30 mm., and has $[\alpha]_D = -51.23^\circ$. By the action of magnesium it yields menthene, menthane, dimenthyl, and l-menthol. The mixed isomerides treated in the same way gave the same products, but containing a larger proportion of menthene, and in addition a liquid dimenthyl and a liquid menthol. The author considers that the stable chloride corresponds in structure to l-menthol. A menthane-carboxylic acid was obtained by the action of carbon dioxide on the magnesium compound of the stable menthyl chloride. It is a crystalline substance, m.pt. 65°—66° C., $[\alpha]_D$ (in benzene) = -54.16° . Menthyl-

phenyl ether, $C_{10}H_{19}.O.C_6H_5$, was prepared by the action of iodobenzene on potassium mentholate in presence of finely divided copper at 150°—160° C. for 8 hours. The ether was isolated by fractional distillation, b.pt. 150°—151° C. at 12 mm. It crystallises from alcohol in large needles, m.pt. 52°—53° C. Warmed with hydrogen chloride at 170° C. for 8 hours it is converted into phenol. menthyl chloride (unstable modification), and menthylphenol, $C_{10}H_{19}.C_6H_4.OH$, which forms a colourless vitreous mass.—G. F. M.

Aminoazobenzene derivatives; Epithelising action of—, L. Martinotti. Klin. Wochensh., 1914, 51, 1451. Chem.-Zeit., 1915, 39, Rep., 279.

THE epithelising action, first recorded in the case of Scarlet Red, is a property common to all the dyestuffs of the aminoazobenzene and aminoazotoluene groups. It is more strongly pronounced in the lower members of the series and diminishes in the higher compounds but again increases in the case of disazo, trisazo, etc., derivatives. Benzene derivatives are as a rule far more active than the corresponding toluene derivatives. The most active compound is Chrysoidine and the next is Aniline Yellow. For practical use the aqueous solutions are preferred. All substances which possess an epithelising activity *in vivo* have a specific affinity for fats *in vitro*, becoming fixed on the fats of the fat-cell tissues and resisting the action of oxidising agents for some considerable time.—J. F. B.

Ethers; Synthesis of—by means of the acetals of aldehydes or ketones and organo-magnesium compounds, A. E. Tschitschibabin and S. A. Elgazine. J. Russ. Phys. Chem. Soc., 1914, 46, 802—814. Bull. Soc. Chim., 1915, 18, 414—416.

THE ethers of primary, secondary, and tertiary alcohols may be obtained by the action of organic magnesium halogen compounds on the acetals of formaldehyde, other aldehydes, and ketones respectively, according to the following equation: $R.CH(OC_2H_5)_2 + R'.MgBr = R.CH(OC_2H_5)R' + MgBr(OC_2H_5)$.

The reaction does not occur with the same facility in all cases: with the acetal of formaldehyde only traces of the ether are produced, but with other aldehydes action occurs with greater ease, especially when R is an aromatic radicle. With the acetals of ketones the replacement of the ethoxy-groups occurs with the greatest facility, so much so that both may be replaced to the detriment of the yield of the ether. The best yields of the ether were obtained, in general, when the magnesium compound was added drop by drop to the acetal warmed on a water bath, so that the reaction occurred in presence of an excess of the latter compound. Numerous new ethers are described in the paper of which the following are of most interest:—

$C_4H_9(CH_2)CH.OC_2H_5$, prepared from magnesium isobutyl bromide and acetaldehyde acetal, is a liquid of intense odour reminiscent of terpineol. It has b.pt. 121°—122° C., sp. gr. 0.7767 at 0° C. $C_6H_5.CH_2(CH_2)CH.OC_2H_5$, from magnesium benzyl bromide and acetal, has an odour of oil of neroli. It is an oily liquid, b.pt. 205°—206° C., sp. gr. 0.9305 at 0° C. Magnesium *p*-methylecyclohexyl bromide furnishes with acetal an ether, b.pt. 197°—198° C., having a strong odour of anise. The acetal of acetone, prepared by the action of acetone (1 mol.) on orthoformic ester (1 mol.) and absolute alcohol (3 mols.) in presence of 2 or 3 drops of sulphuric acid, gives but inferior yields of ethers with the magnesium reagents.—G. F. M.

Specific reaction of picric acid, Rodillon. See III.

Determination of iodine in presence of organic matter, Krauss. See XXIII.

PATENTS.

Arylpyrazolones; [Condensation products of acetylpyruvic acids with] aminosubstituted —. W. Kropp, Elberfeld, Germany. Assignor to Synthetic Patents Co., New York. U.S. Pat. 1,151,885, Aug. 31, 1915. Date of appl., May 23, 1914.

THE condensation products of arylaminopyrazolones, such as phenylaminopyrazolone, and their derivatives, such as 1-aryl-2,3-dimethyl-4-amino-5-pyrazolone, with acetylpyruvic acids, such as acetylpyruvic acid, are valuable antipyretics and antineuralgics. They are generally yellowish crystalline compounds, soluble with difficulty in water and organic solvents, but readily soluble in alkalis with formation of salts.—F. W. A.

Acetaldehyde from acetylene; Process of preparing —. P. Duden and G. Peters, Assignors to Farb- u. v. Meister, Lucius, und Brüning, Höchst, Germany. U.S. Pats. (A) 1,151,928 and (B) 1,151,929, Aug. 31, 1915. Date of appl., Jan. 13, 1915.

ACETYLENE is oxidised to acetaldehyde by means of a mercury compound in presence of a compound capable of impeding the separation of mercury, such as (A) a ferric salt, e.g., the sulphate, or (B) a compound of hexavalent chromium, e.g., chromic acid.—F. W. A.

Condensation products [aldols]; Method of producing —. H. W. Matheson, Assignor to E. I. du Pont de Nemours Powder Co., Wilmington, Del. U.S. Pat. 1,151,113, Aug. 24, 1915. Date of appl., Aug. 19, 1912.

SEE Fr. Pat. 449,604 of 1912; this J., 1913, 507.

Acetic acid anhydride; Preparation of —. F. Kauffer, Traiskirchen, Assignor to Bosnische Elektrizitäts-A.-G., Vienna. U.S. Pat. 1,152,098, Aug. 31, 1915. Date of appl., Nov. 25, 1914.

SEE Eng. Pat. 23,190 of 1914; this J., 1915, 982.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

PATENT.

Photographic plates and cinematograph films; Anti-halation coatings for —. S. Coenari, Vieux-Dieu, Belgium. Eng. Pat. 5825, Mar. 7, 1914. Under Int. Conv., Dec. 3, 1913.

SEE Fr. Pat. 469,218 of 1914; this J., 1915, 50.

XXII.—EXPLOSIVES; MATCHES.

Nitrocotton, nitrating acids, etc.; Manonitrometer for the analysis of —. V. Planchon. Ann. Chim. Analyt., 1915, 20, 189.

THE work of Koehler, Marquoyrol, Lorette, Florentin and Jovinet (this J., 1911, 509; 1913, 253) shows that the two most accurate methods for the analysis of nitrates and nitrocellulose are Devarda's (as modified) and the nitrometer method. The former is long and complicated. The latter is criticised on the grounds of the small weight of substance employed, the liability to error in measuring the temperature and volume of the gas liberated, the arbitrary correction which is applied, and the neglect to take account of the air always contained in a sulphuric acid solution of gun-cotton. A manonitrometer is described in which these errors are avoided. It consists of a flask fitted with a three-way metallic stopper allowing connection with the atmosphere and/or with a barometer tube dipping into mercury and

furnished with a movable scale. A rubber ring between the stopper and the flask, compressed by a screw frame in which the flask is clamped, ensures air-tightness. A known weight of nitrocotton (about 2.5 grms.) and fixed volumes of sulphuric acid and mercury are placed in the flask, which is then exhausted by a water-pump. The scale is adjusted so that the mercury in the barometer tube stands at zero, and the flask is shaken violently until the pressure remains stationary. It is then immersed in water and the temperature taken. From the temperature, pressure, weight of gun-cotton, and the known capacity of the flask and barometer tube, the degree of nitration may be calculated. About 5 grms. is used for the analysis of nitrating acids. Variations in the strength of the sulphuric acid employed between 90% and 97% do not sensibly affect the accuracy of the method.—F. SP.

Explosives in coal mines.

AN Order under the Coal Mines Act, issued by the Home Secretary, adds two new explosives to the permitted lists. These explosives are:—

Ingredients.	Parts by weight.	
	Not more than:	Not less than:
<i>Dynobel No. 2 (Nobel's Explosives Co., Ltd.):—</i>		
Nitroglycerin	20.5	18.5
Nitrocotton	0.75	0.25
Trinitrotoluol	} together	1
Dinitrotoluol		
Dinitrobenzol	43.5	40.5
Ammonium nitrate	6	4
Woodmeal (dried at 100° C.) ..	31	29
Sodium chloride	1	—
Magnesium carbonate	1.5	—
Moisture	—	—
<i>Rex Powder (Cotton Powder Company, Ltd.):—</i>		
Nitroglycerin	13	11
Nitrate of ammonium	61	58
Woodmeal (dried at 100° C.) ..	8.5	7
Sodium chloride	20.5	18.5
Moisture	2.5	—

The usual stipulations as to quality, packing, markings, etc., are made in each case.

Titration of nitrates with ferrous sulphate. Bowman and Scott. See VII.

PATENTS.

Match. Process of manufacturing matches. W. A. Fairburn, Short Hills, N.J., Assignor to The Diamond Match Co., Chicago, Ill. U.S. Pats. (A) 1,150,857 and (B) 1,150,858, Aug. 24, 1915. Dates of appl., Nov. 29, 1912, and Dec. 1, 1914.

(A) THE match has a splint impregnated with non-combustible, non-glowing material (e.g., a mixture of ammonium hydrogen phosphate and ammonium sulphate) and with an inflammable substance (paraffin wax) which alone will burn on striking the match. (B) "Double-dipped" matches are made in a continuous machine by applying heads of potassium chlorate or other oxidising composition to the splints, which are then dried between 100° and 150° F. (38°—66° C.), coated with a sensitive igniting composition, and finally dried at about 70° F. (21° C.) in an atmosphere with a relative humidity between 50 and 65%.—C. A. M.

Explosives; Manufacture of —. T. Hawkins, Balmain, N.S.W. U.S. Pat. 1,151,180, Aug. 24, 1915. Date of appl., July 24, 1913.

SEE Fr. Pat. 461,332 of 1913; this J., 1914, 222.

XXIII.—ANALYTICAL PROCESSES.

Photometer; The physical—in theory and practice. W. W. Coblenz. J. Franklin Inst., 1915, 180, 335–318.

IN using a physical photometer (radiometer) for photometry, it is necessary to use an absorption screen which cuts off all infra-red and ultra-violet rays and transmits the visible radiations in proportion to the luminosity curve of the average normal eye. A solution containing 60 grms. of cupric chloride, 1.7 of potassium chromate, 7.5 of cobalt ammonium sulphate, and 15 c.c. of nitric acid (sp. gr. 1.05) per litre, was found to transmit 13.6% of infra-red radiations from a "4-watt" carbon lamp, the solution having a region of considerable transparency at 1.0–1.3 μ . Concentration and thickness not being interchangeable for this solution (at least for the infra-red region at 1.2 μ), the elimination of the infra-red spectrum by means of water required the use of a separate cell, a convenient thickness being 4 cm. for 1 cm. of solution. The physical photometer employed consisted of a bismuth-silver thermopile in front of which the cells containing the solution and water were placed; and tests were made with a standardised vacuum tungsten lamp. In a total change of luminous intensity amounting to over 23 candle power, a difference of less than 0.2% was obtained between photometric and radiometric determinations. The advantage—as regards rapidly and ease of manipulation—of the physical photometer for measurements in heterochromatic photometry is pointed out.—W. E. F. P.

Iodine titrations; Re-appearance of blue colour in —. H. Dubovitz. Kir. Magyar Természettudományi Társulat, Budapest, Mar. 13, 1915. Chem.-Zeit., 1915, 39, 585.

THE most frequent cause of iodine solutions turning blue after titration is the presence of nitrogen peroxide derived from the air or water. Free or combined bromine, which acts more slowly than iodine upon thiosulphate, may have the same effect. Very slight traces of iodine do not act at once upon starch, but only after some time. In the absence of excess of thiosulphate the solution must therefore become blue again after some time, but this continues only 2 or 3 times, not indefinitely.—C. A. M.

Arsenic, antimony, and tin; Separation of —. F. Hahn. Chem. Ges. Frankfurt, Feb. 9, 1915. Chem.-Zeit., 1915, 39, 566.

THE precipitate of the mixed sulphides and sulphur is treated in the cold with sodium sulphide solution; the sulphur remains undissolved in a powdery form and is filtered off. The filtrate is treated with an excess of concentrated sodium hydroxide solution and then with hydrogen peroxide or sodium peroxide until evolution of oxygen occurs. Oxidation is completed by warming. Antimony separates after a short time as a crystalline precipitate, $\text{Na}_2\text{H}_2\text{Sb}_2\text{O}_7$. The filtrate from this is boiled with ammonia, and after the tin has been filtered off as stannic acid the arsenic is precipitated as magnesium ammonium arsenate.—J. H. L.

Molybdic acid recovery. C. G. Armstrong. J. Ind. Eng. Chem., 1915, 7, 761.

ANY phosphomolybdate precipitate mixed with the molybdic acid residues is filtered off, and the filtered solution is evaporated until considerable foaming occurs and only sufficient solution is left to cover the precipitated molybdenum trioxide and retain iron in solution. The mixture is diluted with one-half its volume of water, allowed to settle, the liquid decanted, and the residue washed with water and treated with ammonia solution (1:1).

After warming slightly and allowing to stand for 2 hours, with occasional shaking, the solution is filtered through sand and asbestos, with the aid of the pump, mixed with a further quantity of ammonia solution, and the specific gravity ascertained with a hydrometer at 25°C. From the specific gravity the concentration of MoO_3 in the solution may be ascertained by reference to a graph, as it varies directly with the specific gravity for concentrations not below 0.06 grm. per c.c. The requisite quantity of molybdenum trioxide to bring the concentration up to 0.2825 grm. per c.c. (sp. gr. 1.20 at 25°C.) is added, and the solution when mixed with nitric acid and water is ready for use in the determination of phosphorus. The graph given shows that a solution containing 0.1250 grm. MoO_3 in 1:1 ammonia has the sp. gr. 1.06 at 20°C. and for every increase of 0.0225 grm. per c.c. the sp. gr. rises 0.02. (See also Brown, this J., 1915, 154; Prescott, this J., 1915, 985.) —A. S.

Lead; Detection and determination of—in organic substances. Fauconnier. Ann. Chim. Analyt., 1915, 20, 126–127.

A QUANTITY of 100 grms. of the substance (animal organs, etc.) is treated for 24 hours with nitric acid containing 10% of sulphuric acid, and the mixture then heated until a colourless solution is obtained and the nitric acid has been expelled. The residual solution, measuring about 20 c.c., is neutralised with ammonia, dilute hydrochloric acid is added to dissolve the precipitate which forms, and the solution is treated with hydrogen sulphide. After 24 hours, the precipitated sulphides are collected, dissolved in dilute nitric acid, evaporated to a syrup, diluted with water, and filtered through glass-wool. To the filtrate, measuring about 90 c.c., is added 3 c.c. of saturated potassium thiocyanate solution, the ferric thiocyanate is removed by shaking the solution with several successive quantities of ether, the aqueous solution then heated to expel dissolved ether, cooled, diluted to 100 c.c., and the lead determined colorimetrically as sulphide in the presence of potassium cyanide. The following quantities of lead were found in various animal and vegetable substances:—Human liver (weight, 1250 grms.) 0.0062 grm.; brain (weight, 1160 grms.), 0.0024 grm.; kidney, (weight, 115 grms.), 0.00026 grm.; placenta (weight, 120 grms.), 0.00039 grm.; an artichoke (weight, 215 grms.), 0.0029 grm.—W. P. S.

Nitrogen; Determination of—by Kjeldahl's method. O. Nolte. Z. anal. Chem., 1915, 54, 259–262.

THE addition of sugar to the acid digestion mixture is necessary in the determination of nitrogen in diphenylamine, methylindole, and tetramethylammonium bromide, but the addition is of no advantage in the case of aniline sulphate, betaine hydrochloride, potassium ferrocyanide, hippuric acid, pyrrole, mustard oil, silver thiocyanate, and trimethylamine hydrochloride. Loss of nitrogen may occur when sugar is used in the determination of nitrogen in acetanilide, antipyrine, uric acid, caffeine, and silver cyanide.—W. P. S.

Phosphorus in biological material; Determination of—and the standardisation of solutions of molybdenum. A. E. Taylor and C. W. Miller. J. Biol. Chem., 1915, 21, 255–262.

A QUANTITY of the substance containing about 2 mgrms. of phosphorus is incinerated under conditions which prevent loss of phosphorus, the ash is dissolved in dilute nitric acid and rinsed into a centrifuge tube, 2 grms. of ammonium nitrate and 10 drops of concentrated nitric acid are added, the mixture is heated in a water-bath, and treated with 2 c.c. of 10% ammonium molybdate

solution. After 10 minutes, 5 c.c. of alcohol is mixed with the contents of the tube, this is then filled with alcohol, but the latter is not allowed to mix with the solution, and the whole is centrifuged. The supernatant liquid is decanted, the precipitate washed first by centrifuging with water, dilute nitric acid, and alcohol together, and then with alcohol. The precipitate is now converted into lead molybdate (see Raper, this J., 1915, 102) and weighed as such. The lead precipitation method is the most satisfactory for standardising molybdic acid solutions.—W. P. S.

Chlorides: Determination of—*in small amounts of body fluids.* F. C. McLean and D. D. Van Slyke. J. Biol. Chem., 1915, 21, 361—370.

THE iodometric method for the determination of halides described by the authors (this J., 1915, 608) may be applied to body fluids such as blood plasma, urine, ascitic fluid, gastric juice, etc. Proteins are first removed by heating the fluid with magnesium sulphate and acetic acid, then adding blood-charcoal, and filtering the mixture. The chlorides in the filtrate are precipitated by standardised silver nitrate solution in the presence of nitric acid, the silver chloride is separated by filtration, and the excess of silver is titrated with potassium iodide solution. The titration is carried out in the presence of starch and nitrous acid which act as indicator, and the optimum acidity for the end point is fixed by the addition of sodium citrate in amount equivalent to the free nitric acid present.—W. P. S.

Iodine: Determination of—*in the presence of organic matter.* R. B. Krauss. J. Biol. Chem., 1915, 22, 151—157.

OF the methods hitherto proposed (see Bourcet, this J., 1899, 613; Hunter, 1910, 781; Kendall, 1912, 748) that of Kendall was found the most satisfactory, but occasionally it indicated the presence of iodine in substances containing none, and *vice versa*. The following method is based on the fact that palladous iodide, unlike the chloride and bromide, is insoluble in water, and when precipitated in small quantities lends itself to colorimetry. A quantity of the material to be tested, e.g., thyroid, containing about 1 mgrm. of iodine (larger amounts present no disadvantage but the final liquids have to be diluted), is mixed in a nickel crucible with 8 grms. of an equimolecular mixture of sodium carbonate, potassium carbonate, and potassium nitrate, and covered with a further 5 grms. The crucible is closed so as to leave a vent for escaping gases, and heated in a crucible muffle. As soon as the contents cease burning the temperature is raised until the edges of the mass just begin to fuse; oxidation should then be complete and the whole process should occupy about 10 mins. The cooled melt is dissolved and transferred to a flask with the minimum quantity of water, and treated with 2 c.c. of 10% bisulphite solution to reduce any trace of iodate formed. The solution is made slightly acid to litmus with 85% phosphoric acid, and after a few minutes faint alkalinity is restored by means of solid sodium carbonate and the solution is evaporated until it only just remains liquid when cold. It is then cooled, and shaken with 20 c.c. of acetone until the salts form a semi-solid layer at the bottom of the flask. Successive portions of 5 c.c. of absolute alcohol are well stirred with the mass, and decanted through a filter until the last remains colourless after addition of a few drops of standard palladous chloride solution. Usually 10 c.c. of the solvents is sufficient. The filtered extracts are mixed, brought to an iodine-content of about 0.1—2 mgrms. per 100 c.c. by dilution with water or by concentration, and then treated in a Nessler tube,

drop by drop, with a 0.05% solution of palladous chloride slightly acidified with hydrochloric acid, until no further deepening of colour occurs: 2 c.c. of this palladous chloride solution suffices for 1.5 mgrms. of iodine. The liquid is compared with a series of standards made by diluting potassium iodide solution (0.1 mgrm. of iodine per c.c.) with alcohol, acetone, and water in approximately the same proportions as in the test liquid. These standards are treated with palladous chloride solution, preferably before dilution, as the colour develops best in concentrated liquids. The comparison is made after the solutions have stood for 5 mins.; a difference of colour corresponding to 0.01 mgrm. of iodine is easily recognised by the naked eye. The method was successfully applied to the determination of iodine in iodoacetanilide and other organic compounds.—J. H. L.

Analytical distillation of petroleum. Rittman and Dean. See IIa.

Examination of petroleum lamp oils. Jungkumz. See IIa.

Specific reaction of picric acid. Rodillon. See III.

Determination of methocryl in creosote. Sureda and Gonzalez. See III.

Methylene Blue and its use in analytical chemistry. Atack. See IV.

Toughening action of nitric acid upon filler-papers. Beadle. See V.

Determination of formic acid in presence of acetic acid. Lauffmann. See VII.

Titration of nitrates with ferrous salts. Bowman and Scott. See VII.

The iodide method applied to the determination of copper in presence of tin. Colman. See X.

Extraction of tanning materials, and determination of water-soluble matter in leather. Nihoul. See XV.

Effect of changes in the viscosity of water on the results of the mechanical analysis of soils at varying temperatures. Robinson. See XVI.

Effect of grinding the soil on its reaction [time requirement] by the Feitch method. Brown and Johnson. See XVI.

Determination of sucrose by double polarisation methods. Pellet. See XVII.

Degree of accuracy attainable in establishing constants for the double polarisation method [of sucrose determination], using acid or invertase. Pellet. See XVII.

Determination of sucrose in beet molasses by the double polarisation method, using invertase as catalyst. (1) Saillard. (2) Pellet. See XVII.

Properties and mode of action of honey-diaslase. Gothe. See XVII.

Acid ratio of malt. A new basis for malt valuation. Nowak. See XVIII.

Colorimetric determination of pentoses and methyl-pentoses in wine. Schaffer. See XVIII.

Separation of higher alcohols from ethyl alcohol. Traubics. See XVIII.

Determination of maize flour in admixture with wheat flour. Von Sigmond and Trambies. See XIXA.

Determination of meat extract in soup tablets. Sudendorf and Lahrmann. See XIXA.

Nephelometric determination of traces of phosphoric acid [in water]. Serger. See XIXB.

Determination of temporary hardness in very hard waters. Bennett. See XIXB.

Comparison of methods for determining putrescibility or oxygen demand [of sewage or sewage effluents]. Hale and Melia. See XIXB.

Method of collecting and determining [suspended particles in] smoke and industrial gases. Gautier. See XIXB.

Determination of the wetting power of dipping and spraying fluids. Cooper and Nuttall. See XIXB.

Determination of "lecithin" in small amounts of blood. Bloor. See XX.

Manonitrometer for the analysis of nitrocellulose, nitrating acids, etc. Planchon. See XXII.

Trade Report.

Prohibited exports.

By virtue of an Order in Council of Sept. 16th, the following alterations are made in the lists:—

The exportation of Cumberland hæmatite is prohibited to all destinations.

The exportation of the following (at present prohibited to all destinations) is prohibited to all destinations abroad other than British Possessions and Protectorates:—Compound cakes and meal; cottonseed cake, decorticated and undecorticated, and cottonseed meal; linseed cake and meal; malt dust, malt flour, culms, sprouts, or combings; patent and proprietary cattle foods of all kinds.

The heading "Bone ash" in the list of goods the exportation of which is prohibited to all destinations abroad other than British Possessions and Protectorates is deleted, and there is substituted the heading "Bones for manure, dissolved bones, bone flour, bone meal, and bone ash."

The exportation of the following is prohibited to all destinations abroad other than British Possessions and Protectorates:—Chlorides of sulphur; fustic (chips and extract) and logwood (chips and extract, including hæmatine crystals, and other logwood preparations); whale meal.

The exportation of the following (at present prohibited to all destinations) is prohibited to all foreign countries in Europe and on the Mediterranean and Black Seas, other than France, Russia (except through Baltic ports), Italy, Spain, and Portugal:—Brewers' and distillers' grains; brewers' dried yeast; coconut and poonac cake; gluten meal or gluten feed; maize meal and flour; mill dust and screenings of all kinds.

The exportation of salts of aluminium (other than alunite and nitrate of aluminium), which is at present prohibited to all destinations abroad other than British Possessions and Protectorates, is prohibited to all foreign countries in Europe and on the Mediterranean and Black Seas, other than France, Russia (except through Baltic ports), Italy, Spain, and Portugal.

The heading "Molasses for cattle feeding" in the list of goods the exportation of which is prohibited to all foreign countries in Europe and on the Mediterranean and Black Seas, other than France, Russia (except through Baltic ports), Italy, Spain, and Portugal, is deleted.

The heading "Iron ore" in the list of goods the exportation of which is prohibited to all foreign countries in Europe and on the Mediterranean and Black Seas, other than France, Russia (except through Baltic ports), Italy, Spain, and Portugal, is replaced by the heading: "Iron ore (except Cumberland hæmatite iron ore, the exportation of which is prohibited to all destinations)."

The exportation of the following goods is prohibited to all foreign countries in Europe and on the Mediterranean and Black Seas, other than France, Russia (except through Baltic ports), Italy, Spain, and Portugal: Calcium sulphide; China clay (including China stone and potters' clay); gas carbon.

Trading with the enemy. Royal Proclamation, Sept. 14, 1915.

For the purposes of the Proclamations for the time being in force relating to Trading with the Enemy, the expression "enemy," notwithstanding anything in the said Proclamations, is hereby declared to include, and to have included, any incorporated company or body of persons (wherever incorporated) carrying on business in an enemy country or in any territory for the time being in hostile occupation.

Labour question in the [German] chemical industry after the war. K. Thelen. Chem.-Zeit., 1915, 39, 633—634.

A GREAT scarcity of labour is to be expected after the end of the war, and it is urged that the chemical industry should at once consider and, as far as possible, carry into effect measures for overcoming the difficulty. Further extension of the use of machinery in place of manual labour is advocated, as also, following American practice, the use of apparatus and plant of larger capacity: examples mentioned are the gigantic roasting furnaces of Wedge and Hegeler, the large Kelly filter-press, and the Swenson evaporator. The extension of the employment of women and young persons (under 16 years), to any considerable extent, in the chemical industry is considered impracticable. The most promising method appears to be that of increasing the output per person by adoption of the Taylor system of scientific management. It is stated that by means of this system the number of yard workers in the Bethlehem Steel Works, U.S.A., has been reduced from about 500 to 140. In a German toilet soap factory, after one year's training, the output of two soap cutters was nearly doubled without any complaint of exhaustion or overstrain.—A. S.

German chemical companies' dividends. Chem. Trade J., Sept. 25, 1915.

THE Chem. Fabr. Grünau Landshoff und Meyer earned net profits of £13,000 in 1911-15, as against £17,000 in the previous year, the dividend being 7½%, as compared with 10%. The Heinrichshall Chemical Works reports net profits of £1100, as contrasted with £180, and a dividend of 2½%, as compared with nil in 1913-14. The H. A. Meyer and Riemann Chemical Works, of Hannover-Linden, made net profits amounting to £12,000, as against £6,400, and distributed a dividend of 6%, as against 5%; and the Farbwerke Franz Rasquin, of Köln-Mülheim, have declared a dividend of 6%, as in 1913-14. The Bavarian Company for Chemical and Agricultural Chemical Products is

unable to make any distribution for 1914-15, as was also the case in the previous year; the Phoniak Chemical Works, of Neuss, and the Freiburg Chemical Works, of Freiburg, incurred a fresh loss in 1914-15; and the Chemical Industry Company, of Bochum, is also not in a position to pay any dividend, as in 1913-14. The Nitrit Fabrik, of Copenik, which paid 4½% in 1913-14, is reported to have traded at a loss in the past financial year. The company's investment in the Formate Products Co., Ltd., of London, which was formed in 1909 for the protection of the company's English patents, has been entirely written off the books.

Books Received.

THE ANALYSIS OF DYESTUFFS, AND THEIR IDENTIFICATION IN DYED AND COLOURED MATERIALS—LAKE-PIGMENTS, FOODSTUFFS, ETC. By Prof. ARTHUR G. GREEN, M.Sc., F.R.S., F.I.C. pp. ix. + 144, 9 × 6½ in., with 31 Analytical Tables. Charles Griffin & Co., Ltd., London. 8s. 6d. net.

The importance attaching to this treatise lies in the circumstance that the methods of dye analysis therein presented are for the most part the revised and completed results of investigations conducted by the author and several collaborators during the last twenty years.

The introductory chapter serves as a summary of those elements of organic chemistry which are essential to a clear understanding of the nature of synthetic dyes.

Chapters II. and III. deal with the classification of colouring matters. Two methods are indicated: (1) the chemical classification in which the dyes are arranged according to their specific chromophors or colour bearing groups; (2) the dyeing classification in which the divisions depend on the mode of application of the dye to the textile fibres.

Chapter IV. is devoted to the methods of analysing colouring matters in bulk. These processes, which are tabulated, lead to the reclassification of the dye to its appropriate class in both the chemical and dyeing systems of classification. Further tests for specific dyes are described, and by the aid of these reactions and comparative dyeing tests against standard colouring matters, the identity of the dyestuff under examination is frequently revealed.

A considerable proportion of the commercial brands of dyestuffs are mixtures, and ingenious methods for recognising and even for separating the constituents of such mixtures are described. Among these processes may be mentioned the sprinkling and capillarity tests and the separations by dyeing, solvents, and adsorption.

In detecting artificial dyes in foodstuffs the dye is preferably transferred to white wool, or basic dyes may be fixed on tannin-mordanted cotton. The further treatment of these dyed fabrics is detailed in the following chapters (V. and VI.), which relate respectively to the identification of dyestuffs on animal and vegetable fibres. The identifications on wool present the simpler problem. The general procedure consists in successive stripping tests with dilute acetic acid and ammonia followed by reduction experiments with rongalite (sodium formaldehyde-sulphoxylate) and re-oxidation of any resulting leuco-compounds with air or ammonium persulphate.

One of the initial difficulties in the identification of dyes on vegetable fibres arises from the presence of the tannin mordant used in the case of basic

colours. This mordant is removed by dilute caustic soda saturated with sodium chloride; the basic dye is then transferred to wool and tests applied as in the case of dyed woollen samples.

Chapter VII. is devoted to the important topics of the valuation of commercial indigo and the testing of indigo-dyed fabrics.

Chapter VIII. contains a scheme of analysis for pigments and lake colours employed for paints, printing inks, lithographic colours, and wall paper stains. The final tests for classification and identification of the dyes are effected after transferring the organic colour to wool or cotton.

The concluding chapter gives a concise account of the two general methods employed in determining the constitution of azo-dyes.

This manual is furnished with two indexes, one to the text and the other to the analytical tables. The latter enables the reader to find quickly the reactions of any of the principal organic dyes.

G. T. MORGAN.

ON THE RELATION OF IMPORTS TO EXPORTS. By J. TAYLOR PEDDIE. Longmans, Green & Co., London. 88 pages, 7½ by 5 in. 2s. 6d. net.

The two essays of which this book consists are entitled respectively "On the relation of imports to exports" and "Foreign exchange—The bill of exchange." The author shows that the mere figures extracted from the trade returns cannot be taken as an exact indication of the commercial prosperity of a country, and gives a brief description of the financial system on which international commerce of to-day is founded. The second essay contains numerous quotations from an address by Dr. Ewing Pratt, of the U.S. Bureau of Foreign and Domestic Commerce, on May 27th last, on the economic situation of the United States.

*Dissertations.

[The Roman numerals in thick type refer to the similar classification of abstracts under "Journal and Patent Literature" and in the "List of Patent Applications."]

VII. *Anderson, J. S.*: Die Struktur des Gels der Kieselsäure. Göttingen. 1914. 58 S. 8°.

Bullner, H.: Ueber feste Hydrosol von Metallhydroxyden und -oxyden. Leipzig. 1914. 68 S. 8°.

Kerstein, H.: Reduktionen in der umgekehrten Chlorknallgasflamme. Berlin. 1914. 27 S. 8°.

Patrick, W. A.: Die Aufnahme von Gasen durch das Gel der Kieselsäure. Göttingen. 1914. 40 S. 8°.

Poppe, W.: Ueber die Auflösung von Natriumchlorid- und von Natriumchlorat-Kristallen. Kiel. 1914. 65 S. 8°.

Sachadā, O.: Ueber nitrose Gase. Leipzig. 1914. 57 S. 8°.

Trümmer, F.: Ueber Wasserstoffsperoxyd und Wasserstoffsperoxydpräparate mit besonderer Berücksichtigung des "Ortizon." Würzburg. 1914. 35 S. 8°.

VIII. *Ender, K.*: Ueber den Bleigehalt glasierter Tongeschirre. Tübingen. 1914. 13 S. 4°.

X. *Bormann, W.*: Ueber die Temperaturkonzentrationsdiagramme des Kohlenstoffes mit Mangan, Nickel und Eisen. Danzig (Techn. Hochsch.). 1914. 54 S. 8°.

Debuch, A.: Studien zur elektrothermischen Zinkgewinnung. Berlin (Techn. Hochsch.). 1914. 59 S. 4°.

Hagemann, W.: Ueber die Oberflächenspannung geschmolzener Metalle. Freiburg i. B. 1914. 48 S., 4 Taf. 8°.

Muempel, E.: Ueber die Zerstäubung scheibenförmiger Eisenkathoden unter konstanten Verhältnissen im sehr hohen Vakuum. Halle a. S. 1914. 19 S., 2 Taf. 4°.

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Wolfrum, P.: Beiträge zur quantitativen Analyse des Eisens. München (Techn. Hochschule). 1914. 74 S. 8°.

Wurmback, M. O.: Elektrolytische Entkupfernickelung. Karlsruhe (Techn. Hochschule). 1914. 68 S., 1 Taf. 8°.

XI. *Gummelt, H.*: Ueber den Einfluss kolloidaler Substanzen auf die Ueberführungszahl und das Leitvermögen einiger ternärer Elektrolyte. Halle a. S. 1914. 39 S. 8°.

Hoffmann, W.: Beitrag zur Kenntnis der elektrochemischen Reduktion von Kondensationsprodukten aromatischer Aldehyde und Ketone mit Aminen. Giessen. 1914. 31 S. 8°.

XII. *Thiele, E.*: Ueber vollständig hydrierte Fette. Ueber Phenyl-1-äthanol-1-amin-2 und verwandte Verbindungen. Göttingen. 1914. 50 S. 8°.

XVI. *Nostitz, A.*: Die Fruchtbarkeitsverhältnisse in verschiedenen Schichten eines Bodenprofils. München (Techn. Hochschule). 1914. 40 S., 2 Taf. 8°.

XVIII. *Baumann, A.*: Beiträge zur chemischen Kenntnis der Malzkeime. München (Techn. Hochschule). 1914. 35 S. 8°.

Ruckdeschel, W.: Ueber Melanoidine und ihr Vorkommen im Darmmalz. München (Techn. Hochschule). 1914. 98 S. 8°.

XIXA. *Blanchard, O.*: Ueber die Saponine der Futterrübe. Rostock. 1914. 32 S. 8°.

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XIXB. *Lacour, H.*: Die Reinigung städtischer Abwässer in Deutschland nach den natürlichen biologischen Verfahren. Münster. 1914. IV, 96 S. 8°.

Maier, E.: Vergleiche über Emischer-, Kremer- und Stigbrunnen, Neustädter Becken, biologische und chemische Klärung nach den Ergebnissen der Stuttgarter Versuchskläranlagen. Stuttgart (Techn. Hochschule). 1914. 15 S., 4 Taf. 4°.

XX. *Comberg, Fr.*: Zur Kenntnis der aliphatischen Terpenkörper und über das 1,3-Dimethylcyclohexadien (1,3). Kiel. 1914. 55 S. 8°.

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Schutz, L. A.: Ueber Glukocheirolin, das Glykosid des Goldlacksamens. Jena. 1914. 50 S. 8°.

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Willstätter, R., u. Zechmeister, L.: Synthese des Pelargonidins. Berlin 1914. 7 S. Lex.-8°.

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XXI. *Aron, R.*: Ueber die Farbenwiedergabe mit der Lippmannschen Methode. Mit 2 Taf. Leipzig. 1914. 49 S., 2 Taf. 8°.

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XXIII. *Beckmann, E.*: Verfahren zur Prüfung der Luft auf Gehalt an brennbaren Stoffen. Berlin 1914. 12 S. m. 2 Fig. Lex.-8°.

Dannecker, C.: Ueber doppelte neutrale Punkte und die elektromotorischen Kräfte einiger Thermoelemente zwischen -200° und +1000° C. Freiburg i. B. 1913. 48 S. 8°.

Demharler, L.: Vergleichende Untersuchungen über die gravimetrischen und titrimetrischen Methoden zur Bestimmung der Wolframsäure. Stuttgart (Techn. Hochschule) 1914. 71 S. 8°.

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Petersen, A.: Verfahren zur Messung schnell wechselnder Temperaturen. Berlin (T. H.) 1913. 36 S. 4° (8°).

Zeilis, A.: Zur Analyse von Gemischen niedriger Fettsäuren. Würzburg 1913. VIII, 62 S. 8°.

XXIV. *Pape, H.*: Die Einwirkung von Salzgemischen auf Suspensionskolloide als Grundlage für die Bestimmung von Reaktionsgeschwindigkeiten durch Kolloidfällung. Braunschweig Techn. Hochschule. 1914. 52 S. 8°.

Schultz, G.: Wechselwirkungen in der Entwicklung der modernen chemischen Industrie. München (Techn. Hochschule.) 1914. 17 S. 4°.

* Compiled by H. Grevel and Co., 43, King Street, Covent Garden, London, W.C., from whom all the works in the preceding lists can be obtained.

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LOST CANADIAN AND U.S. COPIES OF THE JOURNAL FOR AUG. 31st, 1915.

Owing to the sinking of the s.s. *Hesperian* by a German submarine on Sept. 6th, some 1500 copies of the August 31st Journal for Canadian and U.S.A. Members and Subscribers were lost. The Council has ordered the text of this issue to be reprinted, as the stock in hand is not nearly large enough to replace the lost copies. There will be some unavoidable delay in dealing with the numerous applications for replacement which are being received by every mail, but the circumstances are, it is hoped, exceptional, and the blame must rest on the criminals responsible for the act.

London Section.

Meeting held at Burlington House on Monday, June 7th, 1915.

PROF. W. R. HODGKINSON IN THE CHAIR.

"ADOBE" AS A MATERIAL FOR THE CONSTRUCTION OF EXPLOSIVES BUILDINGS.

BY ABRAHAM FERRIZ Y SAVINON.

Of the various materials that have been proposed for the construction of buildings for the storage and manufacture of explosives, none has yet fulfilled all the necessary conditions.

The efficiency of fortifications and parapets of clayey earth, the durability, stability, and cheapness of the rural constructions in Mexico, made of a material called "adobe," and the efficient protection which such buildings afford against extremes of temperature, suggested the following experiments with a view to the application of "adobe" for the construction of explosives buildings.

"Adobe" consists principally of clayey earth, water, and straw, mixed in very variable proportions; the straw may be replaced by manure or grass. The components are beaten together to obtain a mixture as homogeneous as possible, called "Barro," which is poured into rectangular wooden moulds. After about three days the "adobes" will have acquired such a consistency that they can be lifted from the ground; they are then stacked in the open air for at least 15 days to facilitate drying. In Mexico there are many buildings of adobe with stone foundations, built more than 100 years ago, and still in good condition.

At the author's suggestion, the "National Mexican Company for Dynamite and Explosives," at Dinamita, State of Durango, Mexico, constructed in 1909 a building of adobe, with a roof of galvanised iron, and wooden ceiling and door. Temperature observations were taken during twelve months, the door being kept closed. Whilst the external temperature varied between -4.6° and $+40.1^{\circ}$ C., the temperature within the building only varied between 13.0° and 35° C.

The temperature variation in buildings entirely constructed of adobe (i.e., with adobe arches) is even less than this.

In February and March of last year, five buildings of adobe and one of reinforced concrete were constructed near the City of Mexico, to obtain an idea of their relative value for the construction of explosives buildings.

Some idea of the resistance of arches of adobe to mechanical shock is given by the fact that iron pulleys, weighing up to 41 kilos., were dropped on the arches from a height of 10 metres without causing injury.

A building of adobe with a galvanised iron roof, protected by mounds of earth supported by adobe walls, was charged with a ton of 40% gelatinous dynamite; this charge was taken to make the experiment comparable with those carried out at Kummersdorf, in 1897 and 1899, under the direction of Dr. C. E. Bichel. As a result of the explosion the walls which sustained the mounds of earth, as well as those of the building, were reduced to powder and to pieces which fell on an area less than 60 metres in diameter. The galvanised iron roof was destroyed, but the walls and arches of adobe in a similar building 25 metres away remained intact. The walls of a building of reinforced concrete at a similar distance showed large cracks.

To compare the buildings of adobe and reinforced concrete, half a ton of the explosive was fired in each building. The reinforced concrete building was $4 \times 3.5 \times 3$ metres high, the mortar used for the walls being composed of 1 part cement to 4 of sand, and for the roof, 1 to 3. The reinforcement of the walls consisted of $\frac{1}{4}$ inch bars 20 cm. apart, and of the roof $\frac{1}{4}$ inch bars 10 cm. apart. The roof was 12 cm. thick and the walls 50 to 60 cm. The adobe building was 3.7 m. high to the centre of the arched roof, and the internal dimensions were 3×4 m. The walls supporting the arch were 1.5 metres thick at the base and 1.3 m. at the top. Neither building was protected by earth parapets.

When the reinforced concrete building was exploded some projectiles were found 700 metres from the centre of the explosion. At 560 metres pieces of cement were found weighing 900 grms. and at 180 metres pieces weighing 4.2 kilos. The iron reinforcements of the walls were broken to pieces and thrown in all directions, whilst the reinforcement of the roof was thrown almost intact to a distance of 35 metres. Five buildings of adobe, at distances of 25 and 50 metres from the explosion, were only very slightly affected. A piece of one of the keystones from the arch of a building at 50 metres and some adobes were displaced from the upper part of the sustaining wall of the parapets of another building at the same distance. None of the charges in these buildings was exploded by the concussion.

The adobe building was then exploded. The walls were reduced to powder and fragments covering an area of 150 metres radius. The fragments found were not large enough to perforate the roof of a building, nor to cause serious damage to persons.

A similar adobe building charged with 180 kilos. of dynamite in 8 boxes each containing 22.5 kilos. was next exploded to observe the effects of a smaller charge upon the walls and arches of adobe. The walls were reduced to powder, and fragments were thrown within an area of 150 metres diameter. Sheep placed in concentric circles, with radii varying from 25 metres from the centre of the building to 300 metres, suffered no apparent damage from the effect of the explosions.

To test the resistance of the adobe to projectiles of portable firearms, 25 shots were fired with a 7 mm. Mauser rifle, from a distance of

25 metres, against a wall of adobe one metre thick. None of the projectiles penetrated more than 60 cm.

The dynamite employed in the experiments was presented by the National Mexican Company for Dynamite and Explosives.

These experiments show that buildings of "adobe" containing less than half a ton of dynamite need not be protected with earth parapets provided they are more than 25 metres apart.

Though these experiments are not put forward as being complete, the author considers them to be of sufficient interest to justify their publication.

The entire manufacture of 1000 adobes $0.5 \times 0.25 \times 0.10$ metre can be carried out by 6 men, in 18 hours of work. The quantity of straw generally used is 180 kilos. In the preparation of the clay sufficient water is used to form a workable paste. The hardness of the adobe increases with the proportion of clay in the earth used.

In the City of Mexico, the manufacture of adobes, of the ordinary dimensions, is contracted at \$7.00 (about 14s.) a thousand; and the construction of the walls 50 cm. thick, at about \$11.00 (22s.) a thousand up to three metres in height. When the water and the necessary earth are obtainable on the spot, the cost of a building of adobe is, approximately, 20% of that of a similar building of reinforced concrete, and in many cases is less than one of wood.

Recently a machine has been placed upon the market in Mexico City for making adobes, similar to those used for the making of bricks, which is claimed to produce 1000 adobes an hour.

It is preferable to construct the walls of adobe upon stone foundations, especially in wet places, and to plaster them with lime mortar and sand.

A sample of the adobes used in the experiments described, showed a mean resistance to breaking by pressure of 8 kilos. per sq. cm. Another sample was analysed in the Geological Institute of Mexico with the following results:—

Straw and organic materials that did not pass through sieve No. 40		1.8%
Sand that did not pass through sieve No. 100		17.3%
Fine sand that did not pass through sieve No. 200		19.1%
Clay that passed through sieve No. 200		61.3%
		99.5%

One cubic metre weighed 1550 kilos. Moisture (130° C.), 5.80%; loss at red heat (water, organic matter, etc.), 7.71%.

DISCUSSION.

Captain C. J. GUTTMANN explained that Major Ferriz had sent the paper to him last year, asking him to read it, but owing to the war it had not been possible.

The building of reinforced concrete as designed by Major Ferriz seemed to be very dangerous. When a charge was exploded inside a building made of weak gravel concrete, as suggested by his late father, the material went into fragments of a very small size, just as in the case of adobe. Adobe would be quite suitable in Mexico, but he was afraid that in this country adobe by itself could not stand the continuous rain. He believed the best material to use was a kind of brick dust; it was quite possible to use in Europe a material similar to adobe and cover it with cement. He thought that if a type of reinforcement was used for the weak gravel concrete walls of the building and possibly also for the roof, which was not tied together to the same extent as the one which was apparently used by Major Ferriz, there should be very little risk of the reinforcement being projected in a dangerous manner. That view seemed to be supported in one of the reports of the Home Office Explosives Department, in which reinforcement was recommended, and he understood that at the present time there were one or two buildings for explosives manufacture

being made in reinforced concrete. As little cement as possible should be used for the concrete, so that there should be very little resistance in the event of an explosion, and the necessary amount of weather-proofing could be obtained by cement rendering. With regard to reinforcement, it seemed to him that it was quite sufficient if there was electrical connection between the individual portions of the reinforcement, to render the building as far as possible proof against lightning.

Dr. S. RIDEAL drew attention to the danger of tetanus and other diseases which might arise as a result of explosions in buildings made with manure.

Mr. W. F. REID said that the use of manure for mixing with clay was very general in the Argentine, when the clay would not dry without cracking. He did not think it was likely to convey any disease such as anthrax, because when that was prevalent there were no cattle about. Poor clays would dry without cracking, but most clays, such as the London clay, would simply crumble into fragments on drying, and would require a considerable mixture of vegetable material, such as sawdust. A very good concrete could be made with sawdust, and he very strongly objected to using gravel concrete in any shape or form, because in case of explosion gravel would make a very fair substitute for shrapnel.

Captain GUTTMANN said the size of gravel intended for the concrete was considerably less than shrapnel.

Mr. REID said that sand would be unobjectionable, but he did not see any object in using gravel. A very fair friable concrete could be made by using one part of good Portland cement to about ten parts of light sand, or other ingredients. A good deal of concrete had been made with breeze, which was supposed to be a very good ingredient, and had been passed by the London County Council as a fireproof material for building an Exhibition. He had seen the building under construction, and the workmen were actually boiling their kettles by means of fragments of the fireproof concrete. The building was all right and was limewashed and there had never been a fire there. He thought adobe clay mixed with vegetable matter such as sawdust could be made very satisfactorily indeed, and it seemed to him it was an excellent idea; but he would suggest that it should not be made into bricks but be made *in situ*, because the bricks would have to be united with some kind of cement. They were not told what it was, but there was little doubt that it was the same clay as was used to make the bricks. One of two things would happen—either the cement between the bricks was of a more friable nature than the bricks and the bricks would then fly asunder as bricks, or a stronger cement than the bricks themselves was used, and it would go in a lump. Adobe was in very general use in the Argentine plains, where they had no other building material. It was made in a very crude way, the walls being built of mud made by wetting the clay. There was a disadvantage in having it in humps; but on the whole he thought that if the stresses were properly apportioned and the material made *in situ*, it would be better for the purpose, and less liable to fly about than by using it in the form of bricks. Another thing that had to be considered in the English climate was the preservation of the clay. Big eaves and waterproof roofs would be necessary. Portland cement would not adhere to clay at all; the best coating one could give was composed of blood and lime. It was a very serviceable mixture and stood water well and adhered to adobe. It was mixed up into thin paste and brushed on, and was renewed every two or three years. The lime combined with the albuminous material of the blood, forming a greenish insoluble product.

Journal and Patent Literature.

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I.—GENERAL; PLANT; MACHINERY.

Apparatus for study of reactions between gases and liquids. Reid. See XX.

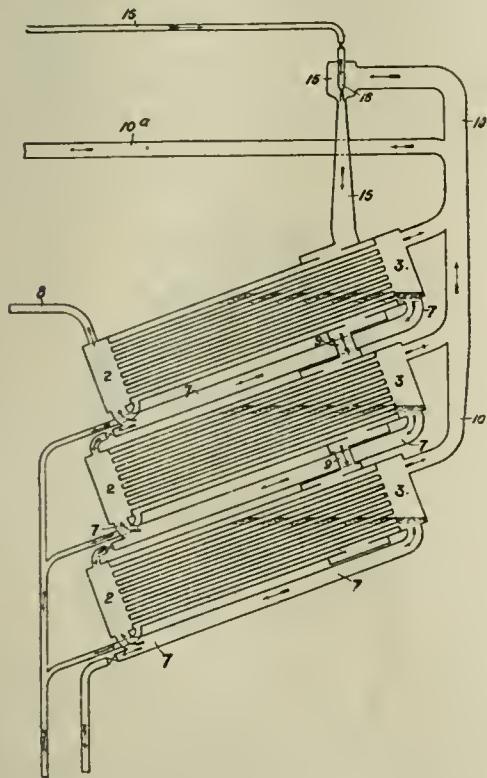
PATENTS.

Evaporating and concentrating liquids; Apparatus for —. Fawcett Preston and Co., Ltd., and A. McA. Lang, Liverpool. Eng. Pat. 19,567, Sept. 9, 1914.

THE upper tube-plate of a tubular evaporator has the form of a shallow inverted cone, and the tubes are fixed at right angles to the plane of the cone. The lower tube-plate consists of two or more stepped cones. An annular heating belt is provided around the bottom of the outer casing. This arrangement of the tube-plates ensures effective circulation of the liquid in the lower part of the apparatus.—W. H. C.

Evaporating and concentrating liquids; Apparatus for —. Fawcett Preston and Co., Ltd., and A. McA. Lang, Liverpool. Eng. Pat. 19,568, Sept. 9, 1914.

THE liquid to be evaporated is fed through the pipe, 8, into the lower header, 2, of the uppermost evaporator, and is partly evaporated, both the



vapour given off and the concentrated liquid passing into the upper header, 3. From this

chamber the liquid passes by the pipe, 7, to the lower header, 2, of the second vessel, and so on to the lowest vessel, from which the concentrated liquid is withdrawn. The steam given off is separated in the header, 3, and passes up the pipe, 10, to the steam jet compressor, 16; any surplus steam passes by the pipe, 10a, to a vessel for pre-heating the liquid to be evaporated. The compressed steam, with the steam used for the compression, passes down the pipe, 15, into the tubes of the upper vessel, and thence by the pipe, 9, to the second vessel, and so on. Condensed water is withdrawn from the lower ends of the steam spaces.—W. H. C.

Evaporating, concentrating, or heating liquids; Apparatus for —. C. Day, A. Farmer, and W. M. Sandison, Glasgow. Eng. Pat. 22,636, Nov. 17, 1914.

THE heating tubes of evaporating or concentrating apparatus are each provided with a core having helical guide ribs, which may be of right and left handed pitch alternately, and baffles at intervals to retard the flow of liquid. The core is of larger diameter at the inlet end and may be rotated by a projecting spindle.—W. F. F.

Cooker or evaporator; Continuous —. A. R. Morse, Chicago, Ill. U.S. Pat. 1,153,170, Sept. 7, 1915. Date of appl., Sept. 26, 1910.

THE material to be treated is pumped at a regulated rate through an externally heated tubular container and thence into a pair of temperature-controlling chambers, within which a partial vacuum is maintained.—W. H. C.

Agitation of liquids during evaporation; Apparatus for the —. M. Wendriner. Ger. Pat. 284,577, Dec. 18, 1913.

A STEAM or gas injector is fixed inside a vertical double-walled cylinder in the centre of the evaporating vessel, and radial pipes, perforated along one side, project outwards from the annular space between the walls of the cylinder, to which also steam or gas is supplied; the radial pipes may be arranged in several superposed series. The action of the injector produces a circulation of the liquid in a vertical direction, and this is supplemented by a horizontal circulation produced by steam or gas issuing from the perforations in the radial pipes.—A. S.

Cooling or heating fluids; Apparatus for —. A. J. E. Munters, Stocksund, Sweden. Eng. Pat. 20,017, Sept. 21, 1914. Under Int. Conv., Sept. 24, 1913.

A NUMBER of concentric inverted cones, spaced apart, are arranged one above the other, on a central vertical shaft in a casing. The fluid to be treated passes in one direction through one alternate set of spaces so formed, and the heating or cooling medium passes in the opposite direction through the other alternate set of spaces. Communication between the spaces of each set is established at the periphery by means of projections from the cones, and at the axis by passages formed in the shaft and perforated rings, which grip the shaft and are interposed between the cones.—W. H. C.

Heating and cooling liquids; Apparatus for —. The Unit Engineering Co., Ltd., and C. Mather, jun., Manchester. Eng. Pat. 5976, Apr. 21, 1915.

THE apparatus described in Eng. Pat. 15,215 of 1910 is modified in that the units or plates, when assembled, are clamped together by bolts outside the intermediate plates and passing only through the end plates. In this way the bolts are not subject to the same variation of temperature as when they pass through the intermediate plates, and consequently the joints between the plates remain tighter. The cavities in the plates through which the fluids flow, in opposite directions in alternate plates, are divided by a central rib, which divides the flow.—W. H. C.

Measuring or regulating the temperature or the differences of temperature of liquids; Apparatus for —. J. F. Simmance, London. Eng. Pat. 23,564, Dec. 4, 1914.

A VESSEL containing a liquid (mercury for example) having a rate of expansion different from that of the liquid of which the temperature is to be measured, is suspended from the arm of a balance, so as to be completely immersed in the liquid. As the temperature of the liquid varies, the vessel rises or falls owing to the difference of rates of expansion of the two liquids, and the tendency to rise or fall is partly compensated by a counterbalance. The temperature is indicated by a pointer attached to the beam of the balance. If the difference of temperature of two liquids is to be measured, a vessel is suspended from each end of the balance, one in one liquid and one in the other. The temperature can be regulated by making the movement of the beam control a tap through which the heating agent is supplied.—W. H. C.

Tunnel dryers. T. C. Fawcett, Ltd., and D. L. Fawcett, Leeds. Eng. Pat. 470, Jan. 12, 1915.

THE material, e.g., sand, stone, ore, or the like, is moved over the heated floor of a closed tunnel by the reciprocation of toothed or twisted scrapers or like conveyers. The floor is heated by hot furnace gases which then pass through the tunnel. A diaphragm, with an opening for the scrapers, is provided at the entrance to the tunnel to prevent the admission of cold air.—W. F. F.

Drying-floors. J. R. and H. N. Torrance, and Torrance and Sons, Ltd., Bitton, Glos. Eng. Pat. 6318, Apr. 28, 1915.

IN a drying-floor of the type consisting of a number of flanged plate sections resting side by side in a continuous network of channels, and heated by the circulation of exhaust or live steam beneath, the plate sections are supported only at the corners (the usual outwardly-inclined flanges being cut away for this purpose) and carried entirely by the junction pieces of the channels. A bituminous composition, or other material semi-fluid and elastic under the influence of steam, is placed in the channels. Escape of the jointing material from between the junction pieces and the troughs is prevented by the use of a caulk of lead wire, for which purpose the parts in question are suitably grooved.—W. E. F. P.

Disintegrating solid substances; Apparatus for —. W. S. and G. S. Barron, Kingsholm, Glos. Eng. Pat. 2505, Feb. 17, 1915.

THE disintegrator chamber is divided into two compartments by a vertical perforated partition. Pivoted beater-arms are rotated in each compartment. The material is fed into one compartment, where it is partially disintegrated, and then passes through the perforated partition into the second compartment, where the disintegration is completed; the lower part of the

second compartment is lined with abrasive material and is provided with a pocket to retain the non-pulverised matter.—W. H. C.

Ball-mills. F. E. Marcy, Salt Lake City, Utah. U.S.A. Eng. Pat. 10,033, July 9, 1915.

THE grate or transverse screen of the ball mill consists of a series of radial segments or sectors supported on radial blades attached to one end of the drum and subdivided into transverse sections or grate bars.—W. H. C.

Rotary furnace or kiln. F. T. Downs, Buffalo, N.Y. U.S. Pat. 1,151,574, Aug. 31, 1915. Date of appl., March 19, 1915.

A MANIFOLD head with attached manifold is fixed to one end of a rotating cylindrical kiln, and a non-rotating blast head is fixed so that it presses against the manifold head but allows free rotary movement of the latter and the attached cylinder.—W. H. C.

Emulsifying two or more liquids; Process for combining and —. J. B. Vogelsang, Webster Groves, Mo. U.S. Pat. 1,152,456, Sept. 7, 1915. Date of appl., Oct. 10, 1914.

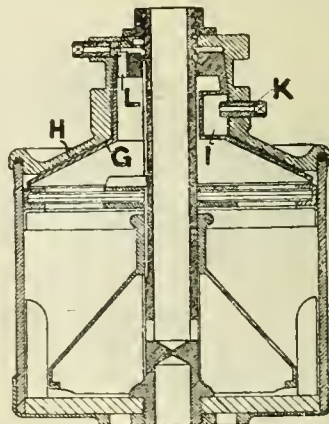
THE liquids are propelled by a steam jet against a solid plate at the end of a chamber, and then through the roughened and perforated walls of the chamber. (See also U.S. Pat. 1,140,548; this J., 1915, 785.)—W. F. F.

Filtering apparatus. C. J. Brockbank, Assignor to The Carborundum Co., Niagara Falls, N.Y. U.S. Pat. 1,152,875, Sept. 7, 1915. Date of appl., Jan. 7, 1914.

A FILTER plate of carborundum without any foreign binding substance is keyed into a support of acid-resisting material, e.g., silicon, by a ring also made of acid-resisting material.—W. H. C.

Centrifugal machine for the separation of liquids of different specific gravities. Dürkoppwerke A.-G. Ger. Pat. 284,578, Oct. 18, 1913.

THE apparatus (see fig.) is intended for the separation of a small quantity of a heavier liquid from a large quantity of a lighter liquid, e.g., of water



from oil. The heavier liquid is forced outwards and rises through the channel, H, formed in the member, G, into the closed chamber, I, whence it is discharged through the adjustable outlet, K; the lighter liquid escapes through L. The tube, K, is arranged so that its distance from the vertical axis of the apparatus is less than that between the axis and the inner edge of the outlet passage, L, on the side remote from the shaft.—A. S.

Centrifugal machine; Continuous discharge — [for separating liquids and solids]. J. J. Armstrong, Honolulu. U.S. Pat. 1,153,307, Sept. 14, 1915. Date of appl., Jan. 31, 1913.

THE material is fed to the centre of a shallow horizontal chamber rotating about a vertical axis. The chamber wall is bent back upon itself at its periphery, the discharge opening for the solids being comparatively near the axis. The outer wall of the chamber at the bend is perforated and surrounded by a concentric wall, forming an annular discharge chamber for liquid in excess of that required to fill the bend.—W. F. F.

Crystallising apparatus. E. Krüger, geb. Köwing. Ger. Pat. 284,696, Aug. 18, 1912.

IN a counter-current cooling apparatus, containing a number of sets of cooling tubes connected in series, the cooling tubes are provided with attached frameworks to which the crystals can adhere, whilst the cooling tubes themselves are kept free from deposits by means of scrapers.—A. S.

Solid-bearing solutions; Apparatus for treating —. L. C. Trent, Los Angeles, Cal. U.S. Pat. 1,152,769, Sept. 7, 1915. Date of appl., June 12, 1912.

SEE Eng. Pat. 21,413 of 1913; this J., 1915, 142.

Concentrating liquids; Apparatus for —. U. Rossi, Milan, Italy. U.S. Pat. 1,152,977, Sept. 7, 1915. Date of appl., June 3, 1911.

SEE Fr. Pat. 432,231 of 1911; this J., 1912, 16.

Emulsions; Process and apparatus for the preparation of —. Flakes Aktieselskab. Fr. Pat. 474,976, July 10, 1914. Under Int. Conv., Oct. 18, 1913.

SEE Eng. Pat. 23,653 of 1913; this J., 1914, 1167.

Emulsions; Process and apparatus for the preparation of —. Flakes Aktieselskab. Fr. Pat. 475,097, July 11, 1914. Under Int. Conv., Nov. 5, 1913.

SEE Eng. Pat. 25,265 of 1913; this J., 1914, 1218.

Evaporating devices [for sulphuric acid]. Eng. Pat. 23,919. See VII.

Catalyser and process of making same. U.S. Pat. 1,151,718. See XII.

Apparatus for grinding chocolate and similar material. Grinding and reducing apparatus. Eng. Pat. 20,860 and 20,861. See XIXa.

IIA.—FUEL; GAS; MINERAL OILS AND WAXES.

Coal; Composition of —. D. T. Jones and R. V. Wheeler. Chem. Soc. Trans., 1915, 107, 1318—1321.

A BITUMINOUS coal from Durham was separated by prolonged treatment with boiling pyridine into an insoluble portion (a), and a soluble portion, which, by extraction with chloroform, yielded an insoluble portion (b) and a soluble portion (c), the latter being of resinous character, whilst (a) and (b) mainly belong to the humic class of compounds. The portions (a) and (b) yielded on distillation very small percentages of liquid products, mainly phenols, whereas 40 to 50% of the portion (c) distilled below 400° C., and no phenols were obtained, the distillates being principally paraffins, olefines, and naphthenes. The formation of phenols indicated the presence of the furan grouping in the humic substances, and the portion of the coal insoluble in pyridine may be regarded as derived from the woody fibre or celluloses of the original coal plants. The gases evolved from the portions (a) and (b), between 300° and 450° C.,

consisted mainly of paraffins, hydrogen, and carbon monoxide, with smaller quantities of ethylene and carbon dioxide, and the similarity in their composition indicates that similar groupings of atoms occur in each of the two portions of the coal, and undergo decomposition in the same manner.—B. N.

Nitrogen in coal and coke; Acceleration of Kjeldahl's method of determining —. B. M. Margosches and A. Lang. Chem.-Zeit., 1915, 39, 673—675.

THE digestion with sulphuric acid in the preliminary stage of the Kjeldahl process for the determination of nitrogen in coke, may frequently be materially shortened by the use of asbestos (1 gm.) impregnated with copper oxide (0.8 gm.). With soft cokes, a longer time is required with asbestos (1 part) impregnated with tungsten trioxide (2 parts) than when mercuric oxide is used. The favourable action of tungstic acid is most noticeable with hard cokes. For example, a specimen which was hardly affected by 19 hours' digestion in presence of mercuric oxide, was ready for distillation after 8 hours' digestion in presence of tungstic acid. By using mercuric oxide, copper oxide, potassium bisulphate, etc., in addition to asbestos impregnated with tungstic acid, the period of digestion may be reduced to 1 to 2 hours. In the case of coal, the addition of mercuric oxide (0.5 gm. per 1 gm.) effects a great reduction in the time of digestion (e.g., 9 hours to 1 hour), whereas tungstic acid has much less effect. Retort graphite was decomposed in 9 hours in presence of 2 grms. of asbestos impregnated with tungstic acid, but was not altered by 25 hours' digestion in presence of mercuric oxide (0.5 gm.).—C. A. M.

Lignite tar; Carbonisation of —. V. Schön. J. Gasbeleucht. J. Gas Lighting, 1915, 131, 697.

THE high water content of lignite tar—up to 40%—is reduced by prolonged settling and heating, to about 10%. The tar is introduced into the carbonising ovens of a gasworks and gasified. In a trial, 220.5 lb. of tar was run at 95° F. (35° C.) through a swan-neck pipe into the carbonising chamber. The average calorific value of the coal gas before the introduction of the tar was 375 B.Th.U. per cub. ft., during the addition 414 B.Th.U., and after the addition of the tar 358 B.Th.U., and it was estimated that 1014 cub. ft. of gas was produced from the tar itself. Analysis of the gas showed 1.1% of heavy hydrocarbons while the tar was being carbonised, compared with 0.7% before its introduction. The products resulting from the lignite tar used in this way indicate that its value is 00% of that of coal tar.—W. G. C.

Toluene; Production and recovery of — from illuminating gas. A. Rollason. J. Gas Lighting, 1915, 131, 696.

THE increase of the ultimate toluene content, by washing the gases, after cooling with the tar made during carbonisation (as in the "C" process of the High Explosives Committee), depends on the age of the coal used, its oxygen content and possible yield of hydrocarbons, and also on the temperature of coal carbonisation. When using second grade and semi-coking coals, many which contain a high percentage of hydrocarbons give off their volatile matter very quickly, and when high temperatures are employed the hydrocarbons are decomposed into methane and hydrogen, leaving carbon in an amorphous form as soft friable coke. The addition of lime does not always improve the quality of the coke, but by adding limestone and then carbonising at a temperature above 850° C. the quality of the gas is improved, the quantity both of gas and ammonia is increased, and the sulphur content of the gas

is reduced. With a coal carbonised at 1080°—1210° C., the toluene recovered on washing with anthracene oil rose from 2.96 lb. per ton of coal without limestone to 3.8 lb. with limestone, and the amount of toluene recovered from the tar rose from 0.14 lb. to 0.41 lb. At a lower temperature of carbonisation the increase of toluene was even greater.—W. G. C.

Gas quality; Substituting heating value for candle power as a standard of——. R. S. M'Bride. U.S. Bureau of Standards. J. Gas Lighting, 1915, 131, 702—705.

THE character of the gas coal available in any district affects the selection of a heating value standard, and it should not be so severe as to prevent a choice of the most economical processes of gas making. In the adoption of a heating value standard it is important to know what the quality of the gas has been in the past, so that comparison can be made, and an estimate obtained of the relative costs for gas of the different qualities.

—W. G. C.

Electrical ignition of gaseous mixtures; The reaction between gas and pole in the——. W. M. Thornton. Proc. Roy. Soc. 1915, A 92, 9—22.

IN experiments on the electrical ignition of gaseous mixtures with various types of sparks, using different metals as poles, it was found that the metal of the sparking points has a great influence upon ignition at pressures up to one atmosphere, whether the sparks are disruptive or formed by separating the poles. The order of difficulty of ignition by continuous current break-sparks is the same as that of the density of the poles; with ethane the order of decreasing difficulty is platinum, copper, nickel, iron, and aluminium. The difficulty of ignition by alternating or condenser discharge sparks is proportional directly to the density and specific heat of the pole and inversely to its thermal conductivity, and is least with platinum poles. In the case of jump or long disruptive discharge sparks, the passage of the spark depends on the number of molecules of gas between the poles, and the difficulty of ignition varies with the tenacity of the material of the poles, that of copper being lowest. In experiments with this type of spark, mixtures of constant proportion of coal gas and air were used, the gas pressure being varied, while with the other varieties of sparks atmospheric pressure was employed, and the percentage of combustible gas in air varied. With carbon poles, a condenser discharge in coal gas has most effect upon the hydrogen, a longer disruptive discharge has most upon the methane.—W. G. C.

Gasoline from natural gas; Condensation of——. G. A. Burrell, F. M. Seibert, and G. G. Oberfell. Bull. 88, U.S. Bureau of Mines, 1915. (106 pages.)

THE proportion of gasoline vapour present in a particular gas is determined mainly by the character of the associated oil, the intimacy of contact existing between the latter and the gas, the temperature and pressure prevailing in the containing sands, and the porosity of the confining strata. Laboratory methods for ascertaining the suitability of a gas for gasoline production are based mainly on solubility and specific gravity tests; the natural gases in present use for this purpose have a density of 0.80 or higher and contain 30% or more of constituents soluble in "claroline oil" (a mineral oil distillate, sp. gr. 0.8667 at 15° C., flash-point by Pensky-Martens closed test, 152° C.) or alcohol, as determined by agitating 100 c.c. of the gas with 35 c.c. of the former or 50 c.c. of the latter solvent. In the condensation process mostly employed, the gas is subjected to pressures up to 300 lb. per sq. in. (the most suitable degree of compression being

found by experiment) and cooled by water at ordinary temperature; cooling by means of other refrigerants, with or without compression, is also practised to a limited extent. Single and two-stage compressors are used, the former when the pressure required does not exceed 110 lb. per sq. in. As received in the accumulator tanks, the condensed product consists principally of the liquids pentane and hexane and the liquefied gas butane; some heptane and liquefied propane may also be present. The yield increases with the degree of compression, but beyond a certain point this increase is nullified by the greater volatility of the liquid on exposure to air. Since mixtures of the condensed product and refinery naphtha have lower volatilities and vapour pressures than the corresponding condensed product alone, blending is advantageous in many cases as regards transport and storage. The cost of equipment for compression and condensation alone varies from about \$2800 (about £580) for a plant handling 120,000, to \$7800 (£1600) for one handling 600,000—700,000 cub. ft. of gas per day.—W. E. F. P.

British Association Committee on Fuel Economy. See Official Notices, p. 62s.

Petroleum for medicinal purposes. See XX.

Constant velocity aspirator. Method of collecting and analysing industrial gases. II. and III. Gautier. See XXIII.

PATENTS.

Coal; Separation of——. *Purification of coal.* F. W. C. Schniewind, Englewood, N.J. (E. M. Schniewind, executrix). U.S. Pats. (A) 1,152,442 and (B) 1,153,182, Sept. 7, 1915. Dates of appl., Jan. 20, 1913, and Dec. 19, 1912.

(A) THE coal mixture is crushed, the conductive pyritical impurities separated by electrostatic means, and the remainder moistened to develop the differences in hygroscopicity of its constituents. The moistened coal is again subjected to electrostatic separation. (B) A mixture of coking and non-coking coal, or of coal and gangue containing pyrites, is separated into its constituents by subjecting the material in a crushed condition to electrostatic separation.—W. F. F.

[Retorts for] carbonising fuels. A. McD. Duckham, Ashtead, Surrey. Eng. Pat. 13,934 of 1914; date of appl., Jan. 5, 1915.

A TIER of horizontal retorts is formed by horizontal plates held between channel irons at either side, the alternate spaces serving as heating flues. The plates extend beyond the side walls, forming spaces which are subdivided into collecting chambers. The collecting chambers communicate with zones of different temperature in the retort by means of openings in the wall, and corresponding chambers of each tier are connected together by short vertical pipes, and also to a gas-collecting main above and a liquid-collecting main below. The openings in the retort wall for the escape of volatile products are formed by bending out a triangular tongue of metal. The installation is intended especially for the low-temperature carbonisation of coal, and renders it possible to collect together products from similar zones in the several tiers of retorts, separately from products coming from other zones.—W. F. F.

Gas retorts; Vertical——. J. Pintsch Akt.-Ges., Berlin. Eng. Pat. 16,199, July 7, 1914. Under Int. Conv., Oct. 11, 1913.

IN apparatus of the type having vertical retorts set in furnace chambers, the platform at the top is cooled by the circulation of air between it and

the furnace tops. A blower or ventilator may be provided at one end of this space.—W. F. F.

Coke: Method of and apparatus for removing and loading a mass of — located on a quenching bench. C. Still, Recklinghausen, Germany. Eng. Pat. 7364, May 17, 1915. Under Int. Conv., May 16, 1914.

A BEAM is placed behind the irregular mass of quenched coke on the bench, and the whole is drawn forward over the screens on to the loading ramp by wire ropes attached to the ends of the beam and wound by a winch on the edge of the bench.—W. H. C.

Gas producer. E. A. W. Jefferies, Assignor to Morgan Construction Co., Worcester, Mass. U.S. Pat. 1,152,514, Sept. 7, 1915. Date of appl., Jan. 20, 1911.

THE fuel is supported in a heating chamber by a rotatory ash-pan below, and a bent, water-cooled poker, extending through the heating chamber, is mounted in horizontal bearings in the walls of the chamber so that it can be rotated.—W. F. F.

Water-gas; Manufacture of —. C. F. Zeek, Pensacola, Fla., Assignor to United Gas Improvement Co., Philadelphia, Pa. U.S. Pat. 1,152,869, Sept. 7, 1915. Date of appl., Mar. 21, 1914.

THE valves of a water-gas plant are automatically operated in proper sequence by fluid pistons moving in cylinders supplied with compressed air from a reservoir. The air supply is controlled by valves operated by suitable cams on a rotating lay shaft, which is driven by clockwork and controlled by a speed governor. (See also this J., 1915, 895.)—W. F. F.

Gas-producer. E. A. W. Jefferies, Assignor to Morgan Construction Co., Worcester, Mass. U.S. Pat. 1,153,623, Sept. 14, 1915. Date of appl., Apr. 1, 1909.

A GAS producer is provided with an outwardly flared rotating ash-pan having a central cone and enclosing the lower end of the producer but spaced from it. An adjustable stationary blade is fixed with one edge in contact with the inside of the flared wall of the ash-pan. The pan is supported on rollers carried by diverging shafts connected by bevel gear, and one of the shafts is rotated.—W. F. F.

Ammonia; Recovery of — in the form of sulphate from gases. T. Rigby, Dumfries, and Wetcarbonizing, Ltd., Westminster. Eng. Pat. 18,559, Aug. 11, 1914.

IN the separation of ammonia as ammonium sulphate from producer or similar gas, the tarry impurities contained in the sulphate liquor are almost completely eliminated by the addition of a light tar oil, which absorbs them. In the case of a peat by-product gas recovery plant, the oil is obtained from the distillation of the tar separated from the gases, and is added to the sulphate liquor as it passes to the evaporators. Oil and liquor are thoroughly agitated to form an emulsion, and after settling, the oil is removed, preferably by decantation.—E. H. T.

Gas washers. C. E. Pope, Pittsburg, Pa., U.S.A. Eng. Pat. 19,847, Sept. 16, 1914.

IN a gas washer of the type in which the gas and washing liquid are brought into intimate contact by blades carried by a rotating shaft, the rotor and driving wheel are carried by a vertical shaft suspended on a ball bearing, which is carried by a member having a spherical seating in a part of the fixed frame. A rubber sleeve keeps the shaft vertical while allowing limited play. The rotor carries a cylindrical member dipping into an annular trough supported by the casing and form-

ing a liquid seal through which the washing liquid is supplied to the rotor.—W. F. F.

Liquid fuels suitable for automobile engines; Production of —. W. A. Hall, New York. Eng. Pat. 12,962, May. 26, 1914.

A MIXTURE of heavy vapours and low boiling products containing a considerable proportion of hydrocarbons of the ethylene series, obtained by cracking mineral oil at about 600° C. under a pressure of about 70 lb. per sq. in., is combined with coal tar distillation products such as toluol and xylo. The combination may be effected in the cold by passing the vapours through the coal tar distillates, or, preferably, by mixing the constituents in a state of vapour, compressing the mixture, and condensing it under pressure by cooling. (See also Eng. Pat. 437 of 1914; this J., 1915, 346.)—W. H. C.

Liquid fuel; Production of — particularly suitable for use in high speed internal combustion engines. Hall Motor Fuel, Ltd., London. Eng. Pat. 6069, Apr. 22, 1915. Under Int. Conv., May 11, 1914.

THE gases and vapours from the cracking and gasifying of hydrocarbon oils are cooled to about 200° C. and then compressed adiabatically to several atmospheres pressure. A fall of temperature due to endothermic reactions takes place, and volatile hydrocarbons are produced; the low-boiling products are recovered from the mixture leaving the compressor by cooling.—W. F. F.

Crude oil and other hydrocarbons; Process and apparatus for distilling —. A. F. G. C. P. J. von Groding, Vienna, and The Burmah Oil Co., Ltd., Glasgow. Eng. Pat. 16,713, July 13, 1914.

THE apparatus consists of a boiler, a still, two or more dephlegmators, and a preheater. The crude oil is passed through the preheater and the jackets of the dephlegmators, and is then sprayed into the upper part of the still above a set of superposed perforated baffles. It is withdrawn from the bottom of the still by a feed pump and forced into the boiler under pressure, a portion being also discharged through a pipe leading to a coil in the bottom of the preheater and thence through a cooler into a storage tank. A second pump circulates the oil from the bottom of the boiler through a system of coils inside the still and back to the boiler. Provision is made for discharging part of the circulating hot oil through a regulating valve into the lower part of the still, where it is partially volatilised. The vapours from the still, pass first into a separator to remove entrained oil and the least volatile constituents, and thence to the dephlegmators. Two or more sets of apparatus may be arranged side by side in combination, the residues from the bottom of the first still being delivered by a separate pump into the top of the second still, instead of passing to the coil in the preheater. The temperature in the consecutive stills may also be made progressively higher, and the separate boilers worked at correspondingly higher pressures. Sufficient pressure may be maintained in the still to effect cracking. For the production of lubricating oils the last still may be worked under vacuum.—W. N. B.

[Petroleum] oils; Process of treating [low-grade] —. W. O. Snelling, Pittsburg, Pa., U.S.A. Eng. Pat. 18,419, Aug. 7, 1914. Under Int. Conv., Nov. 11, 1913.

LOW-GRADE crude oils, asphaltic oils, paraffin wax, rod wax, kerosene, lubricating oils, fuel oils, tarry still residues, etc., are converted into a product resembling high-grade Oklahoma crude oil by heating in a closed vessel to such a temperature

that the vapours evolved produce an added pressure of at least 400 to 800 lb., preferably 600 to 800 lb. per sq. in.; the volume of the oil must not be less than one-tenth or more than seven-tenths, and is preferably from one-fifth to one-half, of the cubic capacity of the container. The presence of catalysts (deflocculated graphite, colloidal carbon, colloidal nickel, etc.) may facilitate the operation, but is not essential. The average amount of gasoline (distilling up to 150° C.) found in the "artificial crudes" produced is 10 to 20%, with 20 to 40% burning oil. These yields may be increased by distilling off the lighter oils and treating the residue again, and the process may be worked continuously by providing means for removing the vapours produced. (See also this J., 1915, 267.)—W. N. B.

Petroleum; Refining of — J. C. Black, Point Richmond, Cal., Assignor to Standard Oil Co., U.S. Pat. 1,152,478, Sept. 7, 1915. Date of appl., Mar. 5, 1909.

THE oil is treated at a temperature above the freezing point of water, with sulphur dioxide under pressure; with certain of the constituents, compounds are formed which separate by gravity from the remainder of the liquid. These sulphur dioxide products are subsequently decomposed by heating so as to yield sulphur dioxide under pressure, available for treatment of fresh oil. The oil remaining after separation of the sulphur dioxide products contains appreciable quantities of absorbed gas; it is first heated to a temperature not above 125° F. (52° C.) so as to yield part of the sulphur dioxide under pressure, and the remainder of the gas is recovered by heating at the same temperature under reduced pressure.—W. N. B.

Petroleum-stills or analogous vessels; Setting for — J. W. van Dyke and W. M. Irish, Assignors to The Atlantic Refining Co., Philadelphia, U.S. Pat. 1,152,576, Sept. 7, 1915. Date of appl., Oct. 13, 1910.

THE still is fitted with external supporting lugs corresponding to braces extending across the interior. The lugs rest upon metal columns rising from the masonry foundation enclosing the fire-boxes and lower part of the heating space. The columns are connected and held in place by removable metal plates, so as to form a gas-tight enclosure for the upper part of the heating space and lower part of the still. The metal columns and plates are protected from heat by a removable lining.—W. N. B.

Hydrocarbons; Process for converting high-boiling — into low-boiling products. Ges. f. Verwertung von Kohlenstoffverbindungen. Ger. Pat. 284,118, July 20, 1912.

THE material is heated in a still provided with an agitator, and the vapours evolved pass through a decomposing chamber heated to a definite temperature, independently of the still, and thence to a dephlegmator and a condenser. An inert gas under pressure is circulated through the entire apparatus by a pump, and high-boiling products, condensed in the dephlegmator, are returned to the still.—A. S.

Heat of coke-cakes; Apparatus for utilising the — C. Semmler, Wiesbaden, Germany. U.S. Pat. 1,153,453, Sept. 14, 1915. Date of appl., Dec. 9, 1913.

SEE Fr. Pat. 463,299 of 1913; this J., 1914, 411.

Gas generator. G. H. Bentley, Assignor to E. G. Appleby, London. U.S. Pat. 1,153,417, Sept. 14, 1915. Date of appl., Mar. 23, 1915.

SEE Eng. Pat. 9010 of 1911; this J., 1915, 540.

Hydrocarbons; Apparatus for treating liquid — for the production of hydrocarbons of lower boiling points. H. Wade, London. From Standard Oil Co., Whiting, Ind., U.S.A. Eng. Pat. 7541 of 1915; date of appl., Oct. 20, 1914.

SEE U.S. Pat. 1,122,003 of 1914; this J., 1915, 132.

Petroleums and other heavy liquid hydrocarbons; Process of converting — into volatile hydrocarbons distilling below 150° C. P. Sabatier and A. Mailhe, Toulouse, Assignors to Soc. des Raffineries Catalytiques des Pétroles et Hydrocarbures, Paris. U.S. Pat. 1,152,765, Sept. 7, 1915. Date of appl., July 11, 1914.

SEE Eng. Pat. 16,791 of 1914; this J., 1915, 826.

Hydrocarbons; Process and apparatus for converting high-boiling — into lower-boiling hydrocarbons. P. Porges, S. Stransky, and H. Strache. Fr. Pat. 474,588, May 8, 1914. Under Int. Conv., May 8, 1913.

SEE Eng. Pat. 11,420 of 1914; this J., 1915, 826.

II B.—DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Substituting heating power for candle power as a standard of gas quality. M'Bride. See II A.

Compounds occurring in commercial calcium acetate. Bergh. See VII.

PATENT.

Coal; Destructive distillation of bituminous — F. C. Blythe, Northwood, Middlesex. Eng. Pat. 19,750, Sept. 14, 1914.

A LARGE proportion of hydrocarbon oil and a small proportion of permanent gas is obtained by adding about 5—10% of heavy oils, such as petroleum, kerosene, shale oils, heavy tar oils, or the heavy oils obtained in the process itself, to the coal and distilling at about 60 lb. per sq. in. and 350°—500° C.—W. F. F.

III.—TAR AND TAR PRODUCTS.

1,2,3-Trinitrobenzene, a new trinitrotoluene, and dinitrohalogen substitution products. G. Koerner and A. Contardi. Z. ges. Schiess- u. Sprengstoffw., 1915, 10, 64—66, 77—78. Z. angew. Chem., 1915, 28, Ref., 335.

1,2,3-TRINITROBENZENE, m.pt. 127.5° C., is prepared by treating β -dinitroaniline (m.pt. 137.8° C.) dissolved in nitric acid (sp.gr. 1.38) with nitrous gases at 0° C., and pouring the resulting diazonium nitrate suspension on to a mixture of ice and sodium nitrite. The dinitrotoluidine of m.pt. 168° C., when treated in a similar manner, yields a trinitrotoluene of m.pt. 137.5° C.; the corresponding trinitrobenzoic acid, obtained by oxidation with chromic and sulphuric acids, melts at 168° C. By pouring the solution holding the diazo compound in suspension, on to a mixture of ice and cuprous halide, instead of sodium nitrite, the following compounds are obtained: 1,5,6-dinitrochlorobenzene, m.pt. 88° C.; 1,5,6-dinitrobromobenzene, m.pt. 107° C.; 1,5,6-dinitroiodobenzene; dinitrochlorotoluene, m.pt. 114.5° C.; dinitrobromotoluene, m.pt. 118.4° C.; and dinitroiodotoluene, m.pt. 158° C.—A. S.

Aromatic nitroamines and allied substances; Transformation of —, and its relation to substitution in benzene derivatives. F. S. Kipping, K. J. P. Orton, S. Ruhemann, and J. T. Hewitt. Brit. Assoc. Report, 1915. Chem. News, 1915, 112, 152—153.

Relation of velocity of chlorination of aromatic compounds to constitution. The activity of ortho-para-directing groups in the chlorination of aromatic compounds decreases in the following order:— NH_2 , $-\text{OH}$, $-\text{Oalk}$, $-\text{NH}_2\text{C}_2\text{H}_5\text{O}$. The method used was the direct measurement of the speed of entrance of the chlorine into a number of substances of suitable constitution. Since the entry of the first halogen atoms into amines and phenols is practically instantaneous, derivatives such as mono-nitro-, or mono-chloro-amines or phenols were employed. A nitro-group in the para-, and still more so in the ortho-position to the directing group greatly inhibits chlorination, and the results obtained with o- and p-nitrophenols would seem to indicate that a free hydroxyl-group is not present. A comparison of the influence of the amino- and hydroxyl-groups was obtained by measuring the rate of entry of a third chlorine atom into 2,4-dichloroaniline and 2,4-dichlorophenol respectively; the velocity in the former case far surpassed that in the latter. Alkoxy-groups were shown to be more active than acylamino-groups by comparing the velocity of chlorination of anisole and phenetole with that of acetanilide, and that of chloro-anisole and chloro-phenetole with that of p-chloro-acetanilide. —G. F. M.

Anthraquinone mono- β -, 2,6-, and 2,7-disulphonic acids; Separation of —. M. L. Crossley. J. Amer. Chem. Soc., 1915, 37, 2178—2181.

THE neutralisation of the sulphonated anthraquinone mixture with lime leads to the rejection of much of the calcium salts of the mono- β - and 2,6-acids with the calcium sulphate. It is preferable to neutralise the mixture with caustic soda and separate the sodium salts by their different solubilities in water, the mono- β - and 2,6-salts separating first. The sodium salt of the 2,6-acid becomes almost black on exposure to sunlight. The mono- β -salt ("silver salt") separates best in faintly acid solution.—F. W. A.

Carbonisation of lignite tar. Schön. See IIa.

Production and recovery of toluene from illuminating gas. Rollason. See IIa.

Use of tar for dust prevention and road preservation. See IX.

PATENTS.

4-Halogen- or 4-alkyl-1-hydroxyanthraquinones and their derivatives; Production of —. F. Ullmann. Fr. Pat. 474,487, July 2, 1914. Under Int. Conv., Nov. 20, 1913, and May 25, 1914.

SEE Eng. Pat. 14,951 of 1914; this J., 1915, 952. THE process may also be used for the preparation of 4-alkyl-1-hydroxyanthraquinones or their derivatives by using alkyl-phenols instead of halogen-phenols.

4-Chloro-1-hydroxyanthraquinone and its derivatives; Production of —. F. Ullmann. Fr. Pat. 474,942, July 9, 1914. Under Int. Conv., Dec. 22, 1913.

SEE Eng. Pat. 15,058 of 1914; this J., 1914, 913.

IV.—COLOURING MATTERS AND DYES.

PATENTS.

Leuco-derivatives of vat dyestuffs; Manufacture of —. A. Brochet, Paris. Eng. Pat. 19,848, Sept. 16, 1914. Under Int. Conv., Sept. 29, 1913.

SEE Fr. Pat. 473,536 of 1913; this J., 1915, 709. The reaction mixture may be heated, and pressure may be used. The process is applicable to the preparation of indigo white, and separate claim is made for the products obtained by the process, i.e., concentrated solutions of indigo white or other leuco-derivatives of vat dyestuffs free from secondary substances, other than an alkali, salt, or the like added to facilitate reduction.

Azo dyestuffs. H. Levinstein and J. Baddiley. Assignors to Levinstein, Ltd., Manchester. U.S. Pat. 1,153,555, Sept. 14, 1915. Date of appl., Jan. 20, 1915.

SEE Eng. Pat. 28,569 of 1913; this J., 1915, 348.

Dyestuffs capable of being diazotised; Preparation of —. L. Cassella und Co. Fr. Pat. 474,564, Dec. 9, 1913.

SEE Eng. Pat. 28,925 of 1913; this J., 1915, 899.

Vat dyestuffs; Preparation of —. L. Cassella und Co. Fr. Pat. 475,010, Jan. 12, 1914.

SEE Eng. Pat. 1443 of 1914; this J., 1914, 743.

Isatins; Manufacture of —. Farb. vorm. Meister, Lucius, und Brüning. Fr. Pat. 474,887, July 8, 1914. Under Int. Conv., July 18, 1913.

SEE Ger. Pat. 281,052 of 1913; this J., 1915, 543.

[Azo] dyestuffs; Production of yellow, substantive —. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 475,068, Jan. 11, 1914. Under Int. Conv., Aug. 16, 1913, and June 19, 1914.

SEE U.S. Pat. 1,147,803 of 1915; this J., 1915, 900.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Jute; Cross and Bevan's reaction for — and its application to cotton. R. Haller. Färber-Zeit., 1915, 26, 157, 173. Chem.-Zeit., 1915, 39, Rep., 361.

Cross and Bevan have described a test for jute based on the formation of an intense blue-black colour when the fibre is immersed in a mixture of equal parts of N/10 ferric chloride and N/10 ferricyanide (see this J., 1893, 104). This reaction is shown by certain kinds of cotton, and is not confined to ligno-celluloses. It appears to be due not to the presence of aldehydic groups but to phenolic substances.—J. H. L.

Fibroin; Conversion of — into nitrofibroin (fibroin-xanthoproteic acid). Nitrated proteins. III. T. B. Johnson, A. J. Hill, and L. P. O'Hara. J. Amer. Chem. Soc., 1915, 37, 2170—2178.

ABOUT 70 per cent. of the fibroin from Italian silk has been shown by Fischer and Skita (this J., 1902, 472) to consist of the three α -amino-acids, 36% being glycine, 21% alanine, and 10% tyrosine. The protein is free from histidine, and the presence of arginine has only been detected by Fischer and Skita. Aspartic and glutamic acids are also present in fibroin, which does not contain tryptophane. Canton and Italian silks contain 1.6 and 1.25% respectively of phenylalanine. Vignon and Sisley (this J., 1892, 430) state that the first yellow colour produced by treating silk with nitric

acid (sp. gr. 1.33) is only obtained in presence of nitrous acid, the nitric acid rendering the colours permanent. The authors have investigated the action of nitric acid (sp. gr. 1.12) on fibroin at 18°–25° C. over definite periods. The reaction proceeds gradually for 192 hours, 30% of the fibroin being dissolved. The remaining 70% is an orange powder, which is not affected by further exposure to the action of the nitric acid. The nitrated protein fails to give Millon's test for tyrosine after 24 hours.—F. W. A.

Hydrocellulose. O. Hauser and H. Herzfeld. *Chem.-Zeit.*, 1915, **39**, 689–690.

HYDROCELLULOSE is differentiated from cellulose by its cupric-reducing properties, ready solubility in cellulose solvents, low hygroscopic moisture, and blue reaction with iodine-potassium iodide which is quickly removed by water. Published analyses vary within wide limits, and there is strong reason to believe that hydrocellulose is not a homogeneous substance. This view is confirmed by experiments with hydrocellulose, prepared by Girard's method, in which the hydrocellulose was extracted in a Soxhlet's apparatus with boiling water and the cupric-reducing power determined at intervals of 12 hours. The copper value (Schwalbe, this J., 1907, 548) of the residue decreased, at first fairly rapidly and later more slowly, as extraction proceeded, from 5.4 originally down to 0.8 after 93 hours' extraction, and the curve representing the rate of decrease had the same form, reversed, as a curve representing the formation of an adsorption compound with a gel. The extracted residue was again treated according to Girard's method and the new product again extracted in the same way. Here also the copper value decreased at a rate represented by a very similar curve, from 4.0 originally down to 0.8 after 71 hours. During the extraction the copper value of the extract increased progressively and dextrose was identified in the solution. It is therefore suggested that hydrocellulose is an adsorption compound of variable composition, consisting of cellulose in combination with its products of hydrolysis, including dextrose and, most probably, various dextrans, the brittle nature of the product being partly attributed to the interpenetration of the cellulose structure by gelatinised products of hydrolysis.—J. F. B.

Paper; Influence of composition, sizing, and content of mineral matter on the mechanical properties of —. E. Rechenberger. *Woch. Papierf.*, 1915, **46**, 659. *Z. angew. Chem.*, 1915, **28**, Ref., 353.

A SERIES of papers prepared from paper stuffs containing different proportions of rags, and differing also in regard to sizing and loading, were examined as to breaking length, elongation, and content of water and of mineral matter. The results show that by increasing the proportion of rag fibres, the mechanical properties of the paper are improved, the content of mineral matter is increased, and the water content diminished. Rosin sizing diminishes the strength of the paper, whilst animal sizing increases it; the content of mineral matter is increased and the hygroscopicity diminished by both kinds of sizing, which are also equally efficacious in retaining loading materials. The percentage loss of strength caused by loading is approximately 2.2 times the percentage (within the limits 25 to 30%) of loading material.—A. S.

Carbon papers and coloured copying papers; Manufacture of —. O. Ward. *Papierzeit.*, 1915, **40**, 635. *Z. angew. Chem.*, 1915, **28**, Ref., 353.

For the manufacture of copying papers a thin and very tough paper, preferably prepared from soda

wood pulp, is used; hemp, linen, and cotton fibre papers are also used, but the soda pulp papers are best on account of their close texture, which tends to prevent penetration of the colouring matter. The colours used are mostly water-soluble dye-stuffs, viz., Pure Blue, Azo Red, Eosine, and Methyl Violet; for black a mixture of Nigrosine and the finest lampblack is used. The colour is very finely ground with hot glycerin and applied to the paper by means of a spreading machine.—A. S.

PATENTS.

Nettle plant; Process for separating the bast fibres of the — and preparing them for spinning. O. Richter and F. Pick. *Ger. Pat.* 284,704, Feb. 7, 1914.

THE cortical layers of the plants are macerated in a 5–27% ammonia solution at 30°–40° C. to destroy the pectin lamellae and liberate the fibres, and the material is then heckled, either wet or dry, treated for 1 hour in a boiling soap solution, and repeatedly scutched and heckled, either wet or dry. An alternative process consists in lixiviating the material with water for 2–5 hours to remove sugars, then either subjecting it to a retting process for 10–72 hours, or heckling it whilst still wet, or drying it and scutching and heckling the dried material. The liquor obtained by lixiviating the material may be treated for the recovery of lævulose.—A. S.

Cellulose and other products; Method of producing —. B. M. E. L. P. v. Ehrenthal. Cöthen, Assignor to M. v. Halles, Hamburg, Germany. *U.S. Pat.* 1,153,834, Sept. 14, 1915. Date of appl., Jan. 19, 1914.

FIBROUS material is boiled with a weak acid sulphite liquor containing almost sufficient of a base to precipitate the monosulphite, at 5–6 atm. pressure and at a temperature not exceeding 125°–130° C.; the product is mechanically disintegrated and washed, and digested with sodium carbonate or caustic soda at the ordinary pressure.—F. W. A.

Cellulose; Manufacture of — by the sulphate process. J. O. Lundberg. *Ger. Pat.* 284,628, June 4, 1914. Under Int. Conv., Nov. 10, 1913.

THE fresh lye before being introduced into the digester, is heated under pressure to such a high temperature, e.g., about 180° C., that it is able to furnish most of the heat required for the digestion. When digestion is complete, the residual black liquor is forced from the digester into a separate vessel, where it is kept under pressure and whence the requisite quantity is introduced into a newly-charged digester together with the fresh lye. The receptacles for the fresh lye and the black lye are provided with heating coils, arranged to leave a vertical cylindrical open space in the centre of the vessel, so that the coils can be easily removed through a manhole in the cover; the coils in each vessel are all connected to a common steam-chest inside the vessel.—A. S.

Cellulose from highly lignified plants, such as jute, manila, rushes, bamboo, esparto, etc.; Manufacture of —. M. Müller and O. Heigis. *Ger. Pat.* 284,681, Feb. 13, 1914.

THE material is digested under pressure with a lye containing alkali acetate and sulphite.—A. S.

Acetylcellulose; Manufacture of solutions of —. Badische Anilin und Soda Fabrik. *Ger. Pat.* 284,672, Jan. 16, 1914.

SOLUTIONS of acetylcellulose in cyclohexanone (see Eng. Pat. 14,042 of 1914; this J., 1915, 956) may be diluted with benzene or its homologues if a small quantity of acetone be first added.—A. S.

Acidylcelluloses and stable solutions of the same; Preparation of —. Knoll und Co. Ger. Pat. 284,726, Feb. 2, 1912. Addition to Ger. Pat. 203,178.

IN the preparation of acidylcelluloses and their solutions by the interaction of cellulose and organic acid anhydrides in presence of acid sulphates and an inert solvent and diluent, a quantity of bisulphate or of a mixture of bisulphate and a neutral salt, less than one-half of that of the cellulose, is used, and the reaction is stopped before products insoluble in acetone are formed. When alkali bisulphate or a mixture of alkali bisulphate and sulphate is used, the reaction is carried out above 80° C. Suitable catalysts are sodium bisulphate, alone or mixed with potassium sulphate, a mixture of sulphuric acid and tartar emetic or copper acetate, and dimethylaniline bisulphate. —A. S.

Paper and other absorbent material; Sizing and colouring —. E. Fues, Hanau, Germany. Eng. Pat. 19,816, Sept. 15, 1914. Addition to Eng. Pat. 13,970, June 9, 1914 (see Fr. Pat. 473,405; this J., 1915, 546).

A SOLUTION containing both an acid and a basic dyestuff is obtained by preventing the formation of a precipitate by adding an animal size, and is used for colouring the so-called parchment papers. The paper is manufactured so that it possesses different absorbent capacities for dyestuff at different places. —F. W. A.

Parchment paper treated with salt solution; Process for improving —. M. Schmidt. Ger. Pat. 283,506, Nov. 14, 1913.

THE paper is immersed in a solution of common salt of 10°—25° B. (sp. gr. 1.075—1.21), to each litre of which from 0.25 to 3 grms. of saccharin, in the form of a saturated aqueous solution, is added, and is afterwards dried. The addition of saccharin prevents the treated paper from having a saline taste, yet does not affect the preservative action of the salt. —A. S.

Paper or fabrics; Process for fixing powdered, granular, or fibrous materials on —. W. Golombek. Ger. Pat. 281,682, Nov. 16, 1913.

THE mixture of regenerated rubber, water, and traces of solvent obtained as an intermediate product in the regeneration of rubber by processes involving solution, is used as an adhesive for fixing powdered and other materials on paper or fabrics. The process is specially applicable to the preparation of sand-paper, emery-paper, and emery-cloth. —A. S.

Nitrocellulose solutions; Process for spinning — for the production of threads, artificial horse-hair, artificial straw, film bands, and the like. E. Berl and M. Isler, Tubize, Belgium. Eng. Pat. 14,216, June 12, 1914. Under Int. Conv., June 16, 1913.

SEE Ger. Pat. 273,936 of 1913; this J., 1914, 746.

Cellulose threads; Process for manufacturing brilliant —. P. Joliot, Lyons, France. Eng. Pat. 1572, Feb. 1, 1915. Under Int. Conv., Mar. 25, 1914.

SEE Fr. Pat. 470,141 of 1914; this J., 1915, 25.

Celluloid-like mass; Non-inflammable — and process of production thereof. E. Bronnert, Niedermorschweiler, Germany. U.S. Pat. 1,153,596, Sept. 14, 1915. Date of appl., Oct. 25, 1911.

SEE Fr. Pat. 423,774 of 1910; this J., 1911, 615.

Cellulose xanthate; Manufacture of solutions of —. L. Lilienfeld. Fr. Pat. 474,793, June 15, 1914. Under Int. Conv., July 5, 1913.

SEE Eng. Pat. 14,339 of 1914; this J., 1915, 830.

Recovery of jelly and other matters from liquids [wool washings, etc.]. Eng. Pat. 23,741. See XII.

Production of tanning extracts [from wood pulp extracts]. Eng. Pat. 18,332. See XV.

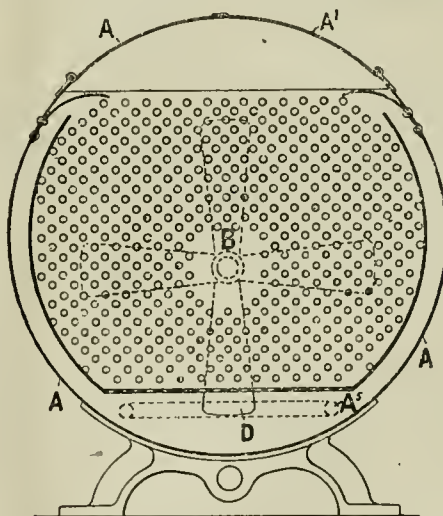
Process of manufacturing tanning agents [from sulphite-cellulose liquors]. Eng. Pat. 24,196. See XV.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

PATENTS.

Washing, dyeing, bleaching, scouring, tanning, and similar purposes; Apparatus for —. J. Heywood, Manchester. Eng. Pat. 21,161, Oct. 19, 1914.

THE apparatus consists of a cylindrical outer vessel, A, with curved covers, A¹, so that the articles to be treated may be inserted in the



stationary inner vessel, B, which has perforated ends and bottom. A propeller, D, is arranged between one perforated end of B and one end of A, baffle plates being fixed to the outer vessel at the top of the inner vessel to prevent the circulating liquid splashing over and to deflect it into the inner vessel; a perforated steam supply pipe, A², is provided below the inner vessel. —F. W. A.

Colours on textiles and other materials [of animal origin]; Production of —. J. Chester, Saltaire. Eng. Pat. 23,214, Nov. 28, 1914.

COLOURS produced on textile materials by treating with nitrous acid and subsequently in a bath containing a metallic salt, are very fugitive except in the case in which stannous chloride is used to produce a cream colour. It is now found that fast colours are produced by using such constituents in a single bath. For example, if wool is immersed in a cold bath containing 5% of sodium nitrite, 5% of commercial sulphuric acid, and 2% of sodium bichromate on the weight of the material, and the bath gradually brought to the boil, a brown colour is obtained; the use of copper

sulphate in place of sodium bichromate tends to produce a reddish brown colour.—F. W. A.

Sizing yarns; Process of—W. A. Nivling, Boston, Mass. U.S. Pat. 1,153,215, Sept. 14, 1915. Date of appl., Mar. 7, 1914.

IN sizing with a liquid which separates into portions of different densities, heated size is introduced continuously to maintain a constant level, the heavier and excess portion of the size being withdrawn near the bottom of the size-box.

—F. W. A.

Weighting silk; Process of—M. Günther, Karlsruhe, Germany. Eng. Pat. 15,784, July 8, 1913.

SEE Fr. Pat. 460,137 of 1913; this J., 1914, 73.

Dyeing machines. J. H. and D. M. Giles, Amsterdam, N.Y., U.S.A. Eng. Pat. 23,284, Nov. 30, 1914. Under Int. Conv., Dec. 29, 1913.

SEE U.S. Pat. 1,114,464 of 1914; this J., 1914, 1153.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Phosphoric acid as a monobasic and dibasic acid. I. M. Kolthoff. Chem. Weekblad, 1915, 12, 644—653. J. Chem. Soc., 1915, 108, ii., 631.

THE equilibrium $\text{H}^+ + \text{HPO}_4^{''} \rightleftharpoons \text{H}_2\text{PO}_4'$ is endothermic from left to right. Addition of sodium chloride displaces the equilibrium from right to left. With dimethylaminoazobenzene as indicator, phosphoric acid can be accurately titrated as a monobasic acid, and with phenolphthalein in presence of an equal volume of a saturated solution of sodium chloride as a dibasic acid.

Phosphoric acid; Behaviour of—with calcium hydroxide. I. M. Kolthoff. Chem. Weekblad, 1915, 12, 662—666. J. Chem. Soc., 1915, 108, ii., 631.

TITRATION of phosphoric acid with lime-water, using dimethylaminoazobenzene as indicator, neutralises one equivalent of the acid. Inversely, primary calcium phosphate can be prepared by titrating lime-water with phosphoric acid in presence of the same indicator. Secondary calcium phosphate cannot be obtained by this method.

Sulphur furnaces; The temperature in the interior of—S. Pagliano. Annali Chim. Appl., 1915, 4, 75—81.

THE calculated maximum temperature attainable by the combustion of sulphur in the quantity of air required to yield burner gases containing about 10% SO_2 is 900° C. The author measured, by means of a Le Chatelier platinum-rhodium thermocouple, the temperature in different parts of the interior of a sulphur-burning furnace of simple construction in a sulphuric acid works. In one case the temperature in the space above the burner pan or plate was found to be 340° C. 10 mins. after charging and 495° C. after 85 mins.; in another case it was 370° C. after 15 mins. and 420° C. after 25 mins., and in a third, 520° C. after 90 mins. The highest temperature observed, viz., 550° C., was in the discharge conduit leading from the furnace to a dust chamber. In furnaces for the extraction of sulphur from crude native sulphur by the heat developed by combustion of a part of the sulphur itself, the most suitable temperature is about 330°—340° C. The low efficiency of such furnaces is due to the need of using such a large excess of air that the ignition temperature of the sulphur does not exceed about 340° C.;

the ignition temperature is about 250° C. with a large excess of air, 445° C. in air containing 5% SO_2 , and 465° C. in air containing 10% SO_2 .—A. S.

Ammonium sulphate factory; Temporary dislocation in an—J. Rodenburg. Het Gas, Jan., 1915. Chem.-Zeit., 1915, 39, Rep., 325—326.

INTRODUCTION of sulphuric acid of 64.4° B. (sp.gr., 1.805) into a storage tank containing acid of 60° B. (sp.gr. 1.711) led to a stoppage in a 1 inch delivery pipe, through deposition of crystals of the dihydrate (m.pt. 8° C.).—F. SODN.

New nitrate works in Russia. Pharm. J., Oct. 2, 1915.

THE Norsk Hydro-Elektrisk Kvaestofaktieselskab, of Christiania, which owns the Eyde-Birkeland patents for the utilisation of atmospheric nitrogen, has granted a working license for Russia. A large plant is to be established near Archangel, which will also be used for making explosives.

Cream of tartar; Manufacture of—O. Best. Amer. Inst. Chem. Eng., Aug. 26, 1915. Met. and Chem. Eng., 1915, 13, 613—617.

THE production of cream of tartar in the United States amounts to 1,500,000—2,000,000 lb. per month, mainly from raw material imported from France and Italy, only a very small proportion coming from other countries and from California. The chief raw material is argol, the secondary deposit in the wine barrels; this contains about 70% of cream of tartar and 5—7% of calcium tartrate. Wine lees, deposited from the fermenting wine, and containing about 35% of cream of tartar and 2—5% of calcium tartrate, is also used, but is mostly employed in Europe for the manufacture of tartaric acid. Nearly the whole of the cream of tartar produced in the United States is made by the so-called roasting process. The raw material (argol or lees) is roasted at about 150° C. so as to decompose albumin, organic colouring matters, etc., without affecting the tartrates, and is then coarsely ground, extracted with hot water in wooden vessels fitted with agitators, and filtered by means of bronze filter-presses; with a pressure of 50—60 lb., 24,000 gals. can be filtered in 3 hours without cleaning the press. The residual mud is extracted twice with mother liquor containing cream of tartar and may then be dried and used as a filling material for fertilisers. The solution is allowed to crystallise for 4—5 days in copper crystallisers, yielding brown crystals containing 90—92% of cream of tartar, the remainder being calcium tartrate, mostly on the surface of the crystals. After coarsely crushing, the crystals are treated with sufficient hydrochloric acid of 20°—22° B. (sp.gr. 1.16—1.18) just to cover them and allowed to stand without agitation: the purity of the cream of tartar increases and the proportion remaining in solution decreases with the time of standing; after 72 hours the crystals usually contain 99% or more cream of tartar, and the mother liquor contains about 1 part of cream of tartar to 2 parts of calcium tartrate. A further quantity of cream of tartar can be recovered from the solution by partially neutralising the hydrochloric acid. The crystals are washed with water, dissolved, the solution decolorised with bone black, filtered, and allowed to crystallise; the crystals, when washed and dried, are colourless and contain over 99.5% of cream of tartar. When pure crystals can no longer be obtained from the mother liquor, the latter is added to the red (impure) mother liquor, and a corresponding quantity of the latter is withdrawn for use in the manufacture of tartaric acid. There is hardly any loss, apart from mechanical losses, in the manufacture of cream of tartar, as all impure products are utilised for the manufacture of tartaric acid; there is prac-

tically no loss from fermentation with the roasting process. In the manufacture of tartaric acid, the solution is neutralised cold with calcium carbonate, the precipitated calcium tartrate is washed rapidly by decantation, decomposed with a very small excess of sulphuric acid, and the solution evaporated first in open vessels at not above 170°F . (77°C .) and then *in vacuo*, and run into crystallisers. The crystals are purified by recrystallisation, after decolorising the solution with bone black. There is no loss due to formation of metatartaric acid when vacuum evaporation is adopted. Usually about 10% or less of the production of cream of tartar is utilised for the manufacture of tartaric acid.—A. S.

Alkali iodides; The action of bromine on—. W. N. Rae. Chem. Soc. Trans., 1915, 107, 1286—1291.

AMMONIUM bromo-iodo-bromide, NH_4BrIBr , was prepared by the action of bromine on ammonium iodide, and it was found that there is no definite break in the absorption curve of the bromine. Experiments on the rates at which solid polyhaloids are formed and decomposed, show that definite breaks in the weight-time curves are only obtained when two polyhaloids of the same elements exist in which the polyhaloid halogen has very different vapour pressures in the two compounds, as with calcium penta-iodide or caesium iodo-chloride, CsICl_4 . No definite results were obtained with sodium iodide, but compounds, similar to the ammonium compound, were obtained with potassium, rubidium, and caesium iodides. When a polyhaloid containing two or more different halogens is decomposed, the residue always contains the halogen of lowest atomic weight, so that this halogen atom and the metal must be united by their principal valencies, and the halogen atom is attached to the extra halogen atoms by its secondary valencies.—B. N.

Potassium cyanate; Decomposition of—by heat. A. Portevin. Comptes rend., 1915, 161, 308—310.

WHEN heated in a closed nickel tube, potassium cyanate is decomposed with formation of potassium cyanide, the quantity of the latter increasing with the temperature within certain limits. For instance, the product contained 21% of potassium cyanide after 2 hours at 700°C ., and 53% after 2 hours at 900°C . When a mixture of equal quantities by weight of potassium cyanate and potassium cyanide was heated at 900°C . for 4 hours, the product contained 70% of cyanide. It is known that potassium cyanide, when fused in contact with oxygen, yields potassium cyanate, and the reaction appears, therefore, to be a reversible one.—W. P. S.

Calcium and magnesium carbonates; Solubility-product constant of—. J. Johnston. J. Amer. Chem. Soc., 1915, 37, 2001—2020.

WHEN calcium carbonate is precipitated from solutions containing magnesium it may be accompanied by an appreciable quantity of magnesium hydroxide, which is only removed slowly by repeated reprecipitations. On the other hand, calcium carbonate may readily be freed from magnesium by precipitation from a liquid saturated with carbon dioxide at a pressure above a certain limiting value, which increases with the temperature and which probably does not exceed 1 atm. under any actual working conditions. If, at 16°C ., a solution containing only magnesium and calcium carbonates is evaporated, or its partial pressure of carbon dioxide reduced, pure calcium carbonate separates while the ratio $\text{Mg}^{++}/\text{Ca}^{++}$ is less than 14,000—which is normally the case in natural waters—provided that the pressure of carbon dioxide is sufficient to prevent

precipitation of magnesium hydroxide, i.e., that it exceeds 0.00037, a value somewhat higher than the partial pressure of carbon dioxide in air. If the above ratio exceeds 14,000, the separation consists of pure magnesium carbonate. The basic carbonates obtained by precipitating magnesium with a soluble carbonate are indefinite mixtures of magnesium carbonate and magnesium hydroxide.—J. R.

Calcium carbide; Shipment of—. Board of Trade Announcement.

THE Marine Department of the Board of Trade has issued the following announcement:—“Carbide of calcium being ‘dangerous goods’ within the meaning of Section 446 of the Merchant Shipping Act, 1891, should, in addition to being marked as required by Order-in-Council dated August 8, 1911, be packed in hermetically sealed drums of a thickness of not less than 6 mm. (or Legal Standard Gauge No. 23). The drums must be covered with a wood overcask, the staves of which must not be less than $\frac{3}{4}$ in. thick. The overcask to be properly fastened and bound with three metal hoops. Care must be taken that the nails used to fasten the outer cask do not penetrate the drum. The gross weight of each package must not exceed 250 lb. The carbide must be stowed in a dry, well-ventilated compartment adjacent to a hatchway, and not overstowed with other cargo. Explosives or cargo of a nature liable to spontaneous combustion must not be stowed in the same compartment.”

Calcium acetate; Compounds occurring in commercial—. A. Bergh. Arkiv. Kem. Min. Geol., 1914, 5, No. 14, 1—15. J. Chem. Soc., 1915, 108, ii., 653.

STILLWELL'S method (this J., 1904, 305) for the estimation of calcium acetate gives results which agree excellently with those obtained by the method adopted by Bayer und Co., Elberfeld, in which the calcium acetate is distilled with phosphoric acid in a current of air free from carbon dioxide. Three processes have been investigated for the estimation of acids, other than acetic present, in the distillate obtained by Stillwell's method, namely, oxidation with potassium permanganate, with mercuric oxide, and with hydrogen peroxide. The first two methods are well known, but oxidation with hydrogen peroxide has not been used before. In the presence of platinised platinum, oxidation of formic acid takes place readily, whereas acetic, propionic, and butyric acids are not affected. Comparison of the results obtained by the various methods with different samples of calcium acetate shows that the mercuric oxide method gives the highest results for formic acid, whilst hydrogen peroxide gives the lowest results in most cases.

Basic copper formates. G. Fowles. Chem. Soc. Trans., 1915, 107, 1281.

ON warming dilute solutions of copper formate at temperatures below the boiling point, a pale green, crystalline, basic salt, $\text{Cu}(\text{HCO}_2)_2 \cdot 3\text{Cu}(\text{OH})_2$, is precipitated. It is also produced as a pale blue salt from copper hydroxide and copper formate, but is unstable in contact with the normal salt, passing slowly in the cold and rapidly on heating into the less basic, crystalline, emerald green salt, $\text{Cu}(\text{HCO}_2)_2 \cdot 2\text{Cu}(\text{OH})_2$, which is also precipitated when solutions of copper formate are boiled.—B. N.

Silver oxide; Solubility of—in water. G. Rebière. Bull. Soc. Chim., 1915, 17, 309—312.

THE solubility of silver oxide in water differs according to its origin, that prepared by precipita-

tion from silver nitrate solution with (1) sodium or (2) barium hydroxide being less soluble than specimens made by the action of sodium hydroxide on freshly precipitated (3) silver chloride or (4) carbonate. Saturated solutions of oxides prepared by methods (1) and (2) contained 50.0 and 51.9 mgrms. Ag_2O per litre respectively at 25°C ., whilst oxides prepared by methods (3) and (4) dissolved to the extent of 53.8 mgrms. and 68.6 mgrms. per litre. At 50°C . the solubility was only about 40% greater than at 25°C .

—G. F. M.

Arsenic trioxide; Vapour pressure of—H. V. Welch and L. H. Duschak. U.S. Bureau of Mines, Tech. Paper 81.

A METHOD for the determination of the vapour pressures of slightly volatile solids was devised, depending on a determination of the weight of the substance required to saturate a known volume of air under given conditions of temperature and pressure. The method was applied to the determination of the vapour pressure of the octahedral modification of arsenic trioxide between 100° and 260°C . The following values were obtained:— 100°C ., 0.00025 mm.; 150°C ., 0.021 mm.; 180°C ., 0.181 mm.; 214°C . 1.54 mm.; 262.5°C ., 13.4 mm. From these figures the heat of sublimation of arsenic trioxide was calculated for various temperatures, e.g., for 1 grm.-mol. at 110°C . $Q=27930$ and at 210°C . $Q=26610$. The melting points of the octahedral and monoclinic modifications were found by various methods to be about 251° and 313°C . respectively, and at all temperatures above 100°C . the monoclinic form is the stable variety, although the rate of transformation of the octahedral form is comparatively slow. As the above experiments were undertaken primarily to study the conditions for the removal of arsenic from flue gases, the vapour pressures of the trioxide in a flue dust, containing 31.4% As_2O_3 , were also determined, and were found to be roughly only one-half that of the pure material under similar conditions, hence the quantity of arsenious oxide carried forward by the flue gases is much less than would be expected from considerations of the vapour pressure of the pure substance. This result may be due to the oxide being rapidly converted in the flue into the monoclinic form, or it is possible that it is not present in the free state but loosely combined with acidic or basic substances present in the flue gases.

—G. F. M.

Arsenious sulphide sol; Coagulation of—by electrolytes. J. Mukhopadhyaya. J. Amer. Chem. Soc., 1915, 37, 2024—2031.

THE stability of arsenious sulphide sols rises with dilution and, for sols of the same concentration, with increased coarseness of the colloidal particles. Coagulation in presence of electrolytes is essentially a process of coalition, the rate of which is determined by the nature and concentration of the electrolyte; the process is retarded by dissolved hydrogen sulphide. The electrolyte is not adsorbed appreciably by the colloid.—J. R.

Cobaltous oxide and aluminium oxide; Reaction between—at high temperatures. J. A. Hedvall. Arkiv. Kem. Min. Geol., 1914, 5, No. 16, 1—10. J. Chem. Soc., 1915, 108, ii., 636—637.

FUSIONS of cobaltous oxide and alumina in varying proportions have been made at 1100° and 1300° — 1400°C . in the presence of potassium chloride as a flux. When the cobalt oxide is in excess, the resulting product can be obtained pure by treatment with water to remove the flux and with hydrochloric acid to remove the excess of cobalt oxide. If alumina is in excess, the pure product

cannot be obtained. The results show that at 1100°C . the blue aluminate, of the composition $\text{CoO}, \text{Al}_2\text{O}_3$, is formed. At temperatures above 1100°C ., a hitherto unknown green aluminate, $4\text{CoO}, 3\text{Al}_2\text{O}_3$, is formed. The analytical figures for this green compound are only in approximate agreement with the formula given, but the small deviations observed may be accounted for by small quantities of cobalt oxide remaining dissolved in the compound. Neither aluminate was obtained in the form of well-developed crystals. The blue compound has sp. gr. 4.37, and the green compound sp. gr. 4.80 at 18°C .

Stannic oxide and cobaltous oxide; Reaction between—at high temperatures. J. A. Hedvall. Arkiv. Kem. Min. Geol., 1914, 5, No. 18, 1—7. J. Chem. Soc., 1915, 108, ii., 638.

MIXTURES of stannic oxide and cobaltous oxide in varying proportions were fused at 1100° and 1300° — 1400°C ., using potassium chloride as a flux. After removal of the potassium chloride by means of water, the stannate formed can be dissolved out from any excess of stannic oxide by treatment with warm, dilute hydrochloric acid. Analyses of the solutions thus obtained indicate the formation of cobalt orthostannate, Co_2SnO_4 . When cobalt oxide was in excess, no method of separating it from the orthostannate could be found. Pure cobalt orthostannate is dark green in colour, and has sp. gr. 6.30 at 18°C . It could not be obtained in the form of large crystals. If excess of stannic oxide is present in the fusion, the colour becomes more and more blue as the dilution with stannic oxide is increased. Cobalt metastannate, made by precipitation of a solution of potassium metastannate with a cobalt salt, is changed into the orthostannate on strongly heating; the colour is then a bright greenish-blue.

Chromic oxide; Hydrous—C. F. Nagel, jun. J. Phys. Chem., 1915, 19, 569—570.

THE fact that hydrous chromic oxide is "peptonised" and not dissolved by caustic alkali has been shown by means of dialysis experiments and conductivity measurements. By using a collodion ultra-filter it is possible to remove the hydrous chromic oxide and obtain a colourless filtrate. On long standing nearly all the peptonised chromic oxide precipitates from a caustic alkali solution. Chromic chloride solutions peptonise hydrous chromic oxide and no appreciable amount of basic chloride is formed. It is not possible to shake out hydrous chromic oxide from an alkaline solution either with benzene or kerosene. (See also this J., 1915, 549.)—W. G. C.

Cerium compounds. Part I. Basic ceric sulphates and the colour of cerium dioxide. J. F. Spencer. Chem. Soc. Trans., 1915, 107, 1265—1273.

BY the hydrolysis of ceric sulphate, a pale yellow basic sulphate, $\text{CeO}_2, \text{SO}_3, 2\text{H}_2\text{O}$, has been obtained; it is stable in contact with 0.37 N to 0.2 N sulphuric acid, but is further hydrolysed by water. On heating ceric sulphate to 195°C ., a white basic sulphate, $3\text{CeO}_2, 4\text{SO}_3$, is formed, which exists in two modifications. Cerium dioxide is white when prepared at low temperatures, but becomes pale yellow on ignition and decreases in volume.—B. N.

Rare earths; Electrolysis of solutions of the—II. L. M. Dennis and P. A. van der Meulen. J. Amer. Chem. Soc., 1915, 37, 1963—1976. (See also this J., 1915, 136, and U.S. Pat. 1,115,673; this J., 1915, 28.)

VALUES of about 2 volts were found for the decomposition voltages of neutral N/1 solutions of salts of neodymium, lanthanum, cerium, and thorium. By fractional electrolysis of a solution of the chlorides of the yttrium earths, the coloured

earths were rapidly concentrated in the earlier fractions, while the later fractions were rich in yttrium and also contained the small amount of neodymium present. A similar result was obtained with a solution of the corresponding nitrates, a diaphragm being used: the hydroxides were, however, precipitated four times as rapidly in this case as in the former. No ammonium salts were formed during the process. Erbium, holmium, and thulium were rapidly separated from yttrium, but not from each other, by fractional electrolysis. In certain cases of this kind the hydroxides were precipitated in the order of the basicities of the earths.—J. R.

Radium standard solutions; Comparison of—
J. Moran. Phil. Mag., 1915, 30, 660—664.

THE Rutherford-Boltwood standard radium solution at McGill University, Montreal, was compared by the emanation method with the Washington standard and so indirectly with the International standard. Whilst the Rutherford-Boltwood solid standard has previously been found to be 4.9% low, the solution standards prepared from it are now shown to be about 3% low, and the strong and weak solutions, originally prepared eleven years ago in the ratio 100:1, are still in good agreement, probably within 2%. Repeated boiling of the radium bromide solution in order to expel the emanation caused a deterioration in activity, but on the addition of a sufficient amount of hydrochloric acid free from radio-active matter, the solution recovered its normal emanating power.—G. F. M.

Ultraviolet rays; Action of—on mercuric chloride solutions, and on other salts of mercury.
J. Pougnet. Comptes rend., 1915, 161, 348—351.

A 5% SOLUTION of mercuric chloride, exposed in a quartz tube 15 cm. from a mercury vapour lamp working under 110 volts and 4 ampères, became cloudy almost immediately owing to formation of calomel. After 30 mins., 42% of the mercuric chloride had been decomposed and the calomel began to darken. After about 70 mins., when 48% of the mercuric chloride had been decomposed, the reaction ceased. The reaction is reversible, 1 gm. of calomel suspended in water and agitated during exposure yielding 0.635 gm. of mercuric chloride in 6 hours; the action, slow at first, was accelerated as the suspended particles became finer. Most of the salts of mercury, especially when moist, are decomposed by ultraviolet rays, and it is therefore advisable to keep them in bottles of orange-red colour.—J. H. L.

Nitric oxide; Reduction of—by contact action of metals and metallic oxides. B. B. Adhikary. Chem. News, 1915, 112, 163—164. (See also this J., 1911, 282.)

NITRIC oxide was reduced to ammonia when mixed with hydrogen, in the proportion of 1 to 3, and passed over heated Au, Ag, Zn, Sn, Pb, Sb, Bi, or Fe, and traces of ammonia were obtained with Mg and Al. Reduction commenced at different temperatures with the different metals, but in all cases, when once started, the temperature could be lowered without stopping the reaction. With some metals, e.g., Au, Zn, and Sn, the yield of ammonia was almost quantitative, and it was always greater when the metal was in a state of fine division and freshly reduced. The oxides of Zn, Cd, Pb, Sn, Bi, Sb, Mn, and Cr were reduced by the gaseous mixture to lower oxides or to metals, which then acted as catalysts.—F. SODN.

Carbon oxysulphide, carbon monoxide, and sulphur; Equilibrium between—G. N. Lewis and W. N. Lacey. J. Amer. Chem. Soc., 1915, 37, 1976—1983.

WHEN carbon monoxide and sulphur are heated

together at 250°—300° C., carbon oxysulphide, carbon dioxide, carbon bisulphide, and carbon monosulphide are formed: $\text{CO} + \text{S} = \text{COS}$; $2\text{COS} = \text{CO}_2 + \text{CS}_2$; $\text{CS}_2 = \text{CS} + \text{S}$. When equilibrium is attained at 302° C., the gaseous reaction product contains about 83% COS and 0.5% CO, whilst at 260° C. the corresponding figures are about 74% and 0.17%. The remainder consists of carbon monosulphide in quantity about the same as the carbon monoxide, and of carbon dioxide and carbon bisulphide in equal proportions. At the temperatures mentioned, the reaction $2\text{COS} = \text{CO}_2 + \text{CS}_2$ appears to be much more rapid than the reaction $\text{CO} + \text{S} = \text{COS}$. Carbon monosulphide interferes with the determination of carbon monoxide by the iodine pentoxide method; it was removed by passing the gas over copper deposited electrolytically on a platinum wire and heated to dull redness.—A. S.

Carbon; Thermo-electric properties of—W. C. Moore. J. Amer. Chem. Soc., 1915, 37, 2032—2037.

EXPERIMENTS were made with a number of different arc carbons, determinations of the thermal electromotive force of carbon-carbon and copper-carbon couples being made. It was found that the thermo-electric properties are reproducible for any one form of amorphous carbon, but they may vary with the temperature, and are determined by the kind of raw material used and the method of manufacture of the carbon. These results confirm the view that amorphous carbon is not a definite individual substance. In some cases a long temperature interval of constant E.M.F. was noted—a result which may be due to a constituent of the carbon passing through a transition interval in the temperature range concerned.—J. R.

Chlorine and hydrogen; Velocity of reaction between—at high temperatures. K. H. A. Melander. Arkiv. Kem. Min. Geol., 1914, 5, No. 12, 1—22. J. Chem. Soc., 1915, 108, ii., 622.

THE velocity of reaction between chlorine and hydrogen at 205°, 239°, and 255° C. has been determined. The gas mixtures were contained in borosilicate vessels connected with a spiral manometer, so that the pressures during filling, and hence the partial pressures, could be measured, and also connected with an exhausted vessel so that the gases could be drawn off at any time for analysis. The gases were well mixed by means of a porcelain ball, which could be rolled about in the borosilicate vessels. The reaction is bimolecular, the temperature quotient for 10° is 2.01, and preliminary heating of the chlorine has no effect on the velocity. The presence of sulphuric acid or of sulphur dioxide has a very marked accelerating action, which can be explained by assuming the intermediate formation of sulphuryl chloride; the order of the reaction is not thereby changed, the concentration of the sulphuryl chloride being directly proportional to that of the chlorine.

Titration of tartaric acid with permanganate. Dean. See XX.

Arsenious oxide as an alkalimetric standard. Menzies and McCarthy. See XXIII.

Transportation of dangerous articles. See Trade Report.

PATENTS.

Nitric acid; Concentration of—Norsk Hydro-Elektrisk Kvaestofaktieselskab, Christiania. Eng. Pat. 19,792, Sept. 15, 1914. Under Int. Conv., Sept. 20, 1913.

THE acid is treated with a counter-current of sulphuric acid in apparatus into which it is passed

as a mixture of liquid and vapour, produced by boiling in an external apparatus. The supply of mixed liquid and vapour is regulated to secure uniform working, without employing heating or cooling means to control the temperature.—F. SODN.

Evaporating devices [for sulphuric acid]. R. N. Lennox, London. Eng. Pat. 23,919, Dec. 11, 1914.

In an evaporating device, *e.g.*, for sulphuric acid, a rotating drum with circumferential corrugations dips into a trough mounted on sliding rods, which is divided into compartments for each corrugation; the whole is enclosed in a casing. The compartments communicate with one another at alternate ends of the partitions. Hot air or the like is passed through the drum, and the acid drops on the drum at the end remote from the hot air inlet, and at a point in advance of the axial plane; the concentrated acid is withdrawn from the last compartment of the trough at the hot-air inlet end.

—W. F. F.

Caustic soda process. J. H. Hirt, El Paso, Tex. U.S. Pat. 1,152,949, Sept. 7, 1915. Date of appl., Feb. 11, 1913.

MOLTEN sodium sulphide is run into water, and calcium hydroxide, preferably as a dilute solution, is added in successive small portions to the hot solution.—F. SODN.

Salt from brine; Process of recovering —. F. J. Wood, Assignor to Wood Apparatus Co., New York. U.S. Pat. 1,152,777, Sept. 7, 1915. Date of appl., Dec. 26, 1912.

A SERIES of surface evaporations is effected by heating brine below its boiling point, in contact with air. The heat of the combined air and vapour from the first body of brine is absorbed by water sprays, which collect into a single column of flowing water and serve to heat a second body of brine. The air is preferably circulated and confined under pressure, the pressure above the first body of brine being higher than above the second body.—F. SODN.

Aluminium oxide; Process for manufacturing —. Elektro-Osmose A.-G. (Graf Schwerin Ges.), Frankfurt, Germany. Eng. Pat. 7212, May 13, 1915. Under Int. Conv., July 24, 1914. Addition to Eng. Pat. 6727 of 1915, dated May 18, 1914 (this J., 1915, 904).

INSTEAD of treating the crude aluminate lye with acid, prior to electrical treatment, acid-forming gases, such as chlorine, are passed in, and the main bulk of the precipitate is separated by centrifuging, thus economising current.—E. H. T.

Sulphides of phosphorus; Process of producing —. F. C. Frary, Minneapolis, Minn. U.S. Pat. 1,153,054, Sept. 7, 1915. Date of appl., Feb. 3, 1915.

SULPHUR and phosphorus are heated together to at least 180° C. in the presence of a high-boiling inert solvent, obtained, for example, by chlorinating a hydrocarbon of the naphthalene series. With suitable proportions, the sesquisulphide is precipitated as a fine powder of high purity on cooling and agitating the mixture.—F. SODN.

Air; Process of liquefying and separating —. Process of liquefying and separating mixed gases. Process of liquefying air and separating it into oxygen and nitrogen. J. F. Place, Glen Ridge, N.J., Assignor to American Air-Liquefying Co., New York. U.S. Pats. (A) 1,152,044, (B) 1,152,119, and (C) 1,152,120, Aug. 31, 1915. Dates of appl., Nov. 29, 1907, and Feb. 17 and Nov. 9, 1911.

(A) AIR, at or above its critical pressure, is freed from moisture and carbon dioxide and partially liquefied, under pressure, by progressive cooling, and the gaseous residue is expanded and further

liquefied at atmospheric pressure. The liquid produced is evaporated fractionally under atmospheric pressure by absorbing heat from liquefied compressed air, which collects in a receiver submerged in the low-pressure liquid. Cooling is effected—(1) by a counter-current of low-pressure expanded air, previously released from the compressed-air column; (2) by a colder counter-current of evaporating liquefied gas released from pressure; (3) by a low-pressure counter-current of still colder expanded air, released from the cooled compressed-air column, and by the vapours arising from evaporation; and (4) by the direct action of the low-pressure evaporating liquid. (B) A gaseous mixture, such as air, is compressed and cooled, and a portion is delivered to a liquefier, whilst another portion passes to an expansion engine. The compressed gas in the liquefier is then partially liquefied by the combined effect of the expanded gas from the engine and the released liquid and expanded gaseous products of previous liquefaction, which flow over the liquefier. The unliquefied residue is utilised in cooling the compressed air before it enters the liquefier. (C) Air is compressed and cooled, and then a portion is liquefied, under pressure, whilst the unliquefied portion, after absorbing heat from compressed air to be liquefied, is expanded, with production of external work, and used to cool further and partially liquefy the cooled compressed air. Portions also are liquefied by thermal contact with dripping liquefied gas which is thereby fractionally evaporated, and other portions by passing through a body of liquefied gas released from pressure.—F. SODN.

Sulphur; [Method of] mining —. H. Frasch, New York, Assignor to The Union Sulphur Co., Jersey City, N.J. U.S. Pat. 1,152,499, Sept. 7, 1915. Date of appl., May 3, 1912.

IN mining sulphur by the fusion method from a water-flooded porous deposit, water is withdrawn from the deposit, at a temperature below the melting point of sulphur, and fusion fluid is introduced at the same time, in part at least near an intake for melted sulphur, whilst the sulphur is removed through piping which is kept at a temperature above the melting point of sulphur by means of the heat of the fusion fluid.

—F. SODN.

Oxygen; Manufacture of —. H. Kriegsheim, Assignor to The Permutit Co., New York. U.S. Pat. 1,153,502, Sept. 14, 1915. Date of appl., Nov. 17, 1914.

A BASE-EXCHANGING silicate is impregnated with a solution of a salt of a catalytic metal, *e.g.*, a cobalt salt solution, the excess of solution is removed, and the impregnated silicate is brought into contact with a hypochlorite solution.—E. H. T.

Nitrogen; Process of fixing — by means of ferro-aluminium. Soc. Gén. des Nitrures. Fr. Pat. 474,322, Nov. 19, 1913.

SEE Eng. Pat. 27,971 of 1913; this J., 1914, 961. The ferro-aluminium may contain other elements, such as silicon, titanium, etc., capable of forming nitrides.

Hydrogen; Manufacture of — by alternate reduction and oxidation of ferrous material in vertical chambers. Soc. l'Hydrogène. Fr. Pat. 474,446, July 1, 1914. Under Int. Conv., July 14, 1913.

SEE U.S. Pat. 1,144,730 of 1915; this J., 1915, 834. The heating gases, before coming into contact with the ferrous material, are passed through a layer of refractory material which serves as a heat accumulator. Any excess of reducing gases leaving the reaction chamber is burnt in a heat recuperator,

and the heat utilised to preheat the steam passed in during the subsequent oxidising stage.

Carbide; Method of manufacturing —. H. L. Hartenstein, Constantine, Mich., Assignor to Continental Investment Co., Duluth, Minn. U.S. Pat. 1,152,506, Sept. 7, 1915. Date of appl., Feb. 18, 1907.

SEE Eng. Pat. 20,654 of 1907; this J., 1908, 160.

Ammonia; Production of —. C. Bosch, A. Mittasch, H. Wolf, and G. Stern, Assignors to Badische Anilin und Soda Fabrik, Ludwigshafen, Germany. U.S. Pat. 1,152,930, Sept. 7, 1915. Date of appl. Oct. 28, 1914.

SEE Fr Pat. 425,099 of 1910; this J., 1911, 1012.

Ammonia from atmospheric nitrogen; Cyclic process for obtaining —. F. W. Dufert and R. Miklausz. Fr. Pat. 474,991, July 11, 1914. Under Int. Conv., July 12, 1913.

SEE Eng. Pat. 16,597 of 1914; this J., 1915, 871.

Radioactive liquids; Process and products for obtaining large quantities of —. H. Farjas. Fourth Addition, dated Nov. 10, 1913, to Fr. Pat. 456,990, July 1, 1912.

SEE Eng. Pat. 18,808 of 1914; this J., 1915, 1010.

Chemical processes [manufacture of cyanides]; Impts. in — especially applicable to the treatment of metals. J. E. Bucher. First Addition, dated June 18, 1914, to Fr. Pat. 459,853, Mar. 6, 1913 (this J., 1913, 1159).

SEE U.S. Pat. 1,138,190 of 1915; this J., 1915, 661.

Nitrogen; Process of fixing atmospheric —. Soc. Gén. des Nitrures. Fr. Pat. 474,365, Nov. 21, 1913.

SEE Eng. Pat. 22,586 of 1914; this J., 1915, 353.

Aluminium nitride; Manufacture of —. Soc. Gén. des Nitrures. Fr. Pat. 474,820, Dec. 24, 1913.

SEE Eng. Pat. 24,533 of 1914; this J., 1915, 423.

Magnesium carbonale; Preparation of — from calcareous silicates and carbonates of magnesium. A. Hamblach and S. Gelléri. Fr. Pat. 474,861, July 8, 1914. Under Int. Conv., Dec. 24, 1913.

SEE Ger. Pat. 280,738 of 1913; this J., 1915, 492.

Calcium cyanamide; Process and apparatus for treating [granulating] —. G. W. Sinclair. Fr. Pat. 474,882, July 8, 1914. Under Int. Conv., July 8, 1913, and Apr. 21, 1914.

SEE Eng. Pats. 15,713 of 1913 and 9821 of 1914; this J., 1914, 933; 1915, 916.

Recovery of ammonia in the form of sulphate from gases. Eng. Pat. 18,559. See 11A.

VIII.—GLASS; CERAMICS.

PATENTS.

Glass-furnace. W. N. Mathews, Wellsburg, W. Va. U.S. Pat. 1,152,828, Sept. 7, 1915. Date of appl., Mar. 27, 1915.

IN a glass-melting furnace, an air-heating chamber and a system of regenerative flues are disposed successively above the combustion chamber. The walls of the latter extend upwards so as to enclose the whole regenerative system, and are provided

with arched openings for the pots and vertical flues for the admission of air.—W. E. F. P.

Glass; Batch for semi-opaque, semi-translucent —. H. C. Stiefel, Assignor to A. M. Neepor, Pittsburgh, Pa. U.S. Pat. 1,153,353, Sept. 14, 1915. Date of appl., July 23, 1914; renewed July 10, 1915.

THE materials used are essentially those required for a crystal glass, to which are added magnesium phosphate and comparatively inert substances which cause a continuous evolution of gas during fusion. The batch consists of: sand, 60 parts; soda ash, 15; lead oxide, 15; calcium nitrate, $3\frac{1}{2}$; magnesium phosphate, $\frac{1}{2}$ — $3\frac{1}{2}$; magnesium carbonate, $3\frac{1}{2}$; alum, $3\frac{1}{2}$ parts.—E. H. T.

Enamel or glaze composition; Opaque —. C. Baezner, Assignor to E. De Haën, Chem. Fabr. List, G.m.b.H., Seelze, Germany. U.S. Pat. 1,153,748, Sept. 14, 1915. Date of appl., Dec. 20, 1913.

THE enamel or glaze contains a vitrifiable material mixed with luminescent zinc sulphide.—E. H. T.

IX.—BUILDING MATERIALS.

Silica (Dinas) bricks; Choice of raw material for the manufacture of —. A. K. Khoétsky. Rev. Soc. russe de Métall., 1914, 1, 170—202. Rev. Mét., 1915, 12, 143—145.

THE value of natural silica for the manufacture of silica bricks is determined by the factors:—chemical purity, size of grain obtainable, and the smallness of the increase in volume on being heated. To withstand a temperature of 1700° C. the brick must contain not less than 96% SiO₂, this condition requiring that the raw material must contain 98% SiO₂. The raw material must not give too fine a powder on crushing, as bricks composed of fine grains are not sufficiently porous, and break down on being heated. As regards the third factor, the order of merit of the natural forms of silica is given as follows:—Chalcedony, plutonic quartzites, quartzite derived from vein quartz, vein quartz. The two latter forms contain a modification, α , which passes on roasting into a second modification, β , with increase of volume. Schistose quartz, sandstones, and sand are unsuitable for the manufacture of bricks, the first on account of its structure and the presence of many impurities in the form of inclusions, the two latter on account of their variability of composition and their too great fineness after being ground.—T. ST.

Dust prevention and road preservation; Use of tar for —. U.S. Dept. Agric., Bull. 257. J. Gas Lighting, 1915, 131, 647.

EXPERIMENTS have been carried out with oil and asphalt preparations, and also with prepared coal tar and water-gas tar. Using a water-gas tar preparation, the condition of the road after twelve months was a perfect mosaic surface with slight indentations, penetration treatment at 104° F. (90° C.) giving slightly better results than cold surface treatment. With refined coal tar which contained 28—29% free carbon, the bituminous material became hard and brittle, and surface treatment with tar was required after twelve months. For the renewal of old work, fairly good results were obtained with crude coal tar, refined water-gas tar, and a water-gas tar preparation containing less middle and heavy oils, but more free carbon.—W. G. C.

PATENTS.

Timber; Method of preserving—from boring organisms. J. E. Cunningham, Sydney, N.S.W. Eng. Pat. 784, Jan. 18, 1915.

THE timber, *in situ* or not, is coated or impregnated with petroleum, creosote, tar, or other inflammable material and then evenly charred, to a depth of about $\frac{1}{4}$ in., by a high power gas flame, such as that from a brazing or welding lamp.—W. E. F. P.

Portland cement clinker; Method of burning—T. A. Edison, Orange, N.J. U.S. Pat. 1,152,615, Sept. 7, 1915. Date of appl., Sept. 29, 1905.

SEE Eng. Pat. 1404 of 1903; this J. 1903, 555.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Iron ores: Recent methods of briquetting—H. Martin. Le Génie Civil, 1913, 62, 306. Rev. Mét., 1915, 12, 134—138.

To be serviceable in a blast-furnace, briquettes should satisfy the following tests:—(1), fall from a height of 3 to 4 m. on to a metal plate without being reduced to powder, and withstand a pressure of about 140 kilos. per sq. cm.; (2), withstand a temperature of 900° C. without being reduced to powder; (3), stand in water for some time without softening; (4), withstand steam at 150° C. without being reduced to powder; (5), be sufficiently porous to absorb 12.5 to 16% by volume of water on being immersed for 25 minutes. The briquettes should be free from sulphur, arsenic, and other objectionable materials, and the cost of briquetting must not be greater than the difference in value of the ore in lump and as smalls. *Methods of briquetting.* (1). (Yeaton). 5 to 10% of slaked lime is added and the mixture made into a paste with water. Briquettes are formed under a pressure of 400 kilos. per sq. cm. and are placed in the open air to dry and harden. This requires at least 2 months. To avoid this delay steam under pressure is sometimes used, or about 10% of sawdust is added to the mixture and the briquettes are heated to 1200°—1400° C., when the wood carbonises and the particles of ore frit together. (2). A mixture of equal parts of lime and sand is used as the agglomerant. (3). (Schumacher). Fresh blast-furnace dust is briquetted with magnesium chloride as binder. (4). Basic blast-furnace slag is used as the agglomerant for dust, hardening being effected by high-pressure steam. If the dust is deficient in lime, 4—4.5% of this material is added. (5). An intimate mixture of ore, limestone, and moistened cement is briquetted under a pressure of 400 kilos. per sq. cm. The briquettes are serviceable after standing in the open air for three or four days. (6). (Weiss). Briquettes containing 5—6% of slaked lime are compressed at 300 kilos. per sq. cm. and subjected to the action of carbon dioxide under a pressure of 20 kilos. per sq. cm., first in the cold and then hot. The treatment requires about 5 hours, after which the briquettes are serviceable. (7). (Ronay). Blast-furnace dust or roasted pyrites is compressed hydraulically into briquettes, without the addition of binders, under a pressure of about 1000 kilos. per sq. cm. (8). (Groenadat). Impure ores are ground and concentrated in magnetic separators. The ore-mud is formed under small compression into briquettes, which are then passed on waggons of special construction through gas-fired tunnel furnaces. The highest temperature reached is 1300°—1400° C., which causes the particles to frit together, and drives off sulphur. The briquettes are of high quality.—T. Sr.

Platinum; Separation of—in iron ore analysis. L. Brandt. Chem.-Zeit., 1915, 39, 553—555.

WHEN using platinum vessels for the treatment of iron ores for analysis, a sufficiently large amount of platinum may be found in the iron solution to affect the titration results in both reduction and oxidation methods of analysis. The presence of the platinum in solution is shown by the reddish brown colour produced by stannous chloride. The platinum can be removed by precipitation with arsenite solution, in presence of stannous chloride; the precipitate is flocculent, and can be filtered easily after the excess of arsenic has been removed, the presence of stannous chloride being harmless.—W. G. C.

Steels; The heterogeneity of—H. Le Chatelier and J. Lemoine. Comptes rend., 1915, 161, 373—378.

FOR revealing phosphorus-rich areas in steel sections, the authors have found Stead's copper reagent (this J., 1915, 616) to be uncertain in its action, and have obtained much more satisfactory results (with steels containing Mn 0.5—1.0% and Si about 0.2%; at 20° C.) with the following reagent:—rectified alcohol 100 c.c., water 18 c.c., concentrated hydrochloric acid 2 c.c., crystallised cupric chloride 1 gm., crystallised magnesium chloride 4 grms. The successful action of the reagent depends on the correct amount of water being present. The reagent may be used in the manner recommended for Stead's reagent, or the specimen may be wholly immersed and connected to the anode of an accumulator, while a copper wire immersed at a distance of 20 m.m. from the specimen serves as the cathode. By this method the zones are sharply defined. The formation of bands of variable composition may be caused not only by phosphorus but by any other element, such as silicon, manganese, nickel, or chromium, which is soluble in ferrite and diffuses slowly or not at all. The action of the copper reagent is intensified in presence of manganese and diminished in presence of phosphorus, silicon, nickel, and chromium. Almost all steels exhibit to some extent a striated structure after rolling, and "work" and annealing remove this heterogeneity. The use of the copper reagent in revealing a heterogeneous structure is therefore a valuable adjunct to the chemical analysis and the ordinary micrographic examination.—T. Sr.

[Gold.] *Refining cyanide precipitates.* H. T. Durant. Eng. and Min. J., 1915, 100, 523—524.

BULLION of higher purity can be obtained if the usual acid treatment of cyanide precipitates is supplemented by treatment with acid and bichromate. After treatment with acid as usual, the solution is separated and the residual slime is mixed with a quantity of water equal to about five times its dry weight. The mixture is heated and continuously agitated, and sulphuric acid and potassium bichromate (4 lb. of 66% acid to 1 lb. of bichromate) are added, in small portions at a time, until an excess of chromic acid persists for 3 or 4 mins. The solution is then separated and the residual slime well washed. The slime settles well, and when dried and smelted in a clay crucible with borax glass and a small quantity of nitre, yields bullion practically free from zinc, lead, and copper.—A. S.

Silver; A new crystalline variety of—T. C. Choudhri. J. Amer. Chem. Soc., 1915, 37, 2037—2039.

SPONGY silver, from ignited silver tartrate, was allowed to stand at the ordinary temperature with nitric acid of sp. gr. 1.42 which had been freed from oxides of nitrogen by boiling with

urea. After the lapse of a fortnight, during which the mixture was occasionally shaken, the undissolved silver had been converted into long, slender needles, which are described as a new variety of crystalline silver belonging to the cubical system. —J. R.

Brasses; The failure of structural—. P. D. Merica and R. W. Woodward. Amer. Inst. of Metals, Sept. 1915. [Advance proof.] 19 pages.

SPECIMENS of brass which had failed in use, and also other samples, were tested for presence of initial stresses by noting the changes in length of a bar caused by turning off successive layers in the lathe (see Heyn, this J., 1914, 596). The experiments proved that season-cracking and similar failures occur in brasses the initial stress of which averages 5000–6000 lb. per sq. in. These stresses can be almost entirely removed by annealing at 300°–400° C. No certain indication of the presence of such stresses has so far been obtained either by etching agents or by examination of the microstructure.—W. R. S.

Zinc-bronze; Standard test specimen of—. *Relation of mechanical properties to microstructure*. H. S. Rawdon. Amer. Inst. of Metals, Sept. 1915. [Advance proof.] 15 pages.

THE relation between the mechanical properties and the microstructure of the alloy, Cu 88, Sn 10, Zn 2%, was investigated by microscopic examination, both before and after the tension test, of specimens prepared by different modes of casting. It was found that the presence of oxides in the form of pits and a network of films is by far the most common cause of weakness. From the frequent occurrence of oxides in the test specimens, notwithstanding the care with which they had been prepared, it is concluded that the failure of commercial zinc-bronze is to be ascribed to the presence of oxides rather than to any other cause.—W. R. S.

Manganese-bronze; Manufacture and uses of wrought—. J. L. Jones. Amer. Inst. of Metals, Sept. 1915. [Advance proof.] 11 pages.

WROUGHT manganese bronze differs chiefly from the casting grade in being free from aluminium. In order to secure ductility as well as high tensile strength, extreme purity of the materials is essential. This applies especially to the zinc, which is more difficult to obtain in a pure state. The alloy is made by melting the copper, superheating it, and adding the iron and manganese. Zinc is then added, a little at a time, with constant stirring; the alloy is poured into moulds and made uniform by remelting. It can be readily forged, drop-forged, rolled, or extruded at a red heat, but it hardens rapidly when worked cold. The fracture of a test piece gives the best indications of its qualities: if cup-shaped or lippled, the metal has received proper heat and forging treatment; if conchoidal and irregular, cold work without proper annealing is indicated.—W. R. S.

Turbadium bronze; Analysis of—. H. Williams. Chem. News, 1915, 112, 175–176.

TURBADIUM bronze contains approximately Cu 48, Zn 46.45, Sn 0.5, Pb 0.1, Fe 1, Al 0.2, Mn 1.75, and Ni 2%; it has a tensile strength of 35–42 tons per sq. in., and elongation (on 2-in. test-piece) 14–20%. It is used for making solid propeller castings, as it is not corroded appreciably by sea water. The following methods of analysis have proved most satisfactory in the Testing Department of Messrs. Harland and Wolff, Belfast. Tin. 1 gm. of drillings is heated with 20 c.c. of nitric acid of sp. gr. 1.2, the solution evaporated to 10 c.c., diluted with 50 c.c. of water, the insoluble residue collected on a small, ashless pulp filter, washed with 5%

nitric acid, the filter ignited in a porcelain crucible, and the tin weighed as SnO_2 . *Copper*. The filtrate and washings are electrolysed with a current of $\text{N.D.}_{100}=1$ ampère and 2.5 volts, with platinum gauze electrodes, the anode being rotated. The cathode is washed, immersed for a few seconds in re-distilled methylated spirit, dried in the air and then in a steam oven, and weighed. Lead is deposited on the anode as peroxide. This is dissolved by means of a mixture of 5 c.c. of concentrated nitric acid, 10 c.c. of water, and 4 drops of methylated spirit, and the solution is evaporated with 3 c.c. of concentrated sulphuric acid till fumes appear. It is then diluted to 30 c.c., the lead sulphate collected in a tared Gooch crucible, and washed with 2% sulphuric acid. *Iron and aluminium*. The solution remaining after deposition of the copper and lead, is evaporated to 30 c.c., treated with 5 grms. of ammonium chloride, and the hydroxides of iron, aluminium, and manganese precipitated by means of 30 c.c. of saturated bromine water and 30 c.c. of ammonia solution (sp. gr. 0.88). The precipitate, after washing, is dissolved in dilute hydrochloric acid, with addition of sulphurous acid, the excess of sulphur dioxide expelled by boiling, the iron oxidised with a few drops of nitric acid, and manganese separated by the ammonium acetate method. The alumina and ferric oxide are weighed together, then dissolved in hydrochloric acid, the iron reduced with stannous chloride and titrated with bichromate. *Manganese*. The filtrate from the lead sulphate and that from the ammonium acetate separation are each treated with bromine and ammonia, and the precipitates collected on the same filter; the manganese is weighed as Mn_3O_4 . *Zinc*. The filtrate and washings from the first precipitation of iron, aluminium, and manganese are evaporated to 150 c.c., made slightly acid with acetic acid, and the zinc precipitated twice in succession as phosphate, the first time with 4 grms. and the second time with 2 grms. of di-ammonium phosphate, and weighed as $\text{Zn}_3\text{P}_2\text{O}_7$. *Nickel*. The filtrate and washings from the zinc precipitate are treated with a slight excess of ammonia, heated to 70° C., and the nickel precipitated with 15 c.c. of dimethylglyoxime solution (5 grms. in 500 c.c. of re-distilled methylated spirit). The alloy usually contains 0.1% of impurities (Bi 0.03%, As 0.05, O as Cu_2O and CuO , 0.02%), and the percentage of zinc may be obtained with sufficient accuracy by subtracting the sum of the other constituents from 99.9%.—A. S.

Copper-nickel ores; Roasting of—. H. Manz. Chem.-Zeit., 1915, 39, 693–694. (See also this J., 1914, 696.)

LABORATORY experiments were made on an ore containing Cu 6.6, Ni 11.1, and Fe 32.4%, and As nil. Sulphatising roasting was more or less unsuccessful; only a small quantity of sulphates was formed, and the resulting oxides were partly insoluble even in moderately strong acid. This is explained by the formation of ferrites at the relatively high temperature caused by the combustion of the sulphides. Diluting the ore with ferric oxide, so as to keep the temperature from rising unduly, increased the yield of copper sulphate, but not that of nickel sulphate. Chloridising roasting for 24 hours at about 600° C. with 20% of salt gave a product from which 90% of the copper and nickel and 10% of the iron was recovered by extraction with water.—W. R. S.

Nickel; Electrodeposition of—. C. W. Bennett, C. C. Rose, and L. G. Tinkler. J. Phys. Chem., 1915, 19, 564–568.

In the electrolysis of nickel ammonium sulphate, the hydrogen ions present are liberated more

easily than the nickel ions, and the efficiency of nickel deposition is therefore low. By adding ammonia, the concentration of the hydrogen ions may be decreased and the efficiency of deposition increased from 87% to 96%. The rotation of the cathode tends to prevent hydrogen ion impoverishment, and therefore diminishes the efficiency. If nickel be deposited from a strongly alkaline solution of nickel cyanide, the hydrogen ion concentration is practically zero, and nickel is deposited more easily than the other ions. A rotating cathode, in this case, prevents impoverishment of nickel and therefore increases the efficiency. (See also this J., 1914, 1012.)—W. G. C.

Manganese-nickel alloys. A. D. Dourdine. Rev. Soc. russe de Métall., 1912, 1, 11—23, 341—395. Rev. Mét., 1915, 12, 125—133.

THE liquidus curve drops sharply from the melting points of the pure metals (Mn 1235° C., Ni 1451° C.) to a flat minimum between Mn 56 and 63% at a little above 1000° C. The alloys containing Mn 0—38% and 71—100% consist of solid solutions, but the thermal curves for the alloys with Mn 38—56% and 63—71% show certain peculiarities which appear to indicate the existence of two modifications, stable and unstable, of the compound MnNi (Mn 48.37%). The microscopic structure of the alloys is described and discussed with reference to the thermal effects observed.

—T. ST.

*Zinc oxide; Production of—*from low-grade carbonate ores at Leadville. Met. and Chem. Eng., 1915, 13, 631—633.

FOR the past few months the production of zinc oxide from the low-grade zinc carbonate ores of Leadville, Colorado, has been carried on continuously by the Western Zinc Oxide Co. The ore is treated in a furnace of the Wetherill type, 65 ft. by 16 ft. 6 in., by 11 ft. high, divided into eight double-ended arched fire-boxes extending across the furnace and having a fire-door at each end. The furnace is built on a concrete foundation forming, beneath the fire-boxes, eight watertight compartments, to each of which water is supplied independently. An air blast at 4 oz. pressure is supplied to the furnace at the rate of 32,000 cub. ft. per minute. Each fire-box receives a charge of 2000 lb. of ore (about 18% Zn) of $\frac{3}{16}$ in. size and 1100 lb. of anthracite coal of $\frac{1}{8}$ in. size; about 30 tons of ore is treated in 24 hours, the sinter being withdrawn 6—7 hours after charging; it contains 2—4% Zn. The gases leave the furnace at about 1000° C. and pass through a U-shaped cooling flue, 4 ft. diam. and 600 ft. long, to the bag-house, which they enter at about 140° C.; air is admitted to the cooling flue at a number of hoppers near the bag-house end. The zinc oxide is collected in 288 cotton bags, 24 in. diam. and 26 ft. long, arranged in lateral groups of twenty-four each, with a hopper for every four bags. The bags are shaken by hand every two hours, and the hoppers are emptied once in 24 hours. About 6 tons of zinc oxide of 95—96% purity is produced per day; it contains 1—1.5% Pb, and is suitable for use as a pigment without reburning.—A. S.

Lead; An allotropic modification of— H. Heller. Z. physik. Chem., 1915, 89, 761—762. J. Chem. Soc., 1915, 108, ii., 634.

WHEN pure lead is allowed to remain in an acidified solution of lead acetate for several days it becomes brittle, and may be powdered. This is an entirely new form of lead, and is designated "grey lead." The same transformation occurs in lead nitrate solution and also in lead chloride solution, but in the latter case much more slowly. The change

is always more rapid if a small quantity of nitric acid is present. There is no change if lead is immersed in acetic acid, nitric acid, or sodium acetate solutions, thus showing that the transition is due to the presence of lead ions. These results, and also the nature of the product, have been confirmed by Cohen and Heldermaun (this J., 1915, 908).

Aluminium; Recent developments in— E. V. Pannell. Amer. Inst. of Metals, Sept., 1915. [Advance proof.] 22 pages.

FROM 3,000,000 to 5,000,000 lb. of aluminium is consumed annually for electrical purposes, the conductivity of the metal being about twice that of copper on the basis of unit weight. For electrical conductors, hard-drawn aluminium wire (99.5% Al) is employed in the form of stranded cable as with copper, except that the strands are usually thicker and fewer in number. In the following specifications for aluminium cable, A (American) relates to sizes 4/0 and 3/0 (B and S), and B and C (European) to size 320,000 c.m.:—

	A.	B.	C.
Conductance (% Int. Standard)	60	58.5	58.5
Number of strands	7	19	37
Tensile strength (min.)	23,000	27,000	34,000
Tensile strength (max.)	30,000	—	—
Elastic limit (min.)	14,000	11,800	13,000
Modulus of elasticity (min.)	8.5×10^6	9×10^6	8.3×10^6
Elongation, % on 2 in. (min.)	6	9.2	7.2

Wrapping test: 6 turns on, off and on, around own diameter.

On account of its greater strength, steel-reinforced aluminium cable is largely used for overhead power lines, a typical form for sizes up to 250,000 c.m. consisting of 6 aluminium wires placed round a core of 7 small, stranded, galvanised steel wires. The ultimate tensile strength, coefficient of expansion (per 1° F.) and modulus of elasticity of such cable are 47,000 lb. per sq. in., 10.5×10^{-6} and 12×10^6 , respectively, the corresponding values for aluminium and steel alone being 24,000 and 160,000 lb. per sq. in.; 12.8×10^{-6} and 6.4×10^{-6} ; and 9×10^6 and 30×10^6 , respectively. Aluminium alloys tend to deteriorate in use and are not to be generally recommended for electrical purposes. Permanent union of aluminium surfaces is only attainable by autogenous welding, which is most satisfactorily accomplished by means of the oxy-acetylene flame and a flux composed of alkali chlorides with or without an alkali sulphate or fluoride.—W. E. F. P.

Stellite [Cobalt-chromium alloys]. E. Haynes. Amer. Inst. of Metals, Sept., 1915. [Advance proof.] 4 pages.

STELLITE is the name given to an alloy, or group of alloys, used for high-speed cutting tools, and consisting essentially of cobalt and chromium with additions of tungsten, molybdenum, or both. The alloy has a colour between those of steel and silver and is unchanged by exposure to dry or moist air at temperatures below a dull red heat. It is very hard and resistant to abrasion, cannot be forged (as it retains its hardness at a full red heat), and can only be reduced to the desired form by casting into bars and grinding the latter to a cutting edge. As showing the efficiency and durability of the material, two examples are given in each of which a tool $2\frac{1}{2}$ in. long and $\frac{3}{8}$ in. square in cross-section was used on cast iron pistons: in the first, 14,000 grooves were cut in pistons $3\frac{1}{2}$ — $4\frac{1}{2}$ in. in diameter, while in the second over 8000 lb. of metal was turned off, before the tool became too short for further use.—W. E. F. P.

Ores of Utah; Metallurgical treatment of the low-grade and complex—. D. A. Lyon, R. H. Bradford, S. S. Arentz, O. C. Ralston, and C. L. Larson. U.S. Bureau of Mines, Tech. Paper 90. 40 pages.

A PRELIMINARY report describing the low-grade ore deposits of Utah and the concentrating, hydrometallurgical, and smelting processes which have been proposed for their treatment. The ores include complex gold, silver, lead, copper, and zinc ores. Two chloridising processes are being tried: an air-blast shaft furnace is used in the Holt-Dern process, and an annular furnace in the Knight-Christensen process; in both, the roasted ore is leached with acid brine. Analyses of the eight principal types of ores are given.—W. R. S.

Vapour pressure of arsenic trioxide. Welch and Duschak. See VII.

PATENTS.

Case-hardening [iron and steel]. A. W. Machlet, Elizabeth, N.J. U.S. Pat. 1,152,959, Sept. 7, 1915. Date of appl., Apr. 13, 1909.

THE articles are uniformly heated in an atmosphere charged with carbon monoxide, ammonia, and oily vapour obtained by passing air first through a heated body of nitrogenous organic matter and charcoal and then through an oil, e.g., naphtha.—W. E. F. P.

Tin iron matte; Production of—from pyritic or other tin ores, tin ore concentrates, tin waste, tin plate waste, stanniferous slag and the like. J. Rueb, The Hague, Holland. Eng. Pat. 20,609, Oct. 6, 1914. Under Int. Conv., Oct. 7, 1913.

THE material is smelted with the addition of lime or other calcium compound, and if necessary with the addition also of pyrites, to a tin-iron-matte. The proportion of pyrites should not be lower than 30%; with the addition of 17% of lime a yield of 92.5% of the total tin may be obtained in one smelting operation, the tin in the slag reduced to 0.4%, and loss by volatilisation rendered practically nil. The action of the lime is to lower the temperature of formation of the slag, increase its fluidity, and prevent passage of tin into the slag.—T. St.

Cuprous sulphide from ores and the like; Recovery of—. Metals Research Co., New York, and R. F. Bacon, Pittsburgh, U.S.A. Eng. Pat. 138, Jan. 4, 1915. Under Int. Conv., Jan. 24, 1914.

SEE U.S. Pat. 1,151,234 of 1915; this J., 1915, 1018. During the reduction of the cupric to cuprous sulphide, the temperature is not allowed to rise above 500°C.

Furnace; Electrical [zinc]—. W. H. Hampton, New York, Assignor to The Conley Electric Furnace Co., Inc., Wilmington, Del. U.S. Pat. 1,152,505, Sept. 7, 1915. Date of appl., Feb. 28, 1913.

THE furnace, for reduction of zinc, is provided with a shaft from which air is excluded, and in which are several guide members composed of central triangular refractory blocks and lateral blocks, thus forming a number of zig-zag communicating passages having sloping surfaces over which the material is passed backwards and forwards in a downward direction. The charge is heated, as it flows over the surfaces, by resistance elements composed of a mixture of clay and graphite embedded within the blocks, and means are provided for conducting away the zinc vapour from beneath the guide members and condensing it.—B. N.

Furnace; Electric [smelting]—. P. Wright, Seattle, Wash. U.S. Pat. 1,152,586, Sept. 7, 1915. Date of appl., Sept. 13, 1913.

THE ore is supplied to a furnace crucible by means of a shoot, a movable arrangement being provided for obstructing the downward passage of the ore, so as to relieve the molten matter in the crucible of its weight. By removing the obstructing means, the melted metal is displaced and is removed through an overflow discharge opening. A smelting zone is produced by an electric heating means, the electrode comprising a shell of wrought iron and a core of copper. A chamber, surrounding the shoot, and closed at its upper end, is supplied with heat from the smelting zone, thus heating and drying the ore, and the shoot is provided with perforations establishing communication between the inside of the shoot and the surrounding chamber.—B. N.

Welding; Method of—. J. H. L. de Bats, Zelenople, Pa. U.S. Pat. 1,152,610, Sept. 7, 1915. Date of appl., Aug. 18, 1913.

THE dissimilar metals to be welded are heated electrically in a vacuum to a temperature near the m.pt. of the softer metal, pressed into contact, and allowed to cool in the vacuum.—W. E. F. P.

[Zinc and silver] ores; Method of treating—. L. C. Drefahl, Assignor to The Grasselli Chemical Co., Cleveland, Ohio. U.S. Pat. 1,153,203, Sept. 14, 1915. Date of appl., Apr. 15, 1914.

TO prepare finely divided zinc and silver sulphide ores for desulphurisation, a plastic mass, formed by mixing the ore with water and a suitable binder, is extruded through small perforations, the resulting streams of the mixture are broken into small nodules, and the latter heated sufficiently to expel the moisture and set the binder.—W. E. F. P.

Tungsten ores; Method of treating—. F. M. Becket, Assignor to Electro Metallurgical Co., Niagara Falls, N.Y. U.S. Pat. 1,153,594, Sept. 14, 1915. Date of appl., April 8, 1914.

LOW-PHOSPHORUS ores of the calcium tungstate type are heated under conditions to reduce the solubility of the contained tungsten, and are then treated with strong sulphuric acid under conditions to increase the ratio of tungsten to phosphorus. The treated ore is mixed with an ore of the iron tungstate type and the mixture smelted to yield ferrotungsten of low phosphorus content.—T. St.

Slimes; Apparatus for thickening—. W. A. Stedman, Wonder, Nev. U.S. Pat. 1,153,722, Sept. 14, 1915. Date of appl., Jan. 19, 1915.

A VERTICAL cylindrical tank has a central feed pipe for slime, a peripheral discharge for separated water, and an inverted, conical bottom with a valved outlet for the thickened product. The feed pipe extends well below the middle of the tank, and is surrounded by concentric cylindrical partitions extending to below the end of the feed pipe and further downwards successively from the innermost one outwards. By suitable adjustment of the outlet and inlet, an upward flow of liquid through a series of vertical paths, and a gradual settling of suspended solid matter by gravity, are maintained simultaneously.—W. E. F. P.

Metallic adsorptions; Preparation and utilisation of—. Elektro-Osmose A.-G. (Graf Schwerin Ges.). Fr. Pat. 474,404, June 27, 1914. Under Int. Conv., Apr. 29, 1914.

SEE Eng. Pat. 15,267 of 1914; this J., 1915, 803. A nickel adsorption may be prepared by integrating the metal by means of an electric arc in presence of a suspension of silicic acid. Metallic

adsorptions may also be obtained by mixing an adsorbent in the form of a sol, *e.g.* colloidal silicic acid, with a solution of a salt of selenium, platinum, silver, gold, or palladium, and then reducing the salt.

Iron and nickel; Process for separating— from copper in certain ores and masses. W. Borchers and E. Thilges, Aachen, Germany. U.S. Pat. 1,152,699, Sept. 7, 1915. Date of appl., May 25, 1914.

SEE Ger. Pat. 271,595 of 1913; this J., 1914, 488.

Reduction of metallic oxides and the like. F. W. Highfield, Caversham. U.S. Pat. 1,153,786, Sept. 14, 1915. Date of appl., Mar. 15, 1915.

SEE Eng. Pat. 6865 of 1914; this J., 1915, 838.

Zinc; Process and electric furnace for the extraction of pure— from its ores. E. F. Côte and P. R. Pierron. Fr. Pat. 474,321, Nov. 19, 1913.

SEE Eng. Pat. 14,192 of 1914; this J., 1915, 497.

Utilisation of blast-furnace slag and recovery of products [fertilisers] therefrom. Eng. Pat. 20,258. See XVI.

XI.—ELECTRO-CHEMISTRY.

Russian electro-chemical industry. Chem. Trade J., Sept. 11, 1915.

HITHERTO no aluminium has been made in Russia, though the demand has been considerable. Magnesium and sodium have not been produced commercially in Russia, and large sums have been paid annually to Germany and America for carborundum. Other materials exclusively imported include calcium cyanamide, hydrogen peroxide, and "Berthollet salts," or fulminating silver. Practically nothing has yet been done there in respect of the electrical manufacture of steel, nor have the electro-thermal processes associated with zinc, phosphorus, and carbon bisulphide been investigated, and, as a natural consequence, there is no native industry for the manufacture of accessory material, such as carbon electrodes. There are believed to have been only two calcium carbide furnaces in Russia on the outbreak of war, whilst for the manufacture of ferro-silicon, ferro-chrome, and other special alloys there was one small works in the Urals, and for the manufacture of fulminate there were reopened one works in the Government of Petrikau and one in Imatrafall (Finland). On the other hand, the electric refining of copper, the manufacture of accumulators, and the production of lye and chlorine were flourishing branches of electro-chemical and electro-metal-lurgical manufacture.

According to the latest available official statistics, consumption and imports of various materials during 1912 were as follows:—

	Consumption.		Imports.	
	Tons.	£	Tons.	£
Electrolytic copper ..	21,000	1,930,000	9,400	595,000
Lye and etching salts	88,500	1,010,000	355	5,700
Accumulators	3,390	180,000	27	5,400
Aluminium	1,290	170,000	1,290	170,000
Berthollet salts and sodium chlorate ..	2,800	114,000	2,800	114,000
Abrasives	1,110	67,000	1,110	67,000
Electro-steel	4,030	66,100	1,940	32,900
Calcium carbide	1,450	42,500	129	6,250
Norw. saltpetre and calc. cyanamide ..	2,200	10,700	2,200	10,700

The development of these industries in Russia should not present serious difficulty, since there is an abundant supply of the necessary raw

materials, and ample capital and skilled labour are believed to be available. The power problem is the crux of the whole situation. It is calculated that the maximum price of electrical energy at which it will be possible to carry on profitable electro-chemical operations varies from 1·28 penny per kw.-hour in the case of copper down to 0·15 penny for aluminium and 0·06 penny for calcium nitrate. Russia is at present so deficient in large hydro-electric works that it can hardly be practicable in the near future to establish such electro-chemical industries as the fixation of atmospheric nitrogen or the manufacture of aluminium in that country. The limitation is, however, only temporary. Healthy development in this, as in so many other Russian fields, depends on the erection of really large power development installations. Large stations must sooner or later be erected in the hard coal districts (*e.g.*, the Donetz area), and in or near the peat fields. At least 100,000,000 kw. could be derived from water-power in Finland and in the Urals and Caucasian districts, and it is estimated that 300,000 kw. of hydro-electric power could be developed in the Petrograd district alone, and sold for electro-chemical purposes at 0·03d. per kw.-hour.

Electrolysis of solutions of the rare earths. Dennis and Van der Meulen. See VII.

PATENTS.

Furnace; Process for producing the lining of an electric induction—. G. Brüstlein, Stavanger, Norway. Eng. Pat. 19,809, Sept. 15, 1914.

The lining material is stamped around the rings of cast steel, or other metal, which are to be used subsequently for heating the furnace, instead of around a special template.—B. N.

Cathode for electrolytic cells. F. G. Wheeler, Appleton, Wis., Assignor to Kimberly-Clark Co., Neenah, Wis. U.S. Pat. 1,152,772, Sept. 7, 1915. Date of appl., Jan. 25, 1915.

A DIAPHRAGM is combined with a perforated cathode, the perforations being sufficiently large to receive portions of the diaphragm for supporting it. At the rear of the perforations the diaphragm is backed with electrically conductive material to prevent rupture.—B. N.

Electrolytic apparatus. I. H. Levin, Newark, N.J., Assignor to International Oxygen Co. U.S. Pat. 1,153,168, Sept. 7, 1915. Date of appl., Feb. 26, 1914. (See also Fr. Pat. 467,945; this J., 1914, 971).

A BI-POLAR electrode is employed, the cathode surface consisting of iron and the anode surface of nickel, deposited electrolytically on the iron.—B. N.

Electrolytic cell. E. E. Norquist, Assignor to Oxygen Gas Co., Kansas City, Mo. U.S. Pat. 1,153,438, Sept. 14, 1915. Date of appl., May 1, 1914.

THE cell consists of a cathode casing, the upper end of which is provided with an in-turned flange, which terminates in a depending wall, thus forming a chamber to collect liberated gas. Within this wall is fixed a gas bell which rests upon the casing but is insulated from it. From the bell an anode hangs freely and dips into the water in the casing; round it, but not touching it, is a flexible bag-shaped diaphragm which, in its turn, is enclosed, without contact, in a flexible tubular diaphragm suspended from the wall.—E. H. T.

Gases; Electrical apparatus for effecting the chemical combination of—. C. C. Meigs, Philadelphia, U.S.A. Eng. Pat. 982, Jan. 21, 1915. Under Int. Conv., Jan. 23, 1914.

SEE U.S. Pat. 1,116,606 of 1914; this J., 1915, 37..

XII.—FATS; OILS; WAXES.

Linseed oil; *Mixed glycerides of* ——. G. Schiebt. Seifenfabr., 1914, 34, 673—674. J. Chem. Soc., 1915, 108, i., 771.

LINSEED oil contains mixed triglycerides of stearic, palmitic, and unsaturated acids. La Plata linseed oil was exposed to a temperature of -8° to -10° C., and the crystalline deposit was separated and allowed to crystallise at -10° C. from acetone. After repeated crystallisation from light petroleum, alcohol, and ether, a white, crystalline substance was obtained, m.p.t. 33° — 34° C., the constants of which are in accord with the requirements of a linolopalmitostearin.

From the mother liquors, a crystalline mass, m.p.t. 31° — 32° C., was separated, apparently consisting of mixed glycerides of oleic, linolic, and stearic acids, probably dioleostearin and linolodistearin in the proportions of 1 to 2. A substance which was probably an oleolinolopalmitin was also isolated. The above glycerides amount to scarcely $\frac{1}{2}\%$ of the weight of the oil, and the remaining 9—10% of saturated fatty acids must therefore be components of glycerides of very low melting point.

A new oil-nut from Central America. U.S. Comm. Rept. No. 222, Sept. 22, 1915.

ATTENTION is directed to a possible source of oil which exists in the nuts of the coyol palm of Central and tropical South America. This tree grows very abundantly in Costa Rica, Nicaragua, and upper Panama, especially on the Pacific side. It is stated that the nuts can be gathered in great quantities and very cheaply. At present cattle eat them where they fall. Specimens of the nuts examined by the Bureau of Plant Industry of the Department of Agriculture, have been identified as *Acrocomia vinifera* Oerst., and contained 57.7% of petroleum ether extract. An analysis of the seed oil of the same palm from Nicaragua was published in 1903 as follows: Sp. gr. at 25° C., 0.9136; m.p.t., 25° C.; clouding point, 17° C.; free acid, 1.69%; saponification value, 246.2; iodine value, 25.2; Reichert-Meissl value, 5. Both the oil and residue are similar in composition to that obtained from the coconut and other palms, and could be used in the manufacture of similar food products. The difficulty of producing this oil in commercial quantities, however, is a mechanical one, there being no machinery on the market at present that can be economically used for cracking the extremely hard shells that inclose the kernels. It is suggested that the cake, after the oil had been extracted, might be of value for fertilising or for cattle feeding, but nothing definite is known on this point.

Oil [of seeds] of Pistacia lentiscus. E. Sernagiotto and N. Vita. Annali Chim. Appl., 1915, 4, 92—93.

THE greenish oil obtained from the seeds of *Pistacia lentiscus* by pressing and by prolonged boiling with water, is used in Sardinia as an edible oil. After removing volatile substances (about 0.5%) by distilling with steam, the oil had the following characters:—sp. gr. at 15° C., 0.919; refractometer reading (Zeiss) at 14° C., 66; acid value, 15.9; saponif. value, 165.6; saponif. value after acetylation, 203; Hehner value, 91.8; Maumené value, 46.2; iodine value, 83.6; iodine value of fatty acids, 86. The non-volatile fatty acids consisted entirely of palmitic and oleic acids.—A. S.

Vegetable waxes; *Three new* — from Madagascar. A. Hébert and F. Heim. Bull. de l'Office Colonial, 1915, 8, No. 86, 96—101. Bull. Agric. Intell., 1915, 6, 831.

THREE new wax-bearing plants have been dis-

covered growing wild in the desert region of Southern Madagascar: *Cynanchum messeri* (*Vohemaria messeri*), *Asclep.*, *Euphorbia xylophyloides*, and *E. stenoclada*. The best method of extraction consists in pounding the dried cut pieces on a cloth, throwing them into boiling water, and removing the scum. A quicker but less economical method is to immerse the branches in boiling water and to skim off the floating, liquefied wax. All three plants are very abundant; the best yield was obtained from the first mentioned, six small plants furnishing 7 oz. of wax. In each case the wax melted at 88° C., a higher melting point than that of any known vegetable wax and of beeswax. The waxes contained a little free acid: alcohols, including cerylic and melissic: calcium palmitate, glycerides of palmitic acid, and entriacontane ($C_{31}H_{64}$). The acid values of the waxes in the order given above were 17.7, 28, and 19.3 respectively; saponification values, 159.6, 142.8, and 140; iodine values, 3.2, 5.3, and 5.9; and the hydrocarbons (% of wax), 11, 14, and 15.—E. H. T.

Gondang wax (Cera Fici). A. J. Ullée. Pharm. Weekblad, 1915, 52, 1097—1101. J. Chem. Soc., 1915, 108, i., 825.

GONDANG wax contains an alcohol, named ficoceryl alcohol by Greshoff and Saek (this J., 1901, 817). This alcohol has been proved to be identical with β -amyrin, m.p.t. 196° — 197° C., $[a]_D^{20} = +87.35^{\circ}$. Lupeol acetate is also present in Gondang wax.

Analysis of moellons and hard greases. Bumcke. See XV.

PATENTS.

Fatty and other matters from liquids [wool washings, etc.]; *Method for the recovery of* ——. T. W. Barber, London. Eng. Pat. 23,741, Dec. 8, 1914.

WOOL fat or similar fats are separated without chemical alteration from liquids such as wool washings, by the introduction of air or gas under pressure, the action being promoted by the use of baffles within the tank. After removal of the separated fat, the liquid may be used again for washing wool.—C. A. M.

Catalyser and process of making same. W. D. Richardson, Assignor to Swift and Co., Chicago. U.S. Pat. 1,151,718, Aug. 31, 1915. Date of appl., Aug. 19, 1912.

AN oleate of nickel or other catalytic metal is dissolved in an oil or fat, and the nickel or other metal reduced by means of hydrogen.—C. A. M.

Catalysts [for hydrogenating fats]; *Manufacture of* ——. R. F. Bacon and B. H. Nicolet, Pittsburgh, Pa., Assignors to Acme Manufacturing Co., Chicago, Ill. U.S. Pat. 1,152,591, Sept. 7, 1915. Date of appl., Nov. 4, 1914.

A FINELY divided medium is impregnated with a precipitant of nickel (e.g., sodium hydroxide) and a salt capable of yielding a bulky precipitate (e.g., sodium aluminate), and then treated with a solution of nickel nitrate or other nickel salt. A mixture of nickel hydroxide and aluminium hydroxide is precipitated, and the nickel hydroxide is rendered catalytically active by reduction.—C. A. M.

Fat or oil substances; *Process of producing* ——. O. T. Joslin, Cincinnati, Ohio. U.S. Pat. 1,152,023, Aug. 31, 1915. Date of appl., May 10, 1913.

FATS that have been hydrogenated in presence of a metallic catalyst are treated at a low temperature with about an equal volume of a solvent in which the impurities are soluble. The solvent and impurities are separated from the sparingly soluble

fat, and the last traces of solvent expelled by volatilisation.—C. A. M.

Soaps containing active oxygen and process of making them. E. Kochendoerfer, Frankfurt, Germany, Assignor to Roessler and Hasslacher Chemical Co., New York. U.S. Pat. 1,153,167, Sept. 7, 1915. Date of appl., June 24, 1915.

FINELY divided dehydrated soap is incorporated with compounds that yield active oxygen (e.g., a perborate), and the mixture pressed into a homogeneous mass.—C. A. M.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

American colophony. L. Paul. Seifensiederzeit., 1915, 42, 237—238, 258—259, 285—286, 307. Z. angew. Chem., 1915, 28, Ref., 337. (See also this J., 1914, 429, 557.)

γ -PINIC acid, first m.pt. 70°—71° C., second m.pt. 76°—77° C., forms up to 90% of commercial American colophony; another amorphous constituent of the colophony, namely sylvic acid, m.pt. 122°—123° C., can be prepared from γ -pinic acid by the action of cold alcohol. On keeping, both γ -pinic acid and sylvic acid are transformed into the water-soluble acids, α -pinic acid, m.pt. 100°—105° C., and β -pinic acid, m.pt. 122°—123° C.; α - and β -pinic acids are also present in colophony, especially in colophony powder. When α - and β -pinic acids are crystallised from hot alcohol, α -, β -, and γ -abietic acids, m.pt. 150°, 160°, and 162° C., respectively, are obtained.—A.S.

Colophony; The resene of—L. Paul. Chem. Rev. Fett-Ind., 1915, 22, 30—33. Z. angew. Chem., 1915, 28, Ref., 337. (See also preceding abstract.)

THE chief constituents of colophony, the resinol-resin acids, are formed from terpenes by polymerisation. The resenes, i.e., the constituents which are soluble neither in alkalis nor acids, and are relatively inert and of low oxygen content, are regarded as oxypolyterpenes, formed from terpenes by simultaneous polymerisation and oxidation. The reaction by which α - and β -pinic acids are formed from colophony, by the action of water and alkali, probably involves also the formation of resene. The author has isolated resene-like products from the syrupy alcoholic mother liquors from colophony powder, and also from ethereal solutions of γ -pinic acid, after removing the resin acids by treatment with ammonium carbonate and ammonia.—A. S.

PATENTS.

White lead; Apparatus for making—L. V. Barton and W. P. Thompson, Liverpool. U.S. Pat. 1,152,693, Sept. 7, 1915. Date of appl., Jan. 3, 1914.

IN an apparatus for making white lead from lead oxide, water, carbon dioxide, and a catalyst, the materials are fed into the inverted, conical bottom of a vertical, cylindrical chamber divided into a series of communicating compartments by superposed, perforated, conical partitions. Immediately above each of the latter a stirrer is rotated from a common, central shaft; separate exits are provided at the top of the chamber for the waste gases and the resulting mixture of white lead and water.—W. E. F. P.

Phenolic condensation products; Cold moulding of—E. Hemming, and Hemming Manufacturing Co., Garfield, N.J., U.S.A. Eng. Pat. 21,264, Oct. 20, 1914.

AN initial condensation product of a phenol is

made to react below 95° C. with a substance containing the methylene group until the sp. gr. of the product lies substantially between 1.15 and 1.21. The mass is then mixed with a filler, moulded at the ordinary temperature (if necessary after further heating or thinning with a solvent) and subsequently hardened by heat after removal from the mould.—C. A. M.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Rubber; Preparation and properties of chemically pure—F. Heim and R. Marquis. Bull. de l'Office Colonial. No. 86, 1915, 8, 101—108. Bull. Agric. Intell., 1915, 6, 874.

WILD Para rubber coagulated by smoke, and plantation Para rubber coagulated by acetic acid, were purified by maceration, washing in cold water in a darkened tube, and washing with acetone. When the latter had evaporated, the rubber was dissolved in ether or benzene, the solution filtered through a Buchner funnel, and precipitated with alcohol or acetone. After removing traces of benzene by digesting with alcohol, the pure caoutchouc was dried over sulphuric acid in the dark. The pure substance is white, that obtained from smoked rubber, slightly yellow. Analysis confirmed the absence of resins and proteins, and the fact that pure caoutchouc is a polymer of isoprene. Solutions of it were less viscous than those of impure rubber, and the pure substance oxidised more rapidly in air than the impure, particularly when dissolved in chloroform.—E. H. T.

PATENTS.

Vulcanised rubber products; Method of making—R. B. Price, New York. U.S. Pat. 1,152,838, Sept. 7, 1915. Date of appl., Mar. 18, 1914.

LAYERS of unvulcanised rubber are superimposed, with a coating of a medium (e.g., glycerin) liquid at the temperature of vulcanisation between adjacent layers to prevent adhesion. The pile is then surrounded by an external jacket and vulcanised.—C. A. M.

Caoutchouc; Process for promoting the vulcanisation of natural or artificial—P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Leverkusen, Germany. Eng. Pat. 12,661, May 22, 1914.

SEE Ger. Pat. 280,198 of 1914; this J., 1915, 436.

Caoutchoucs; Process of purifying by osmosis natural and regenerated—and other matters soluble in hydrocarbons, and apparatus therefor. H. Debaugé, Paris. Eng. Pat. 4541, Mar. 23, 1915. Under Int. Conv., Apr. 9, 1914. Addition to Eng. Pats. 1976 of 1912, dated Feb. 3, 1911, and 8040 of 1913, dated Apr. 13, 1912.

SEE Addition of Apr. 9, 1914, to Fr. Pat. 426,457 of 1911; this J., 1915, 188.

Caoutchouc; Process and apparatus for purifying—H. Debaugé, Paris. U.S. Pat. 1,153,040, Sept. 7, 1915. Date of appl., Apr. 6, 1915.

SEE Addition of Apr. 9, 1914, to Fr. Pat. 426,457 of 1911; this J., 1915, 188.

Process for firing powdered, granular, or fibrous materials on paper or fabrics. Ger. Pat. 284,682. See V.

XV.—LEATHER; BONE; HORN; GLUE.

Tanning substances; New or little-known —. R. Lauffmann. *Collegium*, 1915, No. 541, 197—209. *Bull. Agric. Intell.*, 1915, 7, 947—948.

THE names, etc., and percentage tannin content of some new or little-known vegetable tanning materials are given as follows:—"Cuero" bark (*Malpighiaceae*), S. America, 16.8; "Morocco" wood (resembles quebracho), 19.0—22.6; *Azelia* wood, 15.2—15.7; pods of "barbatimao" (*Stryphnodendron barbatimao* Mart.), Brazil, 27.0; "Lingue" bark (*Persca lingue* Nees.), Chili, 22.1; "Pangin," probably the pulp of fruit of an unknown plant, 20.5; "Guara," ground pods of a kind of "divi-divi" (*Paulina sorbilis* Mart.), 51.0—55.8; "Carabin" ("vainille"), probably pods of *Cuculps. tinctoria* Benth., 30.3; sumac, Turkey, 20.5; sumac, Caucasus, 20.0—23.0; leaves of "mangue" or "mange," Brazil, 31.6—33.3; "Bablah," pods of *Acacia arabica* Willd., 20.2; "Araca" bark, Brazil, 18.4; "Cascara" bark (plant unknown), San Francisco, 25.0—28.5; "Cebil" bark (*Acacia cebil* Gris.), Argentina, 17.0; Elephant roots (*Elephantorrhiza burchelli* Benth.), 17.5; "Ganib" roots (*Ilydnora longicollis* Welw.), German S.W. Africa, 32.0; "Sunlethet bones," fruit of unknown plant, probably *Casatpinac*, pods with seeds, 23.6—27.2, pods without seeds, 51.5—56.6.—E. H. T.

Drum tanning. E. Nihoul. *Leather Trades' Year Book*, 1915, 180—185. J. Amer. Leather Chem. Assoc., 1915, 10, 460—465.

IN drum tanning constant motion gives the effect of constant folding and unfolding, so that fresh liquor is continually sucked into the hide and brought into contact with the fibres. The slight rise in temperature also hastens the tannage, partly by decreasing the viscosity of the liquor. Further, the shorter time required for tannage lessens the amount of insoluble matter formed by oxidation or fermentation of the liquors.—F. C. T.

Moellons and hard greases; Analysis of —. G. Bumeke. J. Amer. Leather Chem. Assoc., 1915, 10, 448—456.

THE determination of moisture by heating causes losses of oily matter when light mineral oils are present. Distillation of the moellon with xylene is recommended instead. For the extraction of unsaponifiable matter the alcoholic solution should be diluted with an equal volume of water, and no more, to avoid dissociation of the soap. The author considers that the greatest errors in the determination arise in the drying of the residues. Revised methods are given for the determination of oxidised fatty acids (where stress is laid on rapidity of working), of free fatty acids, and of mineral acids. Ubbelohde's apparatus for the melting point of greases (this J., 1905, 941) and Shukoff's method for the solidifying point (*Chem.-Zeit.*, 1901, Nr. 95) are both recommended.

—F. C. T.

PATENTS.

Tanning extracts [from waste wood pulp extracts]; Production of —. W. E. Horrocks, Knutsford, and J. K. Tullis, Manchester. Eng. Pat. 18,332, Aug. 7, 1914.

WOOD pulp extracts obtained as waste products in the manufacture of paper pulp, etc., are heated with neutral soluble salts (*e.g.*, aluminium sulphate and magnesium sulphate), and the mass which separates is pressed, dissolved in warm water, and used for tanning.—C. A. M.

Tanning agents [from sulphite-cellulose liquors]; Process of manufacturing —. J. G. Byrom, Stockport. Eng. Pat. 24,196, Dec. 17, 1914.

CONCENTRATED sulphite-cellulose liquors are treated with phenols, amino-compounds, or naphthalenedisulphonic acid, or with mixtures of these, or with the middle oil or heavy oil from the distillation of coal tar. A soluble, light coloured tanning agent is obtained.—F. C. T.

Manufacture of gelatin for photographic emulsions. Eng. Pat. 21,484. See XXI.

XVI.—SOILS; FERTILISERS.

Soil protozoa. G. P. Koch. J. Agric. Research, 1915, 4, 511—559.

AS the dilution method of counting protozoa in artificial culture solutions has been proved unsatisfactory (in some cases involving an error of several hundred per cent.), a modification of the loop method was adopted. By this improved method the average weight of solution that can be transferred from a permanent loop in a sterilised platinum wire to a glass slide is first determined, and then the average volume is deduced. The central area of the slide (about 0.25 sq. inch) is divided into 60—80 small squares, the liquid film is placed upon it, and then the number of organisms is counted. If the number be very great, a smaller loop is used, and if still too great, the film is transferred to a slide containing a cell (3.7 × 3.7 mm.) in the centre, the bottom of which is ruled into 25 divisions, and each of these into 25 subdivisions. By such means, and with the aid of a high magnifying power, organisms that are very abundant, very small, or very motile, can be estimated. As it is very difficult to distinguish small flagellates from large bacteria under a high power, a low one was used in these investigations. The average experimental error in counting was about 7%. The counts were made at a constant temperature, and at the same time of day, as it was found that the number varied at different hours of the same day. Cultural solutions made from dried blood extract and from soil extract (Löbner), containing di-potassium phosphate, were inoculated with different amounts of various manured greenhouse soils, and incubated at 22°C. over a period of 30 days, daily examinations of the number and types of protozoa being made. The maximum number of protozoa developed was found to vary greatly both with the nature of the culture solution and with the condition and quantity of soil used for inoculation. Dried blood extract favoured the early development of all types, and in every case, after the maximum was reached the number gradually decreased until very few were left. Early development also took place in those solutions to which the largest amounts of soil had been added, but the number of protozoa per gram. of soil was very much greater when 1 gm. was used than for larger quantities. Soil extract seemed to be more favourable than dried blood, and dry soil improved the development of flagellates in soil extract, dried blood being indifferent. Flagellates were the first to excyst and their number was far greater than that of the ciliates. The number of ciliates varied inversely with the amount of manure in the soil; with dried blood, flagellates developed best in the more heavily manured soils. Many different types of ciliates were present; amœbæ were very poorly represented. Similar experiments in which solutions containing dried blood and hay infusion were inoculated with greenhouse and with field soils, led to similar results: different cultural

media and different types and amounts of soil caused the development of different numbers and types of protozoa. Hay infusion was a better medium for all forms than dried blood extract; in it bacteria flourish better, and if protozoa feed upon bacteria, the favourable nature of such infusions would be explained. To ascertain the effects of different temperatures, varying amounts of different soils were inoculated into hay infusion and dried blood extract, and the mixtures were incubated at temperatures ranging from 5° to 30° C. for 30 days. In hay infusion, the small ciliates developed earliest, and most favourably at 15°–16° C. The large ciliates and the amoebæ do not flourish in either medium, but the former will develop under suitable conditions. Flagellates develop at a lower temperature than ciliates, their maximum being reached at 6°–7° C. in dried blood extract, and at 15°–16° C. in hay infusion; the latter was again the better medium. The development of each kind of protozoa examined varied with the temperature of incubation. Thus for cultural media, the nature and number of protozoa vary with the nature of the medium, the type and amount of soil used, and the temperature of incubation. (See also this J., 1915, 438, 564, 565, 880.)—E. H. T.

Acid and alkaline substances in mineral soils; Determination of—. A. Stutzer and W. Haupt. J. Landw., 1915, 63, 33–45. J. Chem. Soc., 1915, 108, ii., 655–656.

IN estimating acidity the following method, based on Baumann and Gully's qualitative test (Naturw. Zeitsch. Land. Forstwirts., 1908, 1) is employed. The soil, dried at 100° C. (40 grms.), is treated with 50 c.c. each of solutions containing, respectively, 120 grms. of potassium iodide per litre and 5 grms. of potassium iodate per litre (prepared with water previously boiled), and shaken for fifteen minutes, after which 300 c.c. of water, which has been boiled and cooled to 17°–20° C., is added. After being well shaken, the liquid is filtered through asbestos (not filter-paper, which absorbs some of the iodine), rejecting the first 50 c.c., and titrated with *N*/100 thiosulphate, after adding freshly prepared thin starch solution. Soils containing particles of calcium carbonate may contain acid silicates, organic acids, and acid colloids, so that roots of plants may come in contact with acids. One soil, containing more than 1% of calcium carbonate, contained 0.014% of acid (as H_2SO_4). In estimating alkalinity, 40 grms. of the soil is treated with 400 c.c. of water, previously boiled and cooled to 17°–20° C., shaken for 30 mins., and filtered through a large double filter. To 300 c.c. of clear filtrate, thin starch solution is added, and then, in succession, 25 c.c. each of the potassium iodide and iodate solutions and 25 c.c. of *N*/100 sulphuric acid, and the solution is titrated with *N*/100 thiosulphate.

Nitrogen transformations of moor soil; Injurious action of heavy dressings of lime on—. T. Arnd. Landw. Jahrb., 1914, 47, 371–442. Bull. Agric. Intell., 1915, 6, 808.

THE loss of nitrate in moorland soils is due to reduction to nitrite by the action of bacteria, and subsequent decomposition of nitrite by chemical interaction with peaty matter; in soils neutralised with lime the decomposition of nitrite is caused by micro-organisms. Denitrification is impeded in unlimed, acid moor soils, because these are unfavourable to bacterial development; but when they are neutralised or made alkaline with lime, denitrification is rapid and a great loss of nitric and total nitrogen results, the amount of loss being in relation to the amount of lime used.—E. H. T.

Soil; Amino-acid nitrogen of— and the chemical groups of amino-acids in the hydrolysed soil and their humic acids. R. S. Potter and R. S. Snyder. J. Amer. Chem. Soc., 1915, 37, 2219–2227.

IN an investigation undertaken to correlate, if possible, the amounts of the various groups (see Van Slyke, this J., 1911, 771, 1135) in the soil with its humic acid, with the kind of organic fertiliser applied previously to the soil, and with similar groups found in pure proteins, and to compare the amounts of amino-acid nitrogen, as such, in the soil with that formed by hydrolysis, the authors found that the amount of nitrogen precipitated from a neutralised alkali extract of a soil varied inversely with the concentration of the acid. The amount of humin nitrogen, as found by the Van Slyke method, extracted by dilute alkali solution from soil is very high when compared with the amounts in protein, and dilute alkali solution did not extract any typical class of organic compound from the soil. The amount of amino-acid and peptide nitrogen in soil was found to be very small as compared with the quantities formed by hydrolysis. Further information, to be obtained from analyses of the soils of the same plots in future years, is required before definite conclusions can be drawn as regards the other results yielded by the Van Slyke method.—W. P. S.

Sulphur [dressing]; Action of free— on vegetation. G. Bosinelli. Staz. Sper. Agrar. Ital., 1915, 48, 175–184. Bull. Agric. Intell., 1915, 7, 931–932.

NEITHER pot nor field tests gave reliable indication that the application of sulphur to soil produces any effect upon the crop. It was, however, found that sulphur accelerates the conversion of organic nitrogen into ammonia compounds, but the effect was very small, so that the practical value of sulphur dressing is inconsiderable.—E. H. T.

PATENTS.

Blast furnace slag; Utilisation of— and recovery of products [fertilisers] therefrom. T. Twynam, Redcar, Yorks. Eng. Pat. 20,258, Sept. 28, 1914.

MOLTEN slag is poured into water and the granulated material treated with nitric acid to produce calcium nitrate for use as a fertiliser, alumina and magnesia being also recovered by known means; the nitric acid is obtained from the atmosphere by means of high-tension electricity generated from the steam produced in the initial operation.—W. E. F. P.

Fertiliser from natural phosphate rocks; Production of a—. W. F. Downs. Fr. Pat. 474,799. July 7, 1914.

SEE U.S. Pat. 1,120,917 of 1914; this J., 1915, 94.

XVII.—SUGARS; STARCHES; GUMS.

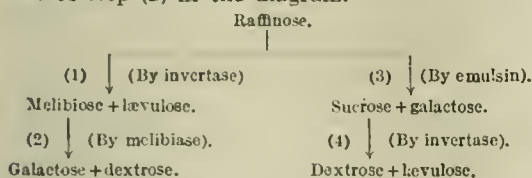
Glutamic acid and betaine from molasses residues; Preparation of—. K. Andrlík. Z. Zuckerind. Böhm., 1915, 39, 387–391. J. Chem. Soc., 1915, 108, i., 781–782.

THE concentrated residue (1 kilo.) is treated with 450 grms. of tartaric acid in 30% solution. After one hour it is filtered from the potassium tartrate, evaporated to about 15° Balling (sp. gr. 1.061), and crystals of glutamic acid added. In about twelve hours the glutamic acid crystallises out. The acid is recrystallised twice, the second time with a little blood charcoal. The yield is about 60 grms. If instead of tartaric acid, sulphuric or phosphoric acid be employed, the yield of glutamic acid is only about 30 grms. To obtain betaine, the residues, treated with phosphoric acid as

already mentioned, are left for forty-eight hours, filtered from the mixed crystals of potassium phosphate and glutamic acid, treated with a further 300 c.c. of 40% phosphoric acid, and evaporated until the weight is about 800 grms. After forty-eight hours, the solution is filtered from the crude betaine phosphate (160—190 grms.) which separates. It is desirable to obtain the phosphate in as pure a state as possible before preparing the free betaine. The phosphate (100 grms.) is dissolved in 750 c.c. of warm water, treated with about 20 grms. of slaked lime, as milk of lime (sp. gr. about 1.035), until alkaline, filtered from calcium phosphate, and evaporated until crystals begin to form. The yield of pure betaine is about 7% of the molasses residue.

Raffinose; Determination of—by enzymotic hydrolysis. C. S. Hudson and T. S. Harding. J. Amer. Chem. Soc., 1915, 37, 2193—2198.

THE use of emulsin in the determination of raffinose, as indicated by steps (3) and (4) in the following diagram, leads to untrustworthy results, owing to the complex nature of the enzyme. The authors' method depends on the measurement of step (2) in the diagram.



The melibiase used, prepared from bottom fermentation yeast as described previously by the authors (this J., 1914, 802), is free from enzymes which hydrolyse glucosides, and also from maltase, cellulase, lactase, trehalase, inulase, and diastase. It does, however, contain a very powerful invertase, but the removal of this enzyme is unnecessary, since top fermentation yeast yields an extract rich in invertase and quite free from melibiase, and this top yeast extract can be used to complete step (1), whereupon an accurate measurement of step (2) can be carried out. The only interfering substance would be melibiose itself, which would be determined as raffinose, but, since melibiose reduces Fehling's solution and raffinose does not, it is possible to exclude it from consideration in some cases. For instance, an aqueous extract of cottonseed meal is practically free from reducing sugars but contains a large quantity of raffinose, whilst low-grade beet sugars are nearly free from reducing sugars but often contain raffinose; in the determination of raffinose in these products, in plant material, and in sugar mixtures, the method is sufficiently trustworthy, but does not distinguish between raffinose and melibiose.

The sugar solution is clarified with normal lead acetate and the excess of lead is removed as oxalate or sulphide; the resulting solution, which should not contain more than 13% of total sugars, is neutralised, then acidified with a few drops of acetic acid, diluted to 100 c.c., and 95 c.c. of it is treated with 5 c.c. of invertase solution from top fermentation yeast (*loc. cit.*) and a few c.c. of toluene; the mixture is shaken and kept at the ordinary temperature until its optical rotation becomes constant, which usually requires from 18 to 24 hours. At this stage all sucrose has been inverted and all raffinose has been hydrolysed into melibiose and levulose. The polariscopic readings should be taken at 20°C. To 9.5 c.c. of the hydrolysed solution is now added 5 c.c. of bottom fermentation yeast extract, and the polarimetric reading of the mixture is determined; this reading should correspond with that calculated from those of the yeast extract and of the solution. The mixture is

kept at ordinary temperature and its polarimetric reading determined every day; a change of rotation in the laevo direction indicates the hydrolysis of melibiose. The specific rotation of this sugar is +143°, and since 1 gm. of it yields 0.527 gm. of dextrose and the same quantity of galactose, which have specific rotations of +52.5° and +81°, respectively, the specific rotation of melibiose changes from +143° to +70.4° on hydrolysis. If the readings are observed in a 200 mm. tube, a 1% solution of melibiose will change in rotation during hydrolysis 0.317°, or 4.18° Ventzke; a change of 1° Ventzke in the rotation is, therefore, equivalent to 0.239 gm. of melibiose in the final solution, a quantity which corresponds with 0.352 gm. of anhydrous raffinose. Results of determinations of raffinose in the presence of sucrose, dextrose, levulose, invert sugar, lactose, maltose, cellose, and trehalose are recorded; in solutions containing from 1.5 to 3% of raffinose, the quantity of the latter found varied from 0 to 0.07% less than the amount actually present.—W. P. S.

Honeys; Fiehe's reaction with mixed—. O. Lünig. Z. Unters. Nahr. Genussm., 1915, 29, 117. Chem.-Zeit., 1915, 39, Rep., 343.

FIFTY cwt. of honey, from nine casks, was heated, 3 cwt. at a time, for 4 hours or less to liquefy it, and then forced through a hair sieve and mixed together in a large vat. All the honey gave negative results when subjected to Fiehe's test (see this J., 1908, 1127) before heating; but the contents of one barrel, which required a temperature of nearly 90°C. for liquefaction and which contained a rather high proportion of acid (2.2 mgrms. equivalent per 100 grms.), gave a doubtful result when tested after the heating. The whole mixed charge in the vat cooled very slowly; after 24 hours its temperature was 50°C., and it then gave Fiehe's reaction distinctly. The diastase of the honey had not been destroyed. Further experiments showed that honeys of high acidity are particularly liable to give Fiehe's reaction after such prolonged warming. (Cp. Quantin, this J., 1910, 1072; Witte, this J., 1911, 564).—J. H. L.

Wheat and wheat-meals as raw materials for the starch industry; Valuation of—. Goldbeck. Chem.-Zeit., 1915, 39, 689.

THE following method of valuation of wheat-meals is designed to reproduce as closely as possible the conditions of separation practised on the large scale and to give results comparable with those to be expected in the factory, particularly as regards the proportion of gluten practically recoverable:—200 grms. of meal is moistened in a mortar with 60% of water and kneaded to a dough. This is allowed to steep for 25 mins. reckoned from the time of wetting and is then washed in about 2.5 litres of water by simple manipulation with the hand until most of the starch has gone into suspension. The gluten remaining in the hand is washed twice in fresh water and lightly pressed. The wash waters are united and poured through a coarse silk sieve, 20 meshes per cm., on which the flocculent gluten is collected. This is weighed separately, then mixed with the main mass which, after draining for one hour, is weighed as moist gluten. Glutens of different origins retain different proportions of water, so that the moist mass should be spread out, dried at 40°—45°C., and weighed also as dry gluten. The ratio of total moist gluten to the flocculent gluten affords a measure of the yield to be expected in practice, the latter being lost in the washing. A meal from which more than 2.5% of moist gluten is collected on the sieve will generally disintegrate almost completely in the washing machine. The wash waters from

the gluten are poured through a No. 20 silk sieve to collect the bran, which is dried and weighed. The starch-milk is allowed to settle for 6 hours, the liquid poured off, the starch diluted to a density of 14°—16° B. (sp. gr. 1.101—1.118), and centrifuged in tubes for 12 mins. at 750—800 revs. per min. The slimy refuse starch forming the upper layer is separated from the good white starch beneath, and both are dried and weighed.—J. F. B.

PATENTS.

Sugar and chemical substances of similar soluble properties [in a dry granular state]; Manufacture of—. J. C. Grière, Padua, Italy. Eng. Pat. 13,361, May 30, 1914.

A HOT concentrated solution is treated continuously with a suitable quantity of fine sugar, kieselsuhr, animal charcoal powder, decolorising carbon, or other substance absorbing water, in order to cause an instantaneous crystallisation in fine grain (cf. Eng. Pat. 9148 of 1909 and Fr. Pat. 402,305; this J., 1909, 1216), the pasty product subsequently being passed successively through a helical screw mixer, a cooler, and a drier. In the case of sugar, the added substance may be a denaturing agent; and with raw sugar intended for refining the added foreign matter may be separated after remelting. During the formation of the fine-grained mass, invert sugar, a food substance, or other material increasing the quality or nourishing value of the product may also be added. Sulphurous acid may be allowed to act during the formation of the fine grain, at which stage its effect is especially marked.—J. P. O.

Sugar; Apparatus for refining—with animal charcoal. [Utilisation of the heat of the waste wash water.] J. Buchanan, Liverpool. From J. Miesener, Dartmouth, Nova Scotia. Eng. Pat. 7068, May 11, 1915.

IN order to obviate the loss of heat in the waste water used for washing animal charcoal previous to revivification, the hot water is passed, before being run to waste, through a number of small tubes contained in one or more vessels, while fresh water to be used for washing is passed round the tubes in the reverse direction.—J. P. O.

Process for separating the bast fibres of the nettle plant and preparing them for spinning. Ger. Pat. 284,704. See V.

XVIII.—FERMENTATION INDUSTRIES.

Wine, perry, and cider; Influence of sulphurous acid upon the fermentation processes due to yeasts and bacteria in—. H. Müller-Thurgau and A. Osterwalder. Landw. Jahrb. der Schweiz, 1914, 28, 480—548. Bull. Agric. Intell., 1915, 7, 977—980.

THE action of sulphurous acid upon wine, perry, and cider was investigated by introducing it in the form of potassium metabisulphite into the fermented or partly fermented juice of grapes, pears, and apples. After one hour, or longer, the amounts of free and fixed sulphurous acid were determined by titration with N/50 iodine solution. The increased fixing power for sulphurous acid shown by the juices of over-ripe pears and apples, and of grapes infected by *Botrytis*, probably depends upon the amount of acetaldehyde they contain. The aldehyde unites with the acid to form a stable compound. Juice from normally ripe fruit is free from aldehyde and fixes sulphurous acid to a far less extent, forming an unstable compound which contains dextrose. Whatever the state of maturity of the fruit, free sulphurous acid

is always found in the juice after treatment, and this undergoes oxidation to sulphuric acid during the storage period before fermentation. The compound of sulphurous acid and dextrose also undergoes decomposition during this period. During fermentation, the sulphurous acid-aldehyde compound remains unchanged, but the sulphurous acid-dextrose compound is decomposed with the liberation of free sulphurous acid, which however becomes fixed very quickly, and is subsequently oxidised to sulphuric acid. Acetaldehyde produced as an intermediate product, and the aldehyde originally present in the juice, undergo reduction to alcohol during fermentation, hence most of the sulphurous acid added remains in the free state, but as the production of aldehyde increases it gradually becomes fixed. As fermentation proceeds, the free sulphurous acid becomes oxidised by atmospheric oxygen to sulphuric acid, but some of it may be fixed by the acetaldehyde formed by oxidation of the alcohol. Only free sulphurous acid has a retarding or inhibiting action upon fermentation. The resisting power of yeasts to this acid differs with different varieties. The inhibition of alcoholic fermentation is dependent upon the kind of juice, the initial yeast flora, and probably also upon the oxydase content. The effect of the acid is greater if it be added to the fresh grape juice than if introduced after fermentation has set in: with the juice of "sleepy" pears the reverse holds good, owing to the acid combining with aldehyde. The decomposition of malic acid in wines by *Bacterium gracile* is prevented by smaller amounts of free sulphurous acid than are necessary to inhibit alcoholic fermentation: to prevent such decomposition, the acid should be added before fermentation. Small amounts of free sulphurous acid will prevent a wine tasting of lactic acid; perry rich in aldehydes will require more, but an undue excess should be avoided, as the sensitive lactic acid bacteria would be adversely affected.—E. H. T.

Wines; Influence of clarification on the chemical composition of—. F. La Marca. Staz. Sperim. Agrar. Ital., 1915, 48, 185—232. Bull. Agric. Intell., 1915, 6, 871—872.

EXPERIMENTS with nine types of Italian wines indicated that fish-glue was the best clarifying agent; the content of tannin and extract are reduced, but the organoleptic properties are unaffected. Egg-albumin is also an excellent clarifier and does not alter the composition of the wine. Blood is an effective clarifying agent, but slightly changes the aroma, flavour, and colour: it diminishes the tannin content, and also to a slight extent the ash, extract, and nitrogen. These three constituents are increased when wine is clarified with milk, but tannin and colouring matter are reduced, and the organoleptic properties are considerably changed. Milk serum is of little value, but casein gives fairly good results when well prepared and properly preserved. Aluminous earth markedly reduces the acid content and also the extract, but not the colour or the tannin. Acidity and colour are diminished by charcoal, which also reduces the tannin to a slight extent, leaving ash and nitrogen practically unchanged.—E. H. T.

Wines; Clouding of—by iron phosphate compounds. H. Weil. Z. Unters. Nahr. Genussm., 1915, 29, 60. Chem.-Zeit., 1915, 39, Rep., 343.

CLOUDY wines from the Rhinegau and the Upper Moselle, when centrifuged, yielded sediments of ferric phosphate which, in the case of the French wines, was mixed with a colouring matter. In experiments with a 0.7% solution of tartaric acid in 8% alcohol, containing also ammonium

phosphate and ferrous or ferric ammonium sulphate equivalent to 0.025% Fe_2O_3 , a turbidity of ferric phosphate developed rapidly in the case of the ferric salt, and after two days in the case of the ferrous salt. The haze soon vanished in the light, owing to photochemical reduction, but it reappeared on addition of hydrogen peroxide. The presence of a considerable quantity of sulphurous acid did not prevent its formation. In experiments with concentrations of ferrous salts approximating to those occurring in wines (0.005 and 0.0025% Fe_2O_3), and different quantities of tartaric, malic, lactic, or succinic acid, the cloudiness appeared only in presence of the last two acids. There appears, therefore, to be no danger of such a turbidity in a wine which, before the biological degradation of acids, contains a sufficient quantity of tartaric or malic acid, but if the malic acid becomes transformed into the weaker lactic acid and sufficient iron salts and phosphates are present, and the iron becomes oxidised, *e.g.*, owing to access of air during bottling, cloudiness may be produced. In such a case it is advisable to precipitate the ferric phosphate completely by strong aeration, then filter, and finally increase the acidity of the filtered wine slightly.—J. H. I.

De-alcoholised wine. S. Cettolini. *L'Italia Agricola*, 1915, 52, No. 5. *Bull. Agric. Intell.*, 1915, 7, 980—982.

DE-ALCOHOLISED wine is obtained by removing the alcohol from ordinary wine, and is quite different from alcohol-free wine prepared from unfermented grape juice. The de-alcoholisation is effected by fractional distillation under reduced pressure. The esters and higher alcohols which give wine its aroma are separated at 25°—30° C., and the ethyl alcohol at 50°—55° C. On adding the former to the remaining wine, a beverage containing less than 1% of alcohol, and the other constituents in slightly increased amounts, is obtained. Probably some of the volatile acids are lost, but the loss can be remedied by adding carbonic acid; in the case of very dry wines, the addition of about 3% of sugar is recommended.—E. H. T.

German spirit industry for the year 1913–14; Statistics of the —. *Chem.-Zeit.*, 1915, 39, 703.

The statistics for the fiscal year are incomplete, owing to the absence of returns from East Prussia for Aug.–Sept., 1911. Exclusive of these, the production of spirit was 3,844,340 hl., against 3,753,264 in 1912–13. The consumption of materials was distributed as follows (previous year's figures in brackets):—Potatoes, 2,598,788 tons (2,730,447); cereals and other meals, 320,116 tons (365,781); molasses, beets, and beet-juice, 57,769 tons (52,293); brewery refuse, 80,770 hl. (84,690); core-fruit and residues, 116,136 hl. (406,605); stone-fruit, 201,585 hl. (224,332); fruit and grape wines, 47,728 hl. (37,319); wine yeast and grape marcs, 176,228 hl. (305,408); other materials, 24,066 hl. (25,959) and 16.8 tons (13.8). The production of pressed yeast amounted to 45,651,900 kilos. (48,709,500). The issue of duty-free spirits amounted to 1,726,426 hl. (1,724,507), of which 1,412,097 hl. (1,378,367) was completely denatured, 270,869 (309,260) partly denatured and 15,471 (15,223) not denatured. The consumption of the partly denatured spirit for industrial purposes was distributed as follows:—For table-vinegar, white lead, lead acetate, etc., 151,389 hl. (162,058); brewers' lacquers, 886 (1181); artificial camphor, 407 (607); celluloid, 29,460 (34,489); imitation leather, 686 (2992); sulphuric ether, 7,376 (19,387); photographic emulsions, etc., 3107 (2262); accumulator electrodes, 5 (8); acetic

ester, 658 (536); collodion varnish, 114 (110) adhesive preparations, 71 (—); artificial silk, 2711 (3330); coal-tar dyestuffs, including intermediate products, 4466 (6607); solutions of coal-tar dyestuffs for printing, 387 (98); surgical dressings, 576 (567); goods enumerated under Sec. 4, d, 27,620 (24,130); chloroform, 103 (124); iodoform, 188 (174); ethyl bromide, 43 (36); ethyl chloride, 208 (415); fats containing bromine or iodine, 54 (30); colour-lakes, 3460 (4779); lacquers of all kinds, 19,019 (14,959); scientific preparations, 78 (113); hard soaps, 2024 (2594); wool-fats, 791 (731); wool-dressing oils, 104 (122); galalith, 118 (166); other purposes, 764 (1018).—J. F. B.

Synthetic and hydrolytic oryxnitrilase. Kriebel. *See XXIV.*

PATENTS.

Yeast; Apparatus for handling, skimming, and pressing—W. Scott, Birmingham. Eng. Pat. 23,795, Dec. 9, 1914. Addition to Eng. Pat. 21,925, Sept. 29, 1913 (this J., 1914, 978).

In apparatus of the kind described in the previous patent (*loc. cit.*), the filtrate from the filter-press is received in a closed portable vessel; the latter is then moved to the fermentation vat into which its contents are discharged. The filtrate is admitted into the bottom of the vessel and discharged from the top through a pipe extending nearly to the bottom and having its external end connected with a length of flexible tubing; the air pressure in the vessel forces the liquid out of the vessel when the tap on the discharge pipe is opened.—W. P. S.

Diastase preparations and method of making same. I. Pollak, Vienna. U.S. Pat. 1,153,640, Sept. 14, 1915. Date of appl., May 11, 1914.

SEE Ger. Pat. 283,061 of 1914; this J., 1915, 729.

Malt extract and method of making same. I. Pollak, Vienna. U.S. Pat. 1,153,641, Sept. 14, 1915. Date of appl., May 11, 1914.

SEE Fr. Pat. 473,476 of 1914; this J., 1915, 729.

Carbonic acid (especially carbonic acid of fermentation); Apparatus for cooling — during compression. H. Müry. Fr. Pat. 474,389, May 29, 1914. Under Int. Conv., June 4, 1913.

SEE Eng. Pat. 13,530 of 1914; this J., 1915, 505.

Fermentation of sugar or materials containing it, by Bacillus maccarus; Process of —. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 474,891, July 8, 1914. Under Int. Conv., July 18, 1913, and Jan. 24, 1914.

SEE Ger. Pat. 283,107 of 1913 and Eng. Pat. 14,371 of 1912; this J., 1915, 729, 976.

XIXA.—FOODS.

Ash manna; Production of — in Italy, and its adulteration. G. Marogna. *Ann. R. Staz. Chim.-Agrar. Sper. di Roma*, 1915, 7, 77—145. *Bull. Agric. Intell.*, 1915, 6, 835—836.

THE manna ash is cultivated only in Sicily, where it is grown on an area of over 13,800 acres. In 1913, 344 tons of manna, valued at £97,100, was exported from Italy, chiefly to Central and South America; some of it is used in Sicily for the extraction of mannitol. The trees principally grown are: *Frazinus ornus rotundifolia*, *F. o. angustifolia*, *F. frazinaster oryphylla*, *F. f. australis*, and *F. f. excelsior*. The *Ornus* trees yield the best manna, but the *Frazinaster* the greatest quantities. Analyses

of genuine commercial samples of manna gave the following approximate percentages: moisture 5—11; mannitol 33—61; reducing sugars, before hydrolysis, 10—16; after hydrolysis at 100° C., 26—55. A method of analysis and means of detecting adulterations are given in the original.

—E. H. T.

Valuation of wheat and wheat-meals as raw materials for the starch industry. Goldbeck. See XVII.

Determination of raffinose by enzymotic hydrolysis. Hudson and Harding. See XVII.

Purification of waste water from dairies. Weigmann and Wolff. See XIXB.

PATENTS.

Eggs; Process for the preservation of —. H. L. S. Loft, Copenhagen. Eng. Pat. 19,721, Sept. 12, 1914.

Eggs are placed in a closed vessel and subjected for 2 hours to the action of a mixture of air and formaldehyde at 35° C.; if desired, steam may also be admitted. The temperature is then lowered and maintained at 10° C. for 30 mins., after which the eggs are coated with a suitable substance, e.g., melted paraffin wax.—W. P. S.

Chocolate and similar material; Apparatus for grinding —. *Grinding and reducing apparatus [for cacao beans].* National Equipment Co., and T. Kihlgren, Springfield, Mass., U.S.A. Eng. Pats. (A) 20,860 and (B) 20,861, Oct. 12, 1914. Under Int. Conv., Oct. 13, 1913.

(A) On each side of a rotating disc fixed to a shaft are cut some thousands of small spoon-shaped recesses and also a number of cutting and feeding grooves extending from the centre of the disc towards the circumference at an angle to the radii. On either side of the rotating disc are similar stationary discs. The recesses are so arranged that a recess on one disc will act as a free passage between two radially adjacent recesses on the other disc in order to avoid flat rubbing surfaces. The chocolate is fed between the discs from spaces adjacent to the shaft. (B) An apparatus for grinding cacao beans consists of a rotating disc mounted between two stationary discs. Non-radial cutting and feeding grooves extend from the centre of each disc to about one-half the distance to the circumference, the remainder of the surfaces being formed of small recesses arranged concentrically. The bases of the recesses in one disc are cut reversely to the bases of the recesses in the adjacent disc. The cacao beans are introduced through openings adjacent to the shaft, pass between the discs, and the ground material is discharged at the circumference of the discs.—W. P. S.

Kola preparation; Manufacture of a —. G. C. Zimmermann. Fr. Pat. 474,353, June 30, 1914. Under Int. Conv., July 2, 1913.

See Eng. Pat. 15,725 of 1914; this J., 1915, 374.

XIXB.—WATER PURIFICATION; SANITATION.

Bacteriological examination of water; Studies on the culture media employed for the —. III. *Composition of the gases formed in lactose-peptone fermentation tubes.* E. M. Chamot, C. M. Sherwood, and R. C. Lowary. J. Amer. Chem. Soc., 1915, 37, 2198—2201. (See this J., 1915, 730, 918.)

The gases formed by faecal bacteria in lactose-peptone media increase in volume with an increase

in the peptone concentration; the percentage of carbon dioxide in the gases increases until the peptone concentration reaches 4%, and then remains constant, whilst the amount of hydrogen decreases with a rise in peptone content until 5% of peptone is reached, and then remains approximately constant. The "gas ratio" varies with the concentration of the nitrogenous constituents of the medium. Methane is not formed unless the inoculated medium is allowed to stand for over 24 hours in free contact with air; an excess of oxygen retards gas formation and tends to increase the amount of carbon dioxide produced. The presence of enriching agents (bile, bile-salt, phenol) also retards gas formation but does not materially alter the composition or total volume of the gas produced. A small but nearly constant amount of nitrogen is found in the gases.—W. P. S.

Nitrites in potable waters; Detection of —. L. Rosenthaler and V. Jahn. Apoth.-Zeit., 1915, 30, 265. Chem.-Zeit., 1915, 39, Rep., 356.

The best reagent for use in the field is a solution of 0.02 grm. of synthetic indole in 150 c.c. of 95% alcohol. One hundred c.c. of the water is treated with 3—5 c.c. of the reagent and 1 c.c. of 50% sulphuric acid. If nitrites are present a bluish red colour appears after about a minute; even 0.001 grm. N_2O_3 in 100 c.c. of water produces a faint violet colour after 10 mins. The reagent remains stable for months.—J. H. L.

Carbonic anhydride in natural waters; Determination of —. A. Cavazzi. Annali Chim. Appl., 1915, 4, 81—91.

As an absorbing medium for carbon dioxide the author uses an ammoniacal solution of calcium chloride, prepared by dissolving 2.5 grms. of calcium chloride in 40 c.c. of water and 20 c.c. of concentrated ammonia solution in a flask, which is closed with a loose-fitting rubber stopper and heated nearly to the boiling point of the solution for 45 mins., whereupon the mixture is filtered hot; this quantity is sufficient for absorbing the carbon dioxide from 2 litres of water containing less than 0.4 grm. total CO_2 per litre. Total carbonic anhydride is determined by boiling 2 litres of the water with dilute sulphuric acid, and free and half-bound carbonic anhydride by boiling with 1.5 grms. of hydrated calcium sulphate: in both cases the carbon dioxide is absorbed in the ammoniacal calcium chloride solution and estimated by separating the precipitated calcium carbonate, decomposing it with excess of standard acid, and titrating with sodium hydroxide. Combined carbonic anhydride may be determined by evaporating 2 litres of the water with 1 grm. of hydrated calcium sulphate and 0.1—0.2 grm. of sodium chloride and determining the calcium carbonate in the residue. The following results were obtained with a sample of tap water by the methods given: total CO_2 , 0.1700; combined CO_2 , 0.0835; free and half-bound CO_2 , 0.0872 grm. per litre.—A. S.

Water; Influence of algae in sand filters on the chemical composition of —. L. Gizolme. Comptes rend., 1915, 161, 313—316.

The reduction in alkalinity owing to the precipitation of calcium carbonate, and the increase in the amount of dissolved oxygen, which are observed when water is passed through a sand filter, are caused by the action of algae. The change in the composition of the water is most pronounced during daylight, and is also influenced by the degree of growth of the algae, the age of the filter, climatic conditions, etc. The decrease in the quantity of calcium carbonate reaches a maximum when the filter has been in use for about 7 days, and then diminishes gradually.—W. P. S.

Waste water from dairies; Purification of—Weigmann and A. Wolff. *Milchwirt. Zentralbl.*, 1915, 44, 49—60, 65—73. *Bull. Agric. Intell.*, 1915, 6, 876—877.

PURIFICATION of a dairy effluent by bacteriological filter-beds removes about 70% of albuminoids and about 85% of the easily oxidised matter, but it is by no means complete. Further purification by spraying into the air and passing through a sand filter is recommended. Preliminary clarification with lime-water is inadequate and does not assist the subsequent biological treatment. The use of colloidal clay and lime-water is condemned, but ferric sulphate has a marked clarifying effect, decomposing 65% of the total albumin, and aiding the further biological purification.—E.H.T.

Dust in mine air and the causation of miners' phthisis. J. Moir. *J. Chem., Met. and Min. Soc., S. Afr.*, 1915, 16, 1—8.

CALCULATION shows that a particle of 1 μ diameter takes 5½ hrs. to fall through 5 ft.; therefore the smallest particles of quartz dust formed in dry drilling cannot settle in the eddying atmosphere of a mine. The average size of such particles is 3—4 μ and the number in 1 mgrm. is 1200 millions. Respirators are of little use in preventing the inhalation of these particles. The various grades of dust particles in mine air may be determined by filtering the air through sugar, dissolving the sugar, filtering the solution through a 260-mesh screen, and treating the filtrate by the method of repeated subsidence. In drilling in the mine, the dust is laid by a water jet, which removes 97—98% of the 'very fine' dust, namely that under 12 μ diameter, which is the maximum size of the silica particles found in the lungs in fatal cases of miners' phthisis. The average amount of carbon dioxide in mine air after blasting is 0.248%, and of carbon monoxide 0.0156%. Numerous photomicrographs of the dust particles are given.—J. H. J.

Noxious gases; Apparatus for testing materials employed for the absorption of—E. Kohn-Abrest. *Comptes rend.*, 1915, 161, 310—313.

A TUBE for containing the substance to be tested is connected at one end with a reservoir holding the noxious gas, whilst the other end is connected with a glass bulb of 250 c.c. capacity, provided with two side tubes, one of which is connected with a pump and manometer, whilst the other serves for the introduction of reagents. After 1 grm. of cotton-wool has been packed into the tube, a similar quantity of cotton-wool, impregnated with 4 grms. of the liquid to be tested, is introduced, followed by another layer of cotton-wool. The tube is then placed in position, the air is exhausted from the bulb, the tap leading to the pump closed, and the gas aspirated slowly through the tube into the bulb. The extent to which the gas has been absorbed may be ascertained by drawing a small quantity of a suitable reagent into the bulb. Experiments dealing with the absorption of chlorine are described, the cotton-wool being impregnated with saturated solutions of sodium carbonate, sodium bicarbonate, sodium thiosulphate, or mixtures of the same, with or without the addition of glycerol. With air containing 1 part of chlorine per 1000, the whole of the latter was removed by cotton-wool alone. The relative value of the other substances was apparent only when the air contained more than 1% of chlorine; sodium bicarbonate was the least effective. A 30% solution of potassium iodide also absorbed the chlorine completely, the liberated iodine remaining in solution in the excess of the iodide.—W. P. S.

B. subtilis; Resistance of certain races of—obtained from insects, to chemical agents. P. Portier. *Comptes rend.*, 1915, 161, 397—399.

BACILLI of the group *subtilis*, obtained from the larva of *Tenebrio molitor* (Coleoptera) and *Myeloides Cribrella* (Lepidoptera), were cultivated in beef broth or yeast broth containing glycerol, and portions of the films thus produced were immersed in one or other of the liquids mentioned below, for a certain period, and afterwards freed completely from the liquid and incubated in a nutrient solution at 40° C. The results showed that the bacilli were not destroyed by boiling absolute alcohol, ether, or chloroform, and were able to survive immersion for more than 50 hours in 5% phenol, more than 25 hours in 20% formol, between 24 and 48 hours in 10% tincture of iodine, between 13 and 24 hours in Bouin's fixing liquid, more than 14 months in 65 or 95% alcohol, more than 4 hours in oil of cloves, more than 15 hours in turpentine or cedar oil, or more than 14 months in pure chloroform. After many of the treatments mentioned, the organisms only developed slowly (requiring for instance 7 or 10 days to produce a culture) and then frequently exhibited involution forms.—J. H. L.

Solubility product constant of calcium and magnesium carbonates. Johnston. See VII.

Constant velocity aspirator. Method of collecting and analysing industrial gases. II. and III. Gautier. See XXIII.

PATENTS.

Sewage; Tanks for purification of—J. W. Redfern, C. Dean, and A. E. Osman, Leek, Staffs. Eng. Pat. 22,571, Nov. 16, 1914.

THE tank is filled with layers of porous blocks having semi-circular recesses in their sides and ends, and so arranged that a number of vertical channels are formed in the tank. The holes in alternate layers are of larger size than in the other layers, so that ledges are formed on which suspended matters collect. The blocks may also be formed with conical holes of the same size in each layer, so that ledges are formed at the bases of the cones. The sewage is passed upwards through the tank. The tank is cleaned by passing a rotary brush down each of the holes, and the sludge is discharged through a suitable outlet.—W. P. S.

Iron and manganese from water; Process for removing—O. Vollmar. Ger. Pats. (A) 284,223 and (B) 284,224, Sept. 2, 1913. Additions to Ger. Pat. 283,155 (see Fr. Pat. 466,177 of 1913; this J., 1914, 663).

(A) THE water is filtered through material containing algal growths, as described in the chief patent, and a partial vacuum is produced in the space above the filtering layer to favour the development of the algæ. (B) The water is purified by contact with growths of algæ on the surfaces of perforated plates, systems of tubes, or similar devices used to divide the water into a number of streams of small cross-section.—A. S.

Sewage sludge and the like; Apparatus for drying—J. Bromet, F. Thorman, and H. C. Wood, Tadcaster. U.S. Pat. 1,153,192, Sept. 14, 1915. Date of appl. Mar. 30, 1914.

SEE Eng. Pat. 7822 of 1913; this J., 1914, 565.

Sterilisation of liquids by ozone; Apparatus for the—J. Steynis. Fr. Pat. 474,523, Dec. 6, 1913.

SEE Eng. Pat. 23,681 of 1914; this J., 1915, 814.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Eserine, gencserine, and their derivatives; Action of sulphur dioxide on —. Alkaloids of Calabar bean. III. M. Polonovski and C. Nitzberg. Bull. Soc. Chim., 1915, 17, 290—297. (See also this J., 1915, 920.)

SULPHUR dioxide forms with eserine and its derivatives, eseroline and eserethol, unstable yellow addition products which decompose when the gas is expelled from their solutions by warming or passing a current of air. The action of sulphur dioxide on the gencserine series gives rise, on the other hand, to two stable products in each case, namely the corresponding derivative of the eserine series as previously described (*loc. cit.*) and a monosulphonic acid. Thus, with gencserine, eserine sulphate and eserinemonosulphonic acid are produced according to the equations: $C_{15}H_{21}N_3O_3 + H_2SO_3 = C_{15}H_{21}N_3O_2 \cdot H_2SO_4$ and $C_{15}H_{21}N_3O_3 + SO_2 = C_{15}H_{20}N_3O_2 \cdot SO_3H$. Eserinemonosulphonic acid forms small prisms, soluble in water and alcohol, m.pt. 174° C., $[\alpha]_D = -426^\circ$. Eserolinemonosulphonic acid, similarly prepared from gencseroline, is a strong acid of m.pt. 235° C. The barium salt is soluble in water.—G. F. M.

Hæmatoxylin as an indicator in the titration of alkaloids. G. Frerichs and E. Mannheim. Arch. Pharm., 1915, 253, 117—135. J. Chem. Soc., 1915, 108, ii., 655.

MANY workers have found that the method described in the German Pharmacopœia for the estimation of alkaloids is unsuitable. The process consists, roughly, in dissolving the bases from the chloroform and ether extract with an excess of *N*/10-hydrochloric acid, and titrating the excess with *N*/10-potassium hydroxide until the yellow colour given by a grain of "hæmatoxylin" changes to bluish-violet. The authors have found that many of the difficulties are due to the oxidation of the dye in alkaline solution to hæmatein, which it is that gives the yellow and blue colours. Even if a solution of the dye containing hæmatein is employed as the indicator, the results are inconsistent, for the alkaloid interferes with the end-point. Direct titration with *N*/10-hydrochloric acid is trustworthy, and is recommended in the Swiss Pharmacopœia. The alkaloid is dissolved in 10 c.c. of alcohol, mixed with three drops of 1% hæmatoxylin and 10 c.c. of water, and titrated until the blue colour changes to brownish-red, when a further 50 c.c. of water is added. The colour again becomes blue, and the acid is now run in until a sharp change to yellow takes place.

"*Terpacid*" [*fenchone*] and *terpacid* preparations. J. Schlesinger. Klin.-therap. Wochenschr., 1914, 21, Nr. 48/19. Chem.-Zeit., 1915, 39, Rep., 322.

FENCHONE, prepared by oxidation of fenchyl alcohol, has been brought into commerce as a camphor substitute, for external application in rheumatic affections. The commercial product is a mobile liquid, sp. gr. 0.95, b.pt. 193°—196° C.; it has an odour of camphor, a bitter and burning taste, and is miscible with oils and alcohol.

—F. SODN.

Geranyl chloride. J. Dupont and L. Labaune. Sci. Ind. Rep. Roure Bertrand Fils., 1914. [iii], 9, 3—4. J. Chem. Soc., 1915, 108, i., 825.

In reference to the paper of Forster and Cardwell (this J., 1914, 102), the authors state that they have never designated the product of the action of hydrogen chloride on linalool as linalyl chloride, but as geranyl chloride. The thionyl chloride pyridine method gives good results with linalool, but with geraniol, sulphur-containing substances

are also formed, and consequently for the preparation of geranyl chloride the action of hydrogen chloride on geraniol in toluene solution is preferable. The authors confirm the statement that linalool is the main product of the action of alkalis on geranyl chloride. So, for example, linalool is formed by shaking geranyl chloride with potassium carbonate solution at 100° C., and linalyl acetate by the action of potassium acetate.

Essential oils. Schimmel and Co. Schimmel's Geschäftsber., Oct., 1914—April, 1915. J. Chem. Soc., 1915, 108, i., 826—828.

AMMONIACUM oil is a yellow oil of peculiar odour, sp.gr. at 15° C. 0.8875, $n_D^{20} = 1.47250$, acid value 3.7, ester value 40.5, acetyl ester value 106.4; it is soluble in 0.5 and more vols. of 90% alcohol.

Pine needle oils:—Oil from *Pinus heterophylla*, sp.gr. at 15° C. 0.8879, $n_D^{20} = 1.48568$, $a_D = -35.23'$, acid value 0.6, ester value 10.1; it is soluble in 7 vols. and more of 90% alcohol to a cloudy solution. *l-a*-Pinene, *l-β*-pinene, and probably camphene are present. Oil from *Pinus palustris* has sp.gr. at 15° C. 0.8844, $n_D^{20} = 1.48277$, $a_D = -30.15'$, acid value 0.9, ester value 4.6. It dissolves with faint opalescence in 6 vols. of 90% alcohol and contains *l-a*-pinene and *l-β*-pinene. Oil from *Pinus ponderosa* has sp.gr. at 15° C. 0.8796, $n_D^{20} = 1.48033$, $a_D = -17.16'$, acid value 0.6, ester value 8.6. It is soluble in 5.5 parts and more of 90% alcohol. It contains *l-a*-pinene and *l-β*-pinene.

The oil described in the reports of October, 1905, and April, 1908 (compare this J., 1905, 1321), is derived from *Lavandula dentata*, L., not from *Lavandula stoechas*.

Mastix oil contains small quantities of inactive *a*-pinene and of an unidentified terpene in addition to much *d-a*-pinene. The solid acid of musk kernel oil is palmitic acid. A pale brown oil is obtained in 0.5% yield from *Anomum Melegueta*, Roscoe, which has sp.gr. at 15° C. 0.8970, $n_D^{20} = 1.49116$, $a_D = -3.10'$, acid value 2.7, ester value 41.2, acetyl ester value 63.9. It is miscible with an equal volume of 95% alcohol, but when more alcohol is added a turbidity ensues. Roman camomile oil is occasionally laevorotatory ($-2.30'$). Syrian sage oil contains camphor and, probably, also thujone.

Copalillo oil, extracted from a Mexican wood, probably *Erothea Copalillo*, is a brownish-yellow substance, sp.gr. at 15° C. 0.8504, $a_D = +0.50'$, acid value 10.2, ester value 13.1, soluble in 0.5 and more vols. of 90% alcohol. The oil from a Bombay wood, probably a variety of *Artemisia maritima*, is dark green, sp.gr. at 15° C. 0.9696, acid value 1.8, ester value 4.2. It dissolves in about 3 vols. of 70% alcohol with separation of paraffin.

Himalaya cedar oil is obtained as a pale brown substance, with the odour of balsam, from *Cedrus Deodora* and *C. Libani* Barrel var. *Deodora*. It has sp.gr. at 15° C. 0.9530, $n_D^{20} = 1.51565$, $a_D = +53.8'$, acid value 2.9, ester value 14.9, acetyl ester value 39.2. It is not completely soluble in 10 vols. of 90% alcohol, and is miscible with 95% alcohol. It appears to contain the ketone (semicarbazone, m.pt. 158° C.) identified in Atlas cedar oil.

The oil from *Libocedrus decurrens* (California) has sp.gr. at 15° C. 0.8756, $n_D^{20} = 1.47514$, $a_D = -0.51'$, acid value 0.9, ester value 4.6. It dissolves in 7 or more vols. of 90% alcohol to a turbid solution. It contains *l-a*-pinene, and, probably, *β*-pinene and carvone.

The oil from the leaves of *Melaleuca hypericifolia* has a pale green colour with the odour and properties of the oil of *Eucalyptus globulus*. It has sp.gr. 0.9145, $n_D^{20} = 1.46271$, $a_D = +0.18'$, and is soluble in 2.5 and more vols. of 70% alcohol. It contains 72% of eucalyptol. Oils from *Melaleuca lcuadendron* var. Two plants of the Cajeput class,

raised in Amami, gave oils differing from that of Cajuput. The narrow-leaved variety contains only a small quantity of eucalyptol, which is completely absent from the broad-leaved variety. The oil from the latter contains 78% of methyl-eugenol. It has sp.gr. at 15° C. 1.0019, $n_D^{20} = 1.52500$, $n_D^{25} = 1.52411$, acid value 0.4, ester value 7.2, acetyl ester value 15.2; it dissolves in 0.6 and more vols. of 90% alcohol. The oil from the narrow-leaved variety has sp.gr. at 15° C. 0.9056, $n_D^{20} = 1.47936$, $n_D^{25} = 1.47822$, acid value 0.7, ester value 11.8, acetyl ester value 84.8. It is soluble in 1.5 and more vols. of 80% alcohol.

Clove tree oil has sp. gr. at 15° C. 1.0933, $n_D^{20} = 1.54332$, $n_D^{25} = 1.54111$, phenol content 88%. It dissolves in 1.8 and more vols. of 70% alcohol. The phenols consist of 60% eugenol (53% of the total oil) and 35% of a solid phenol of paraffin-like odour. The latter has m.pt. 44°–45.5° C., b.pt. 309°–310° C. at 751 mm., 146°–149° at 4 mm., sp.gr. at 15° C. 1.188. It is inactive, and yields a benzoyl derivative, m. pt. 87°–88° C.

A pale yellow oil, with a strong odour of camphor, is obtained in 1.7–2.1% yield from Japanese wild cinnamon bark. It has sp.gr. at 15° C. 0.9245, $n_D^{20} = 1.4779$, $n_D^{25} = 1.47631$, acid value 0.6, ester value 14.8. It is soluble in 1 or more vols. of 80% alcohol. The main constituent is camphor, but terpenes and cymene appear to be also present.

β -Hydroxy- β -phenylethylamine and related compounds. C. Mannich and E. Thiele. Arch. Pharm., 1915, 253, 181–195. J. Chem. Soc., 1915, 108, i., 812–813.

The well-known difficulties associated with the reduction of amino-alkyl aryl ketones to the corresponding carbinols have been overcome by the use of hydrogen and palladised charcoal, and compounds of the type of β -hydroxy- β -phenylethylamine are now rendered easily available.

Palladised charcoal is made by passing hydrogen into a suspension of finely powdered animal charcoal, extracted with hydrochloric acid until free from iron, in a solution of palladous chloride, the quantities being arranged so as to give a preparation which contains about 2% of palladium when dried. This catalyst is more suitable than colloidal palladium. The mixture of the hydrochloride and hydrobromide of ω -aminoacetophenone, as obtained by the action of hexamethylenetetramine on ω -bromoacetophenone, was saturated with hydrogen in the presence of the above catalyst, and the new base was precipitated from the concentrated filtrate as the carbonate, and then converted into the hydrochloride, m.pt. 211° C. The free β -hydroxy- β -phenylethylamine, $\text{HO} \cdot \text{CH}(\text{C}_6\text{H}_5) \cdot \text{CH}_2 \cdot \text{NH}_2$, was isolated from the alcoholic solution of the salt by adding sodium ethoxide, and was obtained in glistening needles, m.pt. about 40° C. The base is much more stable than adrenaline towards acids and alkalis.

A concentrated solution of ω -amino-*p*-methoxyacetophenone was also reduced to β -hydroxy- β -*p*-methoxyphenylethylamine hydrochloride, and ω -amino-*p*-hydroxyacetophenone hydrochloride, obtained by the action of hydriodic acid on the above methoxy-compound (compare Mannich and Hahn, *loc. cit.*), was reduced to β -hydroxy- β -*p*-hydroxyphenylethylamine hydrochloride, m.pt. 172° C. (decomp.), free base, m.pt. 157°–158° C.

Urea; Determination of— in small quantities of blood. A. Hahn. Deutsch. med. Woch., 1915, 41, 134–136. J. Chem. Soc., 1915, 108, ii., 651–655.

The urease method (this J., 1915, 981) may be simplified as follows. One c.c. of the serum is placed in a 50 c.c. flask, diluted with 20 c.c. of water, a small quantity of the dry enzyme and three drops of toluene are added, and the flask is

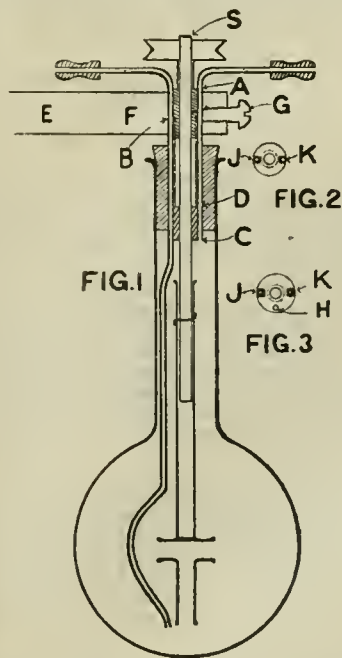
closed with a stopper. A similar mixture, but without the enzyme, is prepared in another flask. After ten hours, the mixtures are each treated with 20 c.c. of *N*/100-hydrochloric acid, 0.5 c.c. of 5% potassium iodate solution, and a crystal of potassium iodide; 20 c.c. of *N*/100-thiosulphate solution is then added to each mixture, and the excess of thiosulphate titrated with *N*/100-iodine solution. The difference in the quantity of the iodine solution required for the two titrations, multiplied by 0.0003, gives the amount of urea in 1 c.c. of the serum. For the estimation of urea in urine, 1 c.c. of the latter is diluted in a flask with 10 c.c. of water, two drops of methyl-orange solution are added, and the solution is titrated with *N*/10-hydrochloric acid until the indicator shows an orange-yellow (not red) colour; a small quantity of the dry enzyme and three drops of toluene are then added, the flask is closed, and, after twenty-four hours, the mixture is titrated with *N*/10-hydrochloric acid.

Petroleum for medicinal purposes. Brit. and Col. Drug., Oct. 8, 1915.

The refined American petroleum oils which have recently been available as substitutes for "liquid paraffin" of Russian origin (see this J., 1915, 859), do not always satisfy the requirements of the British Pharmacopœia. Many of the American products have a sp. gr. of 0.858, whereas the B.P. specifies a product of sp. gr. not less than 0.860, and moreover they do not satisfy the sulphuric acid test.

Gases and liquids; Apparatus for study of reactions between— E. E. Reid. J. Amer. Chem. Soc., 1915, 37, 2112–2114.

THE apparatus shown in Fig. 1 is suitable for use in the study of catalytic hydrogenations, being gas-tight for both increased and reduced pressures.



The bearing, AC, is made of two pieces of steel rod, AB and BC, 0.5 and 1.5 ins. long respectively, both having $\frac{1}{8}$ -in. holes drilled longitudinally, the longer one being then drilled out to $\frac{1}{2}$ in. from B to D. The shorter piece is turned for half its length to fit into the other, forming a double

bearing with an enlarged cavity in the central portion. When the parts are assembled, channels $\frac{1}{16}$ in. square, J and K (Fig. 2), are cut in opposite sides. The $\frac{1}{16}$ -in. brass inlet and outlet tubes are laid in these channels, which are then filled with solder, the excess of solder being removed by turning to make a cylinder which will form a tight joint when passed through a cork. The Witt centrifugal stirrer shown is made of glass and is fastened to the shaft by a wire; the shaft, S, is of $\frac{1}{8}$ -in. drill rod. The bearing passes through a hole in a $\frac{1}{2}$ -in. rod, EF, and is held in position by the set screw, G; the rod is clamped to a retort stand. In assembling the apparatus, the shaft is pushed a short distance up the bearing and mercury poured in; the shaft is then pushed through, leaving the cavity full of mercury. In case samples are to be taken, the bearing is cut from a larger rod and a hole, H (Fig. 3), drilled through the assembled bearing. In cases where the velocity of the reaction is being studied, it has been found that the reaction practically ceases immediately the stirrer is stopped.—F. W. A.

Hydrogenation of volatile substances; Catalytic — and rate of hydrogenation of ethylene. J. B. Rather and E. E. Reid. J. Amer. Chem. Soc., 1915, 37, 2115—2118.

THE mixture of the volatile substance (vapour or gas) and hydrogen is passed through a non-volatile, inert liquid containing the catalyst, agitated in the apparatus described in the preceding abstract. The rate of hydrogenation of ethylene at 180° C., using a nickel catalyst in melted paraffin medium, was found to be regular for a gas mixture containing 10% of ethylene, but irregular for richer mixtures; the determining factor is considered to be the solubility of the ethylene and hydrogen in the paraffin.—F. W. A.

Preparation of glutamic acid and betaine from molasses residues. Andriik. See XVII.

Synthetic and hydrolytic oxynitrilase. Kriebel. See XVIII.

PATENTS.

Pharmaceutical compounds [containing arsenic]; Manufacture of new —. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Leverkusen, Germany. Eng. Pat. 295, Jan. 7, 1915.

PHENYLPROPIOLIC acid combines with halogen compounds of arsenic to give new organic acids, which are absorbed in the digestive organs and appear valuable for therapeutic purposes. The products form white to brown crystals practically insoluble in water but soluble in acetone; on treatment with dilute alkalis the halogen is split off, giving new products of therapeutic value.

—F. W. A.

Bismethylaminotetraminoarsenobenzene; Manufacture of water soluble derivatives of — substituted in the nucleus. C. F. Boehringer und Söhne, Mannheim-Waldhof, Germany. Eng. Pat. 8759, June 14, 1915. Under Int. Conv., June 19, 1914. Addition to Eng. Pat. 1667 of 1914, dated Jan. 23, 1913 (see Ger. Pat. 269,660; this J., 1914, 374.)

IN place of converting bismethylaminotetraminoarsenobenzene into the readily soluble carbamate by means of an alkali or ammonium bicarbonate, its derivatives substituted in the nucleus are so treated, giving almost neutral yellow to brown solutions of therapeutic value, stable in absence of oxygen.—F. W. A.

Nicotine; Process of freezing tobacco leaves from —. W. Kraus, Berlin-Charlottenburg. Eng. Pat. 2926, Feb. 23, 1915. Under Int. Conv., Jan. 22, 1915.

TOBACCO leaves are freed from nicotine, tobacco resins, and colouring matter by extraction at the ordinary temperature in a partial vacuum with a solution prepared by saturating hot trichloroethylene with calcium nitrate.—F. W. A.

Tobacco leaves; Process for bleaching —. A. Dellling. Ger. Pat. 284,458, Aug. 17, 1913.

TOBACCO leaves are treated first with a pure aqueous solution of hydrogen peroxide and then with a solution of the peroxide acidified with a suitable acid, e.g., citric acid. The process is specially suitable for preparing light-coloured tobacco from Java and Sumatra tobaccos.—A. S.

o-Sulphaminobenzoyl-p-phenetidine; Antipyretic, — and process for producing same. J. Lagutt, Basle, Switzerland. U.S. Pat. 1,153,121, Sept. 7, 1915. Date of appl., July 7, 1915.

o-BENZOICSULPHIMIDE is heated with p-phenetidine in molecular proportions, giving o-sulphaminobenzoyl-p-phenetidine (m.pt. 171°—172° C.), which forms white, tasteless, lustrous crystals, soluble in water and alcohol.—F. W. A.

Anhydrides; Manufacture of organic acid — or of mixtures of such anhydrides with their acids. R. Müller, Eilenburg, Germany. U.S. Pat. 1,153,402, Sept. 14, 1915. Date of appl., Mar. 4, 1914.

SEE Fr. Pat. 468,963 of 1914; this J., 1914, 985.

Olefinic terpene alcohols, aldehydes, and acids; Process for hydrogenating —. C. Paal. Fr. Pat. 474,809, July 7, 1914. Under Int. Conv., Aug. 6, 1913.

SEE Eng. Pat. 16,180 of 1914; this J., 1915, 982.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

PATENT.

Gelatine; Manufacture of — for photographic emulsions. Ges. für Elektro-Osmose, Frankfurt, Germany. Eng. Pat. 21,484, Oct. 24, 1914. Under Int. Conv., Mar. 2, 1914. Addition to Eng. Pat. 21,448, Mar. 2, 1914 (this J., 1915, 971).

THE process described in the original patent gives a gelatin free from fat and from mineral and reducing constituents, and particularly suitable for photographic purposes. Turbidity due to suspension of albumin is eliminated.—F. C. T.

XXII.—EXPLOSIVES; MATCHES.

1,2,3-Trinitrobenzene, a new trinitrotoluene, and dinitrohalogen substitution products. Koerner and Contardi. See III.

PATENT.

Nitroglycerin from waste acid; Process for accelerating the separation of —. Dynamit A.-G. vorm. A. Nobel und Co. Ger. Pat. 283,330, Oct. 10, 1912.

TO accelerate the separation of nitroglycerin from the nitrating acid, silicon tetrafluoride is generated by addition of fluorides and silica or easily decom-

posable silicates, or of silicofluorides, alone or together with silica or easily decomposable silicates, to the reaction mixture towards the end of the nitration or after nitration is completed.—A. S.

XXIII.—ANALYTICAL PROCESSES.

Alkalimetric standard; Arsenious oxide as an —.
A. W. C. Menzies and F. N. McCarthy. J. Amer. Chem. Soc., 1915, 37, 2021—2024.

IN view of the accuracy of the arsenious acid-iodine titration and the sharp end-point given by arsenic acid when titrated with alkali, it is suggested that arsenious oxide forms a highly convenient primary standard both for alkalimetry and oxidimetry. Good commercial oxide is sufficiently pure after subliming once; it is oxidised to arsenic acid with concentrated nitric acid free from chloride, the excess of nitric acid being removed by evaporation at about 200° C. under a jet of ammonia-free air, followed by two similar evaporations with water. The titration with alkali, using phenolphthalein as indicator in presence of barium chloride (this J., 1912, 920), gave results in good agreement with those obtained according to other standard methods.—J. R.

Silver; Determination of small quantities of — by cyanimetry. G. Rebière. Bull. Soc. Chim., 1915, 17, 306—309.

DENIGÈS' cyanide method for the determination of silver, using potassium iodide as indicator, may be modified in order to secure greater sensitiveness by working with *N*/100 solutions, the opalescence of silver iodide being rendered visible by titrating in the dark and throwing a beam of light across the liquid. To 100 c.c. of the silver solution 100 c.c. of standardised *N*/100 potassium cyanide, 20 c.c. of ammonia, and a drop of potassium iodide solution are added. The liquid is placed in a vessel with parallel sides in the path of a beam of light, and *N*/100 silver nitrate solution added from a burette graduated in 0.05 c.c. A quite clearly perceptible opalescence is produced at the end point by 0.05 c.c. of silver solution, indicating a degree of sensitiveness of the order of 0.05 mgrm. of silver.—G. F. M.

Aspirator; Constant velocity —. Method of collecting and analysing industrial gases. II.
A. Gautier. Bull. Soc. Chim., 1915, 17, 297—301.
(See also this J., 1915, 1028.)

AN apparatus to overcome the disadvantages attendant on the use of an exhausted aspirator, viz., that the velocity of the entering gas is very great at first and gradually diminishes as the external and internal pressures become more and more equalised, is described. It consists essentially of a steel tube about 1 metre long, the upper end of which is in connection through a screw throttle with the reagent flasks, etc., and the supply of gas to be examined, whilst the lower end dips into mercury; the steel tube is contained in an outer tube of glass or other transparent material, also dipping into the mercury. The steel tube is furnished with a very narrow longitudinal slit, through which the gas can pass from the interior of the tube into the outer glass tube, which is in direct connection with an exhausted steel chamber. At the commencement, owing to the vacuum, the mercury rises in the glass tube and the longitudinal slit is thereby almost covered, but when the throttle at the upper end of the steel tube is opened and the gas allowed to enter, the pressure gradually rises, the mercury falls, and the slit is thereby enlarged in such a way that the

product of the difference between the external and the internal pressure and the length of the slit is a constant. The decreased velocity of the gas owing to diminution of pressure is thereby compensated by the increased size of the opening.
—G. F. M.

Industrial gases; Method for collecting and analysing —. III. A. Gautier. Bull. Soc. Chim., 1915, 17, 301—306.

THE apparatus for collecting industrial gases previously described (see preceding abstract and this J., 1915, 1028) is used in the following manner for their analysis. The gases pass through the smoke filter into a potash absorber to remove acids, and thence through the special regulator into the exhausted receiver. The gases collected in this vessel are thus deprived of suspended particles, acid vapours, water, and, if necessary, of oxygen, and represent a sample collected at constant velocity over an extended period of time during the course of an industrial operation. The further analysis is carried out by passing the gases through a series of weighed absorbers which remove the constituents in turn—(a) pumice and sulphuric acid to remove water, (b) an acetic acid solution of iodine bromide to absorb unsaturated hydrocarbons, (c) iodine anhydride warmed to 80°—100° C. followed by a tube of reduced copper to oxidise carbon monoxide, the dioxide being absorbed in potash bulbs, (d) a miniature combustion tube containing copper oxide to oxidise hydrogen and saturated hydrocarbons. The volume of gas passed through the absorbers from the receiver is obtained by observing the difference in pressure as indicated by the mercury column of the regulator (*loc. cit.*), and from the increase in weight of the absorbers the volumes of the respective gases can be calculated. Nitrogen is obtained by difference. Even with complicated mixtures fairly accurate results can be obtained in a minimum of time.—G. F. M.

Arsenic in organic secretions and tissues; Determination of —. P. Klason. Arkiv. Kem. Min. Geol., 1914, 5, No. 9, 1—10. J. Chem. Soc., 1915, 108, ii., 649—650.

NITRIC acid is the only easily volatile mineral acid which is readily obtained free from arsenic; all that is necessary is to distil it gently from a tubulated retort. Oxidation of the organic matter containing arsenic is then carried out as follows:—A litre of urine, for example, to which has been added 100 c.c. of the pure nitric acid, is evaporated to dryness on the water-bath. The residue is again evaporated with 50 c.c. of nitric acid, and then dissolved in a further 100 c.c. of acid, when more or less sodium chloride separates. The solution is poured into a separating funnel opening into a quartz glass distilling flask partly filled with small lumps of quartz or of pure felspar porcelain. The flask is heated in a bath of strong sulphuric acid, and when the temperature is 270° C., the solution is gradually dropped on to the quartz lumps, the temperature not being allowed to fall below 250° C. The sodium chloride is washed twice, each time with 25 c.c. of nitric acid, the acid then being run into the flask. When all the acid has been distilled from the flask, pure nitric acid is run in, if the quartz lumps appear dark from separated carbon, until the carbon is completely oxidised. The contents of the flask are then dissolved in warm water containing a little nitric acid, and the solution evaporated to dryness on the water-bath. The residue, which should be snow-white, and consists chiefly of sodium chloride and ammonium nitrate, is then heated at 130° C. until no more acid vapours are evolved, after which it is dissolved in water and filtered. The arsenic in the filtrate

can be estimated by precipitation of the sulphide by means of thioacetic acid, solution of the sulphide, and electrolytic reduction of the solution to give arsine, and hence arsenic mirrors. If the mirror contains at least 0.01 mgrm. of arsenic, it is best estimated by direct weighing with a micro-balance.

Acceleration of Kjeldahl's method of determining nitrogen in coal and coke. Margosches and Lang. See IIA.

Cross and Bevan's reaction for jute and its application to cotton. Haller. See V.

Phosphoric acid as a monobasic and dibasic acid. Behaviour of phosphoric acid with calcium hydroxide. Kolthoff. See VII.

Compounds occurring in commercial calcium acetate. Bergh. See VII.

Separation of platinum in iron ore analysis. Brandt. See X.

Analysis of turbidum bronze. Williams. See X.

Analysis of molten and hard greases. Bumcke. See XV.

Determination of acid and alkaline substances in mineral soils. Stutzer and Haupt. See XVI.

Determination of raffinose by enzymotic hydrolysis. Hudson and Harding. See XVII.

Fiehe's reaction with mixed honeys. Lüning. See XVII.

Valuation of wheat and wheat-meats as raw materials for the starch industry. Goldbeck. See XVII.

Culture media employed for the bacteriological examination of water. III. Composition of gases formed in lactose-peptone fermentation tubes. Chamot and others. See XIXB.

Detection of nitrites in potable waters. Rosenthaler and Jahn. See XIXB.

Determination of carbonic anhydride in natural waters. Cavazzi. See XIXB.

Apparatus for testing materials employed for the absorption of noxious gases. Kohn-Abrest. See XIXB.

Haematoxylin as indicator in the titration of alkaloids. Frerichs and Mannheim. See XX.

Determination of urea in small quantities of blood. Hahn. See XX.

Titration of tartaric acid with permanganate. Dean. See XX.

PATENT.

Gaseous mixtures of known constituents; Analysis of—. Siemens und Halske A.-G. First Addition, dated June 29, 1914 (Under Int. Conv., July 2, 1913), to Fr. Pat. 458,916, June 7, 1913.

SEE Ger. Pat. 278,676 of 1913; this J., 1915, 380.

XXIV.—MISCELLANEOUS ABSTRACTS.

Light absorption and fluorescence. III. E. C. C. Baly. Phil. Mag., 1915, 30, 510—526.

THE infra-red spectrum of a compound is an additive function of the spectra of its constituent

radicles, and the wave lengths of the absorption lines of the ultra-violet band groups of phenol and aniline have been calculated from the infra-red spectra of benzene and water, and benzene and ammonia respectively, by making use of the basis constants of each, which were calculated on the Bjerrum principle as extended by Eucken, namely that the rotational frequencies (ν_r) of the infra-red bands exhibited by a compound are given by the expression $\nu_r = nh/2\pi^2 I$, where I is the moment of inertia, h is the Planck constant, and n is one of a series of whole numbers, 1, 2, 3, etc. —G. F. M.

Chromogen universally distributed among plants; Properties of a —. J. Wolff and N. Ronchelmann. Comptes rend., 1915, 161, 399—401. (See also this J., 1915, 738.)

INVESTIGATION of a large number of plants indicated that the chromogens contained in them, which react to the test previously described (*loc. cit.*), have many characters in common. They become brown under the influence of laccase or of alkali or alkaline-earth carbonates; they form strongly fluorescent products when heated with strong sulphuric acid and resorcinol and afterwards diluted and rendered alkaline; their reaction with laccase and hydriodic acid is inhibited by small quantities of quercitannin, and (like tannin) they prevent the oxidation of guaiacol by laccase. It appears probable that they are all identical and that the oxidation of this chromogen accounts for the brown products formed in different vegetable tissues, e.g., in dead leaves and in cut apples. Palladin has suggested that the chromogens occur in plants as glucosides. The authors subjected a number of glucosides to the test previously described (*loc. cit.*), but invariably obtained a negative result, though the plant tissues in which the glucosides occur responded readily. Guaiacol appears to be the only well-defined aromatic compound which approaches the chromogen of plants in its sensitiveness to the combined action of laccase with potassium iodide and acetic acid.—J. H. L.

Oxyntirilase; Synthetic and hydrolytic —. V. K. Krieble. J. Amer. Chem. Soc., 1915, 37, 2205—2213.

ROSENTHALER has indicated (this J., 1910, 1269) that emulsin contains a synthetic as well as a hydrolytic enzyme for benzaldehydecyanohydrin, but the authors have, so far, been unable to obtain any evidence of the possible separation of the two enzymes in a preparation of oxyntirilase (Krieble, J. Amer. Chem. Soc., 1913, 35, 1643) according to the methods suggested by Rosenthaler; no variation was observed in the equilibrium point in the synthesis of mandelonitrile, even when the oxyntirilase was obtained from widely different sources.—W. P. S.

Trade Report.

Prohibited exports. Orders in Council, Oct. 4 and 13, 1915.

THE Proclamation dated the 28th day of July, 1915, as amended and added to by subsequent Orders of Council, is further amended as follows:—

The heading "Antipyrine (phenazone)" in the list of goods the exportation of which is prohibited to all destinations is deleted, and there is substituted the heading "Antipyrine (phenazone) and its derivatives."

The heading "Mica (including mica splittings) and micaite" in the list of goods the exportation of which is prohibited to all destinations abroad other than British Possessions and Protectorates is deleted, and there is substituted the heading "Mica (including mica splittings and mica chimneys) and micaite."

The heading "Milk, condensed, sweetened or not," in the list of goods the exportation of which is prohibited to all destinations abroad other than British Possessions and Protectorates is deleted, and there is substituted the heading "Milk, condensed or preserved, whether sweetened or not."

The heading "Coal (including anthracite and steam, gas, household and all other kinds of coal) and coke" in the list of goods the exportation of which is prohibited to all destinations abroad other than British Possessions and Protectorates is deleted, and there is substituted the heading "Coal, all kinds, and coke, but not including coal allowed by the Commissioners of Customs and Excise to be shipped as bunker coal."

The heading "Salts of aluminium (other than alunite and nitrate of aluminium)" in the list of goods the exportation of which is prohibited to all foreign countries in Europe and on the Mediterranean and Black Seas other than France, Russia (except through Baltic ports), Italy, Spain, and Portugal, is deleted and replaced by the heading "Salts of aluminium (other than alunite, ammonium alum, and nitrate of aluminium, the exportation of which is already prohibited to all destinations abroad other than British Possessions and Protectorates)."

The exportation of "Magnesite and magnesite bricks" is prohibited to all destinations.

The exportation of the following goods is prohibited to all destinations abroad other than British Possessions and Protectorates:—Chromium, compounds of, except chromium acetate, chromium chlorate, and chromium nitrate (the exportation of which is already prohibited to all destinations) and bichromate of soda (the exportation of which is and remains only prohibited to all foreign countries in Europe and on the Mediterranean and Black Seas, other than France, Russia (except through Baltic ports), Italy, Spain, and Portugal). Oil fuel, but not including any such fuel allowed by the Commissioners of Customs and Excise to be shipped for use on board the exporting ship. Stearine pitch and other pitches derived from fatty oils and acids.

The exportation of the following goods is prohibited to all foreign countries in Europe and on the Mediterranean and Black Seas, other than France, Russia (except through Baltic ports), Italy, Spain, and Portugal:—Formic acid; sodium carbonate (including soda ash, soda crystals, and bicarbonate of soda); borax, boric acid, and other boron compounds.

Prohibited exports. Order in Council, Oct. 19, 1915.

THE heading "Coal, all kinds, and coke, but not including coal allowed by the Commissioners of Customs and Excise to be shipped as bunker coal" in the list of goods the exportation of which is prohibited to all destinations abroad other than British Possessions and Protectorates is deleted, and replaced by the heading "Coal, all kinds, and coke made in gas works, but not including coal allowed by the Commissioners of Customs and Excise to be shipped as bunker coal."

The heading "Grindstones, carborundum wheels, and emery wheels" in the list of goods the exportation of which is prohibited to all foreign countries in Europe and on the Mediterranean and Black Seas, other than France, Russia (except through Baltic ports), Italy, Spain, and Portugal, is deleted, and there are substituted the headings

"Grindstones" and "Emery, corundum, natural or artificial (such as alundum), carborundum and crystolon, and manufactures thereof (including wheels, discs, paper, cloth, stones, and powder)."

The exportation of acetic ether, ether, phosgene (carbonyl chloride), and platinum is prohibited to all destinations.

The exportation of arsenical ore is prohibited to all foreign countries in Europe and on the Mediterranean and Black Seas, other than France, Russia (except through Baltic ports), Italy, Spain, and Portugal.

Contraband of war. Royal Proclamation, Oct. 14, 1915.

THE lists of contraband contained in the Schedules to the Royal Proclamation of Dec. 23rd, 1914, as amended by the Proclamations of March 11th, May 27th, and August 20th, 1915, are withdrawn and the following substituted.

Absolute contraband. Emery, corundum, natural and artificial (alundum), and carborundum, in all forms. Paraffin wax. Powder and explosives specially prepared for use in war. Materials used in the manufacture of explosives, including:—Nitric acid and nitrates of all kinds; sulphuric acid; fuming sulphuric acid (oleum); acetic acid and acetates; barium chlorate and perchlorate; calcium acetate, nitrate, and carbide; potassium salts and caustic potash; ammonium salts and ammonia liquor; caustic soda, sodium chlorate and perchlorate; mercury; benzol, toluol, xylo, solvent naphtha, phenol (carbolic acid), cresol, naphthalene, and their mixtures and derivatives; aniline and its derivatives; glycerine; acetone; acetic ether; ethyl alcohol; methyl alcohol; ether; sulphur; urea; cyanamide; celluloid. Manganese dioxide; hydrochloric acid; bromine; phosphorus; carbon disulphide; arsenic and its compounds; chlorine; phosgene (carbonyl chloride); sulphur dioxide; prussiate of soda; sodium cyanide; iodine and its compounds. Capsicum and peppers. Tanning substances of all kinds, including quebracho wood and extracts for use in tanning. Wool, raw, combed, or carded; wool waste; wool tops and noils; woollen or worsted yarns; animal hair of all kinds, and tops, noils and yarns of animal hair. Raw cotton, linters, cotton waste, cotton yarns, cotton piece goods, and other cotton products capable of being used in the manufacture of explosives. Flax, hemp; ramie; kapok. Mineral oils, including benzine and motor spirit. Resinous products, camphor, and turpentine (oil and spirit); wood tar and wood tar oil. Rubber (including raw, waste, and reclaimed rubber, solutions and jellies containing rubber, or any other preparations containing rubber, balata, and gutta-percha, and the following varieties of rubber, viz.:—Borneo, Guayule, Jelutong, Palembang, Pontianac, and all other substances containing caoutchouc), and goods made wholly or partly of rubber. Lubricants. The following metals:—Tungsten, molybdenum, vanadium, sodium, nickel, selenium, cobalt, hematite pig-iron, manganese, electrolytic iron, and steel containing tungsten or molybdenum. Asbestos. Aluminium, alumina, and salts of aluminium. Antimony, together with the sulphides and oxides of antimony. Copper, unwrought and part wrought; copper wire; alloys and compounds of copper. Lead, pig, sheet, or pipe. Tin, chloride of tin, and tin ore. Ferro alloys, including ferro-tungsten, ferro-molybdenum, ferro-manganese, ferro-vanadium, and ferro-chrome. The following ores:—Wolframite, scheelite, molybdenite, manganese ore, nickel ore, chrome ore, hematite iron ore, iron pyrites, copper pyrites and other copper ores, zinc ore, lead ore, arsenical ore, and bauxite.

Conditional contraband. Foodstuffs. Forage and feeding stuffs for animals. Oleaginous seeds, nuts, and kernels. Animal, fish, and vegetable oils and fats, other than those capable of use as lubricants, and not including essential oils. Fuel, other than mineral oils. Powder and explosives not specially prepared for use in war.

Patents and Designs Regulation.

AN Order-in-Council, dated 14th October, further amends the Regulations (called the Defence of the Realm (Consolidation) Regulations, 1914), made under the Defence of the Realm Consolidation Act, 1914, for securing the public safety and the defence of the Realm. The Order-in-Council referred to above orders, *inter alia*, the following amendment in the Regulations:—

18b.—(1) Where an application has been made, whether before or after the date of the making of this order, for the grant of a patent or the registration of a design in the United Kingdom, and the Comptroller-General of Patents, Designs, and Trade-marks is satisfied that the publication of the invention or design might be detrimental to the public safety or the defence of the Realm, or might otherwise assist the enemy or endanger the successful prosecution of the war, he may delay the acceptance of the complete specification filed with the application for the patent, or, as the case may be, the registration of the design, and in such case may by order prohibit—(A) the publication or communication in any way of the invention or design; (B) application being made for the protection of the invention or design in any enemy or neutral country; and (C) application being made for the protection of the invention or design in any allied country or in any of His Majesty's Dominions without the permission of the Admiralty and Army Council.

(2) No person shall apply for the grant of a patent in respect of any invention or the registration of a design in any foreign country, or in any of His Majesty's Dominions, unless he has left at, or sent by post to, the Patent Office, a notice of his intention, together with a provisional specification describing the nature of the invention or, as the case may be, a representation or specimen of the design, nor until after the expiration of one month from the time when such notice was given, and if during the said month the Comptroller-General is satisfied that the publication of the invention or design might be detrimental to the public safety or the defence of the Realm, or otherwise assist the enemy or endanger the successful prosecution of the war, he may make a like order as in respect of cases in which application is made for the grant of a patent or the registration of a design in the United Kingdom.

(3) Before exercising any of his powers under this Regulation as respects any matter, the Comptroller-General shall consult with the Admiralty and Army Council and shall not act except upon the request of the Admiralty or Army Council.

(4) If any person contravenes the provisions of this Regulation, or of any order made thereunder, he shall be guilty of an offence against these Regulations.

Transportation of dangerous articles on steam vessels carrying passengers. U.S. Comm. Rept. No. 211, Sept. 9, 1915.

THE following is a summary of rulings made by the United States Steamboat-Inspection Service during the months of July and August, 1915, relating to transportation of certain articles on steam vessels carrying passengers:

Muriatic acid or hydrochloric acid may be accepted for transportation under the same conditions as sulphuric acid.

The transportation of *Tanner's oil* on steamers carrying passengers, a sample of which was submitted, tested, and did not flash or burn when heated in an open cup to about 470° F., is not prohibited by section 1472, Revised Statutes.

Dolomite consisting of magnesia and hydrated or slaked lime may be transported on steamers carrying passengers, but dolomite composed of magnesia and unslaked lime shall not be transported on steamers carrying passengers, and *unhydrated or quick lime* shall not under any conditions be transported on steamers carrying passengers.

Non-inflammable, non-combustible, non-explosive metal polish may be transported on steamers carrying passengers and may be used as stores on passenger and pleasure steamers.

Sesquisulphide of phosphorus and amorphous (or red) phosphorus may be transported on steamers carrying passengers, provided that these commodities are stowed in iron drums and carried on deck; and *white or yellow phosphorus* shall not be transported on steamers carrying passengers.

New Russian chemical companies. Chem. Trade J., Oct. 2, 1915.

THE desire of the Russians to become independent as far as possible of foreign supplies of raw materials and manufactured and partly manufactured goods led to the formation a few months ago of the Company for the Economic Regeneration of Russia, which has received the support of the Ministers of Commerce and War. Since then a number of companies have been formed with the co-operation of this particular company, or at its direct instance, in connection with the chemical and metal industries. The proposed new chemical works number eighteen, of which four are to be situated at Moscow, two at Perm, two at Kieff, two at Ekaterinoslaw, and one each at Petrograd, Mohileff, Tiflis, Kharkoff, and other towns. The most noteworthy among these is a large superphosphate factory which is being built by the Perm provincial council. This factory is to produce 19,250 tons of superphosphates per annum, and will be the first of its kind in Russia. Next to these enterprises are the Russian Chemical and Pharmaceutical Industry Company, with a share capital of £500,000, and the Galeneka Company, of Kharkoff, whilst a chemical and dyestuff manufacturing works is to be equipped near Moscow to meet the requirements of the local textile factories.

Italy; "Concession Tax" on certain exports from —. Board of Trade J., Oct. 7, 1915.

AN annex to a Royal Decree dated Sept. 15th provides that when licences are granted to export goods of a kind which are, in principle, prohibited to be exported, a special "concession tax" shall be levied at the rates shown below:—

	Rate of "Concession Tax."	
	Lire	et.
	per 100 kilos.	
Sulphuric acid	0	50
Nitric acid	0	80
Tannic acid (including tanning extracts)	1	00
Sugar	1	00
Sodium nitrate	0	50
Copper sulphate	1	00
Carbon bisulphide	0	50
Medicaments	10	00
Woods, barks, and roots for tanning, and sumac	0	51
	per ton (metric)	
Iron ores and iron pyrites	1	00
Copper ores and copper pyrites	2	00
	per 100 kilos.	
Oil cakes, from nuts and other material	0	50
Other goods	1% ad valorem	

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Obituary.

ANDREW NOBLE.

Sir Andrew Noble, Bart., Chairman of Messrs. Armstrong, Whitworth and Co., died at Ardkinglas, Argyllshire, on October 22nd, at the age of 84.

Born in Greenock, he was educated at the Edinburgh Academy and the Royal Military College, Woolwich. In 1819 he entered the Royal Artillery and was promoted to the rank of captain in 1855. In 1857 he was appointed Secretary to the Royal Artillery Institute and in the following year became Secretary to the Special Commission on Rifled Cannon and a little later to the Committee on Plates and Guns. In 1859 he was made Assistant Inspector of Artillery and in 1860 was appointed a member of the Ordnance Select Committee and of the Committee on Explosives, on which he served for forty years. In his official capacity Noble was brought into close contact with Sir William (later Lord) Armstrong, and in 1860 entered the firm of Armstrong, Whitworth and Co., which owes its proud position in no small measure to his scientific and organising ability.

Noble's scientific researches in connection with the firing of explosives were commenced in 1862, when he invented the chronoscope for determining the velocity of a projectile in a gun barrel. It was in 1868 that he became associated with Sir Frederick Abel in the classical series of researches on the results of firing gunpowder, in which exhaustive measurements were made of the pressure and amount of heat developed on explosion, as well as a study of the gaseous and solid products. He arrived at the conclusion that the maximum pressure developed by the firing of gunpowder, unrelieved by expansion, did not greatly exceed 40 tons to the square inch. He also showed that with large charges quick-burning powder increased the strain on the gun without increasing the velocity of the projectile. During

his researches on cordite he succeeded in obtaining muzzle velocities of over 3000 ft. per second, combined with much higher energy and penetrative power than had been attainable previously. These and other researches have had a profound influence on the design of modern artillery.

Noble was made a Knight Commander of the Bath in 1893 and a Baronet in 1902. He was elected a Fellow of the Royal Society in 1870 and ten years later received the Gold Medal of that Society. In 1908 he was awarded the Medal of the Society of Chemical Industry and in 1909 received the Albert Medal of the Royal Society of Arts. He was also member of a large number of foreign orders.

VIVIAN BYAM LEWES.

Vivian Lewes was born in 1852 and educated at University College, London. In 1879 he became Assistant to the Professor of Chemistry at the Royal Naval College, Woolwich, and in 1888 was appointed Professor, a position which he held until 1914. Since 1892 he had been Chief Superintending Gas Examiner to the City of London.

Lewes was the author of numerous original papers, several of which were contributed to this Journal, on various subjects connected with fuel, including the spontaneous combustion of coal, gas manufacture and purification, acetylene, liquid fuels, the chemistry of flames, and the products of combustion. He was also the author of a number of technical handbooks, e.g., on "Acetylene," "Liquid and Gaseous Fuels," "Oil Fuel," and "Service Chemistry," and of numerous articles in the "Dictionary of Applied Chemistry" and the "Encyclopædia Britannica." He was a most accomplished lecturer, and delivered several series of Cantor Lectures on the above subjects, and also on explosives and munitions of war, before the Royal Society of Arts.

Professor Lewes died at Mold, Flintshire, on October 23rd, after an illness of a few days.

Journal and Patent Literature.

PATENT SPECIFICATIONS may be obtained by post by remitting as follows:—

English.—6d. each, to the Comptroller of the Patent Office, Southampton Buildings, Chancery Lane, London, W.C.

United States.—1s. each, to the Secretary of the Society.

French.—1 fr. 05 c. each, as follows: Patents dated 1902 to 1907 inclusive, Belin et Cie., 56, Rue Ferou 8, Paris (6e.)

Patents from 1908 to date, L'imprimerie Nationale, 87, Rue Vieille du Temple, Paris.

I.—GENERAL; PLANT; MACHINERY.

PATENTS.

Grinding mills. E. F. McCool, Victor, Colo., U.S.A. Eng. Pat. 19,982, Sept. 19, 1914.

A MOVABLE grinding disc is mounted on a shaft which passes eccentrically through a sleeve parallel to the axis. The sleeve and shaft are rotated at different speeds so that the grinding disc has a rotating and an orbital motion. A stationary or rotary disc presses against the rotating disc, and grinding balls are provided in ball races cut in the

surfaces of the discs. The ball-races are relatively wide to allow of the orbital movement. The grinding discs are enclosed in an outer casing through which a current of air is passed to remove the ground material.—W. H. C.

Drying or desiccating; [Vacuum] apparatus for —. M. W. Travers, London, and F. Shaw and Co., Ltd., Manchester. Eng. Pat. 430, Jan. 11, 1915.

A VACUUM drying chamber is connected with a vertical tubular condenser by a narrow vertical slot or a vertical series of narrow openings opposite

each of the trays in the drying chamber. The floor of the drying chamber is inclined towards the condenser to facilitate the flow of any liquid, which may condense in the chamber, into the condenser, from which it is discharged together with the liquid condensed in the condenser itself.—W. H. C.

Kiln. A. Vogt, Assignor to E. C. Tecktonius Manufacturing Co., Racine, Wis. U.S. Pat. 1,153,980, Sep. 21, 1915. Date of appl., Dec. 3, 1913.

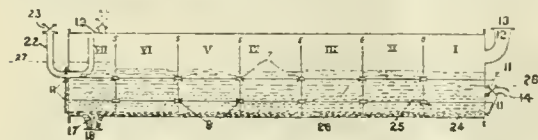
A KILN of circular section with a domed top is provided, at intervals round the wall, with furnaces or fire openings, and interior flues which lead from the openings into the upper part of the kiln. A radial flue leads from the centre of the lower part of the kiln to a stack, and a transverse flue extends across the kiln and communicates with the inner end of the radial flue. A lower series of flues extend across the kiln, parallel with the radial flue, and open into the top of the transverse flue, and an upper series of flues, parallel with the lower series and having perforated sides, communicate with the lower series of flues at their outer ends. A false floor or partition is formed between the upper and lower series of flues, with openings through which the flues communicate with each other. An open-work floor is formed above the upper series of flues.—W. H. C.

Furnace; Calcining or roasting—. C. Ros tenne. Fr. Pat. 474,714, July 6, 1914.

THE material is preheated in a hopper chamber above the furnace, through which the hot gases pass, and then falls into cars running on a circular track within the lower part of the hopper, so that the material can be charged uniformly into the furnace. The furnace has a double grate, the upper being removable to allow the passage of large pieces of material, while the lower allows dust to pass through to a discharge conduit. Air is supplied through a vertical passage passing through the grate, and also through a number of preheating chambers formed in the lower wall of the furnace. The inner walls of these chambers consist of gratings supporting the material in the furnace, and the outer walls are provided with ports capable of regulation.—W. F. F.

Clay and like materials; Leaching process for—. Soc. d'Exploit. de Procédés Evaporatoires, Système Prache et Bouillon. Fr. Pat. 474,318, Nov. 18, 1913.

To extract soluble matters without removing fine particles, such as clay, in suspension, the material is treated with water in a rotary cylinder divided



into compartments, communicating at the top, by partitions, each of which is provided with two adjustable openings. The cylinder is charged, rotated for some time, and then stopped. The insoluble materials settle to the bottom of each compartment, leaving the fine materials in suspension in the lower part of the supernatant liquid, with a layer of clear solution above. The solid matter is removed from chamber VII, through the valve, 17, and this chamber is then filled with fresh water to the level, 27. A suitable quantity of clear solution is then run out of chamber I, through the pipe, 14, until the remainder is at the level, 28. The central openings, 7, in all the partitions are now opened by the lever, 11; part of the clear

liquid then flows consecutively from chamber VII to I, but the lower turbid liquid does not move. When the flow has ceased the openings are closed. A fresh charge of material to be treated is fed through the hopper, 12, until the water level in chamber I is at the bottom of the hopper. The lower series of apertures, 8, are then opened and the turbid liquid is allowed to flow from chambers I to VII until the level in each is the same. These apertures are then closed and the cylinder is rotated. During the rotation the heavier particles pass through the openings, 5, and form an uniform layer along the bottom of the cylinder when the rotation ceases. If a mixture of sand and clay is treated in this apparatus, the soluble salts will be removed but no clay will be withdrawn from the sand.—A. B. S.

Evaporating apparatus with intensive circulation. E. Barbet et Fils et Cie. Fr. Pat. 474,327, Nov. 20, 1913.

HEATING tubes are arranged vertically in a cylindrical casing, and the liquid to be evaporated is forced upwards through them at such a rate that a higher boiling point at the lower ends of the tubes, due to hydrostatic pressure, is avoided. The mixed liquid and vapour pass into a chamber provided with a deflector which directs the liquid downwards, whilst the vapour passes upwards through a liquid separator consisting of tubes containing helical deflecting strips. The liquid flows into a chamber, where its level is adjusted by a valve controlled by a float, and then passes downwards through a pipe having a cross-section one-sixth to one-half of the total section of the heating tubes, and opening into the bottom of the heating chamber below the tubes, where a sudden change in direction causes a separation of solid particles.—W. F. F.

Furnace-gases; Apparatus for cooling and purifying—. E. Hofmann, Duisburg, Germany. U.S. Pat. 1,155,237, Sept. 28, 1915. Date of appl., Nov. 7, 1913.

SEE Fr. Pat. 459,737 of 1913; this J., 1913, 1150.

Drying granular material; Apparatus for—. E. Bornmann, Assignor to J. A. Topf und Soehne, Erfurt, Germany. U.S. Pat. 1,155,402, Oct. 5, 1915. Date of appl., Mar. 31, 1914.

SEE Addition of Feb. 11, 1914, to Fr. Pat. 461,679 of 1913; this J., 1915, 16.

Screw-conveyors. Eng. Pat. 15,381. See IIB.

Process and apparatus for the fractionation of gaseous mixtures of very low boiling point, especially air. Fr. Pat. 474,379. See VII.

IIA.—FUEL; GAS; MINERAL OILS AND WAXES.

Coal and gas coke; Export licences for—. War Trade Dept., Nov. 6, 1915.

AN announcement was issued by the War Trade Department on Oct. 14, 1915, in which it was intimated that on and after 1st November, 1915, it would be necessary for a revised form of application for a licence to be used. Applications cannot be considered by the Coal Exports Committee unless the new form (dark blue) containing a declaration that the proposed shipment is in pursuance of an existing contract or in execution of a definite order, is used. Any applications received on the old form must therefore be

returned. The new forms are obtainable at the Custom House at coal ports.

Coal ash; New method and furnace for the determination of the softening temperature of — under fuel bed conditions. A. C. Fieldner and A. L. Feild. *J. Ind. Eng. Chem.*, 1915, 7, 829—835.

THE coal ash, obtained by incineration of the coal at a temperature not exceeding 800° C., is ground to 200-mesh, made into a plastic mass with a 10% solution of dextrin, and moulded into cones, 1 in. long and $\frac{3}{16}$ in. at the base, which are partially dried, and mounted, with one side of the cone vertical, in a refractory base composed of equal parts of kaolin and alumina. After drying, the softening temperature of the cone is determined in an atmosphere composed of equal parts of hydrogen and steam (this *J.*, 1915, 1001) in a special electric furnace. The furnace comprises an alundum tube having on its outer surface a spiral groove in which molybdenum wire is wound to serve as a heating resistance. The tube is enclosed in another alundum tube surrounded by a fireclay tube, and the whole is packed around with refractory material within an outer gas-tight casing of sheet iron. The end plate of the furnace carries a tube provided with a glass plate through which the temperature is measured by means of an optical pyrometer. The cone of coal ash is placed inside a short alundum tube near the closed end, and the tube is pushed into the alundum heating tube. The mixture of hydrogen and steam is obtained by bubbling hydrogen through water kept at 81° C. (for 740 mm. barometric pressure) by electrical heating in a specially devised saturator. When a temperature about 200° C. below the probable softening temperature of the ash is reached, the furnace heating current is adjusted so that the temperature rises 5° per min. until deformation begins and then 2° per min. until the "down point" (softening temperature) of the cone is attained, i.e., when the top of the cone bends over so that it touches the base, or when the whole cone settles down to a more or less spherical lump. Softening temperatures determined in this way agree to within about 25° C. in duplicate tests. In tests with 50 miscellaneous coals, the softening temperatures of the ashes ranged from 1060° to 1596° C., and the average interval between the initial deformation point and the softening temperature was 47° C.—A. S.

Hydrogen; Determination of — in gaseous mixtures by catalytic absorption. E. Bosshard and E. Fischli. *Z. angew. Chem.*, 1915, 28, 365—366.

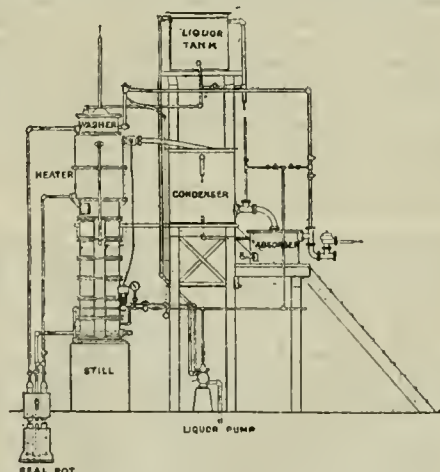
THE absorption of hydrogen by sodium oleate solution in presence of a reduced nickel catalyst is utilised for the quantitative determination of this gas in mixtures. The catalyst must either be used immediately after its preparation by the reduction of nickel oxide at 340° C., or it must be preserved in sealed glass tubes in 3-grm. quantities in an atmosphere of hydrogen. Absorption is effected in a Hempel pipette or in a spherical pipette with a mercury seal. The gaseous mixture is freed from carbon dioxide, carbon monoxide, oxygen, etc., by the usual methods, and 15—20 c.c. of the residue is introduced into the pipette charged with concentrated aqueous sodium oleate solution containing 3% of the catalyst in suspension; the whole of the hydrogen will be absorbed after 10 mins. shaking. The foam which is produced may be destroyed by allowing a small quantity of alcohol to enter the pipette, but as this substance retards the rate of absorption it is recommended that two pipettes be employed; when absorption is complete the gas and foam are transferred to the second pipette before adding alcohol, so that the solution in the first pipette may retain its absorbing capacity for a number of operations.—G. F. M.

Condensate from carburetted water-gas; Examination of a —. E. T. Sterne. *J. Ind. Eng. Chem.*, 1915, 7, 898—899.

A LIQUID which condensed, during a very cold winter, in the service pipes of a gasworks where carburetted water-gas is made from anthracite coal and Pennsylvania crude petroleum, had the sp.gr. 0.740 and yielded 95% distilling below 120° C. and 99% below 130° C. On fractionating with a 12-pear still-head, breaks in the boiling-point curve were observed at 80°—82°, 98°—100°, and 110°—112° C. The presence of toluene in the fraction distilling at 108°—112° C. was detected by the nitration test. The proportion of olefines was estimated from the bromine absorption value and that of paraffins and olefines together by the dimethyl sulphate test. In this way the original liquid was found to be composed of 75.9% of paraffins, 1.6% of olefines, and 22.5% of aromatic hydrocarbons. The percentage distilling at 78°—82°, corresponding to crude benzol, was 12%, and between 108° and 112° (crude toluol), 10%. The results point to the possibility of recovering toluol on a commercial scale in the manufacture of carburetted water-gas.—A. S.

Gas liquor; Distillation of — without lime. J. S. Unger. *Gas Age*, Oct. 1, 1915. *J. Gas Lighting*, 1915, 132, 144.

WHEN gas liquor is distilled without lime, in the ordinary apparatus, it is difficult to obtain a concentrated liquor containing more than 13% of



ammonia without serious trouble due to the crystallisation of ammonium carbonate. In the apparatus described (see fig.) the liquor passes from the liquor tank through a washer, and thence through a seal-pot where it is heated by the waste liquor from the still. It then passes through a tubular heater, where it is heated by the vapours from the still to about 190° F. (88° C.), and thence into the still proper. At 190° F. a large proportion of the carbonic acid and hydrogen sulphide is given off, together with a little ammonia. These vapours are scrubbed by the cold liquor in the washer, the ammonia is recovered, and the other gases are discharged. The mixture of steam and ammonia, coming from the still is passed through the heater, where part of the steam is condensed and returned to the still, and the remainder along with the ammonia passes through the condenser into the absorber. The exhaust steam from the liquor pump is utilised in the still, and additional steam is supplied through a valve controlled by a thermostat placed in the vapour pipe, so that the supply of steam is regulated automatically. It is stated

that liquor containing 20% of NH_3 is easily made in this apparatus, and that a still 24 inches in diameter can treat 150 gallons of weak liquor per hour.—W. H. C.

Petroleum lamp oils; Examination of—. II. *Determination of origin.* R. Jungkunz. Chem.-Zeit., 1915, 39, 659—661. (See also this J., 1915, 1003.)

As a rule ordinary European lamp oils have a higher sp.gr. than American oils, but in the case of safety oils the sp.gr. shows only slight differences. The critical line of the oil when examined in the butyro-refractometer at 17° C. varies in breadth and colour with the origin of the oil. American oils show a narrow dark line, whilst European oils (with the exception of Russian oils) show light to deep blue lines, 2 to 3 mm. in breadth. American oils usually give a lower refractometer reading than European oils. The iodine value by Hübl's method (6 hours' absorption) of American oils ranged from 11.13 to 13.54, and that of European oils from 0.64 to 2.90, but there were no material differences in the case of oils from different parts of Europe. By Arragon's reaction (this J., 1909, 383) typical American oils give violet colorations and typical European oils a yellow coloration. In the case of oils giving intermediate colorations it is advisable to apply the test to the portion of the sample distilling up to 300° C. If a yellow coloration appears within 15 seconds European oil is indicated; the violet coloration of American oils does not usually appear until after 30 mins.' shaking. In the case of mixtures, which usually contain American oil, the final coloration will be yellow. The age of an oil has an influence on the reaction. After keeping for 2 to 3 years in glass bottles American oils gave bluish-black colorations and European oils dark yellow to brown colorations. American safety oils should have a flash-point of at least 38° C., and ordinary American lamp oils at least 23° C. The initial b.pt. should not be less than 110° C., and the proportion of heavy oils (b.pt. over 360° C.) should not exceed 8% by vol.—C. A. M.

Aromatic hydrocarbons in cracked petroleum; Determination of—. W. F. Rittman, T. J. Twomey, and G. Egloff. U.S. Bureau of Mines. Met. and Chem. Eng., 1915, 13, 682—686.

METHODS of separation and differentiation based on physical properties were investigated, and results approximating to those of the best chemical methods obtained by the following means:—700 grms. of cracked oil was distilled in a flask of 1 litre capacity provided with a fractionating column (one at least as efficient as a 5-in. Hempel column of aluminium beads), and the portion distilling up to 175° C. collected. 200 grms. of this portion was next distilled, a similar column being employed, and fractions separated at 105°, 130°, and 160° C. These fractions were then redistilled separately and fractions separated at 95°, 120°, and 150° C., respectively. The specific gravities of the three final distillates were then determined and the percentage of aromatic hydrocarbons calculated on the basis of the following specific gravity relations:—

Distillation temp. of fraction, upper limit.	Sp.gr. of aromatic hydrocarbons.	Sp.gr. of non-aromatic hydrocarbons.
95° C.	0.880	0.720
120° C.	0.871	0.730
150° C.	0.869	0.760

Methods depending on solubility in dimethyl sulphate (Valenta, this J., 1906, 366), and the freezing method for the determination of benzene, were unsatisfactory.—W. E. F. P.

PATENTS.

Fuel briquettes; Smokeless and damp-proof—. J. E. G. Morand de Jouffrey. First Addition, dated June 16, 1914, to Fr. Pat. 460,123, June 18, 1913 (see Eng. Pat. 14,589 of 1914; this J., 1914, 1196).

THE agglomerant for the ground coal is modified by the substitution of rich or hydraulic lime for the Portland cement; the formation of a double silicate of sodium and calcium is facilitated by treating with steam; the product is heated after leaving the press; and a small quantity of rosin may be added to increase the cohesion.—W. F. F.

Briquetting with bituminous binding agents; Process for—. C. Fehr and E. Kleinschmidt. Ger. Pat. 284,789, June 20, 1913. Addition to Ger. Pat. 263,158 (this J., 1913, 901).

ASPHALT, soft pitch, rosin, or other materials which can be atomised whilst in a molten condition, and solidify to a dry powder, are used as binding material instead of pitch.—A. S.

Coke oven. K. Ellingen, Assignor to Dr. C. Otto and Co., G.m.b.H., Bochum, Germany. U.S. Pat. 1,151,298, Sept. 21, 1915. Date of appl. June 13, 1913.

COMBUSTION flues with passages for air supply are provided in the heating walls of the coking chamber, and are supplied with two kinds of fuel gas either separately or simultaneously. The valves controlling the gas supply passages are operated from a tunnel below the coking chamber.—W. F. F.

Carburettling method. T. D. Bottome, Indianapolis, Ind. U.S. Pat. 1,153,889, Sept. 21, 1915. Date of appl., Nov. 13, 1912.

LIQUID fuel is heated to a point just below boiling point, the pressure is reduced to produce volatilisation, and the volatilised fuel heated sufficiently to produce cracking, and then mixed with heated air.—W. F. F.

Gas-generating apparatus. C. D. McHenry, Martins Ferry, Ohio. U.S. Pat. 1,154,869, Sept. 28, 1915. Date of appl., Feb. 9, 1914.

OIL and water pass under pressure through pre-heating coils in the top of a furnace to an emulsifier, thence through a gasifying coil in the furnace, to a tank where the gas is expanded and superheated; the tank is encircled by the gasifying coil and communicates with it at the lower end.—W. F. F.

Suction gas producer. G. Martin. Fr. Pat. 474,558, July 3, 1914.

STEAM is generated in a pan having a metallic cover which supports the fuel in a vertical producer, so that the heat transmitted to the water is proportional to the temperature of the fuel, and thus to the rate of withdrawal of gas. The steam passes up through the incandescent fuel, and the gas passes around the fuel hopper, and thence to one or more delivery pipes.—W. F. F.

Gas producer with indirect heating by gas. A. Bormann. Ger. Pat. 284,702, Nov. 18, 1913.

THE walls of the producer chamber are formed by a series of firebrick heating tubes, in each of which is an inner firebrick tube. Steam or gas is supplied to the upper ends of the inner tubes and serves to transmit heat from the heating tubes to the fuel in the lower part of the producer chamber. The gas and air required for heating are preheated by passing through tubes or channels on the outer side of the heating tubes.—A. S.

Purifying gas; Process and substance for —. Gas purifying material. J. C. Heckman, Avalon, Pa. U.S. Pats. (A) 1,154,858 and (B) 1,154,859, Sept. 28, 1915. Dates of appl., March 2 and March 9, 1915.

(A) A FILTERING material for gas consists of a colloidal mass containing granulated blast-furnace slag mixed with hydrated iron oxide. (B) Coal mine water containing iron sulphide is passed through a bed of granulated blast-furnace slag, to produce hydrated sesquioxide of iron, which is deposited in the pores of the slag.—W. F. F.

Gas; Process of purifying —. M. P. P. Riis, Seattle, Wash. U.S. Pat. 1,156,022, Oct. 5, 1915. Date of appl., Oct. 21, 1914.

THE gas passes (1) through a tank of water or lime-water, (2) upwards through a second tank containing successive layers of charcoal, sawdust, and slaked lime, (3) through a third tank containing successive layers of (a) charcoal, sawdust, and slaked lime, (b) horse manure, (c) rusty iron chips, (d) sawdust and slaked lime, (e) a covering of burlap, and (4) through a mixture of sulphates of copper, zinc, and iron, and anhydrous copper sulphate.—W. F. F.

Washing and purifying [coal] gas; Apparatus for —. Soc. Gén. de Matériel à Gaz. Fr. Pat. 474,905, July 9, 1914. Under Int. Conv., July 15, 1913.

A RECTANGULAR washing chamber is provided at the bottom with a series of partitions of gradually diminishing height; the washing water passes in series through the troughs thus formed, whilst the gas passes through the chamber above the troughs in the opposite direction. The water is raised by a pump or the like from each trough to the top of the chamber, and falls back again into the same trough, as spray, between perforated plates. The space between the plates may be filled with fibrous or like material.—W. F. F.

Cyanogen and ammonia from distillation gases; Recovery of —. P. von der Forst. Ger. Pat. 280,652, Oct. 22, 1913.

THE ammoniacal liquor condensed from the distillation gases is distilled and the ammonia passed into a cyanogen washer placed before the ammonium sulphate saturator. The ammonia combines with the copper compounds in the cyanogen washer to form complex cyanogen compounds of ammonium and copper. On subsequent treatment of the solution from the cyanogen washer with dilute sulphuric acid to recover hydrocyanic acid, ammonium sulphate is formed and remains dissolved, and after removing the insoluble copper compounds for use again in the cyanogen washer, the ammonium sulphate solution is passed to the saturator.—A. S.

Refractory masses for flameless surface combustion; Process for obtaining porous —. O. Knöfler und Co. Ger. Pat. 284,395, Feb. 21, 1914.

ZIRCONIUM oxide, with or without titanium oxide, is used for the manufacture of porous refractory masses for flameless surface combustion.—A. S.

Hydrocarbons; Process and apparatus for refining —. E. D. Kendall, Elizabeth, N.J., Assignor to L. T. Haggin, Closter, N.J., M. V. Haggin and A. McCulloh, New York, and H. E. Moller, Montclair, N.J., Executors of J. B. Haggin, and to Estate of W. A. McGrath, Brooklyn, N.Y. U.S. Pats. (A) 1,154,516 and (B) 1,154,517, Sep. 21, 1915. Date of appl., Apr. 29, 1912.

(A) REGULATED quantities of the hydrocarbon and sulphuric acid are brought together and forcibly projected over restricted surfaces which can be rubbed together to effect intimate mixing

of the liquids. The treatment may be repeated with a fresh quantity of acid, and the hydrocarbon is then separated and washed with water and with alkali. (B) The acid and hydrocarbon are mixed in one or more tapering rotating vessels, having their lower sides horizontal, and provided with a perforated plate at each end and with movable balls between these plates. There is also a settling tank, communicating with a closed washing vessel divided into two compartments, each of which contains a perforated diaphragm.—C. A. M.

Motor spirit; Manufacture of —. Mme. la Marquise Veuve de Alunada née M. Baratoft. First Addition, dated Nov. 15, 1913, to Fr. Pat. 462,909, Dec. 3, 1912 (this J., 1914, 304).

ALCOHOL is saturated with hydrogen, methane or its analogues, or a mixture of the two, by agitation at atmospheric pressure and temperature. Easy starting of the motor from the cold is thus obtained.—W. F. F.

Agglomerates [of coal, ores, etc.]; Manufacture of —. A. Exbrayat, Paris. U.S. Pat. 1,154,980, Sept. 28, 1915. Date of appl., June 22, 1914. SEE Fr. Pat. 470,949 of 1913; this J., 1915, 215.

Coking coal briquettes; Apparatus for —. P. Hein, Essen-Rüttenscheid, Assignor to Diamant-Brikett-Werke Ges. m. b. H., Berlin, Germany. U.S. Pat. 1,155,486, Oct. 5, 1915. Date of appl., June 19, 1914.

SEE Fr. Pat. 472,402 of 1914; this J., 1915, 413.

Coke-oven. L. L. Summers, Chicago, Ill. U.S. Pat. 1,155,526, Oct. 5, 1915. Date of appl., May 22, 1914. SEE Eng. Pat. 10,284 of 1914; this J., 1915, 70.

Combustible gases; Method of producing —. H. Strache, Vienna. U.S. Pat. 1,154,455, Sept. 21, 1915. Date of appl., Feb. 12, 1915.

SEE Eng. Pat. 5730 of 1914; this J., 1914, 910.

Coal gas; Manufacture of ammonium sulphate and purification of —. J. MacKenzie, Middlesbrough. U.S. Pat. 1,155,753, Oct. 5, 1915. Date of appl., Mar. 29, 1915.

SEE Eng. Pat. 10,059 of 1914; this J., 1915, 897.

Petroleum and the distillates and residues from its distillation; Method of refining crude —. S. W. Whitmore, Cleveland, Ohio, U.S.A. Eng. Pat. 19,884, Sept. 17, 1914.

SEE U.S. Pat. 1,125,422 of 1915; this J., 1915, 218. Reference is directed, in pursuance of Sect. 7, Sub-sect. 4, of the Patents and Designs Act, 1907, to Eng. Pat. 9796 of 1900.

Gas analysis apparatus. Gas absorbing and indicating apparatus for gas analysers. U.S. Pats. 1,153,911 and 1,153,912. See XXIII.

IIB.—DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Examination of petroleum lamp oils. II. Determination of origin. Jungkunz. See IIA.

PATENTS.

Volatile products; Separation of — from solid carbonaceous material. Oil and Carbon Products, Ltd., London. Eng. Pat. 15,368, June 26, 1911. Under Int. Conv., Jan. 7, 1914.

COAL, shale, peat, or the like is conveyed by a helical conveyor through a slightly inclined retort from the lower to the higher end. A gradually increasing temperature from the inlet to the outlet

end is maintained by suitable external gas jets and by the internal conveyor (see following abstract). A cool inert gas is passed through the retort in the reverse direction so that volatile products are carried back through the cooler parts, being thereby condensed, and then withdrawn. The permanent gas evolved may be washed and used as the inert gas or the process.—W. F. F.

Screw conveyors [for retorts]. Oil and Carbon Products, Ltd., London. Eng. Pat. 15,381, June 26, 1914. Under Int. Conv., Jan. 7, 1914.

A SCREW conveyor, such as that used in the process described in the preceding abstract, is provided with rotary perforated gas burner pipes in its hollow shaft, the perforations being of graduated size corresponding to the range of temperature required in the retort.—W. F. F.

Volatile products distilled from carbonaceous material; Method of obtaining—, and apparatus therefor. J. R. H. and W. L. St. J. Prioleau, London. Eng. Pat. 9375, June 26, 1915.

THE material is slowly fed by a conveyor through a horizontal retort which is surrounded by a series of separate heating compartments, each provided with an adjustable gas burner. The volatile products are withdrawn separately from each zone of the retort by pipes leading to ejector condensers, which are operated by cool non-condensable gases as in Eng. Pat. 23,165 of 1914 (this J., 1915, 949). Part of the non-condensable gases from the retort may be supplied to the gas burners.—W. F. F.

Arc-lights; Electrode for—. C. W. Hill, Lakewood, Ohio, Assignor to National Carbon Co., Cleveland, Ohio. U.S. Pat. 1,154,393, Sept. 21, 1915. Date of appl., Aug. 25, 1911.

IN a flaming arc lamp, one electrode has a centre of pure carbon, and the other has a central core of pure carbon surrounded by a shell of flaming material. As the electrode is consumed, the core projects beyond the shell.—W. F. F.

Incandescent lamp. R. Jacoby, Berlin, Assignor to General Electric Co., New York. U.S. Pat. 1,154,514, Sept. 21, 1915. Date of appl., June 27, 1914.

A TUNGSTEN filament is used in a globe containing argon and 0.1 to 10% of nitrogen at a relatively considerable pressure, the filament being of such size that it operates at an efficiency higher than that which it would have in a vacuum for the same life of the lamp.—W. F. F.

Tungsten filaments; Process of producing—. E. A. Krüger, Seehausen, Germany. U.S. Pat. 1,154,701, Sept. 28, 1915. Date of appl., Aug. 25, 1913.

SEE Fr. Pat. 460,556 of 1913; this J., 1914, 69.

III.—TAR AND TAR PRODUCTS.

Phenol and picric acid; Synthetic—. A. H. Ney, National Exhibition Chem. Ind., New York, Sept. 24, 1915. Met. and Chem. Eng., 1915, 13, 686—690.

UP to the time of the Boer War synthetic phenol had only been produced in small quantities, but at that time, owing to the embargo placed on phenol, there was a considerable shortage on the Continent and F. Raschig commenced the manufacture on the large scale at Ludwigshafen and has continued it since whenever the comparative prices of benzol and phenol made it remunerative. In America it had not been produced up to the outbreak of the present war, when Edison, who required considerable quantities for the production of the artificial resins used in making phonographic disc records, took up the manufacture.

Manufacture of synthetic phenol from benzol. The benzol is sulphonated in a cast iron vessel of 300—350 gall. capacity, provided with heating and cooling means, and connected to a reflux condenser. An agitating device is used consisting of two oppositely mounted propellers on a vertical shaft or of one complete turn of a broad spiral, which is rotated in an open cylinder. 410 lb. of 98% sulphuric acid and then 153 lb. of benzol are run into the kettle and the agitator is started. The temperature rises to 62°—68° C. and when no further rise takes place, the vessel is heated to about the boiling point of benzol. The sulphonation takes about seven hours; the resulting sulphonic acid is run into a lead-lined vessel and neutralised first with milk of lime and finally with waste calcium carbonate. The mixture is boiled for about 30 minutes, a little water being added if it becomes too thick, and then, after turning off the steam, water equal to 1½ times the volume of the original sulphonation mixture is run in. These precautions are necessary to ensure the calcium sulphate being in a suitable condition for filtration and washing. The mixture is pumped through a filter-press and is washed with about 50% of its volume of water. The calcium benzenesulphonate solution is treated with solid sodium carbonate to convert it into the sodium salt. The precipitated calcium carbonate is used to neutralise the sulphonation mixture, and the sodium benzenesulphonate solution is evaporated and the product dried and powdered. 480 lb. of caustic soda and 30 to 50 lb. of water are melted in a fusion vessel of about 300 gall. capacity, heated to 270° C. and 600 lb. of dry sodium benzenesulphonate added. The temperature rises to about 300° and is finally raised to 315° C., when the heating is stopped. A slight further rise of temperature takes place, and the operation is complete when all the sodium salt has dissolved and the melt becomes thin. The product is ladled out into shallow trays, cooled, roughly crushed, dissolved in water, and treated with dilute sulphuric acid until evolution of sulphurous acid begins. A lead-lined vessel is not necessary, as only sufficient acid to form the bisulphite is used. The sulphurous acid is blown out with air and the crude phenol separated and distilled. The crystalline phenol obtained frequently possesses a disagreeable odour, due to sulphur compounds, which can be removed by digesting or distilling the crude phenol with animal charcoal. Many so-called improvements have been proposed but have not been successful in practice.

Manufacture of picric acid. Technically two methods are employed: (i) phenol is first sulphonated and then nitrated with a mixture of nitric and sulphuric acids; (ii) chlorobenzene is nitrated, the dinitrochlorobenzene formed is heated with caustic soda, and the resulting dinitrophenol is nitrated. The first process is most generally used and is carried out as follows. One part of phenol is sulphonated with four parts of 98% sulphuric acid in a large steam-jacketed vessel provided with an agitator. The resulting sulphonic acid is treated in a nitrating vessel, provided with cooling and heating coils, with an equal amount of sulphuric acid cooled to 20° C. and the nitrating acid, usually a mixture of equal parts of nitric and sulphuric acids, is run in. Instead of the three molecules of nitric acid required by theory, four are used. The contents of the vessel are kept below 40° C. while the first 30 or 40% of the nitric acid is added and then raised gradually to 70° or 80° C. The contents are then transferred to a non-metallic acid-proof vessel and diluted with an equal volume of water. The crystals which separate on cooling are drained on a vacuum filter. A purer product is obtained by melting the crystals and running the melted

material through a sieve of gold or platinum into cold water in a wooden tank. Large makers of picric acid use a filtering box in which a vacuum can be applied both above and below. The crystals are first drained by the vacuum and then washed with alcohol spray which removes the resin formed in the nitrating process. A cover is then put on and vacuum applied above so as rapidly to dry the crystals.—W. H. C.

p-Chloro-*m*-cresol and *p*-bromo-*m*-cresol. II. R. von Walther and K. Denmmeyer. *J. prakt. Chem.*, 1915, 92, 107—132. (See also this *J.*, 1915, 951.)

A LARGE number of further derivatives of *p*-chloro-*m*-cresol are described, of which the following are the most important: *p*-chloro-*m*-cresolsulphonic acid forms leaflets, m.pt. 93° C., containing two mols. of water. The sulphonic group is easily split off, even on treating the acid with water. Di-*p*-chloro-*m*-cresylcarbonate was obtained in silky needles, m.pt. 141° C., by passing carbonyl chloride into an alkaline solution of the cresol. By treatment of the cresol in alkaline solution with methyl and ethyl chloroformates, and mono-chloroacetic acid the corresponding carbonic acid esters, and *p*-chloro-*m*-cresoxyacetic acid were formed respectively. The latter crystallises from hot water in white prisms, m.pt. 176° C.; its salts and esters and mononitroderivative are described in detail. *p*-Chloro-*m*-cresol aldehyde was obtained by Reimers and Tiemann's method (*Ber.*, 9, 423, 824; 10, 1562; 15, 2685) from the chlorocresol, in relatively good yield, as pale yellow prisms melting at 68° C. Mono- and dinitrobromocresols were obtained in yellow crystals, melting at 124° and 111° C. respectively, by nitration in acetic acid solution. They form orange coloured salts with the metals of the alkalis and alkaline earths. From *p*-bromocresol a series of derivatives was prepared analogous to those from *p*-chlorocresol.—G. F. M.

Quinol; *Sulphonation of*—. J. Pinnow. *Z. Elektrochem.*, 1915, 21, 380—388.

THE sulphonation of quinol under conditions which exclude the formation of quinoldisulphonic acid, namely with sulphuric acid of a concentration not appreciably exceeding 13 molar, is a reversible process; when a considerable excess of sulphuric acid is used, the reaction is unimolecular as regards both quinol and its monosulphonic acid. The water formed in the reaction strongly retards the process, unduly prolonged heating of the reaction mixture leads to the formation of by-products owing to oxidation of the quinol by the sulphuric acid, and the use of a large excess of sulphuric acid may result in the formation of the disulphonic acid. Hence for the preparation of quinolmonosulphonic acid it is best to use a small excess of sulphuric acid and effect the reaction under diminished pressure so as to remove the water as it is formed. The best yield (about 71% of the theoretical) was obtained under the following conditions:—a mixture of 14.2 grms. of quinol and 18.3 grms. of concentrated sulphuric acid containing 1.3 grms. of water was heated for 1 hour on the water bath in a vessel connected with a suction device. The reaction product was diluted with water, the sulphuric acid precipitated with barium carbonate (the last traces with barium acetate), the solution treated with the calculated quantity of potassium acetate to convert the monosulphonic acid into the potassium salt, evaporated, and the potassium quinolmonosulphonate purified by recrystallisation from water acidulated with acetic acid. The potassium salt is readily soluble and is well suited for the preparation of concentrated stock solutions for photographic purposes (this *J.*, 1913, 451).

—A. S.

Phenylhydroxylamine; *Electrochemical synthesis of*—. F. M. Frederiksen. *Amer. Electrochem. Soc.*, Sept., 1915. [Advance proof.] 6 pages.

NITROBENZENE can be reduced electrochemically to phenylhydroxylamine without a diaphragm by using zinc electrodes and an aqueous alcoholic electrolyte containing ammonium chloride, the yield being about 20 to 28%, which is less than is obtained by the chemical process using zinc dust. Rising temperature increases the reduction efficiency, but also increases the formation of azobenzene. The best results were obtained at about room temperature.—T. C.

3-Oxy(1)thionaphthen; *Syntheses of derivatives of*—. S. Smiles and B. N. Ghosh. *Chem. Soc. Trans.*, 1915, 107, 1377—1381.

o-THIOLBENZOIC acid condenses with many substances containing the $-\text{CO}.\text{CH}_2.\text{CO}-$ group, giving either 3-oxy(1)thionaphthen itself or a derivative, but the reaction is not universal. In the case of ethyl malonate, ethyl acetoacetate, and acetylacetone, 3-oxy(1)thionaphthen is obtained, as the carbethoxy- or acetyl group is removed by the sulphuric acid employed in the condensation, but with dibenzoylmethane and benzoylacetone the corresponding dibenzoyl and monobenzoyl derivatives can be isolated. 2,2-Dibenzoyl-3-oxy(1)thionaphthen forms orange-brown needles with a characteristic odour, m.pt. 79° C., whilst the monobenzoyl derivative forms dark orange needles, m.pt. 115° C. When *o*-thiolbenzoic acid is condensed with excess of ethyl acetoacetate in sulphuric acid at 55° C., the 3-oxy(1)thionaphthen first formed again condenses with ethyl acetoacetate, yielding methyl(1)thionaphthocoumarin, crystallising from hot alcohol in pale buff-coloured prisms, m.pt. 164°—165° C. *o*-Thiolbenzoic acid condenses with ethyl oxaloacetate giving a compound crystallising from acetone or acetic acid in orange needles, m.pt. 186°—187° C., with decomposition, from which the oxythionaphthen complex could not be isolated.—T. C.

β -Methylantracene and β -anthraquinonecarboxylic acid. O. Fischer and K. Reinkober. *J. prakt. Chem.*, 1915, 92, 49—54.

THE action of chlorine on β -methylantracene results in the formation of mixtures of chloro-substitution products which differ according to the solvent employed and the duration of the treatment. Thus in carbon bisulphide solution a mixture of penta- and hexa-chloromethylantracenes is formed, and by longer treatment the nona- and deca-chloro compounds. In chloroform solution the product is mainly the hexachloro-compound melting about 193° C. In benzene a mixture of mono- and di-chloromethylantracenes is obtained when the hydrocarbon is suspended in the solvent, and chlorine passed in till a clear solution is obtained. By bromination dibromomethylantracene, m.pt. 141° C., and pentabromomethylantracene, m.pt. 300° (with decomp.), are formed. β -Methylantracene is reduced to *meso*-dihydro- β -methylantracene, m.pt. 51° C., by vigorous reduction with sodium and amyl alcohol. β -Methylantracene is very stable towards nitric acid, six hours' boiling being required to convert it into β -methylantraquinone and 8—10 hours heating in a sealed tube at 170° C. to oxidise it to β -anthraquinonecarboxylic acid. This acid forms ammonium and sodium and barium salts, all of which are soluble with difficulty in water. Crystalline salts with pyridine and quinoline were also prepared.—G. F. M.

Determination of aromatic hydrocarbons in cracked petroleum. Rittman and others. See IIA.

Examination of a condensate from carburetted water-gas. Sterne. See IIA.

Acid potassium and acid sodium phthalates as standards in acidimetry and alkali-metry. Hendrixson. See XXIII.

PATENTS.

α -Chloroanthraquinones [and other aromatic chloro-compounds]; Manufacture of—. Farb. v. m. Meister, Lucius, und Brüning. First Addition, dated June 24, 1914, to Fr. Pat. 446,323, Sept. 29, 1911. Under Int. Conv., July 5 and 9, and Nov. 18, 1913.

The process claimed in the main patent (this J., 1913, 130) for the manufacture of α -chloroanthraquinones by heating α -anthraquinone-sulphonic chlorides in presence or absence of indifferent solvents, e.g., by heating α -anthraquinonesulphonates with thionyl chloride, is applicable to the production of chloro-compounds from any arylsulphonic acids, arylsulphonic chlorides being produced as an intermediate stage. When a methyl group is present, it forms a CCl_3 group, which is converted into a carboxyl group by treatment with water, acids, or alkalis.

—F. W. A.

1-Hydroxy-2-nitroanthraquinone; Preparation of—. Chem. Fabr. Griesheim-Elektron. Fr. Pat. 474,551, July 2, 1914.

1-HYDROXY-2-NITROANTHRAQUINONE (m.pt. 189°C.) is prepared by nitrating 1-hydroxyanthraquinone in sulphuric acid solution in absence of boric acid, the small amount of the 1.4-isomer produced being removed by boiling with 80% acetic acid. In presence of boric acid the 4-nitro derivative is mainly formed. Reduction of the nitro-compound and diazotisation gives 1-hydroxy-2-diazoanthraquinone, which is converted with great difficulty into alizarin by heating in presence of water.—F. W. A.

Waterproofing and insulating agent [from coal tar]; Manufacture and application of a—. Soc. Anon. des Combustibles Industriels. Fr. Pat. 474,929, Jan. 9, 1914.

AN impervious, insulating, elastic, and stable substance, suitable for impregnating rigid or flexible porous substances, e.g., paper, fabrics, etc., is produced by the addition of heavy tar oils to coal tar freed from phenol, naphthalene, etc., and oxidising the mixture completely by a current of air at a suitable temperature. The impregnated material is cooled rapidly to cause the substance to solidify.—F. W. A.

Plastic and elastic material for tarring roads or for other purposes; Manufacture of a—. J. Rosen, Paris. U.S. Pat. 1,155,442, Oct. 5, 1915. Date of appl., Aug. 8, 1913.

SEE Fr. Pat. 460,943 of 1913; this J., 1914, 18.

Impregnating material [from coal tar]; Manufacture of—. J. Rosen, Assignor to Soc. Anon. des Combustibles Industriels, Paris. U.S. Pat. 1,155,443, Oct. 5, 1915. Date of appl., July 22, 1914.

SEE Fr. Pat. 474,929 of 1914; preceding.

IV.—COLOURING MATTERS AND DYES.

Dye testing; Use of the flame arc in paint and—. W. R. Mott. Amer. Electrochem. Soc., Sept., 1915. [Advance proof.] 26 pages.

THE light of a high amperage white flame arc at a distance of two feet is more powerful than sunlight, and, unlike sunlight, is exactly reproducible for dye and paint testing. Differently coloured flame effects are obtained as follows: "snow-white

flame" carbons give a light nearly equal to sunlight plus blue sky; "blue flame" carbons give strong ultraviolet light; "yellow flame" carbons give light rich in red, yellow and green, but weak in blue, and with some violet and ultraviolet; "red flame" carbons give light strong in red rays. A large number of dyestuffs have been compared in June sunshine and in the light of the snow-white flame arc, with essentially similar results: exposure to June sunshine for 50 hours gave an effect equal to that obtained in from 10 to 20 hours with a 28 amp. white flame at 10 in. distance. The nitrogen-filled incandescence lamp is much less effective than the 28 amp. flame arc, a deficiency in the blue causing considerably different results from sunlight. The white flame arc tests can be made in 10 hours, cheap dyeings fading in one hour. Fading is most marked with diluted dyestuffs, similar behaviour being shown by complex mixtures.

Lithopone gives the maximum darkening (also of greatest persistency) by exposure to the light of the "blue flame" carbons, rich in ultraviolet light. The maximum action occurs at low temperatures, supporting the theories of O'Brien (this J., 1915, 290) and Bancroft (Orig. Com., Inter. Congr. Appl. Chem., 1912, 20, 59) on the cause of the darkening of lithopone, and explains why lithopone is especially suited for interior painting.

A full summary of the literature referring to the fading of dyestuffs, with an abstract of each paper, is appended.—F. W. A.

Hydroxyketonic dyestuffs and their ethers; Action of Grignard's reagent on—. A. Sirker. Chem. Soc. Trans., 1915, 107, 1241—1247.

ALIZARIN dimethyl ether (1 mol.) on boiling with the Grignard reagent prepared from $1\frac{1}{2}$ mols. magnesium and $1\frac{1}{2}$ mols. ethyl iodide is converted into 10-hydroxy-5-keto-1.2-dimethoxy-10-ethylidihydroanthracene, crystallising from absolute alcohol in reddish-yellow needles, m.pt. 188°C. This substance on heating for one hour at 160°C. with anhydrous aluminium chloride is demethylated to form the corresponding trihydroxy derivative, which crystallises from absolute alcohol in pale red needles, m.pt. 275°C., and dyes chrome-mordanted wool a deeper violet than alizarin. When $2\frac{1}{2}$ mols. of the Grignard reagent is used, both keto groups of the alizarin dimethyl ether are attacked and 5.10-dihydroxy-1.2-dimethoxy-5.10-diethyldihydroanthracene is formed, crystallising from absolute alcohol in fine crimson needles, m.pt. 149°C., which on heating with anhydrous aluminium chloride are converted into the corresponding tetrahydroxy derivative, crystallising from absolute alcohol in brown needles, m.pt. 198°C. This substance dyes maroon shades on chrome-mordanted cotton. 7-Ethoxy- γ -benzopyrone treated with excess of magnesium *o*-methoxyphenyl bromide in ethereal solution gives a white crystalline substance, m.pt. 240°C., whilst ethyl 7-ethoxy- γ -benzopyrone-2-carboxylate treated with magnesium *o*-bromo-anisole gives only tarry products.—T. C.

PATENTS.

Vat dyestuffs of the anthraquinone series; Manufacture of—. A. G. Bloxam. London. From Chem. Fabr. Griesheim-Elektron, Frankfurt, Germany. Eng. Pat. 610, Jan. 14, 1915.

AN *o*-aminoazo-dyestuff, such as benzene-azo- β -naphthylamine, is condensed with anthraquinone-2-aldehyde or a substitution product thereof, giving in the example mentioned a quantitative yield of naphtho-N-phenyl-C- β -anthraquinonyl- α -dihydrotriazine, which dyes cotton a fast yellow shade from an alkaline hydrosulphite vat.

—F. W. A.

[Azo] dyestuffs; Red wool—*and process of making same.* O. Wulff, Assignor to Farb. vorm. Meister, Lucius, und Brüning, Höchst, Germany. U.S. Pat. 1,154,826, Sept. 28, 1915. Date of appl., Oct. 17, 1914.

DIAZOTISED aniline-*o*-sulphonic acid is combined with 2-amino-8-naphthol-6-sulphonic acid in acid solution. The resulting dyestuff yields salts which are red powders, readily soluble in water, very slightly soluble in alcohol, insoluble in petroleum spirit, and which dye wool from an acid bath red shades of great fastness to light. —F. W. A.

Vat dyestuffs of the anthracene series; Preparation of —. Farb. vorm. Meister, Lucius, und Brüning. Ger. Pat. 284,207, July 6, 1913.

o-DIAMINOANTHRAQUINONES are condensed with halogen derivatives of acetaldehyde, *e.g.*, chloral, to give blue to black vat dyestuffs, water and a halogen acid being also formed.—F. W. A.

Halogenated anthracridones; Production of —. Badische Anilin und Soda Fabrik. First Addition, dated June 19, 1914, to Fr. Pat. 459,105, June 11, 1913 (this J., 1913, 1101). Under Int. Conv., Nov. 26, 1913.

SULPHURYL chloride is used in place of the halogen solutions claimed in the main patent for converting 1-arylaminoanthraquinones containing a methyl group in the aryl or anthraquinone radical in *ortho*-position to the imino group, into halogenated anthracridones.—F. W. A.

Benzanthrone vat dyestuffs. Badische Anilin und Soda Fabrik. Second Addition, dated July 4, 1914, to Fr. Pat. 462,576, Nov. 25, 1912 (see Eng. Pats. 26,551 of 1912 and 5248 of 1913; this J., 1913, 1004; 1914, 194). Under Int. Conv., Dec. 27, 1913.

PURER and more reddish shades are obtained by introducing a halogen into the dyestuffs claimed in the main patent and the first addition; *e.g.*, the dyestuffs are prepared from halogenated amino-dibenzanthrones.—F. W. A.

Lakes; New coloured — *and process for their manufacture.* Badische Anilin und Soda Fabrik. Fr. Pat. 474,706, July 4, 1914. Under Int. Conv., Aug. 8, 1913, and May 28, 1914.

COLOURED lakes are obtained by precipitating basic dyestuffs with phosphotungstic, silicotungstic, or other complex acid or one of its salts.—F. W. A.

Azo dyestuffs; Production of new substantive —. Soc. pour l'Ind. Chim. à Bâle. Fr. Pat. 474,331, Nov. 20, 1913.

ONE mol. of a tetrazotised diamine, such as benzidine, tolidine, dianisidine, or their *ortho*-substitution products, is combined with 2 mols. of a monoazo-dyestuff prepared from 1 mol. of the diazo derivative of a *p*-nitroamine or of a monoacidyl-*p*-diamine with 1 mol. of 2,5,7-amino-naphtholsulphonic acid in neutral or acid solution. The polyazo-dyestuff obtained is converted into the corresponding aminoazo-compound by a suitable reducing agent or by saponification respectively. This reduction or saponification may be effected before combining with the diazotised *p*-diamine. The products are valuable direct cotton colours, which may be diazotised on the fibre, and then give with β -naphthol or *m*-diamines blue and black shades of excellent fastness to washing. —F. W. A.

Pyrazolone dyestuffs; Production of yellow — for wool, fast to milling. L. Cassella und Co. Fr. Pat. 474,561, Dec. 8, 1913.

DYESTUFFS for wool, fast to milling and to light,

are obtained by combining tetrazo-compounds of diaminotriarylmethanesulphonic acids with 2 mols. of the same or different arylmethylpyrazolones or their sulphonic acids.—F. W. A.

Sulphurised dyestuffs; Preparation of —. L. Cassella und Co. Fr. Pat. 475,014, Jan. 13, 1914.

N-SUBSTITUTED carbazoles (N-alkyl, N-aralkyl, and N-acyl) are heated to a high temperature with sulphur, preferably in presence of benzidine, tolidine, or other substance having a similar action. The yellow sulphurised dyestuffs obtained are distinguished by their purity of shade and good fastness to chlorine.—F. W. A.

Vat dyestuffs of the anthracene series; Preparation of —. M. Kardos. Ger. Pat. 284,210, May 4, 1913. Addition to Ger. Pat. 275,220 (this J., 1914, 827).

IN place of anthracene-1-9-dicarboxylic acid imide or its halogen substitution products, acanthrenequinoneoxime or its halogen substitution products are fused with alkali, the melt dissolved in water, and the dyestuff precipitated by treatment with air or other oxidising agent. Hydro-compounds of the vat dyestuffs described in the main patent are obtained.—F. W. A.

Azo dyestuffs; Mordant —. O. Stachlin. Assignor to Farb. vorm. Meister, Lucius, und Brüning, Hoechst, Germany. U.S. Pat. 1,155,765, Oct. 5, 1915. Date of appl., Oct. 1, 1913.

SEE Addition of July 25, 1913, to Fr. Pat. 361,649 of 1905; this J., 1914, 195.

Catalytic method of hydrogenation [and reduction]. Addition to Fr. Pat. 458,033. See XX.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Wools; Difference in weight between raw and clean —. W. S. Lewis. U.S. Bureau of Standards J. Franklin Inst., 1915, 180, 473.

THE loss in weight of various sorts of wool, due to removal of grease and dirt, was determined by scouring in a warm solution of pure olive-oil soap, and then extracting the residual grease with ether. The results obtained were from 1–3% higher than those of ordinary mill practice. Forty-nine fleeces treated in this manner gave losses of from 19.5 to 54%, according to the breed of sheep. With South Australian wools the greatest difference between two determinations of the same fleece was 3%, calculated on the basis of raw wool weight; for New Zealand wools, the maximum variation was 6%. The difference in the loss of weight shown by two fleeces of the same nature and place of origin was 9.5%; similar tests upon wools from 13 different breeds of sheep gave a mean variation of 4.5%.—E. H. T.

Sulphite pulp waste lyes and their utilisation [for the production of alcohol]. W. Kiby. Chem.-Zeit., 1915, 39, 212–214, 261–265, 284–285, 307–308, 350–352.

THE data published in connection with the manufacture of alcohol in Sweden from waste sulphite lyes by the processes of Wallin and Ekström (this J., 1910, 1032) are discussed, also the modifications more recently proposed by Landmark (this J., 1915, 275), according to which milk is added, and the yeast is specially acclimatised to the sulphite lye. Critical reference is also made to the fuel processes proposed by Strehlenert and Rinman (this J., 1913, 652; 1915, 274). As a result, the author concludes that the manufacture of alcohol

from the fermentable sugars of the lyes must form the nucleus of any successful system of utilisation, and that the recovery of other useful products, such as sulphurous acid, cell-pitch, fodders, fuels, or products of destructive distillation, must be made subsidiary to that object. Taking a ratio of 8—10 parts of lye to 1 of cellulose, the fermentable sugars are at a concentration of about 1.0—1.5%, with 0.5% of unfermentable, mainly pentoses. A higher yield than 88 litres of 100% alcohol per ton of cellulose from the sulphite lyes alone is hardly to be expected; calculations may be based on a yield of 80 litres. The points of fundamental importance in the treatment are the following:—The free sulphurous acid in the lye must be expelled by heating, preferably with recovery for re-use in the mill; this operation should be combined with concentration of the lye to about two-thirds of its original bulk in order to economise space in the distillery. The concentrated lye should be nearly neutralised with waste lime and decanted from the sludge, the final acidity being adjusted, if necessary by the subsequent addition of sulphuric acid, to the equivalent of 0.025% H_2SO_4 . It is imperative that complete attenuation should be effected with 24 hours' fermentation. For this, the yeast must be acclimatised to the lye and brought into the most active condition by preparation according to the principles of pure culture, first by absolute and then by "natural" pure cultivation. Secondly, attenuation must be stimulated by continuous removal of the carbon dioxide and by keeping the yeast in active suspension, either by moderate aeration or by mechanical agitation. Aeration is also desirable in the preliminary cultivation which immediately precedes the main fermentation. A triple-effect evaporating apparatus is described in which the first and second effects are used for concentrating the lye and the last effect for concentrating the spent wash from the distillation; the vapour from the last effect is utilised for heating the distillation plant. The fermented liquor must be distilled in a combined automatic distilling and rectifying apparatus of modern design, with maximum economy of heating-steam. A plant of this type is described, capable of treating 15,430 litres of wash per hour, producing rectified spirit of 97% strength and the usual by-products, from washes used in the manufacture of bakers' yeast by the aeration process, no richer in alcohol than the fermented sulphite liquor, *i.e.*, containing 0.77—1.05% by vol. This plant showed a consumption per 100 litres of wash of 14—15 kilos. of steam when producing rectified spirit and only 11.5 kilos. when making crude spirit. The cost of manufacturing alcohol from sulphite lyes is estimated at 10—15 s. per hl. of 100% alcohol. The spent wash may be mixed, after further evaporation, with the lime sludge from the neutralisation of the lye and subjected to destructive distillation, or may be dried for the manufacture of "cell-pitch" or of fodder preparations, the presence of the dead yeast being advantageous for this purpose. It is calculated that from the manufacture of 500,000 tons of sulphite pulp in Germany, 400,000 hl. of alcohol could be produced annually.—J. F. B.

PATENTS.

Degreasing raw and treated fibres with fat solvents; Process for —. C. Netz und Co., and F. Koch. Ger. Pat. 284,125, Nov. 15, 1913.

The current of gas used for the recovery of any solvent remaining in the material is treated with water to obtain a definite degree of humidity; the condensed water may be used for this purpose in order to avoid loss of the solvent suspended or dissolved in it. The fibrous material is placed on superposed hurdles in a casing, and the current of gas passes downwards through the layers in

succession. Beneath each hurdle are heating elements and also guide plates by which condensed liquid is conducted away, whilst the gas is made to pass close to the heating elements.—F. W. A.

Cellulose esters; Manufacture of new —. Soc. Chim. des Usines du Rhône, ancien. Gilliard, P. Monnet et Cartier, Paris. Eng. Pat. 10,822, July 26, 1915. Under Int. Conv., Aug. 4, 1914.

In the manufacture of cellulose esters with organic acids, methylene sulphate (obtained, *e.g.*, by the action of fuming sulphuric acid on trioxymethylene) is employed as a catalyst. Example: 100 grms. of cotton is treated with 610 grms. of acetic acid, 50 grms. of acetic anhydride, and 10 grms. of methylene sulphate at 30° C.; 250 grms. of acetic anhydride is added and the reaction allowed to proceed at 40° C. until the cotton is dissolved.

—J. F. B.

Hydrocellulose suitable for the manufacture of cellulose esters; Preparation of —. L. Paris and G. Picard. Fr. Pat. 474,464, Nov. 29, 1913.

THE esterification (acetylation) of cellulose on a large scale is difficult to control, on account of the necessity for hydrolysing the cellulose simultaneously. The difficulty may be overcome by employing a hydrocellulose prepared by the action of sulphuric acid (45° to 50° B., sp.gr. 1.453—1.53) on cotton in the cold. Example.—50 grms. of bleached carded cotton is soaked for four hours in 2.5 kilos. of sulphuric acid of 47° B. (sp.gr. 1.480, containing 57.83% H_2SO_4). It is then wrung out, washed successively with several changes of water, dilute sodium carbonate solution, and finally two more changes of water. The product is dried at 100° C. It requires less catalyst in acetylation than unchanged cellulose.—F. SP.

Viscose threads; Precipitating bath for the preparation of —. Soc. Anon. des Celluloses Planchon. Fr. Pat. 474,727, Dec. 19, 1913.

THE double sulphite of ammonium and sodium, *e.g.*, a solution of sodium bisulphite neutralised by ammonia and cooled, is used in the form of a saturated solution both as a coagulating and a decomposing bath for the preparation of threads and films from viscose. At 30°—40° C. it may be used as a precipitating bath, and loses practically no ammonia if kept slightly acid with excess of sodium bisulphite. At 80° to 90° C. it transforms cellulose xanthate into cellulose hydrate in about half an hour, and also removes sulphur and alkali polysulphides from the threads. The ammonia may be recovered from the spent bath by distillation with lime.—F. SP.

Viscose; Preparation of a saline solution of —. Soc. Anon. Soie de Saint-Chamond. Fr. Pat. 474,777, Dec. 26, 1913.

A SALINE viscose solution is prepared by dissolving cellulose xanthate in a solution of acid salts in water. Preferably salts of weak acids are used, *e.g.*, sodium bisulphite, sodium bicarbonate, or disodium phosphate, in the proportion of 10 to 15 kilos., 8 to 12 kilos., and 13—20 kilos. respectively to 100 kilos. of cellulose. The viscose solution thus obtained contains no free alkali, but a certain proportion of alkaline salts derived from the acid salts employed: the viscose is in a condition approximating to neutral xanthate. It requires less coagulant than the usual alkaline solution.—F. SP.

Wood pulp; Process of bleaching ground —. E. P. Foley, Thorold, Ont., Canada. U.S. Pat. 1,154,851, Sep. 28, 1915. Date of appl., Apr. 19, 1915.

THE pulp is formed into a thin sheet, pressed

between rolls, and wound up on the upper press-roll, while a thin film of "bleach" is applied to the pulp as it is being wound on the roll.—J. F. B.

Wood sulphite plants; Process of treating by-product liquors from—[to produce alcohol]. C. Marchand, Portland, Oreg. U.S. Pat. 1,155,256, Sep. 28, 1915. Date of appl., Mar. 24, 1915.

SULPHURIC acid is added to the waste sulphite liquor and the major portion of the sulphur dioxide recovered while evaporating the liquor under vacuum. The remaining traces of sulphurous acid are oxidised, e.g., by the addition of a "peroxide material," the acidity of the liquid is neutralised by lime, and the clear liquid decanted after settling and fermented to produce alcohol.—J. F. B.

Paper-machine [couch rolls]. L. J. Deane and M. P. Wingate, Millinocket, Me. U.S. Pat. 1,155,219, Sept. 28, 1915. Date of appl., Apr. 26, 1915.

THE couch-roll has open-work end walls and apertures in its cylindrical shell, and is covered with a water-absorbent jacket, which is continued inwards around the outer edge portions of the end walls. A flush pipe is arranged to discharge fluid into the shell through one of the open end walls, in order to remove deposits accumulating between the jacket and the shell.—J. F. B.

Shingle; Weather and flame resistant—and method of making same. S. R. Church, Brooklyn, N.Y., Assignor to Barrett Manufacturing Co., New York. U.S. Pat. 1,155,130, Sept. 28, 1915. Date of appl., June 16, 1915.

FIBROUS materials are treated with a composition comprising an incombustible waxy body and a combustible waxy body, which serves as a non-volatile solvent of the former, with or without a volatile solvent for both. A suitable combination consists of hexachloronaphthalene with wax tailings.—J. F. B.

Pulp for making paper and like materials; Process for treating—H. Arledter, Frodsham. U.S. Pat. 1,153,883, Sept. 21, 1915. Date of appl., July 25, 1910.

SEE Fr. Pat. 418,584 of 1910; this J., 1911, 80.

Sugar-cane [bagasse]; Process of treating—[for paper-making]. T. Lee, Dedham, Mass., Assignor to United Fruit Co., Boston, Mass. U.S. Pat. 1,155,741, Oct. 5, 1915. Date of appl., Sept. 16, 1913.

SEE Eng. Pat. 17,834 of 1914; this J., 1915, 606.

Manufacture of a waterproofing and insulating agent [from coal tar]. Fr. Pat. 474,929. See III.

Preparation of a tanning extract from waste sulphite-cellulose liquors. Fr. Pat. 474,336. See XV.

Preparation of organic acid anhydrides, of corresponding new industrial products, and their technical application. Fr. Pat. 474,828. See XX.

Manufacture of an explosive from liquid air and carbon [from waste sulphite-cellulose lye]. Fr. Pat. 474,819. See XXII.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Mercedised cotton; Investigations on—W. Harrison. J. Soc. Dyers and Col., 1915, 31, 198—203.

THE products obtained by the action of caustic

soda on cotton are most probably adsorption compounds, but as changes in the physical state of the fibre are produced by certain concentrations of caustic soda, the ordinary adsorption formula will not be followed. The nature of the change produced in cotton by the mercerisation process has been investigated by means of the reactions with iodine. Mercerised cotton contains cellulose in a higher degree of dispersion than in ordinary cotton. The shrinking and untwisting of the cotton fibres during mercerisation are due to strains within the fibre acting when the cotton has been softened by the caustic soda. The author's results do not agree with the theory of Hübner and Pope (this J., 1904, 23, 410), the lustre of mercerised fibres being due mainly to their smooth surface in comparison with fibres unmercerised and mercerised without tension; the section of all fibres is found to have an influence on the lustre, particularly if such fibres have smooth surfaces. The lustre of beetle finish is explained by surface reflection, and the lustre of a Schreiner finish is due to fine parallel lines, the cause of lustre differing in both cases from that to which the lustre of mercerised cotton and artificial silk is due.—F. W. A.

Acid dye-bath: Mechanism of the—IV. M. Fort and E. Pearson. J. Soc. Dyers and Col., 1915, 31, 222—224.

THE absorption of an acid dyestuff (Crystal Scarlet) by wool is caused by the addition of hydrochloric acid to the dye-bath in the same manner as previously found for sulphuric acid (this J., 1915, 488). The wool used was prepared specially from selected merino by dry-combing; in the scouring and back-washing no alkali was used, and the soap employed was neutral; the product was a very white fibre, the dyeing and acid-absorptive properties of which had not been increased by alkaline action.—F. W. A.

Nitrate discharges; Processes involving—M. Freiburger. Färber-Zeit., 1915, 26, 41—46, 57—60, 77—81, 93—96, 103—105. Z. angew. Chem., 1915, 28, Ref., 344. (See also this J., 1913, 696.)

IN discharging with nitrosylsulphuric acid, the process is carried out in an acid-proof tank, and is followed by washing and treatment with dilute alkali or a chromate bath. A mixture of nitrate and nitrite is incorporated with the discharge; in addition to the sodium salts, zinc nitrate and lead nitrate have been used, the latter developing to a chrome yellow on immersion in a chromate bath. The following gives a white discharge on deep indigo goods: 30 grms. wheat flour, 15 grms. wheat starch, 240 grms. water, 6 grms. oil, 30 grms. tragacanth water, 280 grms. sodium nitrate, 50 grms. dextrin solution, 50 grms. gum water, 220 grms. barium sulphate paste, 80 grms. sodium nitrite.—F. W. A.

Fixing of vat dyestuffs by steaming. G. Tagliani. Färber-Zeit., 1915, 26, 73. Z. angew. Chem., 1915, 28, Ref., 343.

THE fixing of vat dyestuffs by steaming depends on the physical condition of the material and the manner in which the dyestuffs have been printed. If the material is prepared with a suitable slightly hygroscopic solution, such as a solution of maltodextrin or starch-syrup, and is then printed with a vat dyestuff mixed with hydrosulphite and alkali, reduction occurs on steaming and the dyestuff is fixed. More intense and brighter shades are produced than is the case if the preparation of the material is omitted.—F. W. A.

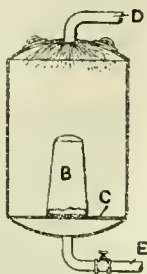
PATENTS.

Mixtures of borates containing active oxygen. Processes of bleaching. F. L. Schmidt, Charlottenburg, Germany, Assignor to The Roessler and Hasslacher Chemical Co. U.S. Pats. 1,155,101 to 1,155,104, Sept. 28, 1915. Dates of appl., Jan. 25, 1910, Jan. 9, 1911, May 7, and May 7, 1914.

SEE Eng. Pat. 475 of 1910; this J., 1910, 816. Separate claim is made for washing and bleaching fibres by means of a perborate in presence of a soluble inorganic compound of an alkaline earth metal or of magnesium in less than an equivalent proportion, or in presence of a soluble inorganic compound of zinc in less than a molecular proportion.

Textile fibres with liquids; Apparatus for the treatment of —. J. Hirschberger, Jersey City, N.J. U.S. Pat. 1,154,631, Sept. 28, 1915. Date of appl., Dec. 10, 1910.

A KIER is fitted with a perforated false bottom, C, for holding textile fabrics, and contains a non-perforated closed conical receptacle, B, by which the interior area of the lower part of the kier is diminished from above downwards. The liquid, admitted at D, thoroughly penetrates the fabric without entangling it, and is removed through E.—F. W. A.



Electro-metallic dyeing; Process of —. A. V. M. and J. L. Bechetoille. Fr. Pat. 475,019, Jan. 13, 1914.

THE metal is deposited electrolytically, e.g., gold on artificial silk from the double cyanide solution, and fixed by means of formaldehyde.—F. W. A.

Mordant dyestuffs insoluble in water; Process for dyeing with —. R. Wedekind und Co. Ger. Pat. 283,716, Dec. 24, 1912. Addition to Ger. Pat. 275,570 (see Fr. Pat. 451,533; this J., 1913, 598).

INSTEAD of oiling and mordanting the goods before treatment with insoluble mordant dyestuffs, the mordant or oil and mordant are added directly to the padding mixture. Unstable lakes are produced in the cold, which are fixed by steaming or boiling with water. Deep, level, and fast shades are obtained by drying unoled goods for some time at 60°–70° C. before developing.—F. W. A.

Drying of printed goods. Soc. Alsacienne des Constructions Mécaniques. Fr. Pat. 474,877, July 8, 1914.

PRINTED goods are submitted to a preliminary drying in a stretching machine before introduction into the drying stoves.—F. W. A.

[Textile] materials; Machine for treating — with a liquid. F. Schubert, Hamburg, Germany. U.S. Pat. 1,154,440, Sept. 21, 1915. Date of appl., Mar. 5, 1913.

SEE Eng. Pat. 4569 of 1913; this J., 1913, 908.

Dyeing machine. J. T. Psarski, Assignor to The Psarski Dyeing Machine Co., Cleveland, Ohio. U.S. Pat. 1,155,438, Oct. 5, 1915. Date of appl., Feb. 28, 1910.

SEE Fr. Pat. 416,866 of 1910; this J., 1910, 1373.

Manufacture of a waterproofing and insulating agent [from coal tar]. Fr. Pat. 474,929. See III.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Decomposition potentials of fused alkali hydroxides. B. Neumann and E. Bergve. Z. Elektrochem., 1915, 21, 143–152.

THE authors discuss the indirect methods of determining the voltage necessary to decompose the various alkali and alkaline-earth hydroxides, and state that the figures thus obtained, namely, 2.7 volts for sodium hydroxide, and 3.1 volts for potassium hydroxide, are of questionable value. The method of direct estimation consists in passing carefully measured currents through the absolutely dry hydroxide, fused at a definite temperature, using nickel electrodes of 2.5 mm. diameter and measuring the voltage by a millivoltmeter. The results are tabulated and plotted on charts, the values for sodium hydroxide being 2.2 volts at 340° C., 2.05 at 390° C., 1.87 at 450° C., 1.6 at 543° C., and 1.32 volts at 640° C.; the average temperature coefficient is 2.95×10^{-3} . Similar results are given for potassium hydroxide, molecular mixtures of sodium and potassium hydroxides in the air, potassium hydroxide in an atmosphere of nitrogen, mixed sodium and potassium hydroxides in nitrogen, and lithium hydroxide.—W. G. C.

Decomposition potentials of fused alkali halides and alkaline-earth chlorides. B. Neumann and E. Bergve. Z. Elektrochem., 1915, 21, 152–160.

THE method used was similar to that described in the preceding abstract, but carbon electrodes were employed. Direct determinations of the decomposition potentials of sodium, lithium, and potassium halides are given, and the results are tabulated. The following table sums up the results.

Com- pound.	Potential, volts.	Temp. coeff.	Com- pound.	Potential, volts.	Temp. coeff.
LiCl	2.62	1.35×10^{-3}	NaI	2.05	1.48×10^{-3}
NaCl	2.6	1.46×10^{-3}	KI	2.2	1.48×10^{-3}
KCl	2.8	1.51×10^{-3}	CaCl ₂	2.85	0.685×10^{-3}
NaBr	2.45	1.465×10^{-3}	SrCl ₂	3.0	0.715×10^{-3}
KBr	2.6	1.165×10^{-3}	BaCl ₂	3.05	—

—W. G. C.

Ammonia equilibrium at the ordinary pressure. Investigations on ammonia. III. F. Haber and A. Maschke. Z. Elektrochem., 1915, 21, 128–130.

A MIXTURE of one part of nitrogen with three parts of hydrogen was dried with sulphuric acid and freed from carbon dioxide by soda lime or barium hydroxide. This mixture was passed over a catalyst in a glazed porcelain tube heated electrically, and then into a known amount of standard acid free from ammonia, and the unabsorbed gas passed into a calibrated burette. The catalyst used was palladium or iron asbestos, or uranium carbide, which becomes converted to a nitride and is very active. The catalyst was placed in the porcelain tube so that no trace touched the cool outlet end of the tube; rubber was excluded. The temperatures were taken by a thermocouple calibrated against the melting points of gold, antimony, and sulphur. Particulars of experiments at 1100°, 1000°, 850°, 700°, and 600° C. are given. The values of the equilibrium

constant $\frac{P_{\text{NH}_3}}{P_{\text{N}_2} \cdot P_{\text{H}_2}^3}$ found were: 1100° C., 0.92×10^{-4} ; 1000° C., 1.39×10^{-4} ; 850° C., 2.71×10^{-4} ; 700° C., 6.57×10^{-4} ; and 600° C., 13.8×10^{-4} .—W. G. C.

Potash from felspar; Investigation of the extraction of —. E. H. Quinney. *Chem. News*, 1915, 112, 189—191. (See also U.S. Pat. 1,125,007 of 1915; this J., 1915, 229.)

DETAILS are given of laboratory experiments in which orthoclase felspar containing 9.02% K_2O was heated with various reagents with the object of producing soluble salts of potassium. Heating with calcium fluoride and sulphuric acid or with phosphate rock and sulphuric acid did not give satisfactory results, the percentage of the total potash rendered soluble being only 37 and 21—22 respectively. By heating to redness with 2 parts of gypsum for 1 hour, 27.4% of the total potash was rendered soluble, whilst with 8 parts of gypsum, 98% of the total potash was rendered soluble after 2 hours. An extraction of 84.6% of the total potash was obtained by heating with 1.2 parts of salt and excess of sulphuric acid for 1½ hours to redness, and then for 20 mins. over a blast flame; and an extraction of 82% by heating with 1 part of salt and excess of sulphuric acid for 2 hours at about 1200° C.—W. E. F. P.

Sulphurous acid in sulphites and bisulphites; Determination of —. E. Knecht and E. Hibbert. *J. Soc. Dyers and Col.*, 1915, 31, 209—210.

SULPHITES may be analysed by addition to an excess of $N/10$ bichromate made alkaline with excess of caustic soda, and gradually acidifying the mixture with sulphuric acid, when the following reaction occurs:



The excess of chromic acid is then determined by means of titanous chloride. The results obtained agree with those obtained by the iodine method of Giles and Shearer (this J., 1884, 197; 1885, 303).

—F. W. A.

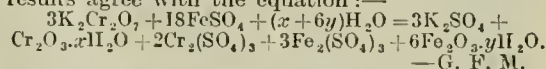
Calcium carbonate; Dissociation of — below 500° C. R. B. Sosman, J. C. Hostetter, and H. E. Merwin. *J. Wash. Acad. Sci.*, 1915, 5, 563—569.

ARAGONITE is rapidly transformed into calcite at 470° C., and hence, if it is a metastable form at all temperatures, its dissociation pressure should be measurably higher than that of the calcite below 470° C. Preliminary experiments showed that aragonite was completely converted into calcite by heating with lime at 425° C., whereas no conversion occurred at 400° C. Measurements were also made on the two forms in a vacuum furnace at 400° C., but without definite result, owing probably to the slow rate of dissociation of the dry materials, whether heated alone or in the presence of lime or ferric oxide. The dissociation pressures observed at 400° C. were of the order of magnitude of 0.003 to 0.009 mm.; and at 425° C. aragonite was completely transformed into calcite within an hour. Pure lime was obtained in two forms, one porous (probably amorphous), resulting from dissociation of calcium carbonate at a low-red heat; and the other crystalline (cubic), produced by heating the porous variety for a considerable time at higher temperatures. The latter has a refractive index of 1.83, forms directly from silicate melts or from fused calcium nitrate, and is the stable form at high temperatures; it appears to have an inversion point between 400° and 430° C., and combines very slowly with dry carbon dioxide. The porous variety combines very readily with dry carbon dioxide, the resulting compound dissociating rapidly with rising temperature.—W. E. F. P.

Oxidation and reduction without the addition of acid. I. The reaction between ferrous sulphate and potassium bichromate. M. Nield and J. C. Witt. *J. Amer. Chem. Soc.*, 1915, 37, 2360—2368.

FERROUS iron is oxidised by potassium bichromate

in neutral solution, but a larger amount of bichromate than the theoretical is required to complete the oxidation, this excess varying according to the dilution of the ferrous solution employed. By stopping the reaction at definite periods by adding ammonia solution and titrating the bichromate remaining, after filtering off the precipitated iron and chromium hydroxides, it was shown that the oxidation was almost instantaneous except in very dilute solutions. Preliminary experiments indicated that ferrous iron was completely precipitated by ammonia, provided that no ammonium salts were present, that the concentration was sufficiently low, and that the solution was boiled before filtration. The order of the reaction with the bichromate was higher than the fourth, and the products were potassium, chromium, and ferric sulphates, together with colloidal hydrated oxides of iron and chromium which adsorb a large quantity of ferric sulphate and smaller quantities of the other two sulphates. The quantitative results agree with the equation:—



—G. F. M.

Ferric and aluminium hydroxides; Effect of ammonium chloride upon — during ignition. H. W. Daudt. *J. Ind. Eng. Chem.*, 1915, 7, 847—848.

EXPERIMENTS in which precipitates of ferric hydroxide and aluminium hydroxide were washed with ammonium chloride solutions of 1%, 5%, and 10% concentration respectively, showed that with 5% and 10% solutions there was a slight loss of iron in the subsequent ignition, but none when 1% ammonium chloride solution was used; there was no loss of aluminium even when 5% ammonium chloride solution was used. In ordinary analytical practice it is not necessary to wash the hydroxide precipitate free from ammonium chloride, because the concentration will never be as high as 1%. Small quantities of ammonium chloride in the washing water facilitate the filtration. Satisfactory filtration of aluminium hydroxide can be attained by precipitating in a boiling solution, boiling for ½ min., and then immediately transferring to the filter.—A. S.

Hydrogen peroxide in aqueous solution; Thermal decomposition of —. W. Clayton. *Faraday Soc.*, Oct. 19, 1915. [Advance proof.] 8 pages.

THE chief factor affecting the rate of thermal decomposition of aqueous solutions of hydrogen peroxide is the degree of purity of the water. The hydrogen and hydroxyl ions of the solvent do not exercise any appreciable influence, nor do factors such as volatility or stirring, but traces of colloidal organic matter have a very pronounced accelerating effect on the rate of decomposition. The rate of decomposition using the purest water obtainable was one-tenth of the rate using conductivity water (conductivity 1.1 gemmho) and one-fiftieth of the rate using tap water. The failure of previous workers to recognise the importance of the purity of the solvent throws doubt on previously recorded results, so that it is still an open question as to whether the surface of the containing vessel has any effect on the rate of decomposition of hydrogen peroxide solutions.—T. C.

Catalytic influence of the walls of the containing vessel [on the decomposition of hydrogen peroxide]. G. von Elissaffoff. *Z. Elektrochem.*, 1915, 21, 352—356.

IT is known that decomposition of hydrogen peroxide takes place in contact with the glass walls of the containing vessel, and in order to study the effect of larger surfaces of solid materials, experiments were made with glass wool and sand. The

rate of decomposition of the hydrogen peroxide was found to be from twice to six times greater in presence of glass wool or sand. When a copper or manganese salt was added in addition to the glass wool, the accelerating effect on the decomposition was considerably greater than the sum of the effects of the glass wool and the metallic salt separately. This is considered to be due to the reaction taking place at the surface of the glass wool, where the concentration of the metallic salt is increased owing to adsorption; and in agreement with this it was found that the velocity constants of decomposition of hydrogen peroxide in presence of glass wool and copper sulphate are proportional to the quantities of copper sulphate adsorbed by the glass wool.—A. S.

Hydrogen and oxygen; Activation of—by platinum. J. Eggert. Z. Elektrochem., 1915, 21, 349—352.

EXPERIMENTS on the reduction of ferric salt solutions by hydrogen and the oxidation of ferrous salt solutions by oxygen in presence of platinised platinum gauze are described. It was found previously (Z. Elektrochem., 1914, 20, 370) that the maximum effect is obtained when the platinised platinum is alternately in contact with the gas and with the solution. This is now shown to be due not to alternate occlusion and discharge of the gas, but to a continuous contact action of the platinum on the reaction between the gas and the thin layer of solution adhering to the platinum. Hydrogen is capable of diffusing in platinised platinum and thus of exerting chemical action at a place different from that at which it was occluded. At pressures between 0.25 and 4 atmospheres the activation of hydrogen and oxygen by platinised platinum is in accord with Henry's law, i.e., the volume of gas absorbed by the platinum is proportional to the pressure. Electrolytically deposited platinum and palladium have approximately the same catalytic activity, but colloidal solutions of these metals are much more active owing to their greater surface.—A. S.

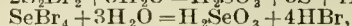
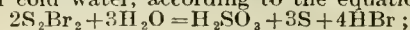
Nitrogen; Electrical activation of—. A. Koenig. Z. Elektrochem., 1915, 21, 267—286.

ACTIVE nitrogen is produced in flames, explosions, and electrical discharges. Strutt (this J., 1911, 638) considers that the after-glow of a Geissler tube with nitrogen under low pressure is due to the spontaneous re-combination of monoatomic active nitrogen to the inactive molecule, and that increase in pressure accelerates the inactivation of the nitrogen. The spectrum of the after-glow is similar to that of ordinary nitrogen, showing that the active nitrogen of Strutt is not free from ordinary nitrogen. Experiments with specially pure nitrogen showed that the production of after-glow is not due to impurities (oxygen, nitric oxide) but is a reaction of elementary nitrogen. This effect is unfavourably influenced by traces of metallic vapour or dust, owing to the formation of nitrides as well as the catalytic hindrance of the activation of the nitrogen, and this difficulty is removed by traces of oxygen which oxidise the metal. Active nitrogen reacts with ethylene, acetylene, pentane, nitric oxide, and metals, but not with hydrogen, methane, water vapour, oxygen, or ozone. Pure oxygen shows a faint after-glow under reduced pressure, and the gas thus obtained combines with active nitrogen to form nitric oxide. This is the first proof of the formation of a compound of nitrogen and oxygen at low temperatures.—W. G. C.

Selenium in sulphur; Determination of—. W. Smith. J. Ind. Eng. Chem., 1915, 7, 849—850.

THE method is based on the fact that the bromides

of sulphur and selenium are decomposed by excess of cold water, according to the equations:



and that the decomposition of the selenium compound is very rapid compared with that of the sulphur compound. The selenous acid, with any selenic acid produced by oxidation, is subsequently decomposed with hydriodic acid, with separation of iodine and selenium. 50 grms. of the finely ground sulphur is treated with somewhat more than 50 c.c. of bromine and after 15 mins. the product is shaken vigorously for 1 min. with 40 c.c. of bromine water in a separating funnel. The aqueous solution is poured through a wetted filter paper, and the residual sulphur bromide shaken four times in succession with 2 c.c. of bromine and 40 c.c. of bromine water, the final extract being kept separate. If sulphur should separate, a larger proportion of bromine is added. The combined extracts, with the exception of the last, are boiled till clear, free bromine is removed by adding potassium metabisulphite or sulphite, the solution diluted to 250 c.c., treated with 15 c.c. of hydrochloric acid and 5 grms. of potassium iodide, and boiled till the precipitation of the selenium is complete. Potassium metabisulphite or sulphite is added to remove free iodine, the solution is boiled for 20 mins., and the selenium collected in a Gooch crucible, washed with hot water, dried at 100° C., and weighed. The last extract is treated in the same way, using proportionate quantities of acid and iodide, and if selenium be present, the extraction is repeated as often as necessary. Satisfactory results were obtained by this method with mixtures of sulphur with red and with black selenium and with a product obtained by melting black selenium with arsenic and sulphur. Four samples of Japanese sulphur were found to contain:—(1) 0.8% As, 0.152% Se, (2) 0.7% As, 0.085% Se, (3) 0.5% As, 0.055% Se, and (4) 0.3% As, 0.045% Se. Tellurium if present would be estimated with the selenium, but in several samples of crude selenium from sulphuric acid chambers, tellurium was either absent or present only in very small quantity (up to 0.1% of the selenium). Selenium and tellurium may be determined together by the method given and then the tellurium in the precipitate determined as dioxide by Browning and Flint's method (Amer. J. Sci., 1909, 28, 112).—A. S.

Distillation of gas liquor without lime. Unger. See IIA.

Electrolysis of nitric, sulphuric, and orthophosphoric acids using a gold anode. Electrolysis of concentrated hydrochloric acid using a copper anode. Jeffery. See XI.

Treatment of sewage for obtaining ammonium sulphate. Kalouchsskii. See XIXB.

Chemical composition and valuation of lime-sulphur wash. Bodnár. See XIXB.

PATENTS.

Sulphuric acid; Manufacture of—by means of a system composed of six or more towers. E. Hartmann (vorm. E. Hartmann und F. Benker) Ges. m. b. H. Ger. Pat. 284,636, Dec. 13, 1912.

THE first tower of the series is connected with the last tower but one, and the second tower with the last tower, to form two closed systems, in so far as circulation of the acid is concerned. The last tower but one serves as the chief Gay-Lussac tower, and if the temperature of the burner gases is not sufficiently high to ensure complete denitration of the acid in the first tower, acid may

be drawn off instead from the second tower, since this tower receives acid from the last tower (auxiliary Gay-Lussac tower) with a considerably lower content of nitrogen compounds than the acid passing to the first tower.—A. S.

Sulphuric acid; Process for increasing the productive capacity of a tower system for the manufacture of—. Metallbank und Metallurgische Ges. A.-G., and H. Klencke. Ger. Pat. 281,095, Nov. 25, 1913.

THE gases are led in a downward direction through some or all of the acid-forming towers. In this way the nitrous vitriol comes in contact with the gases whilst they still have a high content of sulphur dioxide, and the acid and gases flow through the entire height of the tower in intimate contact, thus affording opportunity for vigorous reaction and for condensation of the sulphuric acid formed without obstructing the passage of the gases.—A. S.

Alkali chloride solutions; Electrolysis of liquids, especially of—. Ges. f. Chem. Ind. in Basel. Ger. Pat. 284,022, Aug. 16, 1913.

TUBULAR filter-electrodes are used and are so arranged that the lines of current flow and the direction of the flowing electrolyte are approximately parallel, and at right angles to the filter-surface, i.e., entering and leaving the electrodes in a radial direction.—A. S.

Nitrogen; Fixation of—by means of ferro-aluminium. Soc. Gén. des Nitrures. Fr. Pat. 474,330, Nov. 20, 1913.

A CURRENT of nitrogen is passed over a mixture of ferro-aluminium, bauxite (or similar substance), and carbon, at 1200°—1300° C. The reaction is exothermic and the temperature of the mass rises quickly to about 1850° C., after which it falls slowly; it is maintained at above 1500° C. for 5 hours. Ferro-silicon, ferro-boron, or similar substances, may be used, either separately or admixed, or the oxide of a nitrogen-fixing element may be added to the other materials.—E. H. T.

Copper phosphide; Manufacture of—. C. Janensch. Fr. Pat. 474,437, June 27, 1914.

MELTED phosphorus is forced by hydraulic pressure into a bath of molten copper in the absence of air. The method is applicable to the preparation of other phosphides, notably those of tin, zinc, lead, and aluminium.—E. H. T.

Sulphates; Process for making metallic—. Soc. Minière et Métall. de Peñarroya. Fr. Pat. 474,499, Dec. 1, 1913.

METALLIFEROUS minerals or waste are sprinkled with water and subjected to a current of sulphur dioxide mixed with air. The resulting liquid contains the sulphates of the metals, and may be used again for sprinkling in order to increase its concentration. When ferruginous matter is used the state of oxidation of the metal is determined by the amount of air used. The process may be conducted at the ordinary temperature, but proceeds much more quickly when the temperature is raised. The sulphur dioxide emitted in smelting operations may be used, and the sulphates obtained may be employed for the production of sulphuric acid.—E. H. T.

Calcium sulphate; Utilisation of waste—. H. Jacob. Fr. Pat. 474,509, Dec. 2, 1913.

WHEN calcium sulphate is brought into contact, at a suitable temperature, with sodium or magnesium carbonate in presence of sodium or potassium chloride, which act as catalysts, sodium or magnesium sulphate and calcium carbonate are formed. To obtain magnesium sulphate, 5.86

pts. of calcium sulphate (calculated as anhydrous) and 4.46 pts. of magnesium carbonate of 93% purity are crushed and mixed, and then introduced slowly into water saturated with salt at 34° C. After standing for 1 hour the mixture is boiled for 20 minutes, the supernatant liquid is decanted, and the magnesium sulphate separated from it by crystallisation.—E. H. T.

Aluminium silicides, nitrides, and the like; Manufacture of—. L. C. E. Gautrelet. Fr. Pat. 474,503, Dec. 2, 1913.

A PURE aluminium silicide of the formula $Al_{10}Si$ is produced by the interaction of aluminium, magnesium silicate, and magnesium at a high temperature. To 4320 grms. of molten aluminium at 750°—800° C., 378 grms. of powdered talc and 192 grms. of magnesium are added and well stirred in, thereby lowering the temperature to about 650° C. When the pasty mass has liquefied, two layers are formed, the upper of which, consisting of magnesia and impurities, is skimmed off, and the lower one of aluminium silicide (4432 grms.) is run into moulds. The silicide is silver-white and of metallic appearance; it is very hard, of high tenacity and elasticity, very sonorous, and can be easily rolled or hammered. Its sp.gr. is 2.635—2.655, and it is stable in air and in water, including sea water. To avoid the presence of free silicon in the product, a catalyst, such as colloidal manganese, may be added; it is introduced into the molten mass in the form of manganese pinate (0.13 grm.). If an oxygen compound of aluminium, e.g., bauxite, be roasted at 1200° C. with the same materials, in a current of air, or preferably in an excess of nitrogen, and in presence of coke and the same catalyst, an aluminium nitride containing about 26% of nitrogen is obtained. When this is distilled with caustic soda, ammonia, hydrogen, and sodium aluminate are formed: the ammonia is converted into sulphate, and the aluminate may be converted into oxide, and used as a source of aluminium. The nitride may be distilled with brucite ($MgO.H_2O$) producing ammonia, hydrogen, and magnesium aluminate, and the last-named decomposed with iron-free hydrochloric acid, yielding magnesium chloride and alumina. The alumina may be used for aluminium extraction, or converted into pure aluminium silicide. The manganese pinate is best prepared by dissolving colophony (78.4 grms.) in warm caustic soda (38.7 grms. in 2000 grms. water), filtering, and adding to the warm filtrate a solution of potassium permanganate (66.6 grms.) and sulphuric acid (62 grms. of 66° B. acid) in water (2000 grms.), the precipitate being collected, washed, and dried.—E. H. T.

Alumina; Process for obtaining— from aluminate solutions. F. Hirsch and F. Russ. Ger. Pat. 284,601, Apr. 10, 1912.

IN the preparation of alumina from aluminate solutions by the Bayer process (vigorous agitation in presence of aluminium hydroxide), the aluminate solution is completely decolorised, and pure white aluminium hydroxide precipitated, if ozonised air be passed through before or during the precipitation process. The precipitation is also accelerated by the treatment with ozone.—A. S.

Ammonium salts; Manufacture of pure, permanently colourless— from slightly coloured crude salts. Gebr. Hünsele. Ger. Pat. 284,641, Sept. 23, 1913.

THE crude salt is heated to a temperature below that at which ammonia is evolved, in order to convert soluble impurities into insoluble substances, and the ammonium salt is then purified by recrystallisation. By this process ammonium salts, such as the nitrate or chloride, are freed from

ammonium thiocyanate, which causes the salts to acquire a yellow or red colour on keeping, although the freshly prepared salts are practically colourless.
—A. S.

Potash salts; Process for obtaining —. O. Delion. Ger. Pat. 284,936, Mar. 25, 1914.

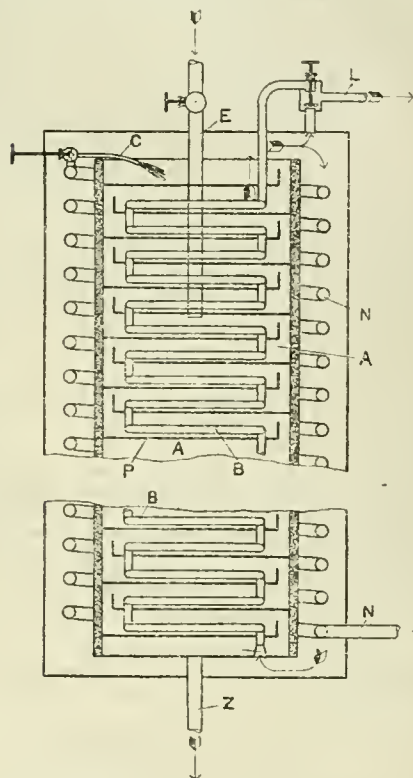
CRUDE potash salts ("Abraumsätze") are ground, and converted into solid masses by a process similar to that used in the manufacture of magnesia cement, preferably after addition of suitable substances to render the product porous. The solid masses are treated in the usual way with a suitable solvent, e.g., sodium chloride solution, to recover the potash salts, and the residues may be used as substitutes for magnesia cement, for example for filling in excavations.—A. S.

Residual liquors from potash and soda works; Process for the solidification of —. B. Rinck. Ger. Pat. 284,970, Sept. 7, 1912.

THE liquor is evaporated in an apparatus consisting of a hollow cylinder, into the lower part of which the liquor and fire gases are introduced in such a way that they flow in opposite directions. The evaporation is carried so far that the liquor will solidify on cooling, and the relative quantities of liquor and fire gases are so adjusted that the concentrated liquid leaves the cylinder at a temperature below the decomposition point of magnesium chloride and calcium chloride.—A. S.

Gaseous mixtures of very low boiling point, especially air; Process and apparatus for the fractionation of —. Sauerstoff- und Stickstoff-Ind. Hausmann und Co. Fr. Pat. 474,379, March 9, 1914.

LIQUID air enters the column, A, by the pipe, E, and passes downwards over the trays, P, while the

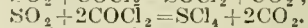
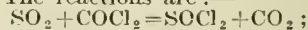


ascending vapour (mainly nitrogen) meets a descending auxiliary liquefied gas, such as nitrogen,

introduced through the coil, N, and pipe, C, which supplies the necessary latent heat to the air for fractionation. The escaping vapour passes downwards over the coil, N, and then upwards through the pipe, B, and is drawn off by the pipe, L. Modifications are described in which the auxiliary gas is air, oxygen, or the gas drawn off at the top of the column. Oxygen flows off by the pipe, Z.
—W. F. F.

Thionyl chloride or sulphur tetrachloride; Manufacture of —. Chem. Fabr. Buckau. Ger. Pat. 284,935, Apr. 15, 1914.

PHOSGENE and sulphur dioxide are allowed to interact at a temperature not below 200° C., e.g., a mixture of the two compounds is passed over a heated contact substance, such as wood charcoal. Instead of phosgene and sulphur dioxide, mixtures of phosgene, sulphur dioxide, and carbon monoxide, of carbon monoxide, chlorine, and sulphur dioxide, or of sulphuryl chloride and carbon monoxide may be used. The reactions are:—



The first reaction predominates at relatively low temperatures and with excess of sulphur dioxide, and by suitable adjustment of conditions, one or other of the reactions may be almost entirely excluded. The sulphur tetrachloride dissociates to a greater or less extent into sulphur chloride (S_2Cl_2) and free chlorine, and if the reaction mixture contains carbon monoxide, the chlorine combines with this to form phosgene, which reacts with a further quantity of sulphur dioxide.—A. S.

Hydrogen; Manufacture of —. Chem. Fabr. Griesheim-Elektron. Ger. Pat. 284,816, Mar. 14, 1914.

IN the production of hydrogen by the interaction of carbon, gases containing carbon monoxide, steam, and alkali or alkaline-earth oxides or hydroxides, claim is made for the use of pressure and for the employment of carbon in the form of lignite or wood charcoal. With lime a temperature of 600°–800° C. is required, but with baryta or alkali a lower temperature may be used. If the process be conducted on similar lines to the manufacture of water-gas, but using a mixture of lime and charcoal, almost pure hydrogen is obtained by working with steam at a pressure of 10 atmospheres.
—A. S.

Nitric acid; Process of concentrating dilute —. E. Collett, Assignor to Norsk Hydro-Elektrisk Kvaelfstafaktieselskab, Christiania, Norway. U.S. Pat. 1,154,289, Sept. 21, 1915. Date of appl., Mar. 27, 1913.

SEE Eng. Pat. 7597 of 1913; this J., 1914, 482.

Sodium sulphate or the like; Apparatus for manufacturing —. Chem. Fabr. Rhenania, Aachen, and C. Thelen and F. Wolf, Stolberg, Germany. Eng. Pat. 13,479, June 2, 1914. Under Int. Conv., June 3, 1913.

SEE Ger. Pat. 279,997 of 1913; this J., 1915, 355.

Atunite and the like; Treatment of — [to recover potassium salts]. Mineral Products Co., New York, and C. H. MacDowell, Chicago, U.S.A. Eng. Pat. 5563, Apr. 13, 1915. Under Int. Conv., July 31, 1914.

SEE U.S. Pat. 1,136,549 of 1915; this J., 1915, 613.

Nitrogen; Process for the production of —. R. W. Wallace and E. Wassmer, London. U.S. Pat. 1,154,145, Sept. 21, 1915. Date of appl., June 17, 1912.

SEE Eng. Pat. 3147 of 1912; this J., 1913, 364;

Nitrogen; Process of fixing—. O. Serpek, Assignor to Soc. Gén. des Nitrures, Paris. U.S. Pat. 1,155,810, Oct. 5, 1915. Date of appl., Dec. 23, 1913.

SEE Fr. Pat. 474,330 of 1913; preceding.

Carbon; Manufacture of pure—. H. Hennenbulte, Assignor to Soc. Anon. des Combustibles Industriels, Paris. U.S. Pat. 1,155,419, Oct. 5, 1915. Date of appl., Feb. 21, 1914.

SEE Eng. Pat. 6351 of 1914; this J., 1914, 1004.

Recovery of cyanogen and ammonia from distillation gases. Ger. Pat. 280,652. See 11A.

Manufacture of draw-plates or the like for metal working [from alumina]. Ger. Pat. 284,808. See X.

VIII.—GLASS; CERAMICS.

Porcelain made at the Royal Porcelain Factory, Berlin; Properties of the—. R. Rieke. Z. angew. Chem., 1915, 28, 374—376.

THE hard paste Berlin porcelain used in the manufacture of evaporating dishes, crucibles, casseroles, tubes, etc., and in the electrical industry for insulators, has a faint greyish yellow colour which is intensified on heating but returns to the original tint on cooling. The specific gravity diminishes during burning; it is 2.64 for unglazed porcelain burned at 950° C. and 2.465 for fully burned ware (1420° C.). The average chemical composition is 67.5% SiO₂, 26.6% Al₂O₃, 0.8% Fe₂O₃, 0.4% TiO₂, 0.4% CaO, 0.3% MgO, 3.3% K₂O, 0.7% Na₂O. The crushing strength of 2.5 cm. cubes averages (according to an unpublished communication of Rosenthal) 4200 kilos. per sq. cm. No direct figures for tensile strength and modulus of elasticity are available, but the values are probably similar to those for Hermsdorf porcelain, viz., 1300 to 2000 kilos. per sq. cm., and 5000—7000 (using the kilo. and sq. mm. as units), respectively. The absolute heat conductivity, or number of calories escaping in one second from a surface of 1 sq. mm. with a temperature-difference of 1° C., is rather greater than that of glass and may be assumed to be between 0.002 and 0.004. The mean specific heat of unglazed Berlin porcelain (Steger, this J., 1914, 422) is 0.202 between 20° and 200° C., and 0.221 between 20° and 400° C. The coefficient of expansion (0.0000336 between 16° and 250° C., and 0.0000434 between 16° and 1000° C., according to Henning, Ann. Phys. Chem., 1907, [4], 22, 631) is less than that of ordinary glass, stoneware, and such refractory materials as Marquardt's porcelain and magnesia, and its increase with rise of temperature is also less than in those materials. Hence the Berlin porcelain is able to withstand sudden changes in temperature. Berlin porcelain has no definite melting point. A rod 80 mm. long and 6 mm. diameter supported at one end was heated over a length of 20 cm.; it began to bend at 600° C. and was markedly deformed at 900° C., but crucibles and short tubes, etc., if properly supported can be used up to 1400° C. The melting point as determined by the Seger cone method corresponds to Seger cone 30—31 (1680° C.). The glaze on the ware begins to soften at 950° C. The porcelain usually contains many minute air-bubbles, but it should be impervious to gases. When a freshly fractured surface is treated with an organic dye, the latter should be entirely removed by washing. One tube tested under a reduced pressure of 30 mm. mercury at 1300° C. was quite impervious to gases, but collapsed suddenly at 1400° C. Pyrometer tubes of Berlin porcelain remain quite impermeable at 1400° C. under ordinary atmospheric pressure.

The electrical conductivity at the ordinary temperature is extremely low; it increases with the temperature, being 300 to 400 times as large at 80° C. The electrical conductivity (reciprocal of the resistance in ohms) of a 1 cm. cube is, according to Dietrich (Physik. Zeits., 1910, 11, 187), 0.25×10^{-12} at 97.5° C., and 0.26×10^{-11} at 189° C.; and, according to Goodwin and Mailey (Phys. Rev., 1908, 27, 322), 0.05×10^{-6} at 400° C., and 1×10^{-6} at 1000° C. Pirani and Siemens (Z. Elektrochem., 1907, 13, 969) observed an electrical resistance of 1.7×10^4 ohms per cm. cube at 727° C. or a conductivity of 6×10^{-5} . At 300° C. and higher temperatures distinct electrolytic current conduction has been observed (Ilaber and others, Z. anorg. Chem., 1908, 57, 154). Rosenthal (unpublished communication) found that plates 2.5 mm. thick will withstand a current up to 40,000 volts. The dielectric constant is 5.73 (Starke, Wied. Ann., 1897, 60, 629) as compared with 6.61 to 6.84 for soft felspathic porcelain. —A. B. S.

PATENTS.

Fireproof porous mass; Manufacture of a—. L. Kern. Ger. Pat. 281,435, Dec. 4, 1913.

A MIXTURE of silicates, alumina, and the like with combustible substances is placed on a grate separating a firing chamber from an air chamber below. The combustible substances are rapidly burnt out with the aid of a powerful, highly heated current of air, produced by a blower or by chimney draught, and the porous mass thus produced is heated further after stopping the current of air, and then rapidly cooled in a strong current of cold air.—A. S.

Glass furnace. W. W. Pilkington; S. L. R. A., and A. C. Pilkington, Executors, Assignors to Pilkington Bros., Ltd., St. Helens. U.S. Pat. 1,154,052, Sept. 21, 1915. Date of appl., Mar. 8, 1912.

SEE Eng. Pat. 9244 of 1911; this J., 1912, 490.

Leaching process for clay and like materials. Fr. Pat. 474,318. See I.

Process for obtaining porous refractory masses for flameless surface combustion. Ger. Pat. 284,395. See 11A.

IX.—BUILDING MATERIALS.

Portland cement clinker; Function of ferric oxide in the formation of—. E. D. Campbell. J. Ind. Eng. Chem., 1915, 7, 835—837.

TWO samples of synthetic celite, in which the R₂O₃ was entirely ferric oxide, were prepared by the method described previously (this J., 1914, 961). The product obtained from a mixture of 31.65% of ferric oxide, 13.15% of silica, and 55.2% of lime (as calcium carbonate), using a maximum temperature of 1600° C., gave a test-pat showing an initial set in about 1 hour and a final, very hard set in 2—3 days; it contained no free lime and remained perfectly sound when submitted to a boiling test for 10 hours. Crystals were separated from the fused synthetic celites by the use of magnesia discs (*loc. cit.*) and were analysed and their optical properties determined. The crystals consisted essentially of tricalcium silicate, but contained small quantities of iron (3.75 and 5.8% Fe₂O₃ respectively in the two cases). It is concluded that ferric oxide is molecularly equivalent to alumina in regard to the formation of celite, but whereas alumina acts only as an acidic oxide, there appears to be a tendency on the part of the ferric oxide to replace part of the lime in the tricalcium silicate (alite), which tendency increases when the original fused mass contains no excess of free lime.—A. S.

Insulating materials; Thermal conductivity of —.
Jakob. Ber. Physik.-Techn. Reichsanstalt, 1913.
Z. Elektrochem., 1915, 21, 289.

INSULATING plates of four different materials were tested for their heat conduction at 36° C., with the following results.

Material.	Weight per unit volume of plate. Kilos. per cb.m.	Thermal conductivity. Kilo.-Cals. per hour per 1° C. per metre.
Cork (with cement)	166	0.039
Compressed horsehair	143	0.042
Compressed cork (with a little cement)	174	0.045
Cork (with a little cement)	317	0.075

The thermal conductivity of cork therefore increases with its weight per unit volume.—W.G.C.

PATENTS.

Cement or hydraulic lime; Process and apparatus for manufacture of —. L. P. Basset. First Addition, dated Nov. 18, 1913, to Fr. Pat. 466,518, Mar. 4, 1913 (this J., 1914, 964).

THE working conditions in the two zones in the furnace used may be modified to suit the proportion of fuel in the charge and to secure the removal of all the sulphur. The proportion of clay in the charge may also be varied according as a Portland cement or hydraulic lime is desired. A slag may be produced by using an excess of clay and this then reheated with such proportions of lime or calcium carbonate as will produce a cement of the desired basicity, or the slag may be granulated and mixed with slaked lime to furnish a slag cement.—A. B. S.

Hydraulic lime; Manufacture of —. E. Bouvier. Ger. Pat. 285,098, Oct. 10, 1913. Addition to Ger. Pat. 284,221 (see Fr. Pat. 435,187 of 1911; this J., 1912, 338).

A MIXTURE of lime and silicious material, such as clay, sand, or acid slag, is treated with steam under pressure so as to obtain a moist mixture of monocalcium hydrosilicate, free silica enclosed in a coating of the hydrosilicate, and calcium hydroxide, and this is heated at 400°–600° C. and then very finely ground; the product contains about 9–11% of combined water, and consists of partially dehydrated monocalcium silicate, calcium hydroxide, and fine particles of silica partially converted into calcium silicate.

—A. S.

Concrete and mortar; Manufacture of impermeable and elastic — requiring no expansion joints. R. Houben. First Addition, dated June 29, 1914, to Fr. Pat. 466,878, Dec. 31, 1913 (this J., 1914, 965).

THE elastic material specified in the original patent (sawdust, cork, leather waste, or cotton) is soaked in tar, bitumen, or oil, previous to its admixture with the concrete or mortar. The impregnating material penetrates into the interstices of the concrete and renders the whole impermeable.—A. B. S.

Sheets and tiles with a base of cement and asbestos, such as "Eternite," "Fibrocement," etc.; Colouring — and rendering them impermeable. D. A. Peniakoff. Fr. Pat. 474,916, Jan. 5, 1914.

THE raw materials or the finished goods are immersed in a solution of a salt of barium, lead, or other metal and then in a solution (such as an alkali carbonate or sulphate) which will form a white or coloured precipitate with the first solution.

Usually, the lime present in the cement may be used as one of the reacting substances. The coloured products are rendered impermeable by immersing the sheets or tiles in molten tar, asphalt, paraffin wax or similar hydrocarbons, or in a solution of sodium silicate. Any excess of these materials is removed by passing the goods between rollers.—A. B. S.

Leaching process for clay and like materials. Fr. Pat. 474,318. See I.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Iron and steel; Heat treatment of — in a neutral atmosphere. A. H. White and H. T. Hood. Michigan Gas Assoc., Sept., 1915. J. Gas Lighting, 1915, 132, 138–140.

IRON and steel wires were heated in a silica tube within which a rich coal-gas and air mixture was caused partially to burn. On leaving the tube the gases passed along the outside of the tube and combustion was there completed by further addition of air. Using a mixture of approximately one vol. of illuminating gas and two vols. of air, it was possible to heat iron and steel to a forging temperature without any oxidation or the formation of scale on the surface of the metal. This mixture would not burn unless preheated, and the atmosphere produced, although neutral to iron, slowly decarburised steel at forging temperatures. The decarburising action was less, however, than that of an ordinary furnace atmosphere. With the arrangement described it was easily possible to maintain a temperature of 2200° F. (1205° C.), and it is considered that the process should prove useful in the automobile industry and other industries where the quality of the product is of paramount importance.—T. St.

Iron; The transformations of pure —. A. E. Oxley. Faraday Soc., Oct. 19, 1915. [Advance proof.] 4 pages.

THE present divergence of opinion as to the nature of the A2 and A3 transformations of iron is largely the result of indefinite conceptions regarding allotropy. In the author's view, allotropy implies a difference in the atomic structure of the molecule and not merely a change in the external configuration of the latter; the simple atomic constitution of the iron molecule makes it improbable that the changes of physical properties of iron are due to a re-arrangement of the atoms in the molecule. From magnetic and thermal considerations, evidence is adduced in support of the view that the transformations in question are due to molecular or crystalline re-groupings, and not to the occurrence of allotropy as above defined.

—W. E. F. P.

Electric steel costs. F. T. Snyder. Amer. Electrochem. Soc., Sept., 1915. [Advance proof.] 10 pages.

COSTS for melting cold scrap, representing continuous records extending over 1½–2 years, are given for two furnaces. The first, having a daily output of 10 tons (4 heats in 11 hours), shows a conversion cost of \$7.46 per ton, the second, with a daily output of 6 tons (4 heats in 12 hours), of \$11.35 per ton. Each furnace consists of a cylindrical shell lined with refractory material. The current passes into the furnace by a single central electrode and leaves through a contact with the bath, an arc being struck between the electrode and the slag. The door of the furnace is a "plug," 14 inches thick, and the furnace operates with an external surface temperature of about 60° C. The thermal efficiency is about 63%. The author discusses the advantages of the single-electrode

over the three-electrode type of furnace, and claims that the furnaces described give costs that are lower than those of most types of fuel-furnaces.—T. St.

Electric steel furnace; Heat losses from an—W. H. Wills and A. H. Schuyler. Amer. Electrochem. Soc., Sept., 1915. [Advance proof.] 10 pages.

THE heat losses due to gases issuing from charging doors and tap holes, and to conduction into the electrodes and their water jackets, were measured on a two-ton electric furnace which had three cylindrical graphite electrodes, 8 inches in diameter, passing through the roof. The power supply was 40 kw., 3-phase, 60-cycle, alternating current, the potential between the electrodes being 80 volts and the normal current per phase 2500 to 3000 amperes. The average loss of heat through the door and tap hole was found to be 12.5% and the electrode loss 7.3% of the power used. The only way to minimise the (graphite) electrode loss would be to run on single phase, but the other losses could be reduced considerably by making the charging doors fit closely against the furnace walls, and by using suitable closing devices for the tap hole.—T. St.

Ferro-alloys; Electric furnace melting of—R. S. Wile. Amer. Electrochem. Soc., Sept., 1915. [Advance proof.] 8 pages.

THE addition of molten rather than cold ferro-alloys to molten steel has the following advantages:—the final steel is more homogeneous; there is practically no loss of the special metal in the slag; time is saved; small pieces and "fines" of the alloy can be used. Ferro-alloys can be melted in an electric furnace without change of composition, and figures are given to demonstrate that the saving of alloy exceeds the cost of such melting.—T. St.

Chromium and manganese in iron and steel; Determination of—F. C. T. Daniels. Chem. News, 1915, 112, 191–192.

Chromium. 1 gm. of the sample is dissolved in 100 c.c. of nitric acid (sp.gr. 1.135) and nitrous fumes are expelled by boiling, the volume not being reduced below 75 c.c.; with steels rich in combined carbon, a few crystals of ammonium persulphate are added and the solution boiled again. 75 c.c. of silver nitrate solution (2 grms. per litre) and 5 grms. of ammonium persulphate are then added and the solution boiled, when dilute hydrochloric acid is added, drop by drop, until the permanganate colour is completely destroyed. After further boiling for 1 min. the liquid is rapidly cooled, a measured excess of $N/10$ ferrous ammonium sulphate added, the solution titrated back with $N/10$ permanganate, and the percentage of chromium calculated. **Manganese in presence of chromium.** 1 gm. of the steel is treated as before, except that after the addition of silver nitrate and ammonium persulphate the solution is heated just to boiling, then rapidly cooled and titrated as described, the manganese content of the sample being calculated from the difference between the volumes of ferrous ammonium sulphate oxidised in this and the preceding titration. The method is rapid, occupying about 20 mins., and sufficiently accurate for routine work. The solutions employed are best standardised against a standard steel.—W. E. F. P.

Metals; Radiography of—W. P. Davey. Amer. Electrochem. Soc., Sept., 1915. [Advance proof.] 12 pages.

RADIOGRAPHS of steel plates were taken by means of a Coolidge tube on Seed X-ray plates at a distance of 20 inches. The tube was excited by

an induction coil with a mercury-turbine interrupter. Exposures were made at 11, 13, and 15 inch parallel spark-gaps between points. An attempt to use a 17-inch spark gap was unsuccessful owing to flashing in the tube. The experiments showed that valuable information as to the presence of blow-holes, slag-inclusions, etc., can be obtained from radiographs. An air inclusion 0.021 inch thick was detected in $1\frac{1}{4}$ inches of steel, and one of 0.007 inch in $\frac{5}{8}$ inches. The following exposure formulae were worked out, x being the thickness of the steel in inches, and E the exposure in milliampère-minutes:—for 11 inch gap, $E = \frac{3}{4} \times \log_{10}^{-1} 2.09x$; for 13 inch gap, $E = \frac{3}{4} \log_{10}^{-1} 1.80x$; for 15 inch gap, $E = \frac{5}{7} \times \log_{10}^{-1} 1.80x$. (See also Tonamy, this J., 1915, 1016.)—T. St.

[Gold-silver-copper] ores; The Geliens process of treating refractory—G. A. Geliens. Min. and Eng. World, 1915, 43, 473–474.

THE process was devised for the extraction of gold, silver, and copper from ores containing pyrites, blende, mispickel, antimonides, etc., together with sulphides and tellurides of gold and silver; ores containing selenides of the precious metals, or much galena, are not amenable to the treatment. The ore, previously freed from soluble sulphates, is ground with water to a thin slime in an iron bed fitted with stone mullers, the mixture made alkaline with caustic soda and transferred to a special amalgamator containing a number of rotating, amalgamated copper plates upon which mercury is continuously sprayed. Potassium chlorate is afterwards added and the pulp aerated by mechanical agitation or compressed air until sufficient sulphuric acid (in the form of sodium bisulphate) is produced to react, with the chlorate, upon the sulphides and tellurides of gold and silver, the silver sulphate and chloride thus formed being reduced and amalgamated (together with the gold) by intimate contact with the mercury and copper. Amalgamation of the free gold begins immediately after the addition of caustic soda, and that of the complex silver compounds after the addition of potassium chlorate; the silver sulphide, argentite, is not amalgamated until sodium bisulphate is produced. Amalgamation should be completed before the formation of sulphates from decomposed sulphides and, in the presence of sulphides yielding hydrogen sulphide, before the pulp becomes acid. Ores containing silver sulphides require preliminary concentration if the gangue is calcitic or otherwise basic. The addition of potassium chlorate is unnecessary for the extraction of gold from sulphide ores containing the metal in the free state. When amalgamation is complete, the pulp is discharged into an agitating tank and blown with hot air to produce copper sulphate, the copper being subsequently recovered by means of scrap iron.—W. E. F. P.

Gold, silver, and copper; Electrolytic precipitation of—from cyanide solutions. G. H. Clevenger. Amer. Electrochem. Soc., Sept., 1915. [Advance proof.] 40 pages.

ELECTROLYTIC precipitation of gold as carried out on the Rand, and at Minas Prietas and El Rayo (Mexico), San Sebastian (Salvador), Virginia City (Nevada), and Nelson (B.C.), is described. Iron anodes are in use on the Rand (Siemens-Halske process), but sheet-lead is almost exclusively used in American practice. Peroxidised lead anodes have been found to have a longer life (about 1 year). Acheson graphite anodes became mushy and soft. The usual material for cathodes is likewise lead, though tin-plate has also been used. Cyanide solutions rich in copper give a strongly adhering deposit instead of a non-adherent slime; the copper is separated

from gold and silver by removing the cathodes from time to time and connecting them as anodes in a special cell containing dilute sulphuric acid. The copper is dissolved, and the gold obtained as a slime. The by-products formed during electrolysis, such as lime deposits, and Prussian blue in the Siemens-Halske process, must be treated for the values they contain. Electrolytic processes are more expensive than zinc precipitation both as regards cost of installation and working costs.—W. R. S.

Silver cyanide plating bath; Single potentials in the —. F. C. Frary and R. E. Porter. American Electrochem. Soc., Sept., 1915. [Advance proof.]

THE cause of a non-adherent deposit in electroplating—apart from improper cleaning, etc.—is that some of the metal upon the surface of the object to be plated dissolves in the bath. In order to determine this tendency in the case of silver plating, the single potentials of mercury, silver, copper, brass, and iron in solutions of potassium silver cyanide with various proportions of excess cyanide, with and without potassium chloride and hydroxide equivalent to the silver content of the double cyanide, have been determined, and the conductivities of the solutions measured. The potentials were measured by the potentiometer method, the apparatus being adjusted by a standard cadmium cell. The values obtained for iron and brass are a little uncertain, the former on account of delay in attaining equilibrium, and the latter because the effect of the free zinc in the alloy could not be determined. Determinations made with zinc electrodes show that this metal is decidedly negative in respect to silver. Copper and brass are only slightly negative to silver in these solutions, and their relation is not affected by the presence of chloride or hydroxide in the proportion studied. Iron and mercury are positive to silver whenever 10% or more of free cyanide is present, but negative to it in the absence of free cyanide. Mercury is not affected by the presence of chloride or hydroxide, but iron is made about 0.1 volt less positive. In general only those metals which are more negative than silver dissolve appreciably in silver potassium cyanide. It appears probable that titration of potassium cyanide with silver nitrate by Liebig's method gives results which are low, to the extent of about 3% of the cyanide present. Titration with mercuric chloride by Hannay's method (Trans. Chem. Soc., 1878, 245) gives results which appear more nearly correct.

—W. G. C.

Silver furnace fume: Treatment of — by the Cottrell process. C. H. Aldrich. Amer. Electrochem. Soc., Sept., 1915. [Advance proof.] 8 pages.

AT the Raritan copper works, the gases leaving the doré furnaces are led through settling flues and a scrubber to remove dust, and the moist gases are then passed to a Cottrell apparatus (see this J., 1911, 1037) containing 6-in. lead strips as collecting electrodes, with discharge electrodes formed of lead strips, 1 in. wide, sharpened at the edges and set transversely between each pair of collecting electrodes. The dust deposited in the Cottrell apparatus contains Se 6.5, Te 6.0, As 10.0, Sb 23.0, Pb 9.0, Bi 2.0, and Cu 0.9%, and Ag 800 oz. and Au 1 oz. per ton; the recovery averages 29.2% of the silver and 6.6% of the gold caught in the whole flue dust system. Another apparatus has been installed recently in which the discharge electrodes consist of $\frac{3}{4}$ in. steel rod covered by extrusion with a layer of lead, star-shaped in cross-section, each discharge electrode being supported in a lead pipe, 18 in. diam., which serves as a collecting electrode.

With this arrangement it is possible to remove 99% of the fume from gases travelling at a velocity of 4.5 ft. per second.—W. R. S.

Copper sulphate liquors; Electrolysis of —, using carbon anodes. L. Addicks. Amer. Electrochem. Soc., Sept., 1915. [Advance proof.] 29 pages.

THE sulphuric acid obtained by roasting copper sulphide ores, is used for leaching the residues, the resulting liquor being electrolysed, using carbon anodes, which are satisfactory if properly depolarised by the use of ferrous sulphate. The use of aluminium sulphate, in solution, as a substitute for a diaphragm, completely stops the solution of the cathode copper. It was found that large quantities of various sulphates, present as impurities, do not foul the cathodes, and, under proper working conditions, 2½ lb. of copper per kilowatt-hour could be recovered. The ferric sulphate produced by the depolarisation was reduced by sulphur dioxide outside the cell room.

—B. N.

Electrolytes [in copper refining]; Solution stratification as an aid in the purification of —. F. R. Pyne. Amer. Electrochem. Soc., Sept., 1915. [Advance proof.] 6 pages.

SPECIAL stratification tanks have been used for electrolytic copper refining, the electrolyte being supplied continuously just above the level of the slime, and withdrawn continuously from the opposite side as a high grade solution at a similar level, and as a low grade solution from the surface of the electrolyte. In order to avoid the accumulation of impurities in the regular refining tanks, in the ordinary method of working, the electrolyte is further passed through two sets of tanks containing insoluble anodes, but with the use of stratification tanks the copper may be extracted from the low-grade solution in a single set.—B. N.

Bronze; Electrolytic deposition of —. W. D. Treadwell and E. Beckh. Z. Elektrochem., 1915, 21, 374—380.

WHILST superposed layers of electrolytically deposited copper and zinc are readily converted into brass by heating at 150°—200° C., it is difficult to obtain bronze from similar layers of copper and tin; even on heating for 8 hours at 500° C. in a current of carbon dioxide, formation of bronze only took place at isolated spots, the greater part of the tin remaining unaltered. In experiments with various electrolytes on the direct electrolytic deposition of bronze, satisfactory results were obtained only with alkaline oxalate-cyanide and alkaline cyanide-sulphide baths. For bronze of a reddish tint the following bath is recommended for use at 40° C. with a cathode current density of 1—2 ampères per 100 sq. cm.:—An aqueous solution of 82 grms. of tin potassium chloride and 37 grms. of potassium oxalate is added to a solution of 50 grms. of copper sulphate, 104 grms. of potassium cyanide, and 70 grms. of potassium hydroxide, the mixture is diluted to 2 litres, and rendered clear by addition of potassium hydroxide solution. For gold-coloured bronze (80% Cu, 20% Sn) the best results were given by a bath containing 0.1 gm.-mol. CuSO₄, 0.8 gm.-mol. KCN, 0.5 gm.-mol. KOH, 0.1 gm.-mol. SnCl₄, and 1 gm.-mol. Na₂S per litre; satisfactory deposits were obtained from this at 40° C. with cathodic current densities ranging from 1.07 to 13.3 ampères per sq. decm., when the cathode was rapidly rotated. The deposited bronze adheres well to platinum, copper, nickel, steel, and iron, even cast iron. It is hard, elastic, free from pores, and shows no evidence of crystalline structure when examined under the microscope with a magnification of 500; it is

attacked only slowly by hydrochloric acid. The alkaline cyanide-oxalate and cyanide-sulphide baths have been patented.—A. S.

Antimony refining; Electrolytic —. A. G. Belts. Amer. Electrochem. Soc., Sept., 1915. [Advance proof.] 13 pages.

LABORATORY experiments on the electrolytic refining of impure antimony in a double fluoride bath proved that lead, bismuth, and copper were eliminated as slime without contamination of the electrolyte, but the removal of arsenic was unsatisfactory, 40–60% being deposited with the antimony. The current density required (6–7 ampères per sq. ft.) was less than is generally used for other metals. The presence of copper did not tend to retain arsenic in the slime as copper arsenide, nor was it found possible to deposit the arsenic with the first fraction of the antimony. Crystallisation of molten antimony-arsenic alloys gave in all cases crystals containing the same amount of arsenic as the liquids.—W. R. S.

Speller; The effects of the common impurities in — upon slush castings. G. Rigg and H. C. Morse. Amer. Inst. of Metals, Sept., 1915. [Advance proof.] 32 pages.

SLUSH castings of pure speller alloyed with the metals enumerated below were produced by pouring the metal into a hollow bronze or brass mould until full and immediately pouring out again, leaving a thin hollow casting chilled upon the inside surface. *Cadmium* is the most objectionable impurity, producing pronounced hot-shortness; 0.05% made it impossible to obtain any acceptable castings. *Lead* weakens the metal in proportion to the quantity present; below 0.2% it has no harmful effect. The influence of *iron* is erratic, probably on account of segregation of an iron-zinc alloy; but it increases the tendency to failure. *Arsenic* in the amounts in which it occurs naturally in speller has little or no effect; in larger proportions it acts like iron. *Aluminium* up to 5% produces alloys impossible to use for slush castings. From 5.0 to 5.5% (the composition of the eutectic) excellent results were obtained with great regularity; the castings were light and smooth, and their outside surface did not show prominent crystallisation.—W. R. S.

Sherardising [vapour galvanising]. S. Trood. Amer. Inst. of Metals, Sept., 1915. [Advance proof.] 11 pages.

UNIFORMITY in working is shown to be the essential element in successful sherardising, the articles to be treated being thoroughly prepared by shot air blasting. The zinc dust used should have the following composition: zinc 85 to 90%, zinc oxide 8 to 10%, lead between 1 and 1.5%, other impurities 0.5 to 1%; it must be cleansed periodically to separate free iron, and also occasionally sifted. There is practically no limitation to the temperature, a longer time being allowed for lower temperatures; with electrically-heated apparatus, a more uniform controllable temperature can be obtained, 350° to 375° C. being the most suitable.—B. N.

Magnalium from turnings; Reclamation of —. J. Coulson. Amer. Inst. of Metals, Sept., 1915. [Advance proof.] 7 pages.

MAGNALIUM may be recovered from turnings, without heavy loss or the aid of cryolite, by melting in an open crucible which has been previously heated to 900° C. A pellet of solid metal is first melted in the crucible, so that the turnings are engulfed in molten metal from the outset, and each addition is thoroughly puddled. The addition of 1% of metallic calcium, or 0.5% of calcium alu-

minium silicide, as a deoxidising agent, is sufficient to restore the metal to its original physical state.—B. N.

Aluminium-bronze alloys. W. M. Corse. Amer. Inst. of Metals, Sept., 1915. [Advance proof.] 11 pages.

ALUMINIUM-BRONZE containing about 10% Al can be hardened by heat-treatment and quenching. The hardness varies between 100 and 260 Brinell, according to the treatment; the alloys show excellent bearing qualities and are much superior to manganese-bronze in withstanding alternating stresses.—W. R. S.

Alumino-vanadium; Manufacture and use of —. W. W. Clark. Amer. Inst. of Metals, Sept., 1915. [Advance proof.] 8 pages.

ALLOYS of aluminium with 2 to 30% of vanadium have been prepared by melting aluminium in a crucible and igniting a mixture of vanadic oxide and aluminium on the top, or by gradually adding a mixture of cryolite, alumina, fluorspar, and vanadic oxide to molten aluminium in an electric furnace. These alloys may be used for introducing a small quantity of vanadium into brass, bronze, copper-nickel, manganese bronze, etc. Small amounts of vanadium do not appear to increase the tensile strength of non-ferrous metals, beyond the amount due to its powerful deoxidising properties. If a cheaper metal is used for deoxidising before adding the vanadium, the full alloying effect of the latter is available, and in small amounts it increases the elongation of the alloy.—B. N.

Acid-resisting alloy; The development of an —. S. W. Parr. Amer. Inst. of Metals, Sept., 1915. [Advance proof.] 7 pages. (See also U.S. Pat. 1,115,239; this J., 1914, 1161.)

THE alloy, to which the name "illium" has been given, has the following composition: Ni 60.65, Cu 6.42, Cr 21.07, Mo 4.67, W 2.13, Mn 0.98, Si 1.04, Al 1.09, Fe 0.76, total 98.81%; C and B not determined. Several test-pieces did not show a weighable loss after 24 hours' contact with 25% nitric acid. The melting-point was 1300° C. and the tensile strength 50,000 lb. per sq. in. A bomb calorimeter made of the alloy showed no trace of corrosion after being used for 1500 determinations of the calorific value of coals.—W. R. S.

Chromium, copper, and nickel; Alloys of —. D. F. McFarland and O. E. Harder. Amer. Inst. of Metals, Sept., 1915. [Advance proof.] 15 pages. (See also preceding abstract.)

TWENTY-ONE binary and thirty ternary alloys were prepared with the proportions of the metals varying by intervals of 10%. The highest chromium content obtained in chromium-copper alloys was 13.15%, while in all alloys containing more than 6% Cr there was a separation of chromium and a non-homogeneous structure. The alloys rich in nickel had a very coarse texture and usually developed blow-holes. Those rich in chromium had very high melting-points; they were extremely hard, and difficult to prepare. Those containing chromium and much copper had inferior mechanical properties caused by segregation. The hardness increased with the chromium content, reaching that of tool steel; the tensile strength of 18 alloys tested varied from 7449 to 56,255 lb. per sq. in., and the modulus of elasticity from $\frac{1}{2}$ to $1\frac{1}{2}$ times that for steel. Corrosion tests were made with N/1 solutions of acids, alkalis, sodium chloride, and pure molten fatty acids. Nitric and sulphuric acids showed a selective action on nickel, hydrochloric acid on chromium, ammonia and fatty acids on copper.—W. R. S.

Alloys used by the American railways for car journal bearings; Effect of changes in the composition of —. G. H. Clamer. Amer. Inst. of Metals, Sept., 1915. [Advance proof.] 24 pages.

At least 75% of the car journal bearings in use on United States railways contain upwards of 2% Zn, and the author has therefore studied the effect of zinc on the mechanical properties of copper-tin-lead alloys. It is concluded, from the results, that alloys containing not less than 65% of copper, and approximately 5% tin, up to 20% lead, and up to 5% zinc, should be satisfactory for all classes of car journal bearings. With an increase in the amount of lead, the zinc content should be correspondingly diminished.—B. N.

Copper and lead; Mutual solubility of —. B. Bogitch. Comptes rend., 1915, 161, 416—419.

COPPER and lead form two liquid layers when the proportion of copper is between 31.5 and 87%, and in the interval 940°—975° C., 940° C. being the freezing-point of the upper layer. Above 975° C. no difference in composition could be detected between the upper and lower part of the liquid.—W. R. S.

Electrometallurgical industries as possible consumers of electric power. D. A. Lyon and R. M. Keeney. Amer. Electrochem. Soc., Sept., 1915. [Advance proof.] 23 pages.

THE prospects of financial success of electrometallurgical industries in the Rocky Mountain and Pacific Coast States are discussed. *Aluminium* could be produced at 16.22 cents per lb., or 18 cents f.o.b. New York; the average price for spot metal in New York was 23.6 cents in 1913, and 18.6 cents in 1914. The cost of production of *pig iron* would be about \$26 per long ton, whereas it can be imported on the Pacific coast at \$18—20. Steel would cost \$30 per long ton, which is higher than the price of imported metal. The electric smelting of *copper ores* is still in the experimental stage, while that of *zinc ores*, while more advanced, has not yet proved to be a technical success.—W. R. S.

Electrolytic and pure chemical processes: Relation between —. IV. [Action of mixtures of sulphuric acid with hydrogen peroxide and with chromic acid on nickel.] D. Reichenstein. Z. Elektrochem., 1915, 21, 359—372.

FURTHER experiments have been made on the behaviour of nickel in mixtures of sulphuric acid and hydrogen peroxide (see this J., 1915, 663) and also on its behaviour in mixtures of chromic and sulphuric acids. The mechanism of the process is similar in the two cases, the second stage with mixtures containing chromic acid being $2\text{CrO}_3 + 10\text{H}^+ \rightarrow 2\text{Cr}^{+++} + 5\text{H}_2\text{O} + 3\text{O}$. In 0.4—0.5N sulphuric acid nickel rapidly becomes passive in presence of 0.125N chromic acid, whereas it remains active in presence of hydrogen peroxide even at N/1 concentration. The cause of this difference is that the chromic acid adsorbed by the nickel yields atomic oxygen (see equation, above) much more rapidly than the adsorbed hydrogen peroxide does. It has not been found possible to attain a constant velocity of solution of nickel in mixtures of sulphuric acid and hydrogen peroxide. Nickel which has been rendered passive in 3% hydrogen peroxide solution and is then immersed in a mixture of hydrogen peroxide with 0.04N sulphuric acid, dissolves with a velocity which increases up to a maximum and then decreases, the nickel ultimately again becoming passive. It is concluded that there are two forms of passive nickel: in one the passivity is due to a high concentration of adsorbed molecular oxygen and in the other to a high concentration

of adsorbed atomic oxygen. In mixtures of chromic acid (less than 0.125N) and 0.4N sulphuric acid, a constant velocity of solution of nickel can be readily attained, starting with either passive or active nickel. Some of the values obtained, expressed in mgrms. per 32 sq. cm. of surface per 10 mins., for different concentrations of chromic acid were:—0.009N, 0.0246; 0.0184N, 0.039; 0.03N, 0.0475; 0.04N, 0.046; 0.047N, 0.0383; 0.057N, 0.0211; 0.069N, 0.0362; 0.08N, 0.0272; 0.12N, 0.021. The values agree satisfactorily with those calculated by means of the formula $v_s = k_1z - k_2z^2$, where v_s is the constant velocity of solution, z is the concentration of the oxidising agent (chromic acid), and k_1 and k_2 are constants; this formula is an approximation of one deduced from theoretical considerations. In the action of mixtures of chromic and sulphuric acids on nickel, the liberation of atomic oxygen from the adsorbed chromic acid takes place practically instantaneously, and a constant velocity of solution would be attained at once were it not for the slow formation of molecular oxygen from the atomic oxygen; this latter process causes the gradual diminution in the velocity of solution of the nickel, and it continues until a condition of equilibrium between atomic and molecular oxygen is attained, corresponding to the constant velocity of solution of the nickel.—A. S.

Tungsten; The melting point of —. I. Langmuir. J. Franklin Inst., 1915, 180, 490—492.

To eliminate former sources of error in determining the melting point of tungsten two methods were used:—(1) the black body melting point of large filaments in nitrogen was determined, and the emissivity from helically-wound filaments of various sizes in a vacuum and in nitrogen obtained; (2) the brilliancy of a surface of molten tungsten was measured, and the brilliancy of the image of a second surface of molten tungsten reflected in the first was simultaneously determined, the reflectivity of the molten metal being thus directly determined. An alternating arc between two tungsten electrodes in nitrogen furnished two molten convex surfaces which could be utilised for the latter method. The values obtained were:—total photometric method, 3540° abs.; filaments by pyrometer method, 3332° abs.; arc electrodes by pyrometer method, 3566° abs. A consideration of the probable errors indicates that the best value is 3540° abs. $\pm 30^\circ$.—T. St.

Electrolysis of nitric, sulphuric, and orthophosphoric acids using a gold anode. Electrolysis of concentrated hydrochloric acid using a copper anode. Jeffery. See XI.

PATENTS.

Iron articles; Production of a rust-preventing coating of iron nitride on —. H. Hanemann and F. Hanaman. Ger. Pat. 284,803, Mar. 29, 1914.

ARTICLES of iron or steel are heated electrically in an atmosphere of a gas, such as ammonia, capable of reacting with the iron to form a nitride; or the articles may be heated electrically to incandescence in a liquid from which a gas capable of forming a nitride is evolved. For example, the articles are immersed in an aqueous solution of ammonia and an ammonium salt, and connected with the negative pole of a source of current, whilst the positive pole is connected with the metallic containing vessel or with a separate anode.—A. S.

Cementation of iron articles; Process for the —. K. Stratmann. Ger. Pat. 284,859, Mar. 21, 1914.

THE powdered carburising material is packed around the articles to be hardened, in receptacles

made of a material which is inflammable or can be carbonised; or the bottom only of the receptacle may be made of such a material, whilst the side walls are made of thin iron plate and are removed as a whole after placing the receptacle in the carburising chamber. Cementation is effected in a vertical retort, and the combustion or carbonisation of the material of the receptacle ensures a non-oxidising atmosphere.—A. S.

Magnetic separation. S. Brück, Charlottenburg, Germany. Eng. Pat. 20,551, Oct. 5, 1914. Under Int. Conv., Oct. 4, 1913. Addition to Eng. Pat. 11,898 of 1911, dated May 17, 1910 (this J., 1911, 1457).

SLIME is supplied to the magnetic field by a distributing cone with radial channels leading to separate poles which are arranged round the periphery of a cylindrical vessel, parallel to the vertical axis. The bottom of the vessel is funnel-shaped, and a second funnel, coaxial with and above the first, serves as a false bottom. The non-magnetic particles are carried off by the upper funnel, while the magnetic particles are attracted to the inner wall of the cylinder. By interrupting the excitation of the magnets and weakening or completely cutting off the residual magnetism, the magnetic particles fall by gravity past the edge of the upper, into the lower funnel. To facilitate the washing out of the non-magnetic matter from the material collected on the poles, the vessel may be made slightly tapering instead of cylindrical, its diameter increasing towards the bottom.—T. Sr.

Metals; Soldering——. J. Lavine, London. Eng. Pat. 22,356, Nov. 11, 1914.

IN dental practice pieces of metal (particularly iron or nickel and their alloys) to be joined together are first soldered with silver solder. Gold, preferably in the form of grains or granules, is then applied, and heated to melting point, when it amalgamates with the silver alloy, thus forming a gold solder.—T. Sr.

Converter for treating matte. W. H. Howard, Garfield, Utah. U.S. Pat. 1,153,921, Sept. 21, 1915. Date of appl., March 2, 1914.

THE converter consists of a cylindrical shell mounted to rotate on its horizontal axis. The discharge opening for smoke and gases is situated in one end near its upper side and eccentric to the axis. A stationary double-walled, water-cooled, cylindrical hood, concentric with the shell, encloses the opening in all positions of the shell, and serves to carry away the gases. Means are provided for removing the hood when desired.—T. ST.

Aluminium; Process for the manufacture of——. J. Bally. Fr. Pat. 474,375, Nov. 22, 1913.

AN alloy composed essentially of aluminium, iron, and silicon, and produced from bauxite or other aluminium ore, is fractionally distilled in a vacuum to recover pure aluminium.—W. E. F. P.

Metallic powders; Process for the manufacture of——. L. Bonnet. Fr. Pat. 474,667, Dec. 16, 1913.

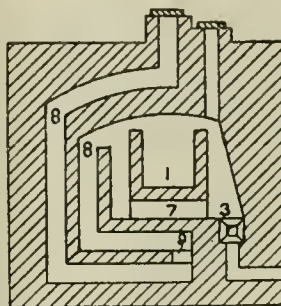
A FINELY-DIVIDED metallic oxide is mixed with graphite and reduced by means of trioxymethylene or formaldehyde at a temperature not exceeding 650° C.—W. E. F. P.

Furnace; Rotary metallurgical——for liquid or gaseous fuel. J. Bichon. Fr. Pat. 474,774, Dec. 26, 1913.

THE discharge end of a cylindrical furnace,

mounted to rotate about a horizontal axis, is connected with a stationary, horizontal, cylindrical recuperator containing a coil through which the air for combustion is passed before entering the burner. A movable, vertical screen is disposed within the coil to effect more uniform distribution of the heat in the recuperator by baffling the stream of waste gases issuing from the furnace chamber.—W. E. F. P.

Furnace; Oil-fired heating——. Gebr. Pierburg. Ger. Pat. 284,738, July 8, 1914.



THE combustion chamber, 3, of the furnace tapers towards the top and is connected by transverse flues, 7, with a flue, 8, on the opposite side of the hearth, 1. The flues, 7, and 8, are provided with partitions which serve as heat-accumulators, and the flue, 8, is composed of two parts, connected by a passage, 9, the

gases in one part flowing in the opposite direction to those in the other part.—A. S.

Manganese and its alloys; Production of——in the electric furnace. C. L. Lenoir. Fr. Pat. 474,927, Jan. 8, 1914.

SLAGS, obtained from preceding operations, are added to the molten charge to reduce the losses of manganese by volatilisation, and aluminous products are also added to reduce the loss of manganese in the slag.—B. N.

Ores; Process for treating——with nitric acid. H. Büeler de Florin. Ger. Pat. 284,741, Oct. 22, 1912.

CARBONATE or oxide ores, e.g., of iron or copper, are treated with nitric acid and nitrous gases, the solution is evaporated to dryness, and the residue heated so as to decompose nitrates of iron and copper but not those of calcium and magnesium, and then lixiviated with water to obtain a solution containing calcium nitrate and a residue rich in copper oxide. Alternatively the dry residue may be heated until all the nitrates are decomposed. Hot gases containing sulphur dioxide, produced by roasting other ores, may be used for the evaporation of the nitrate solution and decomposition of the nitrates; the nitric acid evolved is recovered and used again in the process.—A. S.

Draw-plates or the like for metal-working; Manufacture of——[from alumina]. Allgem. Elek. tricitäts-Ges. Ger. Pat. 284,808, Feb. 7, 1913.

DRAW-PLATES and similar tools for metal working are made of a sintered, amorphous refractory oxide, e.g., alumina. The oxide is mixed with a binding material which will be destroyed in the subsequent treatment, moulded, and heated at a temperature sufficient to sinter the oxide slightly (1300°–1400° C. in the case of alumina). The draw-plate or the like is then formed into its final shape and thoroughly sintered by heating at a temperature below the melting point of the oxide, e.g., at 1800°–2000° C. in the case of alumina. Draw-plates of sintered alumina are stated to be more durable than those of steel; they are as hard as sapphire and possess similar properties to diamond in regard to friction and wear.—A. S.

Zinc; Process for reducing and purifying the gases produced in the manufacture of—in the electric furnace. Trollhättans Elektrotermiska Aktiebolag. Ger. Pat. 284,866, May 10, 1914. Under Int. Conv., Apr. 7, 1914.

THE gases are passed over a layer of incandescent carbon or other reducing substance contained in a space of such form and dimensions that the velocity of the gases is diminished sufficiently to ensure the deposition of any dust on the layer of carbon.—A. S.

Zinciferous ores; Process for the treatment of—with sulphurous acid. Erzverwertungs-Ges. m. b. H. Ger. Pat. 284,982, Apr. 25, 1913.

ORES or other materials containing zinc oxide are treated first with a solution containing combined sulphurous acid, e.g., a solution of zinc bisulphite, to convert the zinc into the normal sulphite, and then with gaseous sulphur dioxide to convert the normal sulphite into zinc bisulphite. The reaction between the sulphur dioxide and normal zinc sulphite is effected continuously, on the counter-current principle, in a tower or the like. The zinc bisulphite solution leaving the tower is used to treat a further quantity of ore, and then again treated with sulphur dioxide, the operations being repeated until the solution is sufficiently concentrated, whereupon it is treated for the recovery of the zinc.—A. S.

Briquetting soot or the like with flue dust, fine ores, or similar materials; Process for—. F. Schuster and C. Lichtenstern. Ger. Pat. 285,078. Dec. 5, 1913.

SOOT or the like is moistened with water, and then mixed with the liquid binding agent used in making briquettes from flue dust, fine ores, or similar materials.—A. S.

Concentration of minerals by flotation; Method and apparatus for the—. New Jersey Zinc Co., New York, and A. R. Livingston, Canon City, Colo., U.S.A. Eng. Pat. 23,626, Dec. 5, 1914. Under Int. Conv., Dec. 27, 1913.

SEE U.S. Pat. 1,147,633 of 1915; this J., 1915, 911.

Ore concentration; Apparatus for—. (A) A. H. Higgins and W. W. Stenning, Assignors to Minerals Separation Ltd., London. U.S. Pat. 1,155,815, Oct. 5, 1915. Date of appl., Nov. 12, 1913, and (B) A. H. Higgins, Assignor to Minerals Separation American Syndicate (1913), Ltd., London. U.S. Pat. 1,155,816, Oct. 5, 1915. Date of appl., Apr. 15, 1914.

SEE Eng. Pat. 21,650 of 1913; this J., 1914, 1160.

Ore concentration. L. A. Wood, Assignor to Minerals Separation American Syndicate (1913), Ltd., London. U.S. Pat. 1,155,861, Oct. 5, 1915. Date of appl., June 2, 1914.

SEE Eng. Pat. 10,312 of 1914; this J., 1915, 620.

Electrostatic separator for sorting out the constituent parts of commodities [ores] according to their permeability. A. Bibolini, Agordo, and P. Riboni, Naples, Italy. U.S. Pat. 1,154,907, Sept. 28, 1915. Date of appl., Apr. 25, 1914.

SEE Eng. Pat. 7274 of 1914; this J., 1915, 364.

Metals; Treatment of—[to render them inoxidisable.] T. Van Aller, Schenectady, N.Y., Assignor to General Electric Co. U.S. Pat. 1,155,974, Oct. 5, 1915. Date of appl., Oct. 4, 1911.

SEE Eng. Pat. 3752 of 1912; this J., 1913, 198.

Manufacture of aluminium silicides, nitrides, and the like. Fr. Pat. 474,503. See VII.

XI.—ELECTRO-CHEMISTRY.

Electrolysis of nitric, sulphuric, and orthophosphoric acids using a gold anode. Electrolysis of concentrated hydrochloric acid using a copper anode. F. H. Jeffery. Faraday Soc., Oct., 1915. [Advance proofs.] (A) 9 pages; (B) 1 page.

(A) ACIDS of various strengths have been electrolysed, using a gold anode and platinum cathode, the latter in some cases being placed in a porous pot. With 100 c.c. of nitric acid (sp.gr. 1.42) and 100 c.c. of water, without a porous pot, a green electrolyte was obtained and metallic gold was deposited on the cathode and in the electrolyte. Employing a porous pot, the cathode acid was reduced, and the anode acid ultimately became deep yellow brown in colour, from which lemon yellow crystals of auri-nitric acid, $\text{HAu}(\text{NO}_3)_4 \cdot 3\text{H}_2\text{O}$, were separated. When the nitric acid was diluted with double and four times the above amount of water, a red-brown precipitate was formed, which appeared to be a mixture of hydrated auric oxide and aurous oxide, but with ten and twenty times the amount of water, the hydrated auric oxide only was produced. With dilute acids, an explosive compound is formed at the anode if ammonium nitrate is allowed to accumulate in the electrolyte. With 100 c.c. of sulphuric acid (sp.gr. 1.84) and 100 c.c. of water, the gold passed into solution as complex ions, principally trivalent but possibly also univalent, the yellow-brown anode electrolyte forming hydrated auric oxide on hydrolysis. With more dilute acids, a mixture of auric and aurous compounds was formed, which were partially hydrolysed, depositing hydrated auric oxide and aurous oxide on the anode. With a liquid containing 15% by weight of H_3PO_4 , a small quantity of gold passed into solution as complex anions, and hydrated auric oxide and aurous oxide were deposited on the anode, the amount of aurous oxide being increased by the use of a 20% solution. The composition of the products is not affected by change of anode current density, but is influenced by the concentration of the acid anode electrolyte. (B) The electrolysis was carried out in a similar manner, but in an atmosphere of nitrogen; the copper passes into solution as complex anions, corresponding, in presence of excess of hydrochloric acid, to the compound H_2CuCl_3 . Black metallic copper was deposited from disintegration of the anode, and a precipitate of cuprous chloride was formed, no chlorine being evolved during the electrolysis.—B. N.

Silver; Anodic potentials of—. II. *Their role in the electrolytic determination of the halogens.* J. H. Reedy. Amer. J. Sci., 1915, 40, 400–412.

THE electrolytic separation and estimation of the halogens by deposition on a silver anode is dealt with. The electrolytic cell used consisted of a glass cylinder, with a heavy frame of silver wire as anode, rotated at about 200 revs. per min. to prevent concentration polarisation, the cathode being a piece of bright sheet platinum held in place by a glass rod. Air was excluded by carbon dioxide, since iodides in acid solution are oxidised to iodine, which volatilises. The voltage was measured by the third electrode method. It was found best to have some electrolyte present other than the halide to be determined, and an acid solution was found most suitable. Most acids have the same reaction potential of 0.521 volt (see this J., 1915, 1019), and this also is the potential at which silver begins to dissolve, irrespective of the nature of the anions present. Sulphuric acid was chosen on account of its good conductivity. The results of the experiments showed that the anodic potential must be known

at every stage of the electrolysis, so that the maximum value of the potential for that particular process may not be exceeded, and the anodic potential must never exceed 0.521 volt, since otherwise the silver would commence to dissolve. The electrolysis cannot be properly regulated by the current, independent of the anode potential. Chlorine cannot be estimated satisfactorily by electrolytic precipitation on silver, since the anodic potential required for its complete deposition is approximately the same as that at which silver dissolves. Quantitative separation of the halogens is possible only within certain definite limits of concentration.—W. G. C.

Hypochlorite-carbon cell as a new type of galvanic element. A. Thiel. *Z. Elektrochem.*, 1915, 21, 325—329.

UNLIKE the Jacques cell (see Haber and Bruner, this J., 1904, 940), the hypochlorite-carbon cell of Hofmann and Ritter (this J., 1914, 917) appears to be a true carbon cell, electrical energy being generated by the oxidation of carbon to carbon dioxide. The carbon acts as a depolariser, combining with atomic oxygen liberated as a result of the oxidation potential of the hypochlorite; this potential is equivalent to that of oxygen under high pressure, and hence the cell may be regarded as an oxygen concentration cell with carbon as depolariser. The depolarising action of the carbon is a purely chemical process and not, as with known galvanic elements, an electrochemical process due to transference of ionic charges. The hypochlorite-carbon cell is thus a new type of galvanic element, i.e., a semi-electrochemical oxidation and reduction cell, and the possibility of utilising other combinations of chemical and electrochemical reactions for the generation of current is indicated. An iodiform cell in which a hypochlorite electrode (platinum in commercial *eau de Javelle*) is combined with a chemically depolarised iodine electrode (platinum in a solution of 25 c.c. of acetone and 20 grms. of potassium iodide in 100 c.c. of 2*N* sodium carbonate solution), will give an E.M.F. of 0.27 volt a few seconds after closing the circuit. In like manner a nitrobenzene cell formed of a zinc electrode in 2*N* sodium hydroxide in conjunction with a chemically depolarised hydrogen electrode (platinum in a solution of 25 grms. of nitrobenzene, 40 grms. of sodium hydroxide, and 50 grms. of water in 350 c.c. of alcohol) will give an E.M.F. of 1.1 volts.—A. S.

Ozone formation. Influence of the current form on the chemical action of the silent electric discharge. G. Lechner. *Z. Elektrochem.*, 1915, 21, 309—324.

EXPERIMENTS were made with alternating current and with interrupted continuous current, using in one series a glass ozoniser and in another a metal ozoniser. From the results the current and E.M.F. curves were plotted, and the form factor of the curves deduced, so that the mean current strength could be calculated. The experimental results confirm Warburg and Leithäuser's rule (*Ann. Phys.*, 1909, [4], 28, 17) that the yield of ozone is proportional to the mean current strength, or, more strictly, to the quantity of electricity flowing through the gas chamber. The yield of ozone per watt-hour is almost independent of the curve form when the ozoniser is suitably electrified. A point of practical importance in connection with the construction of generators for operating ozonisers is that, in general, flatter current and E.M.F. curves are more efficient, because the yield per effective milliampère-hour and per watt-hour and the efficiency factor are greater under these conditions. In the experiments with a metal ozoniser it was found that this

caused a partial conversion of alternating current into continuous current. (See also this J., 1911, 754.)—A. S.

Electrochemical synthesis of phenylhydroxylamine. Frederiksen. See III.

Decomposition potentials of fused alkali hydroxides. Neumann and Bergve. See VII.

Decomposition potentials of fused alkali halides and alkaline earth chlorides. Neumann and Bergve. See VII.

Relation between electrolytic and pure chemical processes. IV. [Action of mixtures of sulphuric acid with hydrogen peroxide and with chromic acid on nickel.] Reichenstein. See X.

Electrolytic coagulation of rubber. Clignett. See XIV.

PATENTS.

Electrolytic apparatus. Electrode for electrolytic cells. J. B. Burdett, Assignor to Davis-Bournonville Co., Chicago, Ill. U.S. Pats. (A.) 1,154,091 and (B.) 1,154,092, Sept. 21, 1915. Date of appl., Oct. 29, 1912.

(A.) A porous diaphragm, interposed between an inner and outer electrode and extending above the upper edge of the former, is supported from a flange on the cover of the outer electrode, the flange projecting downwards into the space between the two electrodes. A safety outlet pipe is arranged in the cover, and its inner end is immersed in the electrolyte when the latter is at its normal level. The electrolyte is supplied, and maintained at a normal level within the cell, through a supply pipe passing through the wall of the cell, the pipe being provided with a feeding arrangement normally sealed by the electrolyte but admitting liquid if the level of the electrolyte is lowered. (B.) The electrode is constructed from a pair of adjacent parallel plates, longitudinally corrugated, with circuit terminal rods provided with extensions extending transversely across the plates and connected to them.—B. N.

Electrolysis; Double diaphragm for continuous —. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 284,937, July 24, 1913.

In electrolytic processes in which the electrolyte flows continuously through the apparatus, the accumulation of impurities on the diaphragm is prevented by providing openings or channels in its surface.—A. S.

Furnace; Electric —. P. L. Hulin. Fr. Pat. 174,165, Nov. 29, 1913.

THE furnace is provided with a heating resistance composed of sheets of conducting material with a carbon base, which may be arranged in the joints between the refractory blocks forming the walls, or in enlarged joints or grooves, formed by hollowing out the refractory blocks, or may be made in a network form with helical elements crossing each other obliquely. In all cases the resistance material is flush with the inner surface of the refractory walls. It may be introduced under pressure, as a paste with a carbon base, into the joints or grooves, and then calcined by an auxiliary resistance temporarily introduced between the poles of the furnace. The furnace may be arranged to rotate, and the material under treatment may be ground by the aid of balls.—B. N.

Furnace; Electric —. A. M. Borit and H. Magron. Fr. Pat. 474,622, Dec. 13, 1913.

THE outer furnace wall is cooled by a great mass of water, e.g., by immersing the furnace in a canal

or river. The furnace chamber is surrounded by a sleeve provided with brackets on which the chamber rests, and the furnace chamber and sleeve may be raised separately from the water by lifting gear attached to rings or hooks, so that by vertical adjustment the amount of water brought into contact with the furnace wall for cooling may be regulated. In double furnaces, the electrodes may be similarly raised and passed from one bath to the other.—B. N.

Furnaces; Cooling electric—by means of air. H. Magron. Fr. Pat. 474,781, Dec. 27, 1913.

THE furnace chamber is surrounded by an outer casing, leaving an annular space through which air is circulated for cooling purposes. The air may be cooled artificially, or it may be highly compressed and cooled by expansion.—B. N.

Process of electro-metallic dyeing. Fr. Pat. 475,049. See VI.

Electrolysis of liquids, especially of alkali chloride solutions. Ger. Pat. 284,022. See VII.

XII.—FATS; OILS; WAXES.

Fish oils; Tests for—. Tortelli and Jaffa. L'Ind. Sapon. Ann. Chim. Analyt., 1915, 20, 226. (See this J., 1914, 1061.)

FISH oils may be detected in vegetable oils by brominating 0.3 gm. of the unsaturated fatty acids (obtained by the lead salt-ether method) in the cold (in acetic acid solution) and allowing to stand 3 hours; the liquid is then filtered and the bromide precipitated by adding a mixture of alcohol, ether, and acetic acid; if the precipitated bromide leaves an insoluble residue on boiling with bromine water, fish oil is present. A more simple method is to shake 10 c.c. of the mixed fatty acids with a mixture containing bromine 1, acetic acid 28, nitrobenzene 4, water 167 vols.; if no insoluble bromide is deposited after standing for 1 hr. the oil is free from fish oil or from oils containing linolenic acid. If an insoluble bromide is obtained, it is filtered off and boiled with benzene for $\frac{1}{2}$ hr.; any insoluble bromide having a m.pt. over 200° C. indicates the presence of fish oil.—R. G. P.

Chaulmoogra oil; Examination of—. P. C. Chattopadhyay. Amer. J. Pharm., 1915, 87, 473—483. (See also this J., 1904, 669; 1905, 741.)

A SAMPLE of cold drawn oil from genuine seeds of *Taraktagenos Kurzii* (true chaulmoogra seeds) and an oil derived from supposedly genuine, but probably mixed seeds, by hot expression, were examined. The former was a pale yellow oil and remained liquid at 15° C., whilst the latter was a brownish yellow buttery substance which was separated by filtration into about equal parts of a clear oil and a solid fat (chaulmoogra fat) before analysis. The following values were obtained:—

These results indicate that the genuine oil consists almost wholly of triglycerides of lauric, chaulmoogric, and linolic acids, whilst the doubtful oil is a mixture of tri- and diglycerides.

On neutralising the oil with alcoholic potash and adding a dilute solution of calcium, magnesium, or zinc chloride, the corresponding metallic salt of "gynocardic acid" is precipitated. Calcium and magnesium "gynocardates" are white crystalline substances slightly soluble in boiling water and more soluble in boiling alcohol, whilst zinc "gynocardate" is white and crystalline, insoluble in water and only very sparingly soluble in boiling alcohol. 10 drops of the genuine oil stirred with 1 drop of sulphuric acid gave a yellow coloration changing rapidly to reddish-brown and finally to dirty brown, whilst the doubtful oil gave similar colour changes, but the final coloration was olive-green, this reaction being also given by the fatty acids from both oils and by chaulmoogra fat.—T. C.

Flash and fire points of animal fats and oils; Effect of free fatty acids upon the—. A. Lowenstein and J. J. Vollertsen. J. Ind. Eng. Chem., 1915, 7, 850.

THE flash and fire points of a number of samples of lard oil, tallow, etc., and of the neutral glycerides and mixed fatty acids separated therefrom, were determined. In all cases the values for the mixed fatty acids were considerably lower than those for the original sample, and in the case of similar oils or fats, the flash and fire points were lower the higher the content of free fatty acids.—A. S.

Relation between the Reichert-Meissl, Kirschner, and Polenske values for butter. Cranfield. See XIXA.

Live stock feeding trials with palm kernel cake. See XIXA.

New apparatus for fat extraction. Selecter. See XXIII.

PATENTS.

Fats or oils; Hydrogenation of unsaturated—. J. Dewar, London, and A. Liebmann, Weybridge. Eng. Pat. 15,668, June 30, 1914.

THE catalyst is distributed over coherent fibrous material, e.g., yarns, fabrics, or sponge, so arranged (e.g., between sheets of wire gauze) as not to be disintegrated during the hydrogenation. Thus the fibrous material may be impregnated with soluble salts of nickel, cobalt, or copper, or mixtures thereof, with or without the addition of a salt of a metal of the platinum group, and the respective catalytically active oxides or carbonates precipitated on the fibres. The yarns or fabric may be supported on frames attached to an agitator, or they may be wound round or attached to the blades of the agitator in the hydrogenating apparatus.—C. A. M.

	Sp. gr. at 30° C.	Solidif. pt.	Maumené test.	Valenta test.	Acid value, calc. as oleic acid.	Saponif. value.	Hübl iodine value.	Acetyl value.	Saponif. value acetylated oil.	Ester value.
Cold expressed oil	0.9488	11.9° C.	86° C.	101° C.	11.18	226.36	96.5	19.1	423.07	204.26
Hot expressed oil	0.9471	21.5° C. & 27° C.	83.5° C.	Sol. in acetic acid	44.39	217.57	105.4	39.9	268.2	129.27
Chaulmoogra fat	—	33° C.	—	Sol. in acetic acid.	59.16	228.3	105.3	—	—	110.6
Fatty acids from cold expressed oil	—	37° C.	—	—	—	230.48	98.2	—	—	—
Fatty acids from hot expressed oil	—	33° C.	—	—	—	233.9	111.6	—	—	—

Fatty acids, fatty esters, and other unsaturated compounds ; Process of adding hydrogen to——. C. Ellis, Montclair, N.J. U.S. Pat. 1,154,495, Sept. 21, 1915. Date of appl., Apr. 5, 1912.

THE fat is mixed with a potential catalyst of organo-metallic nature (e.g. nickel carbonyl) which is decomposed by heat in the presence of hydrogen. Catalytically active nickel is produced, and the unsaturated material is hydrogenated.—C. A. M.

Cotton seed ; Process for sterilising and preserving——. E. R. Barrow, Assignor to Barrow Cottonseed Preserver Co., Memphis, Tenn. U.S. Pat. 1,155,191, Sept. 28, 1915. Date of appl., Oct. 7, 1914.

UNHULLED cotton seed is mixed with about 5% by weight of finely divided sodium chloride containing about 2% of starch and 2% of magnesium carbonate.—C. A. M.

Colloidal metals ; Preparation of——with the object of rendering them applicable to the hydrolysis of fats and in particular of drying oils. L. C. E. Gautrelet. Fr. Pat. 471,328, Nov. 20, 1913.

PINATES of metals such as manganese, obtained by interaction of a salt of the metal with alkali pinate obtained from colophony, are treated with substances (e.g. oil of turpentine) containing "condensed oxygen." Products containing the metal in the colloidal condition are thus obtained, suitable for use as catalysts in the hydrolysis of fats. The conversion of the metallic pinate into the colloidal metal and the hydrolysis of the fat may be effected simultaneously. The metallic pinates may also be used in paints, varnishes, etc.—C. A. M.

Fats and oils ; Process and apparatus for the hydrolysis of——. E. Böhm. Fr. Pat. 474,960, July 10, 1914.

THE fat is emulsified with water, and the emulsion heated indirectly to above 400° C., under pressure, in a vessel containing an agitator, e.g., several separate concentric archimedean screws, and a heating coil.—C. A. M.

Soap powder ; Process for manufacturing——. E. C. Kayser, Beau Sejour, Jersey, Assignor to The Procter and Gamble Co., Cincinnati, Ohio. U.S. Pat. 1,153,625, Sept. 14, 1915. Date of appl., Nov. 14, 1912.

A SOLUTION of sodium carbonate or caustic soda, or both, is heated above the normal b.pt. and sprayed from a nozzle on to a spray of liquid fatty acid, so as to obtain directly a powdered soap.—C. A. M.

Soap ; Manufacture of liquid colloidal——. E. F. Rousseau. Second Addition, dated Dec. 1, 1913, to Fr. Pat. 472,587, Aug. 9, 1913 (this J., 1915, 560, 804).

THE excess of free alkali in the colloidal solution is neutralised by the addition of definite amounts of casein, and by the introduction of a current of air or carbonic acid.—C. A. M.

Sapindus nuts ; Industrial process of pulverising——. H. Gouthière et Cie., and P. Ducancel. Fr. Pat. 474,415, Nov. 25, 1913.

THE kernels are mixed, before crushing, with a suitable quantity of an inert powder, e.g., infusorial earth, so as to obtain a dry powder specially suited to the preparation of emulsions.—C. A. M.

Process of treating sugar cane [to recover wax]. U.S. Pat. 1,153,934. See XVII.

Process of dissolving organic substances of animal origin, [with recovery of fat,] and fixation of their nitrogen in the form of soluble compounds. Addition to Fr. Pat. 466,150. See XIXA.

Removing water and other substances from organic and other matter, e.g., desiccation of foods, purification of oils, etc. Fr. Pat. 474,471. See XIXA.

XIII.—PAINTS ; PIGMENTS ; VARNISHES ; RESINS.

Methyl and ethyl alcohol in spirit varnishes ; Determination of——. G. W. Knight and C. T. Lincoln. J. Ind. Eng. Chem., 1915, 7, 837—843.

IN the absence of acetone and pyridine (from denatured alcohol), ethyl and methyl alcohols may be determined by the method of Leach and Lythgoe (this J., 1905, 913), but since the specific gravities of aqueous solutions of methyl and ethyl alcohols containing more than 7% of alcohol differ by an amount increasing with the concentration of the alcohol, the method of calculating the results must be modified accordingly when the amount of total alcohol in the final distillate is between 8 and 40% by vol. and there is an appreciable amount of methyl alcohol present. If acetone or pyridine be present, a quantity of the varnish, measured at 15.6° C., sufficient to give at least 25 c.c. of distillate, is distilled in a bulb heated in a steam bath, with the aid of a current of air at the end. The distillate is collected in a measuring cylinder placed in ice-water, its volume is read at 15.6° C., and if it contains higher alcohols or esters, as indicated by its odour, it is purified by Thorpe and Holmes' method (this J., 1903, 232) and redistilled over anhydrous potassium carbonate until the final distillate contains less than 50% of water. Portions of 1 c.c. and 0.2 c.c. are tested for methyl alcohol and ethyl alcohol respectively by the methods suggested by Denigès (this J., 1910, 585, 1325). 20 c.c. of the distillate is now added to a mixture of 80 grms. of powdered iodine and 20 c.c. of water (or a smaller quantity if necessary to give a mixture containing not more than 50% of water) in a 125 c.c. distilling flask immersed in ice water and connected with a reflux condenser. After standing for 15 mins., with occasional shaking, 8 grms. of red phosphorus is added, and when reaction has ceased, the flask is heated gradually and kept at 75° C. for about 20 mins., then cooled, the condenser inclined downwards, and its lower end connected by means of an adapter with a measuring cylinder which is immersed in ice water and provided with an attached Pélitot tube containing water to act as a safety valve. The reaction mixture is then distilled, the alkyl iodides being collected under 30 c.c. of water in the measuring cylinder ; at the end, the adapter is raised until it dips into the water, and air is drawn through the apparatus. The volume of the distillate is read at 15.6° C. If methyl alcohol be absent, the percentage of ethyl alcohol by vol. in the varnish is given by the formula : $\frac{3.622V_1V_2}{V}$ where V = volume of varnish used, V_1 = volume of alcoholic distillate, and V_2 = volume of iodide. If ethyl alcohol be absent, the percentage of methyl alcohol is given by the formula : $\frac{3.315V_1V_2}{V}$. If both alcohols are present the iodides are separated, washed with 1% sodium hydroxide solution, dried with anhydrous potassium carbonate, and the specific gravity determined. From the sp.gr. at 15.6°/15.6° C. (G) the percentage of methyl alcohol by volume in total alcohol (α) is given by the formula : $\frac{39.05(G-1.947)+51.25(2.292-G)}{2.292-1.947}$ where 2.292 and 1.947 are the specific gravities at 15.6°/15.6° C. of methyl and ethyl iodides respectively. The percentage of ethyl alcohol by volume in total alcohol (β) is then $100-\alpha$, and the

percentage of total alcohol by volume in the varnish is $\frac{V_1 V_2 (0.03315a + 0.03622\beta)}{V}$. This method

has given satisfactory results with known mixtures of methyl and ethyl alcohols, with and without acetone, but if the percentage of methyl alcohol in total alcohol is less than 10%, more accurate results are obtained by a method based on Riche and Bardy's qualitative test (*Comptes rend.*, 1875, 80, 1076). 5 c.c. of the purified alkyl iodides from the sample and also 5 c.c. portions of the iodides obtained in a similar manner from pure ethyl alcohol and from a mixture of ethyl and methyl alcohols (90:10 by vol.) are each treated with 5 c.c. of aniline, and after standing over night, the mixture is diluted with 150 c.c. of water, heated just to boiling, and treated with 30 c.c. of 10% caustic soda solution and a further quantity of water. 1 c.c. of the oily layer of dimethyl- and diethylaniline is withdrawn, mixed with 10 grms. of an intimate mixture of 100 parts of clean sand, 3 parts of finely powdered cupric nitrate, and 2 parts of finely powdered sodium chloride, heated for 8 hours at 90°C., boiled for 20 mins. with 80 c.c. of 95% alcohol, cooled, made up to 100 c.c. with 95% alcohol, allowed to settle, and 1 c.c. of the clear solution withdrawn and diluted with water to 500 c.c. Standards representing mixtures containing from 1 to 9% of methyl alcohol are prepared and compared with the test solution.

—A. S.

Phenol and formaldehyde: The condensation products of—, especially bakelite. G. Matsumoto. *J. Chem. Ind. (Tokyo)*, 18, No. 207. *Chem. News*, 1915, 112, 195.

THE conditions of formation of "bakelite" (one of the insoluble and infusible condensation products) were investigated. The process may be regarded as comprising three stages, *viz.*, initial condensation, concentration of products, and hardening, and in all stages the reactions are greatly accelerated by small additions of various substances. The best results, as regards yield and quality of product, were obtained by the use of sodium hydroxide and ammonia as condensing and hardening agent respectively. Sulphuric acid, hydrochloric acid, ammonia, hexamethylenetetramine, aniline, sodium sulphite, and sodium carbonate were also satisfactory as condensing agents, but only basic substances such as alkali hydroxides or ammonia were suitable as hardening agents. By the condensation of cresol and formaldehyde a product analogous to bakelite was obtained. Lemme's method (this J., 1903, 1107) for determining formaldehyde was used throughout the investigation with satisfactory results.—W. E. F. P.

PATENTS.

Pigments: Machine for grinding—M. D. Duffy and B. P. Costello, Cincinnati, Ohio. U.S. Pat. 1,151,004, Sept. 21, 1915. Date of appl., July 15, 1914.

GRINDING is effected by horizontal cylindrical rollers having smooth surfaces, which revolve in semi-cylindrical water-cooled beds arranged in steps and supported on shafts adjustable vertically.—W. H. C.

Titanic oxide pigment and method of producing same. L. E. Barton, Niagara Falls, N.Y., Assignor to The Titanium Alloy Manufacturing Co., New York. U.S. Pat. 1,155,462, Oct. 5, 1915. Date of appl., July 14, 1914.

A SOLUTION of titanic sulphate is treated with a soluble salt capable of forming an insoluble sulphate (calcium chloride or other chloride of an alkaline-earth metal), and the resulting mixed

precipitate of alkaline-earth sulphate and titanic oxide is separated and calcined.—C. A. M.

New coloured lakes and process for their manufacture. Fr. Pat. 474,706. See IV.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Rubber of uniform colour: Production of—C. Beadle and H. P. Stevens. Caoutchouc et Gutta-percha, 1915, 12, 8730—8731.

THE darkening of raw rubber is due to the presence of an oxydase. Pale rubber can be produced by coagulating with an excess of acetic acid, *crêping*, and drying rapidly, preferably by heating *in vacuo*, or by placing freshly coagulated rubber in boiling water for 10—15 mins., but in both cases the product yields vulcanised rubber of inferior quality. By adding to the latex small quantities (1 part per 500 to 1 part per 1000 or even less) of substances such as sodium bisulphite or formalin, which inhibit enzyme action, pale rubber of uniform colour is obtained and the treatment has no deleterious effect on the vulcanised rubber.

—R. G. P.

Rubber: Simplified Schadt process for preparing—J. G. C. Vriens. Mededeel. v. d. Adviseur der A.V.R.O.S., 1914, 51—52. *Bull. Agric. Intell.*, 1915, 6, 1064.

SCHADT'S new process consists in spreading a thin layer of latex over tin plates with recurved edges. When the latex has dried, the rubber films are smoked in a revolving drum covered with perforated sheet iron, and then compressed into blocks. The cost of the process is very low, and the rubber is fit for transport two days after tapping.—E. H. T.

Rubber: Electrolytic coagulation of—P. S. Clignett. Caoutchouc et Gutta-percha, 1915, 12, 8721—8722.

ON passing an electric current through latex, rubber is deposited on the positive electrode; the insulation produced by the rubber on the electrode does not prevent further coagulation; reversal of the current causes the rubber to be detached and redeposited on the other electrode. The addition of "electrified latex" to ordinary latex causes solidification of the latter. Coagulation on a manufacturing scale can be effected in $\frac{1}{2}$ to 1 hour by means of a low tension dynamo requiring not more than 1 H.P., porous vessels packed with carbon being used as electrodes.

—R. G. P.

Rubber: Tackiness of—K. Gorter. Caoutchouc et Gutta-percha, 1915, 12, 8724—8725.

ACCORDING to Spence (this J., 1909, 374) tackiness is caused by change in the aggregation of the rubber molecule and is not due to chemical change. The author finds that rubber exposed to light in sealed tubes remains unchanged when the tubes are filled with hydrogen or carbon dioxide but becomes tacky in air or oxygen, and concludes that tackiness is due to oxidation. In one experiment 3% by weight of oxygen was absorbed. A piece of rubber which had become tacky in the middle gave the following results—central tacky portion, C 84.62% H 11.45%, non-tacky portion, C 86.34% H 11.7%; as little as 0.6% of oxygen produces considerable tackiness. The absorption of oxygen is slow for the first six days; it then increases and attains its greatest rapidity in about thirty days. Oxidation does not appear to be due to enzyme action, as Whitby (this J., 1913, 544) has suggested, for it occurs in rubber which

has been boiled with water. Aldehydes were detected in tacky rubber.—R. G. P.

Rubber solutions; Vulcanisation of—by ultra-violet rays. A. Helbronner and G. Bernstein. Caoutchouc et Gutta-percha, 1915, 12, 8720—8721.

RUBBER in solutions containing sulphur becomes vulcanised on exposure to ultra-violet rays (see this J., 1915, 502), but the vulcanised rubber forms a stable gel and is not precipitated even after several months or by heating to 80° C. for 18 hrs.; on evaporation the solution yields a film which is insoluble in rubber solvents. Rubber vulcanised by ultra-violet light only contained 0.6% of combined sulphur, and the authors consider that the sulphur acts as a polymerising agent, and that the combination of rubber with sulphur during vulcanisation is merely a secondary reaction. Small quantities of sulphur (0.2%) exert a similar polymerising action in the synthesis of caoutchouc from isoprene, rendering the product insoluble in benzene.—R. G. P.

Rubber; Drying the acetone extract of—. A. Hutin. Ann. Chim. Analyt., 1915, 20, 212—213.

THE acetone extract should be evaporated *in vacuo* in order to obtain a residue of constant weight; unless this is done serious errors may occur owing to the increase in weight of the residue on drying in the ordinary way; even drying in carbon dioxide appears to be unsatisfactory.—R. G. P.

Rubber; Determination of total sulphur in—. A. Hutin. Ann. Chim. Analyt., 1915, 20, 214—216.

FROM 1 to 2 grms. of rubber is decomposed by means of 30 c.c. of fuming nitric acid, added 2—3 c.c. at a time, the liquid is evaporated to a syrup, made alkaline with caustic soda, and mixed with sufficient calcined magnesia to form a stiff paste, which is dried, first on a water bath and then in an air oven at 140° C., and finally ignited cautiously over a small flame so as to avoid an explosion; after ignition the mass is dissolved in hydrochloric acid and the sulphur determined by precipitation as barium sulphate in the usual way.—R. G. P.

PATENT.

Rubber; Apparatus for treating—. A. Woosnam, London. From R. S. Agar, Talawakelle, Ceylon. Eng. Pat. 7960 of 1915; date of appl., Sept. 11, 1914. (See also Eng. Pat. 6215 of 1914; this J., 1915, 806.)

A ROTATING plain or perforated drum dips into the latex which is contained in a pan, while smoke is conducted into the pan from the upper compartment of a furnace through an intermediate chamber controlled by valves. The coagulated latex is withdrawn from the bottom of the pan into a hot chamber (which may be heated by the smoke from the smoke-generator), pressed between rollers to expel water, and partially dried, *e.g.*, by means of heated rollers.—C. A. M.

XV.—LEATHER; BONE; HORN; GLUE.

Wool and hair rugs; Dressing of—. H. Brumwell. Leather Trades' Year Book, 1915, 157—160. J. Amer. Leather Chem. Assoc., 1915, 10, 496—499.

THE use of "Neradol D" in place of alum tannage has proved satisfactory. The skins have a white and soft flesh, are unaffected by atmospheric changes, and can be washed in water. The untanned skin is soaked in fresh cold water,

well worked on the flesh side, and washed in a solution of borax and soft soap. The skins are limed by a modification of the Pullman-Payne process; they are not immersed in the caustic soda solution, but are treated on the flesh side with a 1½% caustic soda solution made into a paste with French chalk. The skins are next drummed with water and delimed with acetic or lactic acid. The tannage is effected in the drum; it is commenced with a 2% "Neradol" solution which is strengthened to 4% during the first day and to 5% on the morning of the second day. The goods are then drummed until evening and drained overnight. Sheepskins require no fat-liquoring but may need a partial degreasing after drying. Springbok and deer skins are fat liquored with sulphonated oils, not with soaps.—F. C. T.

PATENTS.

Tanning extract; Preparation of a— from waste sulphite-cellulose liquors. H. B. Landmark. Fr. Pat. 474,336, June 30, 1914.

WASTE sulphite-cellulose liquors are evaporated to less than half their original bulk, to remove free sulphur dioxide, then treated with sodium carbonate in about twice the quantity necessary for neutralisation, to remove the iron and part of the calcium, and, after filtering or decanting the liquid, the remainder of the calcium is precipitated by oxalic acid. A further quantity of organic acid is added to the filtered product, which is then concentrated.—F. C. T.

Leather, hides, and skins; Composition for treatment of—. R. Vidal. Fr. Pat. 474,425, Nov. 27, 1913.

ANIMAL or vegetable oils in which a phenol or phenolic compound has been dissolved, are used for treating hides, skins, or leather. The product may be heated to 150° C. for several hours before use; it acts more rapidly and efficiently than ordinary oils.—F. C. T.

Hides and skins; Composition for unhairing—. R. Vidal. Fr. Pat. 474,426, Nov. 27, 1913.

CASTOR oil heated with a concentrated solution of sodium sulphide gives a water-soluble product which in 2½%—5% solution can be used for unhairing.—F. C. T.

Hides and skins; Treatment of—. R. Vidal. Fr. Pat. 474,840, Dec. 31, 1913.

SKINS, treated with a solution of alkali carbonate and dried after draining only, can be unhaired after immersion in water, and can be tanned with ordinary tanning materials or with naphthols, polyphenols, salts of iron, chromium, or aluminium, aluminates, chromates, alkali bichromates, or formaldehyde.—F. C. T.

Horn; Manufacture of products resembling—. W. Plinatus. Fr. Pat. 474,570, Dec. 10, 1913.

CASEIN or other albuminous material, worked in presence of volatile liquids such as alcohol, becomes plastic and easily workable. The material can be hardened by formaldehyde or hexamethylenetetramine, and its flexibility and plasticity adjusted as required by adding esters of higher alcohols, hydrocarbons, esters of cellulose, etc.—F. C. T.

XVI.—SOILS; FERTILISERS.

Limestone; Ground— for acid soils. J. F. Barker and R. C. Collison. New York Agric. Expt. Stat., Bull. No. 400, Mar., 1915. 18 pages.

AT least three-quarters of the farmlands of New York State stand in need of lime-dressing, and

on alfalfa land, where the soil is acid, the use of lime is imperative. At the New Jersey Station some remarkable crop increases have been obtained following upon the application of ground limestone on mildly acid soils. At the Ohio Station the effect of such treatment on maize, oats, wheat, clover, and timothy in a 5-year rotation, was to give an average crop increase valued at \$15.18 per acre. These tests also showed that limestone cannot act as a substitute for fertilisers, and that the total effect of limestone and fertilisers applied together was greater than the sum of the effects when they were applied separately. For a soil obviously deficient in lime, the initial application should not be less than 2 tons per acre, and this should be followed by 1—2 tons once every rotation of 3—6 years. Limestone is best applied in the autumn, after ploughing and before drilling and harrowing. Magnesian limestones are in general as beneficial as ordinary limestones, and the latter are fully equal to burnt lime, air-slaked lime, or slaked-lime. The limestone should be ground to pass through a sieve with 10 meshes to the linear inch.—E. H. T.

Lime requirements of soils: Determination of the immediate —. W. H. MacIntire. J. Ind. Eng. Chem., 1915, 7, 864—867.

TEN grms. of the soil (5 grms. in the case of very heavy clays or peaty or swamp soils) is mixed with 150 c.c. of a solution of precipitated calcium carbonate in carbonated distilled water (equivalent to about 0.15 gm. CaCO_3), evaporated to a paste, transferred to an Erlenmeyer flask by means of 60—70 c.c. of water free from carbon dioxide, and the residual undecomposed calcium carbonate estimated by decomposing with 5 c.c. of concentrated phosphoric acid at the ordinary temperature, and removing the liberated carbon dioxide by agitation and aspiration for 30 mins. with a vacuum of 4 ins. (see this J., 1915, 93, 438); the carbon dioxide is absorbed in caustic soda solution. The concentration of the calcium bicarbonate solution is determined by first boiling and then liberating the carbon dioxide of the precipitated carbonate as described above. A repetition of the above method on the treated soil gave no indication of further lime requirement, as is the case when the method of Hutchinson and McLennan (this J., 1915, 565) is used, and soils treated with the amount of lime found necessary by the method were found to give an alkaline reaction in the Veitch test, whereas when the amount of lime found necessary by Hutchinson and McLennan's method was used, the soils failed to show alkalinity. —A. S.

Nitrates in soil: Determination of —. R. S. Potter and R. S. Snyder. J. Ind. Eng. Chem., 1915, 7, 863—864.

THE authors have made comparative experiments on the action of calcium oxide and calcium carbonate as flocculating agents in the preparation of soil extracts for the determination of nitrates. The nitrate was determined colorimetrically (see Chamot and others, this J., 1911, 442) and also by the reduction method. For the latter method 100 c.c. of the extract was treated with 2 c.c. of 50% sodium hydroxide solution, evaporated to 50 c.c. to expel ammonia, and the solution transferred to the Kjeldahl flask of the aeration apparatus described previously (this J., 1915, 438) for the determination of ammonia; reduction was effected by means of aluminium. It was found that the colorimetric method gives somewhat lower results than the reduction method. Similar results are obtained by the reduction method whether calcium oxide or carbonate is used as flocculating agent; but when the colorimetric method is used, lower results are obtained with

calcium oxide than with calcium carbonate. Experiments with solutions of nitrates showed that the results by the reduction method are the more accurate.—A. S.

Proteoses and peptones in soils; Presence of —. E. H. Walters. J. Ind. Eng. Chem., 1915, 7, 860—863.

REACTIONS indicating the presence of proteoses and peptones have been obtained in extracts prepared from a sandy loam soil by treatment with 2% sodium hydroxide solution, followed by precipitation of humic acid with sulphuric acid, and also in an aqueous extract of the soil.—A. S.

Sulphur; Action of — on crops. T. Pfeiffer and W. Simmermacher. Föhring's Landw. Zeit., 1915, 64, 243—255. Bull. Agric. Intell., 1915, 6, 1014—1015. (See also this J., 1915, 1064.)

THE field experiments described previously (this J., 1915, 294) were continued for a second year to test the efficacy of sulphur on oats and mangels. There was no beneficial after-effect upon the crops, and the influence of sulphur upon the availability of the soil nitrogen was probably slightly malign. —E. H. T.

An oxalic acid-producing Penicillium. Currie and Thom. See XXIV.

PATENT.

Seed-grain; Treatment of — [before sowing]. H. E. Fry, Dorchester, and C. E. De Wolf, London. U.S. Pat. 1,155,560, Oct. 5, 1915. Date of appl., Mar. 27, 1915.

SEE Eng. Pat. 10,202 of 1914; this J., 1914, 1217.

XVII.—SUGARS ; STARCHES ; GUMS.

Sucrose; Experiments on the determination of — by single and double polarisation in the chemical control of white sugar manufacture by the Battelle process. H. S. Walker. Intern. Sugar J., 1915, 17, 467—471.

WHEN operating the Battelle process of making white sugar, in which the reducing sugars present are destroyed by heating with lime (this J., 1915, 916), calcium salts are formed having a weak laevo-rotation in neutral or slightly acid solution, but which on treatment with strong acids assume a strong dextro-rotation. Accordingly, on applying the double polarisation (Clerget-Herzfeld) method of determining sucrose to such liquors, the results are more or less lower than the truth, depending upon the amount of decomposition products formed from the reducing sugars originally present, while the direct polarisation is influenced in the same direction, though in a slighter degree. In explanation attention is called by the author to the compound termed saccharin, $\text{C}_6\text{H}_{10}\text{O}_5$, produced by boiling a solution of dextrose or levulose with excess of lime (see von Lippmann, "Chemie der Zuckerarten," page 335); it forms slightly laevo-rotatory calcium salts, but in the free state possesses a marked dextro-rotatory power in the presence of strong acids, such as hydrochloric acid. Similar results are obtained when the reducing sugars are allowed to stand in contact with lime in the cold; and it is noteworthy that when the decomposition of reducing sugars takes place in the presence of sucrose the divergence from the truth is greater than when the same amount of reducing sugars is decomposed alone, then added to the sucrose solution. Sucrose alone, however, in pure solution may be boiled under similar conditions without undergoing any appreciable decrease in polarisation.—J. P. O.

Dextrose and levulose; Action of alkalis on — C. W. R. Powell. Chem. Soc. Trans., 1915, 107, 1335—1346.

THE velocity of saponification of ethyl acetate by sodium hydroxide and also the conductivity of a solution of sodium or potassium hydroxide decrease on the addition of dextrose or levulose, indicating combination between the alkali and the sugar. This combination takes place in equimolecular proportion and the compounds formed are largely dissociated by water. The rates of decomposition of dextrose and levulose by alkalis, measured by the dilatometric method at 50° C., are equal, probably due to a rapid preliminary decomposition of the sugars into another substance which then decomposes more slowly. The velocity-coefficient for the decomposition of dextrose by alkalis depends very little on the concentration of the free dextrose: it depends on the concentration of the free hydroxyl ions, but is not exactly proportional to this.—T. C.

PATENTS.

Sugar cane; Process of treating — [to recover wax]. T. Lee and A. B. Monks, Denham, Mass., Assignors to Z. G. Simmons, Kenosha, Wis., A. W. Preston, Swampscott, Mass., and B. W. Palmer, Boston, Mass., known as Simmons Sugar, Ltd. U.S. Pat. 1,153,934, Sept. 21, 1915. Date of appl., Aug. 26, 1912.

THE fibrous tissue of sugar cane is dried and digested in a liquor containing caustic soda and sodium chloride (prepared, for example, by electrolysis of a solution of sodium chloride), and wax is recovered from the mixture.—J. P. O.

Sugar product [compressed raw sugar] and method of producing the same. J. J. Armstrong, Assignor to A. G. Hawes, Honolulu, Hawaii. U.S. Pat. 1,154,557, Sept. 21, 1915. Date of appl., Dec. 13, 1913.

RAW sugar is prepared for shipment by compressing it into large blocks; a protective, hard, skin-like layer is formed on the surface by the operation.—J. P. O.

Syrup; Clarification of factory and refinery — by free phosphoric acid. E. Burban. Fr. Pat. 474,669, Dec. 15, 1913.

AFTER defecating with an alkaline earth, the syrup is neutralised by an aqueous solution of free phosphoric acid, from which all sulphates have previously been eliminated by treatment with barium phosphate. Previous to being filtered, the treated syrup is heated almost to boiling point, the proteins thus being coagulated and the precipitate of tricalcium phosphate brought to the surface as a scum. In order to facilitate the separation of the scum, a coagulable protein, as white of egg, blood, or milk casein, may be added to the treated liquor before heating.—J. P. O.

Sugar; Method of boiling — in its manufacture and refining. L. Garet. Fr. Pat. 474,933, Jan. 10, 1914.

WHILE machining the sugar from the first boiling, the run-off is divided into two, the poorer portion being limed and then sulphited, so as to leave an alkalinity of 0.01 grm. per litre. Boiling is recommenced with ordinary virgin syrup and continued till graining takes place, after which first the richer and subsequently the poorer portion of the run-off is drawn into the pan, and boiling then continued to exhaustion.—J. P. O.

XVIII.—FERMENTATION INDUSTRIES.

Yeast; Reducing enzymes of dried (Lebedeff) — and of rabbit muscle. A. Harden and R. V. Norris. Biochem. J., 1915, 9, 330—336.

DRIED yeast, which has been washed with cold water until it loses its power of reducing methylene blue (see this J., 1914, 658), has its activity in this respect restored by a number of substances, including salicylaldehyde, benzaldehyde, anisaldehyde, isovaleraldehyde, phloroglucinol, dihydroxyacetone, glycollic acid, citric acid, glyceric acid, succinic acid, bouillon, boiled yeast extract, normal horse serum, sterile milk, and lactic acid. The following substances do not restore the property:—quinol, *p*-phenylenediamine, pyrogallol, resorcinol, citral, glycerol, propyleneglycol, 2,3-butyleneglycol, formic acid, acetaldehyde, dextrose, levulose, glycine, alanine, tyrosine, malic acid, tartaric acid, mandelic acid, yeast nucleic acid, creatine, asparagine, guanidine-acetic acid, guanidine nitrate, glycol, peptone, acetone, pyruvic acid, and methylglyoxal. When lactic acid restores the power of reduction, it is itself oxidised, giving acetaldehyde, but the yield is not equivalent to the amount of lactic acid lost. The lactic acid is probably first converted into pyruvic acid, which is then decomposed by the carboxylase of the yeast into acetaldehyde and carbon dioxide. Rabbit muscle, like dried yeast, when washed loses the power of reducing methylene blue; this power is restored to the washed muscle by various substances. The enzyme concerned seems to be specifically different from that present in yeast, since acetaldehyde restores the reducing power of washed muscle but not that of washed dried yeast. (See also Harden and Zilva, p. 1120.)—W. P. S.

Sulphite pulp waste lyes and their utilisation [for the production of alcohol]. Kiby. See V.

Oxidation of alcohols in presence of ferrous oxide or ferrous salts. Doroschewski and Bardt. See XX.

PATENTS.

Saccharification of substances containing starch. H. Joucla. Fr. Pat. 474,948, July 9, 1914.

AFTER boiling the grain under pressure with water and cooling to 50° C., the mash is inoculated with a culture of a bacterium termed *B. burdigalense*, which possesses a particularly high saccharifying power, while giving rise to the formation of very little acid. This bacterium closely resembles the *Tyrolthrix tenuis* of Duclaux, but is more active. It is aerobic, and possesses an optimum temperature of 47°—50° C. It may be used in symbiosis with a mould, *Mucor clocis*, which has a saccharifying power twice that of *Amylomyces Rouxii*, and an optimum temperature of 36° C. Unsterilised media and uncovered vats may be used, and the yield of spirit is at least as great as in known processes using hydrochloric acid, and working under aseptic or antiseptic conditions.—J. P. O.

Distillation [of fermented liquids]. A. Woolner, jun., Peoria, Ill. U.S. Pat. 1,153,992, Sept. 21, 1912. Date of appl., June 27, 1914. (See also U.S. Pat. 1,104,948; this J., 1914, 936.)

THE steam for distilling the mash is obtained by passing the residual "slop" in a thin film over a heated surface or projecting it as a fine rain on to a heated surface, so as to obtain steam free from objectionable qualities which would injure the flavour of the distillate.—W. H. C.

Ethyl alcohol; Manufacture of — from monohydroxy acids, their salts, amino-derivatives, or amides. Soc. Veuve Ch. Dècle et Cie. Fr. Pat. 474,364, Nov. 21, 1913.

ETHYL alcohol is produced by the distillation of

monohydroxy acids (e.g., lactic or malic acid), or their salts, amino-derivatives, or amides under reduced pressure in presence of excess of steam. Carbon dioxide and either carbonates, oxides, or ammonia are also formed, e.g., calcium lactate and asparagine decompose thus—

$(\text{C}_2\text{H}_5\text{CHOH.COO})_2\text{Ca} + \text{H}_2\text{O} = 2\text{C}_2\text{H}_5\text{OH} + 2\text{CO}_2 + \text{CaO}$;
 $\text{NH}_2\text{CO.CH(NH}_2\text{).CH}_2\text{COOH} \rightarrow \text{C}_2\text{H}_5\text{OH} + 2\text{CO}_2 + 2\text{NH}_3$.
 The process is applicable to distillery residues from grain, molasses, beetroot, or cider. Steam must be in excess to diminish the formation of saturated hydrocarbons by secondary reactions, and the lower the pressure maintained, the more closely the yield approaches the theoretical value. *Example.*—Vinasses from molasses is neutralised with chalk or lime, concentrated, and distilled under reduced pressure at low red heat in a long iron tube connected to a condenser and vacuum pump. The residue consists of potassium and calcium carbonates, sulphates, chlorides, etc. The distillate is an ethyl alcoholic solution of carbon dioxide, ammonia, and hydrocarbons, and in this case contains also acetic acid and methyl alcohol from the decomposition of betaine. Sulphuric acid or aluminium sulphate is added until the liquor is slightly acid. On distillation the hydrocarbons pass over first, then methyl alcohol, and finally ethyl alcohol. A residue of ammonium salts remains, which when mixed with the residue from the original distillation forms a complete fertiliser.—F. Sp.

Treating by-product liquors from wood sulphite plants to produce alcohol. U.S. Pat. 1,155,256. See V.

XIXA.—FOODS.

Palm kernel cake ; Live stock feeding tests with — Imperial Institute, Oct., 1915.

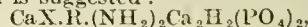
IN order to determine the value of palm kernel cake as a food for live stock in comparison with other foods, Sir Owen Philipps, Chairman of the West African Section of the London Chamber of Commerce, arranged for practical trials to be made at a number of agricultural colleges and elsewhere in Great Britain. At the North of Scotland College of Agriculture palm kernel cake was compared with linseed and decorticated cottonseed cake as a cattle-fattening food. The animals fed on palm kernel cake thrived equally well with those fed on the linseed and cottonseed cake. Palm kernel cake, however, gave considerably the best monetary return, the net cost of food per cwt. of live weight increase being in round figures 43s. for palm kernel cake as against 45s. for cottonseed and 51s. for linseed cake. Results obtained in the winter feeding of cattle at the Edinburgh and East of Scotland College of Agriculture indicated that palm kernel cake is a cheaper feeding stuff than first class Bombay cotton cake and is practically equal in value to the best class of dried distillery grains. At the Norfolk Agricultural Station results indicated that palm kernel cake is equal in food value to linseed cake, while it is of course much lower in price. Results obtained at the Agricultural College, Uckfield, Sussex, go to show that palm kernel cake is a better beef producer than Bombay cotton cake. Experiments at other Agricultural Colleges indicate that palm kernel cake, as compared with other feeding cakes, increases the yield of fat in the milk of dairy cows, and also the actual milk yield. Complete particulars of these latest feeding trials with this cake will appear in the next number of the "Bulletin of the Imperial Institute."

British makers of palm kernel cake are now finding a ready sale for their product. Indeed the recent increase in the price of this cake (which, however, leaves it still relatively the cheapest cake on the market), is no doubt chiefly due to the desire of the manufacturers to restrict the demand, with which, pending completion of the new palm kernel crushing mills in the United Kingdom, now in course of construction, they find it difficult to cope.

Caseinogen ; Preparation and composition of —.

J. Mellanby. Biochem. J., 1915, 9, 342—350.

CASEINOGEN (the chief protein of fresh milk) may be prepared by treating separated milk with three times its volume of alcohol, both milk and alcohol being cooled below 15° C.; the precipitate is collected, ground up with ether, filtered, again extracted with ether until free from fat and pigment, then pressed between filter-paper, and air dried. Analyses of caseinogen and of acidic caseinogen (the protein precipitated from milk by acid) indicate that caseinogen is composed of a complex of protein and calcium phosphate, approximately 3500 grms. of caseinogen containing 1 grm.-mol. of tricalcium phosphate. Approximately 3400 grms. of acidic caseinogen contain 1 grm.-atom of phosphorus. Six grm.-mols. of acetic acid precipitate acidic caseinogen from 3500 grms. of caseinogen. These relations suggest that the protein unit of acidic caseinogen has a weight of 3400 grms. and that caseinogen consists of a complex containing 1 unit of protein and 1 mol. of tricalcium phosphate. The following relation of the protein to the calcium phosphate in caseinogen is suggested:



where the group (X) has feeble acidic properties. —W. P. S.

Solids and fat in milk and other fluids ; Device for the successive determination of —. A. Seidenberg. J. Ind. Eng. Chem., 1915, 7, 769—773.

THE liquid is distributed over a piece of fine-mesh oxidised copper wire gauze (60-mesh for milk, 40-mesh for cream) provided with a series of lateral ridges and having the two long sides bent up to close the ends of the grooves; the gauze is supported on two ridges extending the length of a dish made of heavy tinfoil, the sides of which are not joined at the corners. After determining the total solids by drying in an air-bath at 100° C. the dish is flattened out and rolled up with the gauze, and the fat determined by extraction with ether in the usual way. The same piece of gauze should not be used more than twice; preferably, a new piece is used for each determination. The device may be applied to the determination of total solids in medicinal preparations containing much sugar or glycerin and in other mixtures which readily char or decompose on heating.—A. S.

Milk and butter ; Effect of feeding on the composition of —. Linseed cake and hempseed cake. H. T. Cranfield and M. G. D. Taylor. Analyst, 1915, 40, 433—439.

HEMPSEED cake has practically the same feeding value as linseed cake as determined by the composition and quantity of the milk and butter produced by herds of cows, the one receiving a ration containing hempseed cake and the other a ration containing linseed cake. When the herds of cows were removed from a poor pasture and put on to a well-balanced ration in stall, the quantity of fat in the mixed milk of each herd decreased gradually from 4.1% to about 3.6%; this was probably due to the fact that the quantity of milk increased very much. At the same time, the Reichert-Meissl, Kirschner, and Polenske

values of the butter fats increased considerably, whilst the refractometer values decreased.

—W. P. S.

Butter; Relation between the Reichert-Meissl, Kirschner, and Polenske values for —, H. T. Cranfield. Analyst, 1915, 40, 439–442.

THE Kirschner, Polenske, and Reichert-Meissl values of sixty-two samples of genuine butter are recorded; the average values agreed well with those given by Bolton, Richmond, and Revis (this J., 1912, 553), but in four of the samples the Polenske value was much higher or lower than the average. It is possible that there may be some definite relation between all three of the values mentioned. The figures representing the soluble volatile fatty acids other than butyric acid (i.e., the difference between the Reichert-Meissl and Kirschner values) follow approximately the Polenske values, therefore the ratio (R.M.—K)/P should be fairly constant. This ratio for the sixty-two butters mentioned above varied from 1.97 to 2.98, but in the majority of the samples it lay between 2.2 and 2.8.—W. P. S.

Corn [maize]; Lye hulling of — for hominy. J. W. Marden and J. A. Montgomery. J. Ind. Eng. Chem., 1915, 7, 850–853.

IN the manufacture of hominy on the commercial scale, the maize is prepared by heating with caustic soda solution in large wooden tanks fitted with stirrers, in order to remove the hulls and black tips. Experiments by the authors showed that to obtain good results, the lye should contain at least 1 lb. of caustic soda to 12 galls. of water, but there is no advantage in using more than 2 lb. of alkali. The proportion of maize to liquid should be between 1 bushel per 40 galls. and 1 bushel per 20 galls. The operation occupies about 1½ hours at 70° C. Using water at 70° C. six washings are required to remove 99% and nine washings to remove 99.9% of the alkali retained by the maize; with water at 25° C. about twice as many washings are required.—A. S.

Starch in cocoa: Determination of — by means of taka-diastase. C. Revis and H. R. Burnett. Analyst, 1915, 40, 429–432.

FIVE grms. of the fat-free dry cocoa is mixed thoroughly with 50 c.c. of 10% alcohol (by vol.) and filtered under pressure; the cocoa is then washed with two further quantities of 10% alcohol and finally with 10 c.c. of 95% alcohol, care being taken that it does not become completely dry at any stage of the filtration. The cocoa is now washed into a 250 c.c. flask, with the aid of about 125 c.c. of boiling water, and the flask is placed in a boiling water-bath for 15 minutes. After cooling the contents of the flask to 38° C., 0.05 gm. of taka-diastase mixed with a little water is added, followed by 2 c.c. of toluene, the mixture is shaken, the flask stoppered, and placed in an incubator at 38° C. for 24 hours; 10 c.c. of N/10 sodium hydroxide solution is then added, the mixture is cooled to 15° C., treated with 100 c.c. of water and 10 c.c. of acid mercuric nitrate solution, then diluted to 250 c.c., mixed, and filtered. To 100 c.c. of the filtrate is added 0.5 gm. of crystallised disodium phosphate and, when this has dissolved, 10 c.c. of sodium hydroxide solution is introduced while the mixture is shaken (the strength of the sodium hydroxide solution is such that 10 c.c. exactly neutralises 4 c.c. of the acid mercuric nitrate solution; an excess must be avoided, and it is preferable to leave the solution slightly acid after the addition of the alkali). The mixture is again filtered, and 50 c.c. of the filtrate is used for the determination of the cupric-reducing power, a polarimetric reading being also made on this filtrate. The latter will

contain the maltose and dextrose resulting from the conversion of the starch, and the quantity of this is calculated from the amounts of maltose and dextrose found by the polarimetric and copper-reduction methods. The following quantities of starch were found in various kinds of cocoa nib:—Accra, 12.8; Guayquil, 8.0; Trinidad, 14.5; Grenada, 12.3; San Thomé, 12.4%, in the fat-free dry substance. Four samples of cocoa shell examined by the method yielded only traces of reducing sugars, and it is evident that cocoa shell does not contain any actual starch. The acid mercuric nitrate solution is prepared by dissolving mercuric oxide in twice its weight of nitric acid (sp.gr. 1.12) and diluting the solution to five times its volume with water.—W. P. S.

Soya bean; Carbohydrates and enzymes of the —. J. P. Street and E. M. Bailey. J. Ind. Eng. Chem., 1915, 7, 853–858.

THE composition of a number of varieties of the soya bean grown on the Connecticut Agricultural Experiment Station Farm, calculated to an uniform moisture content of 10% was: ash, 4.67–7.77 (average 5.54); protein (N × 6.25), 33.15–40.99 (38.29); fibre, 3.57–5.87 (4.64); N-free extract, 23.58–29.59 (26.64); fat, 12.72–17.07 (14.89)%. The average composition of seven samples of commercial soya bean flour was: water, 5.1; ash, 4.5; protein, 42.5; fibre, 3.7; N-free extract, 24.3; fat 19.9%. A selected sample of beans of the Hollybrook variety contained: water, 12.67; ash, 4.61; protein, 36.69; ether extract, 14.92; N-free extract and fibre, 31.08%. After extracting with ether, the dried meal was treated successively with boiling 95% alcohol, cold water, malt extract, 1% hydrochloric acid, and 1.25% sodium hydroxide solution, and the different extracts analysed. It was found that the 31.08% of N-free extract and fibre was composed of galactan, 4.62; pentosans, 4.94; organic acids (as citric acid), 1.44; reducing sugars, 0.07; sucrose, 3.31; raffinose, 1.13; starch, 0.5; cellulose, 3.29; hemicelluloses, 0.04; dextrin, 3.14; water, colouring matter, etc. (by diff.), 8.6%. In addition to urease, amylase, and a glucosidase, which have been previously detected, soya beans contain a protease of the peptoclastic type, a peroxidase, and a lipase; tests for sucrase and a protease of the peptonising type gave negative results.—A. S.

Gliadin, lactalbumin, and the protein of the rice kernel; Some products of hydrolysis of —. T. B. Osborne, D. D. Van Slyke, C. S. Leavenworth, and M. Vinograd. J. Biol. Chem., 1915, 22, 259–280.

FROM gliadin an amount of pure lysine picrate (Kossel and Kutscher, Z. physiol. Chem., 1900–1901, 31, 165) was obtained equivalent to a lysine content of 0.64% of the ash-free protein; the lysine content as estimated from the partition of nitrogen by the Van Slyke method (see following abstract) was 1.21%. It appears probable that the true lysine content of gliadin lies between these two results, and may be stated as 0.93 ± 0.28%. Expressed in the same way, the histidine content is 1.84 ± 0.35%, and the arginine content 2.84 ± 0.14%. The lower results obtained by Kossel's picrate method were not due to hydrolysis with sulphuric acid instead of hydrochloric acid, or to precipitation of the phosphotungstates under conditions different from those employed in the Van Slyke method, or to loss in decomposition of the lysine phosphotungstate by barium hydroxide. The amount of nitrogen yielded by gliadin as ammonia corresponds very closely with that required for amide union with one carboxyl group of the glutamic and aspartic acids from gliadin. This fact is added evidence that the nitrogen

yielded as ammonia by acid hydrolysis exists in the protein molecule in acid-amide form, as in asparagine and glutamine. In all three proteins (gliadin, lactalbumin, and the protein of the rice kernel), the free amino nitrogen determined by the nitrous acid method is equal to one-half of the amount of the lysine nitrogen determined by the Van Slyke method; this indicates that one of the two NH_2 groups, probably that in the ω -position, exists free in the protein molecule. The hexone base content of lactalbumin was found to be: lysine, $9.16 \pm 0.68\%$; histidine, $2.06 \pm 0.54\%$, and arginine, $3.23 \pm 0.23\%$, the upper limit in each case representing results obtained by the Van Slyke method. The partition of nitrogen amongst the products of hydrolysis of oryzenin, the chief protein of the endosperm of rice, was determined by the Van Slyke method. Compared with the endosperm proteins of wheat or maize, the protein of rice yields relatively much lysine, histidine, and arginine, and comparatively little ammonia and non-amino nitrogen. It more nearly resembles the majority of the proteins of animal tissues than do the proteins of wheat or maize.—W. P. S.

Proteins: Method for analysis of — by determination of the chemical groups characteristic of the different amino-acids. D. D. Van Slyke. J. Biol. Chem., 1915, 22, 281—285.

A FEW modifications in the procedure adopted in the method described previously by the author (this J., 1911, 771, 1135) are given. The phosphotungstic precipitate of the bases should be collected on a Buchner filter and the washing solution should be cooled to 0°C . before it is used. The number of washings required is ascertained by testing the successive washings for the presence of calcium. The decomposition of the precipitate is effected by treating it with hydrochloric acid and shaking with a mixture of equal volumes of amyl alcohol and ether; this mixture readily dissolves the separated phosphotungstic acid. After the removal of the amyl alcohol-ether mixture, the hydrochloric acid solution of the bases is evaporated under reduced pressure, the residue dissolved in a definite quantity of water, and portions of the solution used for the determination of the amino nitrogen and the total nitrogen.—W. P. S.

Histidine and tyrosine: Diazo reactions of —. G. Totani. Biochem. J., 1915, 9, 384—392.

HISTIDINE and tyrosine yield similarly coloured compounds when combined with diazobenzene-sulphonic acid, but may be distinguished by reducing the azo compounds and then treating with ammonia. The amino-acid solution is rendered alkaline with sodium carbonate and treated with a slight excess of diazobenzene sulphonic acid dissolved in sodium carbonate solution. A dark red coloration develops within 3 minutes if histidine or tyrosine is present. The solution is then reduced by the addition of hydrochloric acid and zinc dust, and, when colourless, a few drops of the solution are removed and rendered strongly alkaline with ammonia; tyrosine gives a rose-red, and histidine a golden-yellow coloration. The latter coloration is specific for histidine amongst the protein cleavage products; the reaction may be obtained with a histidine concentration of 1:20,000. The rose-red coloration given by tyrosine is not specific for this amino-acid, but since the first diazo reaction (dark red coloration) is given only by tyrosine and histidine, it seems possible to detect the presence of tyrosine by means of these reactions. The ammonia reaction will detect the presence of 1 part of tyrosine in 10,000 parts. Nearly colourless solutions result when the red coloured solutions, resulting from the action of ammonia on the azo compounds

from tyrosine and other amino acids, are treated with hydrogen peroxide, whilst the golden-yellow coloration of histidine is but little altered.—W. P. S.

Tryptophane content of proteins; Method for the determination of the — involving the use of barium hydroxide as a hydrolysing agent. A. Homer. J. Biol. Chem., 1915, 22, 369—389.

THE protein is hydrolysed with barium hydroxide solution, e.g., 100 grms. of casein is heated on a water-bath for from 20 to 120 hours with a solution of 350 grms. of barium hydroxide in 2.5 litres of water; the barium is then precipitated by a slight excess of sulphuric acid, the barium sulphate separated by filtration, and the filtrate is made 5% acid with sulphuric acid. An excess of mercuric sulphate solution (10 grms. of mercuric sulphate per 100 c.c. of 5% sulphuric acid) is now added, and, after 48 hours, the precipitate is collected, washed with 5% sulphuric acid, suspended in 2% sulphuric acid, decomposed with hydrogen sulphide, the mercury sulphide separated, excess of hydrogen sulphide expelled from the solution, and the latter treated with phosphotungstic acid in slight excess. The precipitate formed is filtered off, and phosphotungstic acid is separated from the filtrate with barium hydroxide and the latter with sulphuric acid. The quantity of tryptophane in the residual solution thus obtained is found by determining the bromine absorption of the solution; a bromide-bromate solution is used in this determination, and the solution is standardised against pure tryptophane. At 17°C ., and after 30 minutes' contact, 1 grm. of tryptophane absorbs approximately 3 grms. of bromine.—W. P. S.

Proteins; The kyrine fraction obtained on partial hydrolysis of —. P. A. Levene and J. van der Scheer. J. Biol. Chem., 1915, 22, 425—432.

ACCORDING to Siegfried, the kyrines are fragments of the protein molecule, viz., polypeptides, which resemble natural protamines. Levene and Birchard (J. Biol. Chem., 1912—1913, 13, 277) have previously separated the kyrine fraction of gelatin into two peptides, one containing in its molecule only arginine and the other only lysine. The authors have investigated the kyrine fraction of casein. The two kyrines separated from the two silver complexes, one soluble and the other insoluble, were further fractionated into two parts, the one forming a phosphotungstate soluble in hot water, the other an insoluble phosphotungstate. From one of the fractions a crystalline sulphate was obtained having a composition which was not altered by fractional crystallisation; all the basic nitrogen was present in the form of amino nitrogen, hence the peptide contains in its molecule only one basic substance, namely, lysine. Lysine, in fact, was isolated as its picrate. There seems to be no doubt that the substance is a tripeptide containing lysine and two amino-acids; an elementary analysis of the sulphate yielded results agreeing with the assumption that the tripeptide consists of lysine, oxyproline, and valine.

—W. P. S.

New apparatus for fat extraction. Selecter. See XXIII.

Modified method for determining carbon-free ash in plant substances. Boltz. See XXIII.

An oxalic acid-producing Penicillium. Currie and Thom. See XXIV.

PATENTS.

Flour; Process of purifying—during the manufacture thereof. G. T. Smith, Fort Worth, Tex. U.S. Pat. 1,151,517, Sept. 21, 1915. Date of appl. May 23, 1912.

WHEAT is repeatedly ground until it is reduced to flour and the impurities to a fine powder which is lighter than flour. During grinding the material is kept in motion in thin layers, the flour is separated from the wheat, and at the same time a very slight current of air is forced through the moving material, sufficient only to lift and carry away the impurities from the flour.—J. H. J.

Organic substances of animal origin; Process of dissolving—[with recovery of fat] and the fixation of their nitrogen in the form of soluble compounds. J. Sloan and C. Bohon. First Addition, dated Jan. 10, 1914, to Fr. Pat. 466,150, Feb. 21, 1913 (this J., 1911, 661).

THE original process is extended so as to include the recovery of oils and fats from substances yielding them. For this purpose a vessel is provided for the separation of the greasy matter rising to the surface after solution of the substance in alkali.—J. H. J.

Organic and other matter; Removing water and other substances from—, e.g., desiccation of food, purification of oils, etc. E. Bataille. Fr. Pat. 474,471, July 2, 1911.

STEAM is raised in a low-pressure boiler and passed through a reheater where it is deprived of water and is superheated sufficiently to raise its temperature above its saturation point when in contact with the organic matter to be dried. It is then led by a pipe through a safety-valve to the bottom of a closed vessel containing the substance to be treated. If the substance is a fluid, such as oil, it is heated by a steam or hot water coil, and the low-pressure steam bubbled through it; if the substance is a solid, it is supported on shelves heated by waste steam or hot water. A pipe leads from the top of the vessel to an exhaust plant, composed of an ejector and condenser in series, preferably on the Westinghouse-Leblanc system.—J. H. J.

XIXB.—WATER PURIFICATION; SANITATION.

Carbonic acid [in water]; Detection of active—. L. W. Winkler. Z. angew. Chem., 1915, 28, 376.

THE corrosive action of water on pipes, mortar, etc., is due to its content of active carbonic acid, for the detection of which the following tests are suggested:—(1) To 100 c.c. of a fresh, clear sample of water is added 2 drops (0.1 c.c.) of copper sulphate solution (10 grms. $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ per 100 c.c.). If no active carbonic acid is present, the solution will become turbid for a few minutes, owing to separation of copper carbonate, whereas in presence of active carbonic acid, the solution remains clear for at least ten minutes, the copper bicarbonate formed remaining dissolved. On shaking, the carbonic acid escapes and the solution becomes turbid, except in the presence of humic or other acid. (2) The above test is not adapted to very soft waters, which are preferably tested by adding 10 drops of a 1 per cent. solution of alizarin in alcohol. A bluish-red colour is produced if no active carbonic acid is present, a copper-red in presence of traces, a reddish-yellow with moderate amounts, and a pure yellow with large amounts of active carbonic acid.

Waters possessing a considerable degree of temporary hardness will only give the colour reaction when large quantities of active carbonic acid are present, and for such waters the copper sulphate test is preferable.—A. B. S.

Ammonium sulphate; Treatment of sewage for obtaining—. A. A. Kalouchsskii. Moskovskii Selskokhosiastvennii Institut, 1914, 9, 253—345. Bull. Agric. Intell., 1915, 6, 1036—1038.

THE average nitrogen content of the sewage (Moscow) examined was 2.714 grms. per litre, of which about 49% was present as volatile ammoniacal nitrogen, 22.5% as fixed ammoniacal nitrogen, and 28.5% as organic nitrogen. The relative proportions of these forms of nitrogen were, for the liquid portion, 6.7:2.7:1, and for the solid portion, 1.1:1.1:4.6, approximately. The effect of storage for three months on the total nitrogen content was practically negligible when air was excluded, but in contact with air the loss was very great, viz., 5.78% in 4 days, 45.49% in 6 weeks, and 67.76% in 95 days; the ammoniacal nitrogen diminished by 86.96% and the organic nitrogen by only 28.23%. The actual yield of ammonia by treatment with lime was 2.099 grms. per litre of sewage, equivalent to 10 lb. of ammonium sulphate per 100 gallons; 77% of the maximum possible amount of nitrogen was therefore recovered. Boiling off the volatile ammonia and then treating with lime was found to be more economical than treating the whole sewage with lime, involving a saving in lime of 50% or over. The method of heating did not affect the yield of ammonia, but simple boiling was 3—4 times more rapid than treatment with steam. The manufacture of ammonium sulphate by this process is considered to be economically practicable; in European Russia 1,700,000 tons of ammonium sulphate could be recovered from the yearly sewage output.—E. H. T.

Phenols (and phenol derivatives) in urine; Colorimetric method for the determination of—. O. Folin and W. Denis. J. Biol. Chem., 1915, 22, 305—308.

TEN c.c. of the urine is placed in a 50 c.c. flask, acid silver lactate solution (3% lactic acid solution containing 3% of silver lactate) is added until no further precipitate is formed, then a few drops of colloidal ferric hydroxide solution, the mixture is diluted to the mark, shaken, and filtered. Twenty-five c.c. of the filtrate is treated with saturated sodium chloride solution containing 1% of concentrated hydrochloric acid, the mixture is diluted to 50 c.c., and filtered. To determine free phenols, 20 c.c. of this filtrate is treated with 5 c.c. of phosphotungstic-phosphomolybdic acid reagent (see this J., 1912, 949) and 15 c.c. of saturated sodium carbonate solution, then diluted with water at 35°C. to 50 c.c., and, after 20 minutes, the deep blue coloration obtained is compared with that produced by a known quantity of phenol. To determine total (free and combined) phenols, 20 c.c. of the filtrate is mixed with 10 drops of concentrated hydrochloric acid and heated for 10 minutes in a boiling water-bath; after cooling, the mixture is treated with 10 c.c. of phosphotungstic-phosphomolybdic acid reagent and 25 c.c. of saturated sodium carbonate solution, diluted to 100 c.c., and the coloration compared with the standard after the lapse of 20 minutes. The method cannot be applied directly to the determination of phenols in blood, tissues, or faeces.—W. P. S.

Lime-sulphur wash; Chemical composition and valuation of—. J. Bodnár, Chem.-Zeit., 1915, 39, 715—716. (See also Auld, this J., 1915, 609.)

THE sulphur present in lime-sulphur wash, as

thiosulphate and polysulphide respectively, is deduced from the amounts of free sulphur, silver sulphide, and sulphuric acid obtained when the liquor reacts with a solution of silver nitrate, in accordance with the equations: $\text{CaS}_{x+1} + 2\text{AgNO}_3 = \text{Ag}_2\text{S} + \text{S}_x + \text{Ca(NO}_3)_2$ and $2\text{AgNO}_3 + \text{CaS}_2\text{O}_3 + \text{H}_2\text{O} = \text{Ag}_2\text{S} + \text{Ca(NO}_3)_2 + \text{H}_2\text{SO}_4$. Ten c.c. of the diluted liquor (1 in 10) is introduced, with continuous shaking, into 50 c.c. $N/10$ AgNO_3 (diluted to 70 c.c.), water is added to 100 c.c., and the mixture filtered through a Gooch crucible into a dry flask. Known volumes of $N/10$ NaCl (20–30 c.c.) and $N/10$ NaOH (10–15 c.c.) are then added to 50 c.c. of the filtrate, and the solution is titrated successively with $N/10$ H_2SO_4 (in presence of phenolphthalein) and $N/10$ AgNO_3 (with chromate indicator). The residue in the crucible (a mixture of sulphur and silver sulphide) is washed with hot water, dried for an hour and a half in the steam oven, and weighed. Filtering and washing may be done in 6–8 minutes. The results are calculated as follows:—Thio-sulphate-sulphur (t) in 100 c.c. of the original liquor = $0.6111(a-b)$, sulphide-sulphur (s) = $0.3207(25c-d)-t/2$, and polysulphide-sulphur (p) = $100c-7.727(s-t/2)$, where a=c.c. of $N/10$ alkali, b=c.c. $N/10$ acid, c=c.c. $N/10$ AgNO_3 , and d=c.c. $N/10$ NaCl used, and c=weight of residue collected. From the ratio s:p, the amounts of tetrasulphide (ratio 1:3) and pentasulphide (ratio 1:1) may be calculated. If chloride be originally present in the liquor, it is determined in 10–20 c.c. of the diluted solution by adding an excess of ammonia, then hydrogen peroxide, boiling until free from these reagents, cooling, and titrating with $N/10$ AgNO_3 ; the amount of chloride found is deducted (as AgCl) in calculating the proportion of polysulphide. Sodium sulphite, when added to lime-sulphur wash, was converted quantitatively into thio-sulphate; analyses indicating the presence of sulphite are regarded, therefore, as incorrect.

—F. SODX.

Dipping fluid: A new —, J. C. Brümich and F. Smith. *Queensland Agric. J.*, 1915, 3, [4], 161–163. *Bull. Agric. Intell.*, 1915, 6, 1071–1072.

The Stockholm tar contained in the arsenical-soap dipping fluid in common use, can be replaced without detriment by commercial bone oil. This is heated with one-quarter its weight of caustic soda for 15 minutes with agitation, and then a dry, intimate mixture of 1 parts of arsenic and 1 part of caustic soda is added gradually and stirred in. When cold, enough water is added to make a soft paste of uniform consistency, which requires diluting 200 times for use as a "dip."—E. H. T.

PATENTS.

Water still. C. D. Crane, Dayton, Ohio. U.S. Pat. 1,151,590, Sept. 21, 1915. Date of appl. Apr. 15, 1911.

The still consists of a boiler with an overhead condenser divided into two parts, a larger inner part, and a smaller outer part, with a condensing space between the two, tapering towards the top. There are separate water supplies to each part of the condenser, a rapid feed to the outer part, and a slow feed, at about the same rate as condensation takes place, to the inner part; from the water level in the inner part of the condenser a feed tube leads to the boiler, within which is a floating level indicator, the stem of which passes through the feed tube. A separate waste pipe is provided for the outer condenser water.

—J. H. J.

Polable water; Process and apparatus for the simultaneous sterilisation and clarification of —, A. Tixier. Fr. Pat. 171,611, Dec. 12, 1913.

THE water to be treated is mixed with an oxidising agent, as a peroxide or a hypochlorite, in a reservoir, or is filtered through a layer of barium manganate. The sterile water is drawn off at the bottom of the reservoir and passes down a pipe which enters the bottom of an inverted conical vessel at an acute angle, so as to avoid stoppage. This vessel is filled with iron filings or turnings, which remove the excess of oxidising agent used; at the same time ferric carbonate and hydroxide are produced which act as clarifying agents. The water leaves at the top of the vessel and passes through a layer of sand into a pure water reservoir.—J. H. J.

Filter; Sand — of large filtering surface and rapidly cleaned. A. Tixier. Fr. Pat. 171,615, Dec. 12, 1913.

THE filter consists of a cylinder filled with sand which is kept from touching the sides of the cylinder by an arrangement of superimposed annular louvres. A perforated tube covered with filter-cloth forms the central core of the cylinder and carries an exit pipe at its upper end. The cylinder has a dome-shaped cover which forms a sand reservoir. The water enters under pressure at the bottom of the cylinder, rises up the passage-way formed by the louvres, and passes through the sand and perforated tube. The filter is cleaned by reverse action.—J. H. J.

Drinking water, sewage, and other liquids; Sterilisation, clarification, and purification of —, L. Linden. Fr. Pat. 174,907, July 9, 1914.

THE water is mixed with milk of lime in a cylinder containing an archimedean screw, and opening at its lower end into a cup-shaped vessel for the deposition of the sludge. The energetic mixing caused by the screw brings about sterilisation mechanically. The water passes from the upper part of the vessel through a second screw into a second closed vessel, into which carbon dioxide is pumped to remove the excess of lime, the precipitate settling to a sump. The clarified water passes into a third closed vessel containing small sand filters, through which it passes horizontally. Means are provided for cleaning the filters by a reverse flow.—J. H. J.

Sewage or the like; Apparatus for purifying —, G. W. Swinburne, East Orange, N.J., Assignor to Sterilisation Co. U.S. Pat. 1,153,972, Sept. 21, 1915. Date of appl. Nov. 16, 1912.

THE sewage is treated in a tank having an upper sedimentation chamber and a lower reduction chamber, in communication with each other. The sewage enters the sedimentation chamber and leaves by a weir at the end and also by a weir at the end of the reduction chamber. The two weirs are on a level, and the volume of sewage passing through each chamber may be regulated by altering the width of one of the weirs. The sludge is discharged from the reduction chamber independently of the discharge of effluent from the tank.—J. H. J.

Sewage disposal apparatus. G. L. Robinson and E. L. Wagner, New York, Assignors to The New York Sewage Disposal Co. U.S. Pat. 1,154,129, Sept. 21, 1915. Date of appl. Mar. 11, 1915.

THE sewage enters the upper part of a vessel, which acts as a settling tank, and is provided with inlet and outlet pipes on opposite sides at about the level of the water inside. In the centre of the settling tank is a sludge tank, the upper end of which is at a somewhat higher level than the

inlet pipe of the upper tank and has a raised edge at that side; it is much deeper than the settling tank and has an entrance about half-way down on the side of the inlet, and communicating with the settling tank by a sloped floor on that side. The depositing sewage solids sink down this sloped floor into the sludge tank. —J. H. J.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Camphor trade of Formosa. Pharm. J., Oct. 30, 1915.

DETAILS as to the exports of camphor from Formosa are shown in the following table:—

	1913. Lb.	1914. Lb.
United States	3,597,273	3,477,959
Japan	598,847	2,482,740
Germany	1,048,295	1,164,306
United Kingdom	1,229,647	703,052
France	1,373,561	633,607
India	—	72,091
Austria-Hungary	13,228	19,842
Total	7,860,854	8,853,597

The total production of camphor during 1914 was 6,029,338 lb., to which must be added a quantity re-manufactured from camphor oil; about 159,805 lb. of camphor (refined, re-manufactured, and crude) remained in stock at the end of 1914. During 1914 about 3100 acres were planted with 11,688,157 trees, and a similar area is expected to be planted in 1915. The area of camphor forests at present is about 1990 square miles, including a few new camphor woods discovered during 1914; of this total nearly 600 square miles are as yet unworked. The export of camphor oil declined slightly in quantity and value during 1914, 1,771,123 lb., valued at £168,120, leaving the island, as compared with 1,812,519 lb., valued at £172,620, in 1913. The total production was 7,989,571 lb., leaving a large margin over exports for re-manufacture of camphor. At the end of the year about 720,687 lb. of camphor oil was on hand.

Opium alkaloids; Reactions and properties of some — L. E. Warren. Amer. J. Pharm., 1915, 87, 439—461.

NARCEINE forms white, silky needles or prisms, which may be partially effloresced. It is slightly soluble in cold, readily in hot water and insoluble in ether, chloroform, petroleum ether, or benzene, but soluble in a warm mixture of equal parts of chloroform and isobutyl alcohol. The content of water of crystallisation is variable depending on the method of preparation. The hydrated base melts at 170° and the anhydrous base at 163°—165° C., the commercial product usually melting somewhat lower owing to the presence of the hydrochloride. Narceine is the only opium alkaloid which, when 0.01 gm. is dissolved in 10 c.c. of very dilute hydrochloric acid, gives (A) a dark blue precipitate when shaken with a very dilute iodine solution, and (B) a precipitate of white hair-like crystals, becoming blue on standing, with a few drops of potassium-zinc iodide solution. 0.01 gm. of narceine in 5 c.c. of very dilute hydrochloric acid gives an orange-red coloration with 1 c.c. of chlorine water, followed by excess of ammonia, whilst thebaine under similar conditions gives a reddish-brown colour. Narcotine forms colourless, shining rhombic prisms, long needles, or a fine crystalline powder, m.pt. 171°—176° C., $[\alpha]_D = -207.35^\circ$ in chloro-

form. It is insoluble in water but soluble in ether, chloroform, ethyl acetate, and benzene. Narcotine is distinguished from many other alkaloids by giving, when 0.01 gm. is dissolved in 10 c.c. of very dilute hydrochloric acid, (A) a white precipitate with potassium thiocyanate solution, (B) a white resinous precipitate, becoming gradually crystalline, with a few drops of 10% sodium salicylate solution, (C) a white precipitate with a few drops of 25% sodium acetate solution, and (D) a yellow precipitate with bromine water, which dissolves on boiling and develops a fine rose colour on gradually adding bromine to the boiling solution. Narcotine hydrochloride forms a white crystalline powder, containing not less than 91.5% of narcotine, $[\alpha]_D = +13.18^\circ$ in aqueous solution; it gives a neutral aqueous solution. Papaverine hydrochloride is distinguished from the salts of other opium alkaloids by (A) the formation of a lemon-yellow precipitate of papaverine ferri-cyanide when a few drops of potassium ferri-cyanide solution are added to 0.01 gm. dissolved in 10 c.c. of very dilute hydrochloric acid, (B) the formation of short, opaque prisms of the acid oxalate when a hot solution of 0.1 gm. and 0.01 gm. of oxalic acid in 5 c.c. of water is cooled and agitated for some time, (C) the formation of a pale yellow, amorphous precipitate changing to crystalline lance-shaped prisms when a few drops of platinic chloride are added to 0.01 gm. in 5 c.c. of water, and (D) by the test described in the following abstract. Thebaine hydrochloride occurs in colourless or very faintly yellow, rhombic prisms, soluble in water yielding a neutral solution, and very soluble in chloroform; $[\alpha]_D = -168.32^\circ$ in aqueous solution. It is distinguished from the salts of other opium alkaloids by giving a blood-red colour, changing on warming to orange yellow and eventually to olive green, when 0.001 gm. is dissolved in 0.1 c.c. of sulphuric acid, whilst it is also distinguished from many opium alkaloids by giving a white, voluminous precipitate of the salicylate when a few drops of a 10% solution of sodium salicylate are added to 0.01 gm. in 5 c.c. of water. —T. C.

Papaverine; New colour reaction for — L. E. Warren. J. Amer. Chem. Soc., 1915, 37, 2402—2406.

PICOTET and KRAMERS have shown that most of the colour reactions earlier attributed to papaverine are due to cryptopine (see this J., 1910, 781), but at present commercial papaverine and its salts contain only traces of the latter. Papaverine is distinguished from the other more important opium alkaloids by the very sparing solubility of its ferri-cyanide in water and by the deep rose colour slowly developed when the alkaloid is dissolved in sulphuric acid containing a little formaldehyde (Marquis' reagent). If a trace of papaverine ferri-cyanide is stirred with a few drops of Marquis' reagent a light blue colour is produced at once, which changes after a few minutes to bluish violet, and if the solution remains undisturbed it becomes emerald green and finally dirty brownish yellow or nearly colourless. The reaction requires about 30—10 mins. for completion. Almost identical colour changes are observed when an intimate mixture of papaverine and potassium ferri-cyanide or other oxidising agent such as cerium oxide, phosphomolybdic acid, potassium permanganate, or selenious acid, is treated with Marquis' reagent. Of thirty-nine alkaloids tested by the author, only one (an unnamed product from sanguinaria) gave colours which in any way simulated those produced by papaverine, and that one was readily distinguished from the latter by using selenious acid in the test. —J. H. L.

"*Lecithin*"; *Composition of*—*together with observations on the distribution of phosphatides in the tissues and methods for their extraction and purification.* H. Maclean. *Biochem. J.*, 1915, 9, 351—377.

WHEN phosphatides are extracted from tissues by means of alcohol they invariably contain a large amount of nitrogenous impurity. The latter is of very complex composition and contains substances of a purine nature; it is very difficult to remove the impurity by any of the ordinary methods for preparing "lecithin," and many substances described as new products are simply "lecithin" contaminated with this substance. "Lecithin" is a mixture of varying proportions of two somewhat similar substances, one, true lecithin, having the whole of its nitrogen in the form of choline, whilst the other, cephalin, does not contain choline and has all its nitrogen present as β -amino-ethyl alcohol. True lecithin may be obtained as follows: Dried egg-yolk is extracted with alcohol, the alcoholic extract is treated with an excess of cadmium chloride (dissolved in alcohol), the precipitate formed is collected, washed with alcohol, and then ground up with about 15 times its volume of ether containing a trace of alcohol. The emulsion is centrifuged, the deposit washed with ether, dried, and decomposed by boiling with alcohol and ammonium carbonate. The alcoholic solution is then concentrated, the residue treated with ether, an excess of acetone added, the resulting precipitate emulsified with water, and treated by the usual process for the purification of lecithin. The product is now dissolved in alcohol, again precipitated with cadmium chloride, and the double compound recrystallised from a mixture consisting of ethyl acetate, 2, and 80% alcohol, 1 part. By far the greater part of the tissue phosphatides consists of the so-called "lecithin" together with some cephalin; cuorin appears to be present only in small amount and from many tissues only a trace of sphingomyelin can be obtained. Cephalin, like true lecithin, is precipitated by cadmium chloride in alcoholic solution, but the resulting compound is soluble in ether.—W. P. S.

Purine bases, including uric acid; Nephelometric determination of—*in urine and blood.* S. S. Graves and P. A. Kober. *J. Amer. Chem. Soc.*, 1915, 37, 2430—2447.

XANTHINE, hypoxanthine, guanine, adenine, and uric acid are precipitated quantitatively from very dilute solutions (0.0002%) by means of an ammoniacal silver nitrate solution containing ammonium chloride. To prevent flocculation of the precipitate before the nephelometric reading, a clear solution of white of egg is added to act as a protective colloid. The quantity of this albumin solution required varies according to the purine compounds present, and where doubt exists several tests are required with different quantities. In estimating uric acid when mixed with other purine compounds, the latter are determined nephelometrically first with and then without the uric acid. By means of a suspension of manganese dioxide in an alkaline instead of an acid liquid (as used hitherto), the uric acid can be completely oxidised in 1—3 mins. whilst the purine bases remain practically unattacked. In the application of this method to the determination of uric acid and purine bases in urine, the purine compounds are first completely precipitated by the ammoniacal silver nitrate reagent, then separated from the liquid by centrifuging, and redissolved in dilute hydrochloric acid, the salts of the urine being thereby eliminated. Part of the solution is used directly for the nephelometric determination of the total purine compounds. Another part is first made alkaline with lithium carbonate solution saturated

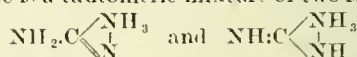
with hydrogen sulphide (which precipitates the silver as sulphide), and then treated with manganese dioxide to oxidise the uric acid; after filtration the solution contains no trace of sulphide, owing to the excess of manganese dioxide employed, and it is then ready for the nephelometric determination of the purine bases. The method is said to be expeditious and the results fairly accurate. It appears to be applicable to the analysis of blood after the proteins have been removed with Greenwald's reagent (trichloroacetic acid) and the calcium with ammonium oxalate.—J. H. U.

Sweet-lasting drugs [Eupatorium rebaudianum and liquorice]; Two—R. Kobert. *Ber. deuts. Pharm. Ges.*, 1915, 25, 162—185. (See also this J., 1914, 937.)

THE sweet principle, eupatorin, $C_{42}H_{70}O_{21}$, which occurs principally in the leaves of the Paraguayan plant *Eupatorium rebaudianum*, Bertonii, is a neutral crystalline glucoside. It foams strongly in aqueous solution, and by its hæmolytic action on blood corpuscles is shown to be a saponin. Regarded as $(C_{21}H_{34}O_{10})_2 + H_2O$, it conforms in composition to the author's general saponin formula $C_nH_{2n-8}O_{10}$. An acid saponin, rebaudin, isolated from the same plant, has no sweet taste. Liquorice root contains two saponins, the acid glycyrrhizin, and a newly-discovered neutral saponin. Neither saponin has itself any hæmolytic action, but by partial hydrolysis sapogenins were generated which showed strong solvent action on blood corpuscles. Similar hydrolysis occurs in the animal organism, and for these and other reasons both glycyrrhizin and the neutral substance are to be regarded as saponins, although they do not conform to the general saponin formula. The same two substances were also found in the bark and juice of the liquorice. The author strongly recommends glycyrrhizin preparations for sweetening purposes for jams, fruit juices, and drinks, and as a substitute for saccharin in diabetic diet.—G. F. M.

Guanidine; Metallic derivatives and constitution of—H. Krall. *Chem. Soc. Trans.*, 1915, 107, 1396—1405.

IT is suggested that guanidine in solution as the free base is a tautomeric mixture of two isomerides,



In accordance with this theory, guanidine never acts as a diacidic base nor as a diamino compound with nitrous acid, yields no urea when boiled in aqueous solution, and when heated with 1 or 2 mols. of potassium ethoxide forms mono- or dipotassium cyanamide. Guanidine gives three silver derivatives, a mono-derivative, white and non-explosive; a di-derivative grey or black and highly explosive; and a yellow, non-explosive derivative, probably a molecular compound of the first two. Guanidine also gives a well-defined, stable, green copper compound, CH_3N_3Cu , and an unstable deep-blue crystalline copper compound of unknown composition.—T. C.

Citrus oils and extracts; Determination of volatile esters in—A. R. Albright and C. O. Young. *J. Amer. Chem. Soc.*, 1915, 37, 2382—2387.

THE terpene fraction is first removed by distillation *in vacuo*. A triple-bulbed Ladenburg flask containing 100 grms. of lemon oil, and connected with a pump producing a vacuum of 2—5 mm., is suspended in a hemispherical iron air-bath heated by a flame of such size that distillation proceeds at the rate of 18—20 drops or less per min. No further adjustment of the flame is made during the process. When distillation has ceased the residue

is distilled in steam so that 200 c.c. of distillate is obtained in not less than 30—15 mins.; the liquid in the flask is maintained at approximately constant volume by means of a small flame. The steam distillate is treated with a concentrated solution of the theoretical quantity or an excess of semicarbazide hydrochloride (calculated from the aldehyde content of the oil, previously found by Hiltner's method; see this J., 1910, 172) and an equivalent amount of sodium acetate crystals. It is next shaken round for a few minutes with 100 c.c. of 95% alcohol and allowed to stand for 10—15 mins. or longer, then neutralised (to phenolphthalein), and boiled under a reflux condenser with 50 c.c. of $N/2$ alcoholic potassium hydroxide for 2 hours, cooled at once to the ordinary temperature, and titrated with $N/2$ hydrochloric acid. A much larger amount of phenolphthalein must be used than in ordinary titrations. The number of c.c. of $N/2$ alkali consumed, multiplied by 0.098 and by an empirical factor (1.28), gives the percentage of saponifiable matter present in the oil, calculated as linalyl acetate. In the case of lemon extracts, 400 grms. is distilled slowly from an ordinary Wurtz flask, and when its volume has been reduced to 50—75 c.c., steam is passed through until no more volatile oil passes over. The combined distillates are treated exactly as the steam distillate from lemon oils (see above), the necessary amount of semicarbazide being calculated from the citral value (1 grm. of citral requires about 0.75 grm. of semicarbazide hydrochloride). In experiments on the saponification of pure linalyl acetate under the conditions prescribed, the amount of alkali required ranged from 77.0 to 80.3% of that calculated; hence the empirical factor, 1.28, mentioned above.

—J. H. L.

Lavender oil: Solubility of—. Perf. and Ess. Oil Rec., 1915, 6, 314.

THE solubility test for lavender oil was originally intended to detect addition of turpentine, but this form of adulteration is no longer practised, and the purity of the oil cannot now be judged by its solubility in 70% alcohol. Two samples of English oil, steam distilled in modern plant, both formed cloudy mixtures with 70% alcohol. Steam distilled oils are generally less soluble than those distilled with boiling water over an open fire, owing to their higher content of floral wax. The oil becomes more soluble on keeping; for example, an oil which when first distilled was soluble in 6.5 to 7 vols. of 70% alcohol, was found after about 8 months to be soluble in 4 vols.

Oils from Acorus calamus L.; Chemical and physical properties of—. G. A. Russell. J. Amer. Chem. Soc., 1915, 37, 2387—2394.

THE fresh aerial parts, air-dried rhizomes, and air-dried roots of *Acorus calamus*, L., cultivated on upland soil at Madison, Wis., yielded respectively 0.123, 0.636, and 2.50% of oil on steam distillation. Plants grown in their natural habitat yield larger quantities. The chemical and physical characters of the oils were compared with those of oils obtained from rhizomes from other sources. The following constants refer to the three oils in the order given above:—sp.gr. at 23° C., 0.9509, 0.9517, 0.9491; n_D^{20} at 23° C., +12.2°, +21.7°, +18.7°; n_D^{25} at 23° C., 1.5035, 1.4990, 1.5065; ester value, 12.6, 15.5, 23.7; acetylation value, 53.05, 38.40, 42.10. The freshly distilled oils contained no free acids; older specimens from other sources gave acid values of 8.15 and 5.75 and ester values of 55.3 and 42.5. Qualitative tests indicated the absence of phenols and the presence of aldehydes in all the oils. The oil from the rhizomes was much more soluble in alcohol than the others, being miscible

in all proportions with 70% and 90% alcohol; it was therefore probably poorer in terpenes and sesquiterpenes and richer in oxygenated compounds. Fractionation of the saponified oils indicated considerable differences in composition between the oils from different parts of the plant.

—J. H. L.

Balsam of Peru. Perf. and Ess. Oil Rec., 1915, 6, 311.

BALSAM of Peru usually contains 30 to 40% of crystallisable balsamic acids (cinnamic and benzoic acids), determined by the method previously applied to storax (see this J., 1911, 832, 833). This determination may be used to supplement the cinnamein test described in the British Pharmacopœia. One sample of the balsam, which contained less than 55% of cinnamein (B.P. minimum 56%), yielded only 23.8% of balsamic acids, and the spirituous solution was deficient in the characteristic odour, though no adulterant could be detected.

Alcohols: Oxidation of— in presence of ferrous oxide or ferrous salts. A. G. Doroshevski and A. J. Bardt. J. Russ. Phys. Chem. Soc., 1911, 46, 754—785. J. Chem. Soc., 1915, 108, ii, 331—332.

METHYL, ethyl, propyl, *n*- and iso-butyl, and iso-amyl alcohols are oxidised by potassium permanganate or hydrogen peroxide in presence of ferrous salts: ferric and manganous salts are without catalytic effect on the oxidation. When ferrous sulphate is present, permanganate oxidises ethyl alcohol in dilute solution, almost exclusively to the aldehyde, but in presence of ferrous oxalate the oxidation proceeds further, part of the aldehyde being transformed into acetic acid; these oxidations proceed so regularly that the course of the reaction may be investigated quantitatively. Hydrogen peroxide acts still more energetically on ethyl alcohol in presence of ferrous sulphate or oxalate, oxidising it to a mixture of acetaldehyde and acetic acid, the aldehyde predominating with the former, and the acid with the latter catalyst; these oxidations serve as striking lecture experiments, decolorised magenta being used as indicator. Ferric salts do not increase the oxidising power of charcoal, but addition of a ferrous salt to a solution of alcohol containing charcoal results in considerable increase in the amount of aldehyde formed. This was found to be the case with thirteen different forms of charcoal obtained from wood or sugar, or of animal origin. The oxidising properties of charcoal are destroyed by either the removal of the adsorbed oxygen or the oxidation of the ferrous compounds present.

Binary mixtures: Thermal analysis of—. E. Baud. Bull. Soc. Chim., 1915, 17, 329—315.

THE mixing of two liquids gives rise either to evolution or absorption of heat, the proportions of the constituents being in some cases a determining factor. Purely physical mixtures, such as are produced when one of the constituents is a saturated or cyclic hydrocarbon, are always accompanied by absorption of heat, and they obey, within the limits of experimental error the equation $\Delta q = Kx(1-x)$, where x and $1-x$ are the number of mols. of each constituent respectively, and Δq the heat change involved on mixing. In these cases it is possible to predict approximately the mutual solubility of the constituents in the solid state. Mixtures in which such substances as aromatic or unsaturated hydrocarbons are involved do not obey the above rule. In normal cases heat is evolved, indicating chemical action, as for example in the case of chloroform and benzene, which in presence of a catalyst actually

give a substitution reaction. In other cases heat is evolved with certain proportions of the constituents and absorbed with other proportions, indicating the superposition of two phenomena, one exothermic due to formation of a compound, and the other endothermic due to the physical mixture or possibly also to depolymerisation. Such cases are, for example, those of mixtures of ethylene dibromide with benzene homologues, an absorption of heat being observed with mixtures poor in hydrocarbon where chemical combination is at a minimum and depolymerisation a maximum. Bromo-derivatives show a greater evolution of heat than the corresponding chloro-compounds when mixed with the same hydrocarbon, and it is likewise the bromo-derivatives which react more energetically in presence of a catalyst to give a substitution derivative of the hydrocarbon (Friedel and Crafts' reaction). A comparison of the observed heat of mixing with that given by the above equation can therefore give useful indications on chemical phenomena which are not always indicated by the curves of incipient crystallisation.

—G. F. M.

Liquor ferri sesquichlorati [ferric chloride solution]: Determination of oxychloride and free acid in —. G. Romijn. Ber. deuts. Pharm. Ges., 1915, 25, 142—145.

THE following improvement of the methods of the Dutch and German Pharmacopœias is suggested for the examination of *Liquor ferri sesquichlorati* for acidity or alkalinity: 2 c.c. of the solution is mixed with 50 c.c. of a solution of cupric chloride and soluble starch (0.01 gm. CuCl_2 and 0.49 gm. starch) and 5 c.c. of $N/1$ thiosulphate solution. The mixture rapidly becomes colourless and, if acid, is titrated with $N/10$ sodium hydroxide using methyl orange-methylene blue solution as indicator, which in acid solution is purple and in alkaline solution green. If, on the other hand, the mixture is alkaline it is best to add previously a known small quantity, say 1 c.c., of $N/10$ hydrochloric acid and proceed with the titration from acid to alkaline as before, since in this direction the colour change is more readily perceived. Tested in this way a limit of acidity corresponding to 1.2 c.c. $N/10$ sodium hydroxide, and a limit of alkalinity not greater than would be neutralised by 1 c.c. of $N/10$ hydrochloric acid is suggested for the pharmaceutical preparation.—G. F. M.

Examination of chammoogra oil. Chattopadhyay. See XLI.

PATENTS.

Hydrogenation (and reduction): Catalytic method of —. A. Brochet. Second Addition, dated Nov. 19, 1913, to Fr. Pat. 458,033, July 27, 1912 (this J., 1913, 1031, and 1911, 18).

THE method of hydrogenation described in the principal patent is modified by the substitution of vigorous shaking for the high pressure, 10–15 kilos. per sq. cm., first recommended. The method is applicable generally to compounds containing acetylenic or ethylenic bonds and to some easily reduced substances such as indigo. Details are given for the reduction of sodium cinnamate to phenyl-propionate, using reduced nickel as the catalyst and hydrogen for reducing, and for the preparation of indigo-white by reduction of indigo both by hydrogen and by water-gas.

—B. V. S.

Methane; Chlorination of —. V. Weickel. Fr. Pat. 474,741, July 6, 1914. Under Int. Conv., July 7, 1913.

METHANE is chlorinated without separation of

carbon by heating to a temperature not above 400°C . a mixture of excess of methane (e.g., 10 vols.) with chlorine (1 vol.), for about ten seconds. Porous catalysts, such as animal charcoal, assist the reaction, and reduce the temperature necessary to about 350°C . Vessels of quartz, porcelain, earthenware, or glass reduce the tendency towards separation of carbon and allow moist gases to be used. The products of the reaction are chiefly methyl chloride, hydrochloric acid, and the excess of methane. The hydrochloric acid is removed by absorption in water, and the methyl chloride is separated from the methane either by solidifying it at -120°C . and atmospheric pressure, or better by liquefying it at -80°C . and 10.5 atmospheres pressure, or at -30°C . and 105 atmospheres pressure. The liquid contains any of the more highly chlorinated derivatives formed in the reaction, which may be separated from the methyl chloride by fractional distillation.—F. Sp.

Alkali-ketones; Production of —, with a view to the preparation of alcohols. Farbenfabr. vorm. F. Bayer und Co. Fr. Pat. 471,745, July 6, 1914. Under Int. Conv., July 21, Aug. 7, Sept. 8, Nov. 21, 28, and 29, and Dec. 10, 1913, and Jan. 28 and Mar. 23, 1911.

ALKALI-KETONES are produced by acting on the ketones with the alkali metals or their amides at a temperature below 0°C . For example, acetone-sodium $\text{CH}_3\text{C}(\text{ONa})\text{CH}_3$ is produced by adding 58 parts of anhydrous acetone to 10 parts of sodium amide in 600 parts of anhydrous ether, the temperature being maintained at -15° to -20°C .; it is a colourless crystalline powder. The alkali-ketones react with acetylene and similar compounds to form alcohols. The process may be varied by carrying out the reaction in one operation; for example, acetone-sodium, or a mixture of acetone with sodium or sodium amide or sodium ethoxide, reacts with acetylene, and acetone reacts with sodium acetylene, NaHC_2 , or with sodium carbide, to form 3-methyl-butanol $(\text{CH}_3)_2\text{C}(\text{OH})\text{C}_2\text{H}_5$, which by reduction gives 3-methyl-butanol $(\text{CH}_3)_2\text{C}(\text{OH})\text{CH}_2\text{CH}_3$. Similarly 3-methyl-pentanol and 3-methyl-pentanol are obtained from ethyl-methyl-ketone, etc.—B. V. S.

Acid anhydrides; Process for the preparation of organic —, and of corresponding new industrial products and their technical applications. Boiteau. Fr. Pat. 474,828, Dec. 29, 1913.

ACETYLENE is used as a dehydrating agent for the preparation of organic anhydrides from the corresponding carboxylic acids in presence of a catalyst such as a mercury salt, a small quantity of an oxidising agent such as potassium bichromate being also added at the beginning of the reaction. When acetic acid is treated by this method acetic anhydride and ethylidene diacetate are produced. The mixture can be used as a solvent, more particularly for cellulose acetate and other cellulose compounds, or it can be separated into acetic anhydride and acetaldehyde by fractional distillation.—B. V. S.

Alkamines, alkamine esters, and salts thereof, and process of producing same. A. B. Davis, Indianapolis, Ind., U.S.A. Eng. Pat. 17,085, July 18, 1914.

SEE U.S. Pats. 1,150,251 and 1,150,580 of 1915; this J., 1915, 982, 983.

Alkamine esters and process of producing same. A. B. Davis, Indianapolis, Ind., U.S.A. Eng. Pat. 17,086, July 18, 1914.

SEE U.S. Pats. 1,150,252 and 1,150,253 of 1915; this J., 1915, 982.

Polyhydrocolchicine. E. Hug, Grenzach, Germany. Assignor to The Hoffmann-La Roche Chemical Works, New York. U.S. Pat. 1,451,314, Sept. 21, 1915. Date of appl. May 22, 1914.

SEE Ger. Pat. 279,999 of 1913; this J., 1915, 452.

Manufacture of ethyl alcohol from monohydroxy acids, their salts, amino-derivatives or amides. Fr. Pat. 471,361. See XVIII.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

I. *The reducing power of photographic developers as measured by their single potentials*. II. *The hydrogen potentials of sodium hydroxide solutions and the dissociation constant of water*. III. *The hydrolysis of sodium carbonate in solution*. IV. *The reaction between alkalis and metol and hydroquinone in photographic developers*. F. C. Frary and A. H. Nietz, J. Amer. Chem. Soc., 1915, 37, 2246–2279.

1. The single potential of a developer varies considerably for some time after commencing observations. The authors have examined the effect of various disturbing factors, such as bubbling air and nitrogen through the liquid, and show that these variations are merely incidental to obtaining equilibrium of potential. The presence of oxygen considerably delays the attainment of equilibrium, so a special apparatus was constructed for producing developer free from oxygen and transferring it to the cell for determining the single potential. With this precaution equilibrium was reached only very slowly, due to the slow rate of diffusion of hydrogen through the liquid and from the liquid to the electrode, and also to a "reaction-resistance" of the developer; about a week was sufficient for an amidol developer, but at least 3 months was required for quinol. Single potentials, determined in this way, are dependent upon the alkalinity of the solution and upon the partial hydrogen pressure of the developer at the electrode; the latter only is considered as being a measure of the reducing power of the developer. In order to eliminate the alkalinity factor the hydrogen potential was determined, i.e., the potential in the same developer of a platinised electrode, saturated with hydrogen at atmospheric pressure; if E_H be the hydrogen potential, E_s the single potential, C and C' the corresponding hydrogen pressures and T the temperature, then

$$E = E_H - E_s = 0.0001983 T \log C/C' = 0.005909 \log 1/C', \text{ at } 25^\circ, \text{ if } C = 1.$$

From this the hydrogen pressure of the developer is calculated. The alkalinity of the quinol solution is not affected by oxidation. The following table shows the potentials for four developers, and the calculated hydrogen pressures; in the last column these are reduced to quinol = 1 and these figures are taken as a measure of the reducing power:—

Developer.	E_H	E_s	E	C' (Atm.).	P .
Quinol	-0.338	-0.152	0.186	0.000712	1.0
Metol-quinol	-0.310	-0.149	0.161	0.00188	2.7
Amidol	-0.031	+0.063	0.094	0.0257	36.0
Thiourea	-0.338	-0.254	0.084	0.0379	33.3

Comparisons with figures obtained by a different method by Sheppard and Mees, and also with the known developing powers of the different

developers, indicate that the results are "photographically reasonable."

II. Using the potential method as in the previous paper, and combining the results with known values for the conductivity of sodium hydroxide solutions, a value $k_w = 1.76 \times 10^{-14}$ is obtained for the ionisation constant of water in presence of sodium hydroxide. By the aid of this constant, or by the use of a curve constructed from the results obtained, it is possible to calculate the dilution of a sodium hydroxide solution from the hydrogen potential. The method was tested analytically and found to be accurate to 0.2%.

III. The hydrogen potential of a specially prepared sodium carbonate solution was determined and from this, by consideration of the sodium hydroxide concentration curve given in the previous paper and the curve showing the dissociation of sodium carbonate, obtained from data of Kohlrausch, and Jones and West, the degree of dissociation of the sodium hydroxide present in the sodium carbonate solution was obtained. From this value the hydrolysis constant of the sodium carbonate solution could be determined. Consideration of the limiting value of this constant showed the necessity for taking the figure $k_w = 1.76 \times 10^{-14}$ for water in the presence of sodium hydroxide as determined in the previous paper.

IV. Addition of quinol to a solution of sodium carbonate and sodium sulphite causes a change in the hydrogen potential of the solution, which is explained by assuming combination between the alkali and the quinol. The sodium hydroxide concentration curve and the hydrolysis constant for sodium carbonate described in the two previous papers give data for calculating, from this change of potential, the amount of alkali used up in combination with the reducer. Four developers were tested having the compositions, in grms. per 1000 c.c. of water:—

No.	Quinol.	Sodium sulphite.	Sodium carbonate
1	11.1	7.8	141.7
2	7.0	50	150
3	7.0	50	75
4	7.0	none	75

and the figures obtained, mols. NaOH consumed per mol. quinol, were 0.63, 0.81, 0.49, and 0.92 respectively; the comparatively high value of the last figure suggests that, where sulphite is present, some form of combination occurs between the quinol and the sulphite. Similar determinations were made with various solutions of sodium hydroxide and quinol and one determination with sodium hydroxide and metol, in both cases without sulphite. The results with quinol indicate that, according to the relative proportion of alkali and reducer, monoquinolate, diquinolate, and mixtures of both are formed, the solution being, however, always alkaline even when excess of quinol is present; they indicate also that the diquinolate is more dissociated and therefore more active as a reducer, which agrees with Sheppard and Mees' previous result, but that in an ordinary sodium carbonate-quinol developer only the monoquinolate is formed. The figures for metol, if the formula be taken as $\text{HO.C}_6\text{H}_4.\text{NH.C}_6\text{H}_3.\frac{1}{2}\text{H}_2\text{SO}_4$, indicate that one molecule of metol absorbs 3 molecules of alkali.—B. V. S.

Sulphonation of quinol. Pinner. See III.

Photochemical sensiliveness and photo-electrical conduction. Volmer. See XXIV.

PATENT.

Photography of colours. E. C. G. Caille. Second Addition, dated Dec. 6, 1913, to Fr. Pat. 163,062. Dec. 7, 1912 (this J., 1911, 410).

Two further methods are described for the production of the second, yellow image. The black silver image may be first bleached with a 1% solution of mercuric chloride and then, after thorough washing, treated with a 0.5% solution of iodine or of potassium iodide; or the silver image may be first converted into a mixture of silver and lead ferrocyanides by the action of a solution of lead nitrate (about 1½%), potassium ferrocyanide (about 1½%), and acetic acid (about 2%), and then into lead chromate by the action of 1% alkali bichromate solution.—B. V. S.

XXII.—EXPLOSIVES; MATCHES.

Synthetic phenol and picric acid. Ney. See 111.

PATENTS.

Trinitrotoluene; Manufacture of—. Soc. Ital. Prodotti Esplosivi. and F. Quartieri. Milan. Italy. Eng. Pat. 19,566, Sept. 9, 1911.

CRUDE solid dinitrotoluene is purified by partial and fractional liquefaction, the residue of pure dinitrotoluene is further nitrated, the mass slowly cooled, and the crystallised trinitrotoluene filtered off, washed with water, melted *in vacuo*, granulated, and dried. The liquefied impurities separated in the first operation are nitrated to give a further quantity of crude solid dinitrotoluene.—C. A. M.

Explosive substances; Machine for compressing—and ejecting the same from the moulds after compression. Soc. Ital. Prodotti Esplosivi, and F. Quartieri. Milan. Italy. Eng. Pat. 19,615, Sept. 10, 1911.

THE compressing piston acts with gradually increasing pressure, and moves synchronously with means for the introduction of the ejecting pistons into the moulds. Means may also be provided for adjusting the moulds in relation to the ejecting pistons, such as rods with bevelled upper ends in alignment with holes in the table supporting the moulds, and moving synchronously with the pistons.—C. A. M.

Explosives [containing cork powder]. A. Aubert. Saetre, Norway, and S. A. G. Nauckhoff, Liljeholmen, Sweden. Eng. Pat. 1283, Jan. 26, 1915. Under Int. Conv., Jan. 27, 1914.

CORK powder is incorporated with gelatinised explosives to increase the rapidity of detonation. For example, from 0.5 to 10% may be mixed with blasting gelatin, or from 1 to 10% with explosives containing nitroglycerin, nitrocellulose, nitrobenzene, nitrates, chlorates, or perchlorates.—C. A. M.

Explosive charges utilising liquid air; Process and apparatus for the preparation of—. A. Kowatsch and C. A. Baldus. Fr. Pat. 171,508, Dec. 3, 1913.

THE cartridge is provided with an interior tube pierced with holes for the escape of the liquid air, and is protected by a cover until it is introduced into the mine. A sufficient quantity of water to obtain a low temperature of explosion is added to the mixture of carbonaceous substances, which also contain a certain proportion of water. The cartridge is charged from a reservoir of liquid air immediately before use, and the explosion is effected by means of a spark or incandescent filament.—C. A. M.

Explosive from liquid air and carbon [from waste sulphite-cellulose lye]; Manufacture of an—. A. Wegelin Akt.-Ges. für Russfabrikation und Chem. Ind. Fr. Pat. 474,819, July 7, 1914.

COKE prepared by carbonisation of waste sulphite-cellulose lye is impregnated with liquid air.—C. A. M.

Nitrocellulose rich in nitrogen and capable of readily being made stable; Preparation of—. A. Voigt. Fr. Pat. 174,833, Dec. 30, 1913.

THE nitrated cellulose is made uniform by progressive grinding after passage through an arrangement of sieves.—C. A. M.

Match-ignition composition. M. Shadid, Peoria, Ill. U.S. Pat. 1,153,525, Sept. 14, 1915. Date of appl., June 13, 1914.

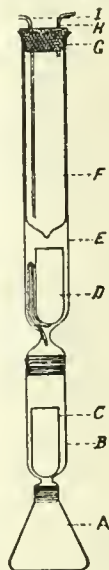
GUM arabic (about 10 parts) is mixed with potassium bichromate (1.75 parts), antimony sulphide (1.50 parts), glass (3 parts), coal dust (1.25 parts), potassium chlorate (3 parts), and sulphur (0.5 part).—C. A. M.

XXIII.—ANALYTICAL PROCESSES.

Collodion dialysers of graded permeability; Preparation of—. W. Brown. Biochem. J., 1915, 9, 320.

AIR-DRIED collodion membranes are treated with varying percentages of alcohol in water for a suitable length of time, and then washed with water. The permeability of such membranes is directly related to the strength of the alcohol employed, so that, by the use of various concentrations, membranes of almost any degree of permeability may be obtained, *e.g.*, from those which will keep back copper sulphate to those which are permeable to such a highly colloidal substance as aniline blue.—W. P. S.

Fat extraction; A new apparatus for—. I. Selector. J. Ind. Eng. Chem., 1915, 7, 871—872.



THE apparatus described (see fig.), when used for the determination of fat in commercial feeding stuffs, gives higher and more uniform results than those obtained with the Soxhlet apparatus. The vapours from the boiling solvent pass from A, through the sample contained in the paper capsule, C, and are condensed by the condenser, F; the latter is flanged at the top and rests on the flanged top of the tube, E, which is connected to the tube, B, by a ground glass joint. The condensed solvent collects in the Soxhlet tube, D, whence it flows through the siphon and floods the sample.—A. S.

Standards in acidimetry and alkalimetry; Acid potassium and acid sodium phthalates as—. W. S. Hendrixson. J. Amer. Chem. Soc., 1915, 37, 2352—2359.

A SOLUTION of hydrogen chloride made up by the

method of Hulett and Bonner (J. Amer. Chem. Soc., 1910, 518) to contain 0.003647 grm. HCl per c.c. was tested, by means of silver chloride, by two samples of specially purified benzoic acid, and by potassium and sodium hydrogen phthalates (Dodge, this J., 1915, 200). The results showed that the latter two substances are very suitable for use as standards. Potassium hydrogen phthalate was prepared by dissolving resublimed phthalic anhydride in a slight excess of potassium carbonate, and crystallising five times from hot water. The salt was dried at 125° C. to constant weight. Sodium hydrogen phthalate was similarly prepared, and was dehydrated at 120° C. The hydrous salt containing $\frac{1}{2}$ mol. of water was unsuitable for quantitative work owing to slight variations in composition.—G. F. M.

Alkaline-earth group; Two methods of separation of the metals of the —. A. G. Paterson. J. Amer. Chem. Soc., 1915, 37, 2346—2352.

The separation is based on slight differences in solubility of the sulphates, carbonates, and oxalates of the alkaline-earth metals. The solution is first treated with excess of a mixture of ammonium sulphate and carbonate, whereby barium sulphate and strontium and calcium carbonates are precipitated. The carbonates are dissolved out of the well washed precipitate by boiling with 1% acetic acid, and to the solution, rendered slightly alkaline with ammonia solution, a mixture of ammonium carbonate and oxalate solutions is added. The precipitate, consisting of strontium carbonate and calcium oxalate, is treated with 1% acetic acid to dissolve the strontium, and the presence of calcium in the residue and of strontium in the solution confirmed. To obtain a clear separation it is particularly necessary to allow the precipitates to stand with occasional stirring for 20—30 minutes, and after filtering to wash them quite free from the precipitants. The second method takes advantage of the solubility of calcium and strontium sulphates in lead acetate solution, whilst barium sulphate, being less soluble than lead sulphate, is undissolved. The three sulphates are precipitated with ammonium sulphate, and, after washing, are gently warmed for a few minutes with lead acetate solution. The residue consists of barium and lead sulphates, and the solution, containing strontium and calcium acetates, is then examined according to the first method.—G. F. M.

Platinum, arsenic, gold, selenium, tellurium, and molybdenum; Qualitative detection and separation of —. P. E. Browning. Amer. J. Sci., 1915, 40, 349—350.

In the Noyes and Bray method of separating and detecting these metals (J. Amer. Chem. Soc., 1907, 29, 137), platinum is first precipitated as potassium chloroplatinate with a potassium salt, arsenic is separated as magnesium ammonium arsenate, gold is precipitated with oxalic acid, selenium by evaporating with hydrochloric acid and sodium sulphite, tellurium by the addition of potassium iodide and sodium sulphite, and finally, molybdenum by means of zinc and potassium thio-cyanate. Considerable experience has shown that the method is not quite satisfactory, as compounds of gold, selenium, and tellurium may be precipitated. Satisfactory results may be obtained by precipitating the gold, preferably with alkaline hydrogen peroxide, immediately after the platinum, and then separating the selenium and tellurium in the manner described. The filtrate is evaporated with bromine or nitric acid, the arsenic precipitated with magnesia mixture, and the molybdenum identified as before.

—E. H. T.

Ash in plant substances; Modified method for determining carbon-free —. G. E. Boltz. J. Ind. Eng. Chem., 1915, 7, 859—860.

From 2 to 10 grms. of material is ignited in a platinum dish over a low flame until most of the carbon is burnt off. The residue is treated with 20 c.c. of hot water, the solution decanted through a filter into a tared Erlenmeyer flask, and the residue washed three or four times with hot water. The filter paper is then added to the residue in the platinum dish, dried, and ignited, and the ash transferred to the Erlenmeyer flask by means of hot water. The solution in the flask is evaporated to dryness, and the residual ash dried at 110° C. and weighed. Carbon dioxide in the crude ash is determined by decomposing with hydrochloric acid, absorbing the gas in caustic soda solution, which is subsequently made neutral to phenolphthalein with hydrochloric acid and titrated with N/20 hydrochloric acid in presence of methyl orange. Unburned carbon and sand are determined as described in Bull. 107, U.S. Bureau of Chem., p. 22. The amount of carbon-free ash is obtained by subtracting the sum of the carbon dioxide, unburned carbon, and sand from the weight of the crude ash.—A. S.

New method and furnace for the determination of the softening temperature of coal ash under fuel bed conditions. Fieldner and Feild. See II A.

Determination of hydrogen in gaseous mixtures by catalytic absorption. Bosshard and Fischli. See II A.

Examination of petroleum lamp oils. II. Determination of origin. Jungkunz. See II A.

Determination of aromatic hydrocarbons in cracked petroleum. Rittman and others. See II A.

Determination of sulphurous acid in sulphites and bisulphites. Knecht and Hibbert. See VII.

Effect of ammonium chloride upon ferric and aluminium hydroxides during ignition. Daudt. See VII.

Determination of selenium in sulphur. Smith. See VII.

Determination of chromium and manganese in iron and steel. Daniels. See X.

Anodic potentials of silver. II. Their rôle in the electrolytic determination of halogens. Reedy. See XI.

Tests for fish oils. Tortelli and Jaffa. See XII.

Determination of methyl and ethyl alcohol in spirit varnishes. Knight and Lincoln. See XIII.

Drying the acetone extract of rubber. Hutin. See XIV.

Determination of total sulphur in rubber. Hutin. See XIV.

Determination of nitrates in soil. Potter and Snyder. See XVI.

Determination of the immediate time requirements of soils. MacIntire. See XVI.

Experiments on the determination of sucrose by single and double polarisation in the chemical control of white sugar manufacture by the Battelle process. Walker. See XVII.

Device for the successive determination of solids and fat in milk and other fluids. Seidenberg. See XIX A.

Determination of starch in cocoa by means of taka-diastase. Revis and Burnett. See XIXA.

Diazo reactions of histidine and tyrosine. Totani. See XIXA.

Method for the determination of the tryptophane content of proteins, involving the use of baryta as a hydrolysing agent. Homer. See XIXA.

Method for analysis of proteins by determination of the chemical groups characteristic of the different amino-acids. Van Slyke. See XIXA.

Detection of active carbonic acid [in water]. Winkler. See XIXB.

Colorimetric method for the determination of phenols and phenol derivatives in urine. Folin and Denis. See XIXB.

Chemical composition and valuation of lime-sulphur wash. Bodnar. See XIXB.

Reactions and properties of some opium alkaloids. Warren. See XX.

New colour reaction for papaverine. Warren. See XX.

Nephelometric determination of purine bases, including uric acid, in urine and blood. Graves and Kober. See XX.

Determination of volatile esters in citrus oils and extracts. Albright and Young. See XX.

Solubility of lavender oil. See XX.

Balsam of Peru. See XX.

Determination of orxychloride and free acid in tiquor ferri sesquichlorati. Romijn. See XX.

PATENTS.

Gas-analysing apparatus. Gas absorbing and indicating apparatus for gas-analysers. J. W. and C. W. Hays, Chicago, Ill. U.S. Pats. (A) 1,153,911 and (B) 1,153,912. Sept. 21, 1915. Dates of appl., July 17, 1913, and Sept. 14, 1914.

(A). A MEASURING vessel is connected with an absorbing vessel which contains a liquid chemical. Means are provided for periodically bringing the liquid in the absorbing vessel back to its normal level when the gas is returned to the measuring vessel. (B). The absorbing vessel contains a distensible bag filled with liquid, so that when gas is transferred from the measuring vessel the bag is deflated to an amount which is measured by the rise of liquid in a tube connected to the bag.

—W. F. F.

XXIV.—MISCELLANEOUS ABSTRACTS.

Photochemical sensitiveness, and photo-electrical conduction. M. Volmer. Z. Elektrochem., 1915, 21, 113—117.

MOST of the more recent work on the theory of photochemical processes is based on its connection with the photo-electrical effect, and according to theory a cleavage of electrons from the light-absorbing substance would be expected when photochemical reaction takes place. With oxygen and chlorine it has been proved that ionisation is not caused by photochemical action, even when the substance is damp or in a dissolved state. The author studied the behaviour of a large number of photochemically sensitive substances on exposure to light transmitted through cobalt glass (180—300 μ); in this region of the spectrum no noticeable Hallwach effect is produced. The substance was brought on to an electrode by sublimation or evaporation, and a potential of 160—320 volts applied to a second wire gauze

electrode placed in juxtaposition to the first; the deflection of an electrometer then gave a direct measure of the current strength due to increased conductivity of the substance exposed. The method was modified for mercury salts and for sulphur and phosphorus. Most of the substances examined by this method gave a positive result, that is, photochemical reaction was accompanied by photoelectrical conduction, but β -naphthol, benzoïn, and acridine gave negative results. It is concluded that photochemical reactions are due not to liberation of free electrons, but to a partial liberation permitting of the transference of electrons from molecule to molecule.—W. G. C.

Enzyme of Bacillus coli communis; Reducing —. A. Harden and S. S. Zilva. Biochem. J., 1915, 9, 379—384.

WHEN *B. coli* is washed by centrifuging with saline solution it loses its power of reducing methylene blue, but regains it on addition of certain substances, such as the washings, bonillon, dextrose, galactose, levulose, mannose, maltose, arabinose, mannitol, xylose, inulin, alanine, albumin, horse serum, peptone, sodium formate, sodium lactate, etc. The effect of the addition of various amounts of broth and glycerol, respectively, shows that two factors are concerned in the effect of those reagents which influence the process of reduction of methylene blue, i.e., an activating factor and a retarding one. The former is thought to be chemical whilst the second is possibly physical. The time of reduction of a certain quantity of methylene blue decreases with an increase in the amount of *B. coli* emulsion, whilst the time of reduction increases when increasing amounts of methylene blue are used for a constant quantity of the emulsion. (See also Harden and Norris, p. 1107.)—W. P. S.

Pancreas; Digestive activity and composition of different fractions of the —. I. J. H. Long, M. Hull and H. V. Atkinson. J. Amer. Chem. Soc., 1915, 37, 2427—2430.

THE finely minced pancreas of the hog, bullock, and sheep, centrifuged for 45 mins. at about 3000 revs. per min., separated into three layers, viz., a compact protein layer, an almost clear aqueous liquid, and on top a fatty layer containing some protein and water. The chemical composition and diastatic and proteolytic activities of the different layers were investigated. In all cases the protein layer possessed the highest proteolytic activity and the aqueous layer the lowest; the fatty layer exhibited the lowest diastatic power in all cases, and diastase was abundant only in the pancreas of the hog.—J. H. L.

Oratic acid-producing Penicillium; An —. J. N. Currie and C. Thom. J. Biol. Chem., 1915, 22, 287—293.

A *Penicillium*, termed *P. oraticum*, isolated from mouldy maize and from soils, was found to produce oxalic acid rapidly when grown in suitable media (e.g., 5% sucrose media containing nutrient salts); although less active in this respect than *Aspergillus niger*, it very quickly produced an acidity in the media which, under favourable conditions, reached 0.8% of free oxalic acid. In presence of calcium carbonate the growth of the fungus was retarded, but the yield of oxalic acid was greatly increased, reaching, in some cases, nearly 10% of the weight of the sugar. *P. oraticum* was also found to be capable of producing oxalic acid from dextrose, lactose, starch, and peptone, but not very freely from glycerol or calcium lactate. Twenty-two other species of *Penicillium* were investigated as regards their power of producing oxalic acid, but none proved to be as active as *P. oraticum*.—W. P. S.

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Official Notice.

THE DISPOSAL OF NITRE CAKE.

THE Special Joint Committee of the Chemical Society and the Society of Chemical Industry, appointed to consider the question of the utilisation of nitre cake (this Journal, 1915, 857), has received a number of suggestions as to possible methods of disposal.

Among the suggestions made at the Committee itself were the following:—

Heating the nitre cake with common salt, collecting the hydrochloric acid, and afterwards treating the sodium sulphate in the black ash furnace in the usual way. The demand for hydrochloric acid is limited and saltcake is very cheap.

Heating with magnesite to make Epsom salts, for which there is a great demand in the textile industries.

Using it to replace sulphuric acid in the manufacture of superphosphates.

Roasting it with iron scale to get off the available acid in its most concentrated form. This requires a high temperature, and the action on the vessels employed is considerable.

Using it in the making and glazing of slag bricks.

Using it for sprinkling on manure heaps to fix the ammonia.

Heating it with mixed sulphide ores to extract the zinc.

The following suggestions have been received in response to the request of the Committee:—

A. G. Byard, c/o Burt, Boulton, and Haywood, 64, Cannon Street, E.C. Blowing steam or air into the melt and directing the mixture of acid vapours into the sulphuric acid plant. Granulating the melt by pouring into water and centrifuging the grains to obtain a clean sodium sulphate, and an acid mixture, which can be sprayed into an auxiliary chamber of acid plant, the chamber acid obtained being concentrated and used again in the nitric acid process where a little sodium bisulphate is unimportant.

A. Caddick, 39, Barker Road, Linthorpe, Middlesbrough. Using the nitre cake to increase extraction of copper when roasting copper pyrites, by charging into the lower floors of a multiple hearth furnace. Utilising nitre cake as a source of acid for lixiviation of copper materials, pyrites cinders, etc. Utilisation in the trenches in place of ferric sulphate.

Dr. H. T. Calvert, West Riding Rivers Board, Wakefield. Using nitre cake instead of sulphuric acid to decompose soap suds and to liberate free fatty acids instead of discharging into rivers.

L. Cheesman, U.S. Patent 714,145 of 1902. Using after neutralising to precipitate barium hydrosulphide to make *blanc fixe* and sodium hydrosulphide.

S. Hoare Collins, 9, Cavendish Place, Newcastle-on-Tyne. Mixing one part of leather clippings with two parts of nitre cake and heating to 300° C., when much of the nitrogen is converted into ammonium sulphate. The product is cooled and mixed with one part of mineral phosphate and sold as manure. Use as weed killer. Use for flushing drains. Use in place of sulphuric acid to make "pearl hardening." Roasting with potash felspar and crystallising out the potash alum.

Wm. Dewar, 24, Finsbury Square, E.C. Using it with salt for the roasting of copper, zinc, and nickel ores previous to leaching.

Using it in the place of sodium carbonate in the manufacture of tungsten powder. This requires more skilful handling. Grinding with dry calcium chloride to produce hydrochloric acid, and then adding more calcium chloride to form gypsum.

S. Dyson, Nyddcombe, Warlingham, Surrey. Using it instead of sulphuric acid in converting sodium chromate into bichromate.

W. B. Giles, The Grange, Leyton, E. Using it for opening up wolfram ores.

John Hargreaves, Widnes, says that no one would go to any expense over nitre cake just now; manufacturers should stock it.

J. MacKenzie, 312, Grosvenor Terrace, Linthorpe Road, Middlesbrough, states that nitre cake contains from 33 to 35% of sulphuric acid and describes a process for recovering acid of 94 to 95%, or any other desired strength. He has made some 10 to 12 tons a week from this source in an ordinary salt cake furnace, and states that there will be no trouble in obtaining from 1 ton of nitre cake of the strength described, 7 to 8 cwt. of 168° Tw. acid and 12 to 13 cwt. of sodium sulphate, which could be utilised as described in other proposals.

Note: Waltham Abbey nitre cake contains about 33% available sulphuric acid but a sample from a private source in the possession of the Society contains considerably less.

Dr. E. Naef, 17, Park Road, Clydach, Swansea, suggests neutralising the free acid, reducing the sulphate to sulphide by means of fine coal at 600°–850° C., and crystallising the product. An estimate of the cost of this process is also given.

Wm. C. Wakefield, Mill Street East, Savile Town, Dewsbury, says that nitre cake contains potash. He has made many thousand tons of superphosphate of lime containing 20% of soluble phosphate by using nitre cake instead of sulphuric acid.

J. Fleming White, U.S. Patent 714,846. Manufacture of soda alum.

The Munitions Inventions Dept. forwards a proposal to fuse nitre cake with sand, producing sulphuric acid and sodium silicate which could be used for glass making, etc.

All the above suggestions have been transmitted to the Government Departments concerned.

Birmingham Section.

Meeting held at Birmingham University, on Thursday, November 4th, 1915.

MR. W. J. REES IN THE CHAIR.

A SIMPLE METHOD OF OBTAINING MELTING POINTS OF FATS, ETC.

BY ARTHUR W. KNAPP, B.Sc., F.I.C.

In this method the substance is placed on the bulb of the thermometer. The thermometer is inserted in a corked test tube, which acts as an air bath, and the test tube is placed in a beaker of water or glycerin. The liquid should be boiled and cooled to prevent the formation of bubbles on the side of the beaker.

For fats, waxes, or fatty acids.—Very fine scrapings are taken with the point of a knife over a

representative surface of the material. These fine scrapings are transferred with as little injury as possible to the bulb of the thermometer. They should cover less than one half of the bulb. Under these conditions one can plainly see when the sharp outline of the scrapings begins to soften, and also when the fat is completely transparent.

For crystalline organic substances.—If the bulb of the thermometer be pushed into a powdered organic substance some of the powder adheres. A very faint film, or a few crystals is all that is necessary. The powder reflects irregularly the light coming from the mirror surface of the bulb, and the point at which the substance becomes liquid is plainly seen. A crystalline substance which does not adhere should be first powdered.

Edinburgh Section.

Meeting held at Edinburgh, on Wednesday, October 20th, 1915.

PROF. J. WALKER IN THE CHAIR.

TECHNICAL AND ACADEMIC CHEMISTRY.

CHAIRMAN'S ADDRESS.

BY PROF. JAMES WALKER, F.R.S.

(Abstract.)

One result of the war in which we are at present engaged has been a stirring of mind and a stirring of conscience. Long before the war there was an uneasy feeling that all was not as well with us as might be, even in the purely material sense. We saw other nations creeping up on us in various paths of industry and commerce, reaching our level and passing to the front. Explanations based on size of population, on natural advantages of mineral wealth or agricultural conditions, were given and accepted, but the feeling of uneasiness persisted. Were we making the best of our opportunities? Candour compelled a negative answer, but on the whole little was done in the way of improvement. Now that the war is upon us we have resolved to better things, and the watchword of this new resolution is "organisation." And here it is suggested that we should learn from our enemies. I would be the last to commend slavish imitation of German methods, and the first to deprecate the exaggerated respect for German science, for German prescience, and indeed one might almost add for German omniscience which is rooted in many minds, and not infrequently finds expression. Our science is at least equal to theirs, and despite our tendency to individualism and voluntarism, we can organise as successfully as the Germans when we have a mind to. Whatever doubts may have been conceived of our military system, surely our naval system is an organisation beyond criticism. The German superiority lies, it seems to me, not in their capacity or powers of organisation, but in their desire for organisation. Whether that desire is native or acquired matters little. It undoubtedly exists and it will be well for us when a similar desire reaches the same intensity in our minds. The will to work is general amongst us, but the will to work *together* to great national ends is only beginning to appear.

Can we in this Society learn anything from the enemy? Do we, as chemists, fall short in any matter of organisation? I think it must be admitted that we can learn, and that in some respects we do fall short. In this Section we have representatives of industrial and academic

chemistry. Now the connection between academic and industrial chemistry is not sufficiently close, and here I am merely repeating what has been said a hundred times before, but the lesson seems very difficult to learn, and the extra repetition will at least do no harm.

First, with regard to the academic side, with which I am more familiar, it seems to me that we stop the education of our chemists at a point short of where that education ought to be stopped. We give our young chemists a good grounding in general, systematic, and theoretical chemistry and usually a good course on the practical side, as far as that can be taught in the University Laboratory; but there we generally stop, and it seems to me that if the education of our young chemists is to bring them abreast of German chemists, we must invent some system by which research, of a very minor type if you like, may be encouraged. The student gets his B.Sc. degree in the Scottish Universities without having done any research, and the prospect of the D.Sc. degree, which involves research, is not sufficiently attractive. The University Commissioners decreed that an interval of five years should elapse between the graduation of a student as Bachelor of Science and the possibility of his graduation as Doctor of Science. The various Universities, through scholarships and so on, encourage research in their own way, but if we could only reduce this interval between the B.Sc. and the D.Sc. degree to something like two years, which would be a reasonable time to spend on research, a good deal would be done to meet our defects on the academic side. I have been a student in the Universities of this country and in the Universities of Germany, and except in this matter of research, I did not see, and do not see, that the German Universities were, or are, in any way better than the Universities here. The modern Universities in Great Britain have always had good scientific sides, and most of them especially good chemical sides, and now even the ancient Universities of England, Cambridge in particular, are passing very rapidly to the front.

Now, of the manufacturing side of chemistry I am not competent to speak, but for success in industrial chemistry—and by success I mean not merely the making of money on old lines, but striking out on new lines—for that sort of success, the interplay of research and manufacture is necessary. In Germany the problem is solved by simply taking the academic chemist as turned out of the University straight into the works. The large works have large research laboratories, and without any technical training whatever the graduate is taken directly there as a purely academic chemist, with however some experience of research, and brought face to face with practical problems. That is certainly a very good way of doing the thing. Other ways have been suggested, and Professor Henderson, in his Presidential Address, drew attention to Professor Duncan's scheme for the interplay of science and industry, which has been adopted in one or two places in America. The manufacturer states his difficulty or problem to the University, and the University supplies the necessary number of chemists who endeavour to work out this practical problem, a financial arrangement being made between the manufacturer and the University. That is another way of bringing industrial chemistry and scientific chemistry together.

There is, I think, a good deal of misunderstanding abroad with regard to research and its value. The research which leads to any considerable scientific advance is of the rarest occurrence, and not one chemist in a hundred, possibly not one in a thousand, is capable of achieving such a result. Small pieces of routine research can, on the other hand, be carried out by any intelligent

graduate, and the results obtained are often of some direct objective value, although not by any means always. The chief value of such research is to the man who conducts it. The worker has learned to look on a problem, however small, with a clear, unprejudiced eye, to come into contact at first hand with facts, to distrust text-books and references generally; in fine, to rely upon himself. Self-reliance and commonsense will carry a man far in a chemical works as in most affairs of life. It would be an excellent thing indeed if industrial chemists would supply, even without any financial arrangement, problems to the chemistry departments of Universities. It is often very difficult for the chief of a department to find a suitable subject of research for his students. He may himself be working out some subject, which is usually somewhat narrow, so that in one University a great many students may be all working on precisely the same, or nearly parallel lines. I do not think that is so good for the students taken as a whole, as if they were all working on different lines; for in the latter case they could discuss each other's problems, and in that way learn a great deal. Manufacturers therefore might benefit the Universities greatly by merely giving them subjects for research. It would not be possible, of course, in every case, even to attack a problem properly, much less solve it, owing to want of material or for some other reason, but at least the manufacturer would have the benefit of the pure chemist's view of the problem, in the light of modern theory and the latest practical work, although no immediate solution were given.

The development of the contact process of sulphuric acid manufacture furnishes an excellent example of the interplay of research and industry. The process, which is of itself of extreme simplicity, had to wait for some 70 years before it was placed at once on a footing of complete scientific investigation and of commercial success.

A patent was taken out in 1831 by Peregrine Phillips, a manufacturer of vinegar in Bristol, which aimed at producing sulphuric acid without the aid of oxides of nitrogen. Sulphur dioxide, generated by burning sulphur or pyrites in a specially constructed burner, was mixed with a suitable proportion of air, and the mixture passed by means of a pump through heated platinum or porcelain tubes which contained platinum wire or platinum sponge. To condense the sulphur trioxide thus produced the gases from these tubes were passed into large sandstone towers, 30 feet high and 8 feet in diameter, lined with lead and filled with pieces of quartz down which water or dilute acid trickled, the acid collected at the bottom being pumped up to the top of the tower to meet further amounts of gas.

Magnus in 1832 (Pogg. Ann., 24, 610) confirmed Phillips' statement by laboratory experiments. He introduced a little platinum sponge into a mixture of sulphur dioxide and oxygen contained in a bent tube over mercury. On heating the sponge to dull redness a contraction was observed, and, as the gases used had not been dried, the simultaneous appearance of a liquid which had all the properties of sulphuric acid. The same result was obtained, only more slowly, with atmospheric air instead of oxygen.

He also passed a mixture of sulphur dioxide and air through a tube containing platinum sponge which was heated to dull redness in a furnace. A receiver filled with wet pieces of glass was used to condense the gases with formation of sulphuric acid. Magnus states that the escaping air contained extremely little sulphur dioxide. He notes that platinum sponge has no effect at the ordinary temperature. Döbereiner in the same volume (p. 609) states that he succeeded in condensing

2 volumes of sulphur dioxide and 1 volume of oxygen by the aid of platinum black (hygroscopically moist) to *fuming* sulphuric acid.

The contact process thus early described in its main lines remained unfruitful for many years. It may be noted that in 1846 the first mention of platinised asbestos occurs in connection with the process, and that in 1852 it was ascertained that various oxides could be substituted for platinum as contact substances, the use of burnt pyrites being recommended for practical purposes.

From 1875 onwards fuming sulphuric acid was manufactured at Freiberg and in London, where Dr. R. Messel was instrumental in placing an invention of W. S. Squire on a commercial basis. The process is described as follows in Squire's Provisional Specification dated Sept. 18th, 1875:—

"I take ordinary sulphuric acid, as concentrated as possible, and cause the vapour of it to pass over a highly heated surface, and for this purpose I prefer to use a platinum tube set in a furnace and filled with either platinum foil or some porous substance such as pumice stone. By these means the sulphuric acid is decomposed into water and sulphurous acid and oxygen in equivalent proportions. I then dry the gases thus obtained by causing them to pass through concentrated sulphuric acid, and then submit the dry sulphurous acid and oxygen to the action of some substance, which at a low red heat possesses the power of causing them to combine to form anhydrous sulphuric acid. For this purpose I prefer to use spongy platinum, either alone or distributed over some porous substance, such as pumice stone, placed in a tube or some suitable apparatus heated to a low red heat. The vapour of anhydrous sulphuric acid thus obtained I either condense by itself in a suitable apparatus, or cause it to be absorbed by concentrated sulphuric acid, and thus produce the so-called Nordhausen oil of vitriol."

Here the reacting substances are used in the proportion required by the equation, $2\text{SO}_2 + \text{O}_2 = 2\text{SO}_3$, and for long it was thought, quite erroneously, that a successful result could only be obtained by close adherence to these proportions. The action was not recognised as being reversible, and no application was made of the law of mass action, according to which the percentage of dioxide converted into trioxide would be the greater, the larger the excess of oxygen employed. Proposals were made to use pure sulphur dioxide, substitute air for oxygen, and compensate for the dilution by increased pressure; also, on the other hand, to roast pyrites in oxygen. Such proposals, though possibly available for fuming acid, could have no application to the manufacture of ordinary sulphuric acid, which must be based, as indicated in Phillips' patent, on the roasting of pyrites in air. It was gradually recognised in various quarters that highly dilute sulphur dioxide could be used with success, but patents for the technical production of contact sulphuric acid were only filed in 1898.

Rudolf Knietsch, in a lecture given to the German Chemical Society (See this J., 1902, 172, 343) sketched the difficulties encountered in the technical development of the process by the Badische Anilin und Soda Fabrik. The competing process of the Verein Chemischer Fabriken is described in "The Chemical Engineer," May and August, 1908.

Knietsch's paper serves as a model for the scientific investigation of a technical problem. The influence of temperature on the reversible equilibrium, $2\text{SO}_2 + \text{O}_2 \rightleftharpoons 2\text{SO}_3$, was shown to be independent of any contact substance, and to be of such a nature that, as could be deduced from the heat of reaction, rise of temperature

diminishes the proportion of dioxide transformed into trioxide. Rise of temperature on the other hand increases the velocity of reaction, and it is on a balance of these opposite effects that the selection of a suitable catalyst depends. Of all the substances tried, platinum in the form of platinised asbestos is the most effective, being active at the lowest temperature, namely a little above 400° C., when a yield of 98% from burner gases may be obtained. The details of temperature regulation and the washing of the gases for the removal of arsenic compounds, which had early been recognised as prejudicial to the action of platinum, are to be found in Knietzsch's paper, and the modern theory of the process in Haber's *Thermodynamik technischer Gasreaktionen*.

NOTE ON THE DETERMINATION OF TANNIN.

BY D. B. DOTT, F.I.C.

The method at present in vogue for the determination of tannin consists in ascertaining the amount of matter which is absorbed by hide-powder from an infusion of the tanning material. Though the absorbed matter consists mainly of tannic acid, the weight is known to be increased by other constituents of the infusion. The hide-powder method is open to the theoretical objection that it does not follow that everything absorbed by hide can fairly be called tannin; on the other hand, a metallic precipitation process is obviously open to the objection that other compounds besides gallotannic acid may be present which give insoluble precipitates with metallic oxides, and there is apt to be some uncertainty as to the composition of the precipitate. On the whole, the preference for the hide-absorption process would be justified provided it were capable of giving constant results. That an unvarying percentage of tannin is not easily obtained by different operators on the same sample, is evident from all the literature on the subject. It seems to have been the object of much patient research to lay down a series of elaborate instructions, by following which it is hoped that uniform results may be attained. J. H. Yocum (this J., 1897, 16, 419) states that "the hide-powder should be freed from readily soluble substances by washing immediately before adding to the tannin solution, a correction being made for the dilution caused by the adhering water. A mechanical means of shaking completes the tanning operation before there is time for the production of more soluble hide. The adoption of 20° as the temperature of filtration removes a source of error. It is of great importance that uniform quantities of hide and solutions of uniform density be employed in the estimations. The most serious cause of discordance is that different preparations of hide-powder do not give the same result." By the Leeds Conference of I.A.L.T.C. (this J., 1903, 22, 114) it is intimated: "The hide-powder must not contain less than 11.5% of nitrogen. The amount of soluble hide-substance must not exceed 5 mgrms. per 50 c.c. of solution. A correction must be made for the tannin absorbed by the filter-paper. It is advisable to discard the first 150 c.c. in filtering the liquor, and the filter ought to be kept as full as possible during filtration." Under the heading of "Non-tannins" we are informed: "this should be conducted by the filter-method till next Conference, but members may use the chromed-hide method of the Association of Official Agricultural Chemists, if it is stated in the Report that the A.O.A.C. method

has been substituted for the I.A.L.T.C. method." J. R. Mardick (this J., 1904, 23, 1187) points out that other matters in considerable quantity are absorbed by hide besides tannin, especially when a large excess of hide-powder is used, as in the approved method. This is specially true of the prepared extracts which are now largely used. The weight of leather obtained in actual working shows that the tannin is always over-estimated. The maceration method gives uniformly about 1% less than the official method. Mardick recommends that the hide-powder should be more highly chromed, in order to make it less liable to yield soluble matter to the tannin infusion, in the process of estimation. R. Lepetit (this J., 1910, 29, 1170) states that the shake method has not given results so nearly agreeing with the old filter-bell method as, on its adoption as the official method, it was stated to do. A concordance to within 1—1½% of tannin between the two methods was claimed, while, as a matter of fact, differences of 4, 5, and 6% have been found in estimating tanning materials by the two methods. Lepetit suggests precipitation by ammoniacal zinc acetate as a preferable method for tannin determination. That it is hoped to attain constancy of result by minute attention to detail, and by every chemist conducting the operations in precisely the same way, is evident from the following quotation from the well-known handbook of Clowes and Coleman. "The whole is agitated for fifteen minutes in a corked bottle, which is caused to rotate not less than 60 revolutions per minute, and the contents are then squeezed immediately through linen, stirred, and filtered through a folded filter of sufficient size to hold the whole filtrate. The evaporations are rapidly carried to dryness at steam temperature in flat-bottomed porcelain, Jena glass, or platinum basins of not less than 6.5 cm. diameter, and the residue is dried at 98°—100° *in vacuo*, or in a water or steam oven with small compartments until it is of constant weight: it is subsequently cooled in a small air-tight desiccator over dry calcium chloride for at least 20 minutes. Not more than two basins are to be placed in one desiccator, and the basins must not be wiped after removal from the desiccator. The basins must be weighed rapidly to avoid absorption of moisture. The moist hide-powder should not be kept for more than a few hours before it is used, without special precautions." Having occasion to estimate a sample of sumach, I followed the above and a number of other directions with reasonable closeness, with the result that I obtained 22.8% tannin. An experienced assistant, using the same hide-powder, obtained 23.7%. On repeating the determination I obtained 23.3%, as the highest of three experiments. The sample was passed on to a very capable analyst, but one who had confessedly no experience of the "shake" method of analysis. He reported 21.0%. We were afterwards informed that the proper expert figure for the same sumach was 25.6%.

One is impelled to the opinion that this so-called official method for estimating tanning materials, is an exceedingly empirical and eminently unsatisfactory analytical method. A good process ought to yield substantially the same result in the hands of different analysts, if these give the matter ordinary care and intelligent treatment. Of methods for tannin determination, other than by the use of hide, nearly all depend on precipitation of the tannic acid by a metallic oxide. This may be effected either by adding a solution of an appropriate salt to an infusion of the tanning material, or by digesting the infusion with excess of metallic oxide. Yellow oxide of mercury has been used in the latter manner with apparent success. I have only experience of the use of a

hot solution of cupric acetate, which is added in excess to the warm infusion, the mixture heated to boiling, the precipitate being collected on a filter and washed with hot water. After drying it is ignited, treated with nitric acid, dried, and again ignited. The weight of CuO is multiplied by 1.305 to obtain the equivalent of tannin. By this means it is easy to obtain practically constant results. In a few comparative experiments, the copper results were from 1 to 2% below the rather variable hide-powder figures. But this raises the question whether 1.305 is really the correct factor by which the weight of CuO should be multiplied. This would be a useful subject of investigation. 0.367 grm. of tannic acid (as used in medicine), dried at 100° , was dissolved and precipitated by copper acetate as above described; 0.623 grm. of dry precipitate was obtained, which gave on ignition 0.252 grm. CuO . This would seem to indicate 1.45 as the factor for gallotannic acid, which if accepted would bring the figures for sumach nearer those found by the hide process. I am not certain how the factor 1.305 was originally derived, but in a paper by Maltseffsky on determination of tannin in tea, for which purpose he uses a standard solution of cupric acetate containing 7.657 grms. of CuO to the litre, and 1 c.c. is said to be equivalent to 0.01 grm. of tannin. These figures correspond to the factor 1.305. The tannin of tea is known to be different from that of galls and sumach. According to Hlilger and Tretzel the tannin of tea has the composition and properties of an anhydride of digallic acid, gallotannic acid being essentially digallic acid, although sometimes associated with glucogallic acid and possibly other compounds in small proportion. Even although a varying factor had to be employed in the estimation of different kinds of tanning materials, the method would possess the great advantage of comparative constancy for the same sample. Different chemists would get the same result with the same thing. It seems to me that the absorption by hide should rather be used as a check on the percentage indicated by metallic oxide, while the latter is the more exact method on which to base analytical data. If there were any reason to suspect the presence of a non-tannin which gives a precipitate in a slightly acid solution of the metallic salt, the hide-powder treatment might also be employed as a useful means of confirming the result or helping to detect adulteration. It may appear audacious to suggest the setting aside or relegating to a secondary place of a method which has received so much attention, and on which so much discussion has been bestowed; but I think that what has been written by others, as well as results that have come under my own notice, indicate that a change in the standard method of estimating tanning materials is much to be desired. I have no doubt that chemists who devote themselves more especially to that kind of work, are capable of devising a better process, and that the successful solution of the problem will lie in the direction of chemical reactions, and not in the absorptive properties of skin.

DISCUSSION.

Professor WALKER said it was well known that absorption phenomena were much less easily reproducible than ordinary precipitations, and probably one could get much more concordant results in the hands of different chemists with the method of precipitation by metallic salts than by the hide-powder method; but of course the problem remained to adjust the two methods to correspond with each other. No official method, which gave different results in the hands of different well-trained chemists, could be said to be satisfactory.

Liverpool Section.

Meeting held at Liverpool University, on Wednesday, October 27th, 1915.

MR. JOHN GRAY IN THE CHAIR.

ACCIDENT PREVENTION IN FACTORIES.

BY JOHN GRAY, F.I.C.

Apart from the trend of legislation during past years, the increasing interest which most manufacturers are showing in the welfare of their employees, and the steps they have taken, and are taking, for the betterment of the conditions of employment and working, have been reflected in improvements in the adequate safeguarding of machinery, and other means for minimising the risks of accidents to employees. The days when employees were looked upon as mere parts of a machine are, I am glad to think, relegated to past history, and an accident entailing even the loss of a finger tip is looked upon by humane employers as of more consequence than a broken-down machine. In the latter case the expenditure of a few pounds will in most instances make the machine as good and useful as ever it was, but no amount of monetary compensation can replace a lost joint or limb, or make up for the pain and suffering borne by the injured worker.

In the advance and progress of industry there must naturally be cases in which accidental occurrences will take place in spite of the best and most carefully planned arrangements. It is not with these that I propose to deal here, but of the far greater number of accidents taking place every day in the routine work of our factories and workshops, which are to a greater or less degree preventable.

The very routine nature of many operations, causing them to become, in the case of skilful workers, rhythmic motions, induces a tendency in the workers to make themselves, as it were, a part of the machine and in a moment of temporary mental abstraction, or from some other cause, to get out of the synchronised motion, with the result that some part of the body, usually the hand, gets trapped and injured. There is only one way of effectually preventing injuries of this kind, and that is by the provision of efficient guards. I shall refer to the question of guarding later.

A considerable proportion of accidents is caused not only through the want of the already mentioned proper care and attention on the part of the employees themselves, but through the want of proper instructions by the foremen and overlookers in the use of their machines. It is in these directions that a very great deal still remains to be done, and it is principally with this class of accident that I wish to deal more particularly here.

The returns given in the Workmen's Compensation Act Blue Books for 1910 and 1913, show that not only is the number of accidents per 100 employees on the increase, but that the amount of compensation paid in respect of such accidents has increased.

	1910.	1913.	Inc.
No. of persons employed....	7,025,074	7,509,353	6.8%
Death claims.....	3,510	3,748	6.8%
Disablement claims.....	378,340	476,920	26.0%
Total compensation.....	£2,700,325	£3,361,650	25.0%
Average payments—Death..	£153	£159	4.0%
Disab- ment	£5.14/0	£5/16/0	1.7%
Total claims per 100 employees	5.4	6.4	

The above figures relate to all employees included in the working of the Compensation Act. The first year taken for comparison in the foregoing statement is three years after the Act came into force, and therefore it may be concluded that the whole machinery of the Act was in active operation and the increases shown in the following three years cannot be explained by more complete methods of reporting and recording. Year after year the Annual Reports of the Inspector of Factories tell the same tale of increased number of industrial accidents, with the attendant loss of life and injury to person. We are therefore face to face with the fact that not only are the numbers of accidents on the increase, but the cost of compensation in respect of these accidents is increasing.

I do not think that we manufacturers in this country have fully awakened to our responsibilities and duties in regard to what can be done by organised effort in the direction of accident prevention. There is too much taking for granted that an accident is merely an accident and cannot be helped. Unless we do something in the direction of accident prevention, the charges on our manufacturers for compensation will still further increase, and our efficiency will be hampered by the maiming and loss of services of good workmen, many of whom it has cost large sums to train for the duties which have been allotted to them. There is, however, evidence that in some of the larger and better organised factories and workshops of this country, much useful and quiet work has been done in the direction indicated, and I know of no reason why the principles underlying this work should not be introduced into all works, large or small. It is a duty which every employer owes to his workpeople, to see that everything possible is done to minimise the risk of accident as well as to provide for suitable treatment for such cases as do occur. Apart from this humanitarian aspect of the question—it pays.

The following statistics have been compiled from the records of a large factory:—

Year.	Accidents per 100 employees.	Average compensation per accident.
		£
1907	2.5	1.24
1908	2.89	2.27
1909	1.97	2.03
1910	2.16	2.64
1911	2.15	2.44
1912	3.18	2.42
1913	1.92	2.41
1914	2.68	2.63

The proportion of "severe" to "moderately severe" averages about 1 to 2. The very marked rise in the year 1912 is accounted for by the starting of certain departments in which the class of work was new, and the attendant risks had to be studied and guarded against. The year 1914 (and the current year 1915, the figures of which are yet incomplete) are also abnormal on account of the large number of new hands employed—about 40% of the males having responded to the call to arms.

Some years ago an attempt was made to prove that there was a greater tendency to accident in the case of men over a certain age, but I have not been able to satisfy myself from personal experience that there is any foundation in fact for such an assertion. Similarly it has been argued that there was a greater tendency to accidents on Monday mornings than on other days of the week, the deduction being that men who were unsteady in their habits were on that particular day of the week not so fully in possession of all their faculties.

So far, I have not been able to ascertain that there are any grounds for such an assumption, and neither is it supported by any deduction to be drawn from the Annual Reports of the Chief Inspector of Factories. So far as regards the hours when accidents are most frequent, it has been found that the greatest number take place between 9 and 12 a.m. and 3 and 5 p.m. This is exactly what is to be expected. These are the hours when most factories and workshops are working at highest speed, and I think a reference to the statistics, when these are available, will show that these are the periods of peak-load for power used.

In the United States there has been in operation during the last few years what is known as a "Safety First" campaign for the purpose of checking the number of accidents due to people taking risks which are quite unnecessary. This applies not only to industrial accidents, but to street, railway, and all other kinds of preventable accidents. In certain of the States the campaign is being prosecuted with the greatest enthusiasm and vigour, and so far as it is being carried out on common-sense lines it is bound to do good. When I was in America last year I found a great display was being made of "Safety First" placards throughout certain towns, and I frequently heard policemen using the slogan to motor drivers and foot passengers who on the streets were disposed to take risks. At busy crossings large placards were exhibited in public places, and one saw many of them in factories and other establishments.

Whilst a systematic campaign of this kind must be productive of good as a matter of education and the getting of people accustomed to thinking of the risks attending their daily occupations, there is a great danger of it being worse than useless if it stops at putting up placards. It is futile to say "be careful," and not guide and instruct people how to be careful. Notwithstanding some glaring failures, I am confident that the "Safety First" campaign in America will bear good fruit. There were many instances in factories which I visited of practical applications of the "Slogan," some of which are well worthy of imitation in this country.

The question which naturally follows is, how are the best results to be obtained? and in what direction can manufacturers, large or small, secure a reduction of accidents in their factories? I suggest that the problem may be subdivided into three heads: 1st, Education; 2nd, Co-operation; 3rd, Organisation.

Education.—One of the first steps to be taken is that of effectively educating the employees to be careful. The "safety spirit" must be fostered and encouraged throughout all classes of employees. They must understand that the management is thoroughly in earnest in its desire to prevent accidents, and that this desire is mainly in the interests of the employees themselves. They should be trained to recognise that neglect of the principles of safety may result in more or less serious injury to their fellow workers as well as to themselves. They must be shown that it is to their interest to use their faculties in the direction of accident prevention, and that although they have worked in certain ways in the past without ill effects, that is no reason why they should continue to take risks that are not called for or necessary. Much can be done through the instrumentality of the departmental managers and foremen. The sympathy and help of these men are essential, and these having been gained, the evolution and development of the "safety spirit" amongst the rank and file will be simplified and will gradually follow.

Take the employees into your confidence in these matters and a new spirit will quickly manifest itself. Meetings of the employees at which the ideas and intentions of the management in respect to accident prevention are explained, will be found most useful, and though the response may not be immediate, a gradual awakening of interest in the subject will be aroused and the consequences will soon be noticeable. Inculcate by every possible means and at every opportunity that the duty of the employees to themselves, their families, and their fellow workers is to be careful and avoid all risks, and the effect on the number of preventable accidents will soon make itself known.

Co-operation.—Unless the closest co-operation between the employers and employees can be attained the full results of safety work cannot be looked for. Education and the promotion of enthusiasm will go a long way towards reaching the goal, but without sympathy, assistance, and co-operation from the workers themselves it is futile to expect successful results. The confidence of the employees must be secured. They must have something more to do than simply carry out orders. Their intelligence and experience must be utilised and their whole-hearted support enlisted in the efforts. Having shown them that it is to their advantage to prevent accidents, their interest and help in the movement must be encouraged. Diplomacy and tact are required to attain this end. Everyone must be impressed with the importance of the subject and the sincerity of the management. The man who does the work is an important element and his co-operation is as necessary as the most highly thought out system of organisation.

Organisation.—Having dealt generally and briefly with the factors of education and co-operation, I come to the wider and more comprehensive heading of organisation, which to a great extent embraces the other two.

The suggestions I am putting forward are not of a merely theoretical nature; they are in practice in many establishments already, and although they have made more progress in other countries than our own, we are now awakening to the need for some organised movement, and in many of our up-to-date institutions good work has been, and is being done. There is, however, a want of knowledge on this important matter, and I trust that as the knowledge becomes more widely spread manufacturers and others interested will take up the safety subject, and I am sure the result will be such that they will not regret having devoted their time and attention to it.

It may be taken for granted that in order to introduce and carry into practical effect a "safety first" scheme careful organisation is necessary. The details must be deliberately and carefully thought out. The scheme must be adapted to the particular plant to which it is to be applied, and must then be carried out systematically and with vigour. Organisation is, after all, a means to an end, and if many of the points referred to in these remarks are not applicable to every set of conditions, it may be possible to modify and adapt them, for the principles I am endeavouring to place before you, whilst basic in character, are readily adaptable to the different conditions which may have to be met in individual cases. The nature of the organisation is the first element to consider. A small factory can be dealt with as if it were a department of a large concern, but the same detail cannot be applied to all institutions.

For the purpose of transmitting knowledge and information, and securing that co-operation from the individual workers which is essential to the success of any scheme of this kind, I have from

my own personal experience found that the establishment of committees, upon which the employers and the workpeople are equally represented, has proved most successful and useful. I strongly recommend this system to any manufacturer who may be considering such questions. I have had a practical experience of the working of such committees for the past 15 years, and as far as the functions of these have been applied to accident prevention, they have been eminently satisfactory. It may be of interest if I give briefly the details of this system as it has been introduced and developed in the business in which I am more particularly interested.

The whole factory is divided into divisions and in each of these divisions or sections, a committee has been formed consisting of the manager and a number of foremen (depending on the size of the division) together with an equal number of employees. The manager or head of the division acts as chairman. The employee representatives must have at least two years' service with the Company. *Inter alia*, the duties of these committees include the following reference:—

Personal Accident Inquiries.

Rules.

1. With the object of further minimising the number of preventable accidents in the Factory, the undermentioned Committees will be constituted.

2. The principal duties of each Committee shall be:—

(A) To promptly and fully inquire into and report to the Company upon any personal accident happening in the division represented by the Committee, which prevents the injured person from following his or her usual occupation for at least three working days after the accident, and the cause of same, and to make recommendations so as, if possible, to prevent repetition of such accidents. The Committee shall have power to visit the site, make full inspection, hear witnesses, and generally investigate all the circumstances connected with the accident.

(B) When specially requested by the Company to do so, to recommend the compensation (if any) to be offered to any injured person or persons. It is not hereby sought to bind such person or persons to accept such compensation.

(C) To nominate quarterly two members of the Committee who, along with the Divisional Manager and a Foreman nominated by the Company, shall make periodical inspections of the Division, point out defects (if any), and make recommendations calculated to prevent accidents of any kind.

(D) To have proper minutes kept of the proceedings at every inquiry and meeting of the Committee.

3. A meeting of the Committee shall also be convened, whether or not a personal accident has happened, whenever required by the Company, or whenever, in the opinion of at least three members of the Committee, any circumstances have arisen which render a meeting of the Committee desirable.

4. Each Committee will consist of the Divisional Manager and the Foreman in the division (being Company nominees) and/or other nominees of the Company, and an equal number of male Employees (being Employee nominees) with not less than two years' continuous service, elected from amongst themselves by the male employees in the division. Any person with less than three months' continuous service shall not be entitled to vote on such election. The proportion which the number of Employee nominees from one department of a division shall bear to the total number of Employee nominees for that Division shall, from time to

time, be fixed by the Company. For the purpose of regulating any Committee under this rule, the Company may at any time require one or more members of the Committee to resign his office as such member. The member or members so to resign to be decided by ballot.

5. A Committee shall also be formed for each division in which females are employed, and all the provisions of these Rules shall apply to such Committee, subject to the following variations:—

(A) The Committee shall consist of the Divisional Manager and the Forewomen or Overlookers in the Division (being Company nominees) and/or other nominees of the Company and an equal number of Female employees (being Employee nominees) with not less than two years' continuous service, elected from amongst themselves by the Female employees in the Division.

(B) Where necessary, words importing the male sex shall be read as importing the female sex.

6. The Divisional Manager shall act as convener of inquiries and meetings, or, in his absence, such other person as may be nominated by the Company.

7. At least four members of the Committee shall form a quorum for any inquiry or meeting, two of whom must be Company nominees and two Employee nominees.

8. Each inquiry and meeting will be presided over by the Divisional Manager, unless the General Works Manager, or some other person nominated by the Company for such purpose, shall elect to preside.

9. Each member of Committee shall have one vote on every resolution. The Divisional Manager, when presiding, shall have a casting vote.

10. The Committee may require any member (except the Divisional Manager) who, in their opinion, may be directly concerned in or affected by any inquiry or proceedings, to abstain from voting on any resolution thereat.

11. The Company may nominate any person or persons, not being a member or members of the Committee, to be present and take part in the proceedings at any inquiry or meeting, but he or they shall not vote thereat.

12. Inquiries and Meetings may be held alternately in the Company's and the members' own time.

13. No member of any Committee shall be entitled to claim payment or remuneration for any services rendered or work done by him as such member.

14. The Company may at any time, at its discretion, alter, vary or annul these Rules, or disband all or any of the Committees, and its decision as to any matter or question arising as to the construction, interpretation, or spirit of these Rules shall be final.

After an extended experience of this system, which has, of course, been altered and improved from time to time, I can honestly say that the results have been most gratifying. The findings of the Committees are posted in the departments concerned, and the fact that a man's own fellow-workers are not only passing judgment on his actions, but, what is more important, are looking out for practical means whereby similar accidents can be avoided, and lessons learned from mishaps, gives confidence to the employees as a whole and helps to link up more closely the interests of employers and employees.

Not the least important function of these Committees is the inspection provided for under Clause 2(c). In these inspections the employees have the opportunity of pointing out personally to their immediate superiors any defects or danger points—(and who knows these so intimately as the workers themselves?)—so that these can be put

right and safeguarded. Much practical and useful information has resulted from these inspections.

Changes in the *personnel* of the employee members of these Committees should take place frequently—say every 6 or 12 months. In this way a larger number of the regular or permanent men become more particularly interested in safety work, and the infusion of new blood maintains the enthusiasm as well as introduces new ideas into the work of these Committees. Employees should also be encouraged to submit suggestions for safeguarding dangerous parts of machinery and for carrying out operations with greater safety than the general practice employed. These Committees have power to recommend the adoption or rejection of any such suggestions, and money prizes are awarded for those adopted, according to the utility or effectiveness of the particular suggestion.

As an example of what can be done in this way I may cite the case of machines operated by women on which accidents of a somewhat serious nature occasionally happened. All attempts to guard the machines adequately had been more or less unsuccessful and materially reduced the output. A suggestion was made by an employee which on being developed was applied to these machines, and although there are many of these at work no accident has taken place since the introduction of these guards some 14 years ago, and the output has not in any way suffered. This is only one case out of many which I could cite.

In order that the best results may be obtained from these suggestions, the recommendations from the respective Committees are laid before a Council consisting of the chairmen of all these committees. Here the combined experience of all the experts is obtained, together with the special advantage of having the suggestions available for all other divisions of the factory.

The time taken up by these meetings is not great. They are held, as a rule, during the day at an hour most convenient to all concerned. There is one element essential to their success, and that is that those responsible for organising and developing such a system must be thoroughly in earnest and serious, and each one must have convinced himself that such measures are in the right direction and in the best interests of all concerned. Unless such a conviction exists better leave such a scheme alone. It will end in absolute failure.

In larger establishments, where the size of the factory and circumstances permit of such an arrangement, a safety inspector should be appointed whose duty it is to be responsible for the whole of the safety organisation throughout the works. His whole time is devoted to the duties, and he makes systematic inspections of all safety appliances and guarding, and sees that these are maintained in an efficient manner, and also suggests the application of new guards and methods wherever such may be advisable. He of course works in close touch with the departmental management, and also with the committees already referred to. Provided the right man is appointed to such a position the results are certain to justify it.

A set of safety rules displayed prominently throughout the factory and also printed in the form of a card handed to each employee when he or she is engaged, are useful methods for educating them in the ways of safety.

It is interesting to note the opinion of H.M. Chief Inspector of Factories on the working of the system I have just described. In the Annual Report for 1909, the Inspector for the North-Western District says:—"In reviewing the cases that have come before him, finds that so minute

a proportion of the whole reveal any breach of the law that he was tempted at first to think the law did not go far enough. Further reflection, however, shows how many are due to carelessness and he suggests as a remedy the adoption of a scheme in force in a very large works in his district, which he thinks would do more to reduce accidents than any Act of Parliament or an army of inspectors." He then proceeds to describe the scheme I have just detailed.

In the Annual Report of the Chief Inspector of Factories for 1913 (the last one published) there is a further reference to the establishment of safety committees, and it is there stated that from 25 to 40% of industrial accidents are preventable if practical means are taken. Some particulars, similar to those mentioned in the report of 1909 regarding the constitution of these committees, are given and their establishment is encouraged. There is also a reference to the appointment of safety inspectors. In the 1912 Report there is a reference to a conference with the employers and employees of the cotton and woollen industries with respect to means to be adopted for reducing accidents. It was recommended and agreed that employers should make some person responsible for the periodical inspection and upkeep of fencing. That is a step in the right direction, but in my opinion does not go far enough. I fear, however, that these Blue Books are not very widely read, and I am sure some better means of publicity for such important recommendations and advice are greatly to be desired.

In spite of all care and all precaution, accidents of one kind or another are bound to occur. When these do happen adequate means of dealing with them should be provided. Thanks to the admirable work of the St. John's Ambulance Association there has been a great deal done in the training of men and women in the practice of rendering first aid. There are very few works where there are not one or more employees holding the St. John First Aid Certificate. It is the duty of every employer to see that the knowledge and experience of that employee is available in all such cases where it may be required. It is also his duty to see that a supply of suitable dressings is kept ready for use, and also that a convenient and suitable place in the factory is set apart and can be at once utilised for the purposes of applying first aid. By far the larger proportion of accidents are originally trivial in character, but unless these are properly and efficiently treated in the first case the wounds become septic, or other complications arise, the employees have to go off work, compensation becomes payable, and they may develop into serious cases.

In all workshops and factories, however small, there should be provided a suitable first aid room or surgery, supplied with the necessary equipment and in charge of some member of the staff with the requisite first aid training, who is always available, and who is responsible to the management for the cleanliness and maintenance of the equipment. In the larger factories, there is usually a fully organised ambulance brigade, and the work done by such means cannot be spoken of too highly.

Guarding.—It is impossible to deal completely or adequately with such a very wide subject in an address of this kind, and I can therefore only refer to one or two aspects in a general way.

It may be taken as an axiom that it is always better to remove a source of danger than it is to establish guards around it. Unfortunately many employers are disposed to consider every part of the plant or machinery which has passed the watchful eye of the Factory Inspector as being safe and not requiring special guarding. This is a great mistake, and generally the first intimation

that such machinery is not adequately guarded is an accident more or less severe. If accidents are to be prevented by safeguarding, the possibilities of their recurrence must be anticipated and provided against. Sometimes an accident happens, the very fact of which opens up the possibilities of others happening under other similar conditions. Not only should the place where the particular accident has happened receive immediate attention, but in order to prevent repetition all similar machines and parts of machines throughout the factory should be subject to investigation in the same manner. It is in such cases the Committee system already explained will prove eminently helpful.

H.M. Factory Inspectors are looked upon in many establishments as necessary evils. Their periodical visits are viewed with anxiety by management and employees alike, and a sigh of relief is given when they take their departure. This is not as it should be. These gentlemen should be looked upon as friends. They are more anxious to help than to criticise. They should be taken into confidence by those with whom they come in contact. Personally I have always received considerable help, assistance, and encouragement in the direction of improvements in conditions and safety from the periodic visits of the Inspectors.

After mechanical perfection has been attained as far as it practically can be, it will doubtless be the general experience that accidents of a certain class will continue to recur with greater or less frequency. It is therefore possible to have had and preventable accidents in a factory which is excellently equipped with all kinds of mechanical guards. Guards are exceedingly important, but they are not *all-important*.

Thorough, frequent, and regular inspections are of paramount importance in connection with accident prevention. Careful and systematic education of the employees in the principles of safety work must receive close and painstaking attention. The need for this can hardly be exaggerated, and the solution of this part of the problem is often surrounded with difficulties. In this direction the Safety Inspector can do much, but he must be backed up and assisted by the officers, otherwise his labour will be in vain. For this reason it is necessary that he should possess tact, as he may frequently find himself in positions of delicacy.

For a safety guard to be effective it must fulfil the following conditions:—(a) It must prevent any part of the body or clothing of the operator or surrounding workers from accidentally coming in contact with any moving part of the machine where it can be injured, caught, or trapped. (b) It should, if possible, be automatic in its action, application, or operation. (c) It should, if possible, be an integral part of the machine itself. (d) It should not materially diminish the output or efficiency of any machine to which it may be applied.

The exact nature of the hazards existing or occurring in each establishment must be first ascertained, and then the best means of avoiding, overcoming, or minimising them must be thought out and applied.

In conclusion I wish to put forward a strong plea to manufacturers generally to take up this subject of accident prevention actively and seriously. It is not philanthropy. It is a strictly business proposition with humanitarian interest thrown in. I am conscious that many progressive employers have done, and are doing, a great deal in this direction, but the ideals have not made the progress they should have done during the past few years. I do not here propose to go into the reasons for this, sufficient to say that it is unfortunately the case. Other countries have

made greater progress than we have, and we ought to see that we do not take "the wooden spoon."

It should always be remembered that so-called little things are often of great importance. The major accidents attract much more attention than the minor ones, but the latter are far more numerous and their cumulative results are great.

Five years ago, I brought before the Home Office a suggestion that a safety museum should be established in this country on the lines of some of those in America and on the Continent, and was informed that the matter was in hand. I have heard nothing of it since, although I observed in a recent Blue Book an announcement that progress with the proposed safety museum had been interrupted by causes outside of the control of the Home Office. It is to be hoped that the scheme has not been dropped. There are, I understand, 24 museums of safety in the world, not one of which is in the United Kingdom. The principal ones are:—New York, Montreal, Paris, Amsterdam, Milan, Moscow, Zürich, Stockholm, Copenhagen, Helsingfors, Berlin, Munich, Vienna, Budapest, Dresden, and Gratz.

In opening the Paris museum of safety, the then President of the French Republic—President Loubet—said:—"Never does one appeal in vain in France when it is a question of social usefulness. Thus the Government of the Republic is associated with this museum. How could it be otherwise? for this work protecting and lengthening the life and labour of our workmen is a most valuable asset to our country and you may be sure that whenever a work of this nature is presented for governmental consideration it will support it with grants of money."

The American museum of safety holds a special Charter of Incorporation granted by the Assembly and Senate of the State of New York. In this charter it is stated:—"The objects of the Corporation hereby created are to study and promote means and methods of safety and sanitation and the application thereof to any and all public or private occupations whatsoever, and of advancing knowledge of kindred subjects; and to that end to establish and maintain a museum, library and laboratories and their branches, wherein all matters, methods and means for improving the general condition of the people as to their safety and health may be studied, tested and promoted with a view to lessening the number of casualties and avoiding the causes of physical suffering and of premature death; and to disseminate the results of such study, researches and other publication." Evening conferences are held at the museum with the Commissioner of Labour and his Inspectors together with Societies such as ours—*e.g.*, the National Electric Light Association, the Iron and Steel Electrical Engineers, Works Engineers and Chemists, etc. Large numbers of safety lectures have been organised by the museum at the larger centres. There is no charge made for exhibits or for the space occupied, but no exhibit is accepted unless it has a safety feature and is passed by the Board of Approval, consisting of experts in the various industries. Personally, I found the time spent in this museum of the greatest value and interest.

Does it not seem preposterous that our Home Office should indefinitely defer such an important method of making known to the manufacturers of this country the adaptations and uses of safety apparatus, and the details of organisations in this and other countries that have with more or less success grappled with the problem of accident prevention? I hope the powers that be will return to this question and see that our manufacturers are informed of all the latest and most useful methods of dealing with this subject. It

is a duty the Government owes to the manufacturers of this country.

Lack of planning and of intelligent supervision is as fatal in safety work as it is in efficiency work. The safety campaign must be carefully thought out and developed to meet the existing circumstances. It must be adapted to the particular conditions it has to meet and then carried out with intelligence and vigour. When such a scheme does not progress as it should, it is probable that the organisation is at fault. The plan adopted has not been the one best adapted to the conditions existing in the particular factory, in which case it must be modified as experience dictates. One of the best ways to give encouragement is to take into consideration the employees' recommendations and carry out the things they recommend whenever and wherever it is possible and practicable to do so. Every accident is a notice that something may be wrong with the man, plant, or methods, and should be immediately investigated to ascertain the cause and to apply the remedy.

I hope I have been able to put forward in these notes a few points for thought and consideration. I have not attempted to deal with any section of the subject in an exhaustive manner; I have rather endeavoured to treat the subject in a more general way, and broadly, so that further interest might be aroused in this source of industrial waste, and in the hope that our Home Office may see their way to help manufacturers still further than they have done by disseminating that mass of useful information which must be locked up in the official "pigeon-holes," and which, if placed collectively at the service of factory owners, would prove a gold mine of useful suggestions resulting in a reduction in the loss of life and limb to which our workers are liable. I am sure the information is available and I am equally sure that manufacturers only want to be shown how difficulties and dangers have been overcome by their neighbours in order to apply the remedies to their own case. There are no business secrets in these things, and they should be published for the good of all.

DISCUSSION.

Dr. J. T. CONROY said that co-operation between employees and manufacturers was essential, and the calling in of capable foremen was also most desirable. Emphasis might be laid on the need for bringing in the workers for inspection, and also for sending in of reports at stated intervals. It was quite true that the Home Office had reports which, if available, would be most useful. As regards the rules Mr. Gray had read out, most manufacturers would like to have them, but very few had actually adopted such a system.

Mr. ARTHUR CAREY said that the necessity for obtaining the co-operation of the men was a point too often lost sight of, and was difficult to attain. The way Messrs. Lever had tackled the question and brought knowledge and experience to bear upon it was a source of admiration. Their scheme showed imagination and pluck.

Mr. W. P. THOMPSON asked whether Messrs. Lever insured their men, for at one small works he had visited there were more accidents than in the whole of Messrs. Lever's, and on inquiry he was told that this was no concern of the works but of the insurance company. He thought insurance was one of the great causes of accident.

Mr. GRAY, in reply, said that Messrs. Lever did insure their men themselves, but they tried to bring in the co-operation of all in acting on the principle of safety first. They must guard against accidents occurring which could be prevented by any human foresight or organisation.

Obituary.

RAPHAEL MELDOLA.

Professor Raphael Meldola, F.R.S., died suddenly on November 16th, at the age of 66.

Born in London, he was educated at the Royal School of Mines, and afterwards spent two years at the colour works of Messrs. Williams, Thomas, and Dower, at Brentford. He then went to the Royal College of Science as assistant to Sir Edward Frankland and later to the Solar Physics Laboratory as assistant to Sir Norman Lockyer. In 1875 he went to the Nicobar Islands in charge of the British Eclipse Expedition, and on his return, in the following year, he resumed his connection with the colour industry, taking up an appointment with Messrs. Brooke, Simpson, and Spiller, at Hackney Wick. He left the firm in 1885 on his appointment to the Chair of Chemistry at Finsbury Technical College, a position which he held until his death.

Meldola carried out a large amount of valuable research work on the chemistry of aniline dyestuffs, and his name is associated with a dyestuff, Meldola's Blue, or Naphthol Blue, prepared by him in 1879 by the action of nitrosodimethylaniline on β -naphthol. Among the other dyestuffs which he discovered may be mentioned Alkali Blue, prepared from Rosaniline and β -naphthylamine, and Viridine (Alkali Green), obtained by the action of crude benzyl chloride on diphenylamine, the product being subsequently oxidised and sulphonated. He showed later that the formation of Viridine was due to the benzotrichloride present in the crude benzyl chloride. He also devised a

general method for preparing disazo and tertiary azo compounds and for the direct production of aminoazo compounds, in addition to carrying out extensive researches on the constitution of azo and diazo compounds. In 1889 he contributed a paper to this Journal (Vol. 8, p. 958) on a new photographic developer, Eikonogen, which is the sodium salt of 1-amino-2-naphthol-6-sulphonic acid, a compound which he prepared in 1881.

He was the author of numerous books on chemical and other subjects. Two of the best known are "Chemical Synthesis of Vital Products" and "The Chemistry of Photography."

Though Professor Meldola's active connection with chemical industry ceased in 1885, his interest in the industry generally, and in the dyestuff industry particularly, never abated, and he lost no opportunity of urging on manufacturers the necessity for chemical research, for he early recognised that the British dyestuff industry must fall into decay unless more scientific methods were adopted by it. A perusal of his Presidential Address to this Society (this Journal, 1909, 554—577) will show how strong were his views on technical education and research.

In addition to being President of this Society in 1908—1909, Meldola filled the office of President of the Chemical Society (1905—1907), of the Institute of Chemistry (1912—1915), and of the Society of Dyers and Colorists (1907—1910). He was elected a Fellow of the Royal Society in 1886 and was awarded the Davy Medal in 1913. In 1912 he was appointed Professor of Organic Chemistry in the University of London, and in July of this year became Chairman of the Advisory Committee in connection with British Dyes, Ltd.

Journal and Patent Literature.

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I.—GENERAL; PLANT; MACHINERY.

PATENTS.

Separation of salts held in solution, or liquids which are miscible, from each other. J. A. Newby, Dumfries, and C. J. Montgomery, Saltcoats, Scotland. Eng. Pat. 9140, Oct. 12, 1914.

By bringing a gaseous or solid moving surface of large area into contact with the solution of a salt, or with a mixture of miscible liquids, the surface tension between moving gas, or solid, and the liquid is so reduced that separation is easily effected. In one method, the solution is placed in a vessel along the bottom of which a number of small orifices, for the injection of a current of air, are placed. When a series of vessels is used, each of the units except the first and the last is provided with a vertical partition by which the inflowing liquid is confined to a relatively small space, and then passes below the partition into

the larger compartment. The separated salt flows with the liquid through a spout at the top of one vessel into the next, and is finally deposited in the last vessel of the series. A second method consists in passing the liquid through a pipe into the capillary space between a pair of horizontal discs mounted on a rotating shaft, the whole being enclosed in a tank; at the same time air may be injected into the space between the discs. The separated solid is removed from the latter either mechanically or by hand, and the residual liquid is run off through a pipe at the base of the tank.—E. H. T.

Crystals from solutions saturated hot; Process for obtaining rapidly.—F. Crotogino. Ger. Pat. 286,085, Feb. 6, 1913.

The solution is cooled in a closed vessel by means of a current of air of such strength that the formation of a coherent layer of crystals on the

surface is prevented. The strength of the air current may be varied at different places. The solution may be either still or slowly moving; in the latter case the air current flows preferably in the opposite direction.—A. S.

Furnaces or kilns; Gas, oil, or dust fired — G. S. Higginson, London, and W. R. de la C. Beamish, Edinburgh. Eng. Pat. 22,909, Nov. 23, 1914.

A CHAMBER is divided by an inclined partition into compartments, of which the upper serves as a combustion chamber and the lower as an air heating chamber. Regulated quantities of air are supplied from the air heating chamber to the upper and lower ends of the combustion chamber, and the products of combustion are led first through flues to heat the main hearth of the furnace, and then through other flues for heating secondary hearths. The walls and other parts of the furnace are constructed of interchangeable, tongued and grooved blocks of refractory material.—W. H. C.

Kilns; Basic lining for — S. B. Newberry, Baybridge, Ohio, Assignor to Sandusky Portland Cement Co., Cleveland, Ohio. U.S. Pat. 1,156,018, Oct. 5, 1915. Date of appl., April 13, 1914.

A REFRACTORY lining for kilns is made by mixing coarsely pulverised cement clinker with water and 10–20% of calcium chloride. The mixture is formed into blocks and dried.—W. H. C.

Kiln; Rotary — R. Kart, Gyöngyös, Hungary. Ger. Pat. 286,604, May 9, 1911.

THE front end-wall of the kiln is formed by a funnel-shaped member, constructed in removable segments, and with its narrow end projecting into the interior of the kiln. The wall is thus free to expand in the direction of the axis of the kiln.—A. S.

Kiln; Rotary — Fellner und Ziegler. Ger. Pat. 285,419, Nov. 29, 1913.

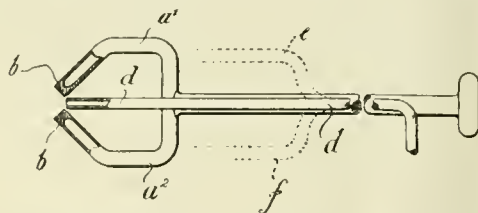
To prevent formation of adherent deposits on the wall of the kiln, the lining is divided into sections by means of hollow pieces, through which a cooling medium is passed. The hollow pieces are longer than the zone of the kiln in which formation of such deposits may occur.—A. S.

Burner for rotary kilns. G. Polysius, Eisengiesserei u. Maschinenfabr. Ger. Pat. 285,455, July 19, 1913.

THE burner, which is intended for use in rotary kilns in which the lower part of the kiln serves as a cooling chamber, is movable in a longitudinal direction, so that the position of the flame can be varied in accord with varying chimney draught.—A. S.

Spray producers or atomisers for liquids. D. H. Thomas, Morriston, Glam., A. D. Berk, London, and P. J. Morgan, Swansea. Eng. Pat. 608, Jan. 14, 1915.

THE liquid to be atomised is conveyed by the unobstructed pipe, *d*, to the point where con-



verging streams of compressed air or steam from the nozzles, *b, b*, meet. For certain liquids, *e.g.*,

corrosive acids, etc., a modified form of atomiser is used; the liquid is supplied by the pipes shown in dotted lines and marked, *e, f*, from the end of which it drips on to the outside of the pipes, *a1, a2*, and flows over them until it reaches the nozzles, *b, b*.—W. H. C.

Charging liquids with gas; Apparatus for — J. F. and R. W. Wittemann, Assignors to Amaranth Machinery and Supply Works, Inc., New York. U.S. Pat. 1,155,983, Oct. 5, 1915. Date of appl., Aug. 6, 1914.

THE liquid and the gas are conveyed to a pump by separate conduits provided with valves controlled by diaphragms. The liquid conduit has different cross-sections at different places, and separate conduits are provided between the parts of different cross-section and the opposite sides of the diaphragms controlling the valves.—W. H. C.

Impregnating liquids with gases; Apparatus for — A. Haupt. Ger. Pat. 286,121, Dec. 11, 1913.

THE apparatus works on the injector principle, and the entering liquid acts on a membrane which is connected with a device for controlling the pressure at which the gas is introduced, the conditions being so adjusted that the pressure of the gas exceeds that of the liquid by an approximately constant amount. The outlet for the impregnated liquid is constricted, so as to utilise to the fullest possible extent the kinetic energy of the liquid in the impregnating chamber.—A. S.

Filler-press; Electro-osmotic — B. Schwerin, Assignor to Ges. f. Elektro-Osmose m. b. H., Frankfurt, Germany. U.S. Pat. 1,156,715, Oct. 12, 1915. Date of appl., Apr. 8, 1913.

SEE Eng. Pat. 10,873 of 1913; this J., 1913, 833.

Process for simultaneously scraping [from a drum] and pulverising calcium nitrate and similar materials. Fr. Pat. 474,996. See VII.

IIA.—FUEL; GAS; MINERAL OILS AND WAXES.

Gas from peat. G. A. Brender à Brandis. Het Gas, 35, 277. J. Gas Lighting, 1915, 132, 34.

TRIALS were made at the Hague gas-works with two descriptions of peat, viz.: (A) dense peat in flat briquettes containing 25% of moisture, and (B) pressed dredged peat briquettes containing 18% of moisture, in a 10 ft. horizontal retort at the same temperature as used for the distillation of coal. Using peat alone the production of gas at first was excessive; with description (A) 17,885 cub. ft. of gas per metric ton was obtained, of gross calorific value 385 B.Th.U., while with description (B) 17,255 cub. ft. per metric ton was obtained, of calorific value 366 B.Th.U. The addition of 10 to 20% of peat to gas coal increased the make of gas without lowering the quality unduly. The coke produced from the mixture was of a "good workable kind." The addition of peat is not advisable in works with water-gas plant, or with vertical retorts into which steam is introduced, owing to the effect on the calorific value of the gas.—W. G. C.

Mineral oils and liquid hydrocarbons of all kinds, fatty acids and similar substances; Distillation of — L. Singer. Petroleum, 1915, 10, 605—608. Z. angew. Chem., 1915, 28, Ref., 376.

APPARATUS for the distillation of mineral oils in a high vacuum has been erected in Germany and yields products suitable for all practical purposes.

Crude oils, rich in paraffin wax, when thus distilled, yield machine oils and cylinder oils of the best quality, together with high-grade paraffin wax. Considerable saving of time, expenses, and fuel is effected. Crude oils are first freed from benzine in a preliminary heater, and then distilled in the vacuum apparatus with the aid of a fractionating dephlegmator. The distillates are anhydrous and free from decomposition products, and are more homogeneous than have hitherto been obtainable. Less chemicals are required for refining such distillates, and the amount of acid tar left in the refining of German oils is reduced by more than 50%. Similar advantages are obtained in the distillation of coal tar, asphalt oils, or fatty acids.

—C. A. M.

Aromatic constituents in hydrocarbon mixtures; Range of applicability of the sulphur dioxide method of determining—W. F. Rittman and R. J. Moore. *Met. and Chem. Eng.*, 1915, 13, 713—714.

EDELEANU'S method of separating the aromatic constituents in hydrocarbon mixtures (this J., 1914, 343) gives satisfactory results with small quantities of the former, but is not applicable when more than about 25% is present. In such cases it is necessary to dilute the mixture with a pure paraffin mixture, such as Pennsylvania kerosene. The temperature at which the extraction is made should be low, preferably about -20°C .—C. A. M.

Switch and transformer oils [; Sludging of —]. P. Digby. *J. Inst. Elect. Eng.*, 1915, 53, 146—156.

A SAMPLE of sludge produced from transformer oil by treatment with ozone in the presence of copper and iron, has been found by Messrs. Ferranti to have the composition:—

Organic acids soluble in petroleum spirit	2.31%
" " " " ether (1) free	7.56%
" " " " ether (2) combined	20.96%
Neutral unsaponifiable solid (1) sol. in ether	42.46%
" " " " benzol (2) sol. in benzol	11.50%
Insoluble in benzol (carbon)	3.31%
Basic solid soluble in ether	10.51%
Copper oxide	0.53%
Ferric oxide	0.06%
Other mineral matter	0.78%

The organic acids soluble in ether are saturated acids of the paraffin series, and form brown needle-shaped crystals of mean molec. wt. 291. The neutral and basic solids are both of the paraffin series. All the products are considered to be the result of oxidation with the formation of complex organic acids, dehydrogenated hydrocarbons, and oxidised resinous asphaltones. The Victoria Falls and Transvaal Power Co. consider sludging to be a purely chemical reaction between certain unsaturated hydrocarbons of the oils and oxygen of the atmosphere, and advise designing transformers to minimise the surface exposed, or covering the surface with inert gas. High temperature greatly influences the rate of action. Copper and lead appear to act as catalysts, and sunlight influences the rate of action. Liability to sludge is independent of specific gravity and viscosity.—F. W. A.

PATENTS.

Torpedoes; Method of increasing the energy of a fluid-motor in motor-driven—M. Bruniquel, Paris. U.S. Pat. 1,151,609, Sept. 28, 1915. Date of appl., July 21, 1914.

A SUITABLE fuel is injected into and burned within the compressed motive fluid as it passes to the motor. Hydrogen peroxide is also injected into the stream of fluid to control the temperature and to provide the necessary oxygen for maintaining combustion.—W. H. C.

Water-gas or other gaseous mixture rich in hydrogen; Process for separating—into its constituents. Badische Anilin und Soda Fabr. Ger. Pat. 285,703, Feb. 18, 1913.

IF water-gas or similar gaseous mixture be compressed and then allowed to expand, the lowering of temperature produced is not sufficient to liquefy the constituents other than hydrogen present in the gas. The present invention consists in adding carbon monoxide or nitrogen, which show a positive Thomson-Joule effect, to the gas, before compression, in such proportion that the lowering of temperature produced on expansion is sufficient to liquefy the major portion or all of the constituents other than hydrogen. The enrichment of the gas in carbon monoxide or nitrogen may be effected by modifying the method of preparation or by adding a suitable gas to the gaseous mixture containing hydrogen. When the process is once in operation it is only necessary to add a certain quantity of the constituents (carbon monoxide, nitrogen) which are liquefied, to the gas under treatment in order to obtain the desired result; or the liquefied constituents may be fractionated and the most volatile portion, still containing some hydrogen, added to the gas under treatment.

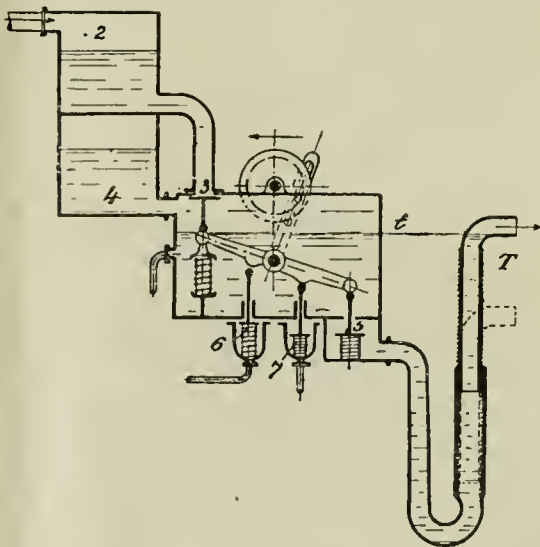
—A. S.

Benzol in gases; Determination of—J. H. Reineke. Ger. Pat. 285,920, June 28, 1914.

THE benzol content is estimated from the illuminating power of the gas, measured with the aid of a photo-electric cell, e.g., a selenium cell, and a current-indicating device. A curve is given showing the relation between the benzol content and the illuminating power.—A. S.

Petroleum, tar, and the like; Apparatus for distilling derivatives of—under vacuum. R. Neumann, Brünn, Austria. Eng. Pat. 20,353, Sept. 30, 1914. Under Int. Conv., Oct. 1, 1913.

A RECEIVER for use in vacuum distillation is described, by means of which portions of the distillate can be discharged at short intervals.



The distillate from a vacuum cooler enters the chamber, 2, which is emptied at intervals into the receiver, 4, through the valve, 3, which is mechanically operated at regular intervals. The valve, 3, is then closed and the valve, 5, opened to allow the liquid to discharge visibly from the outlet, T, which is adjustable in height to vary the capacity

of the receiver, 4. The receiver is thus placed alternately under vacuum and atmospheric pressure, which may be established before the opening of the main valves by the provision of two auxiliary valves, 6, 7, connected with the vacuum and atmosphere respectively, and mechanically operated before the main valves. In an alternative form, the valves, 3 and 5, may be opened by hydrostatic pressure after the auxiliary valves have been mechanically operated. A single pair of auxiliary valves may be provided for a number of receiving chambers, and the exhaust gases of the vacuum pump may be supplied through the valve, 7, to the receiver, 4, instead of air, to restore atmospheric pressure.—W. F. F.

Gas-purifying material; Apparatus for revivifying —. W. Foertsch, Ludwigshafen, Germany. Ger. Pat. 286,550, Nov. 29, 1913.

THE material is discharged from the drum, in which revivification is effected, into an elevator which delivers it into a tower used as a storage receptacle. From the tower the material may be transferred either to the purifiers or back to the drum.—A. S.

Di-electric composition [from spent oil shale]. R. C. Sharp, Glasgow. Eng. Pat. 4820, Mar. 29, 1915.

A HOMOGENEOUS mixture of finely-divided, spent oil-shale with pitch or bitumen in equal proportions by weight.—W. E. F. P.

Low temperature distillation of coal and apparatus therefor. Eng. Pat. 15,892. See IIB.

Destructive distillation of coal and other carbonaceous substances. Eng. Pat. 20,457. See IIB.

Carbonising fuels. Eng. Pat. 8183. See IIB.

Process of making nitrogen and carbon monoxide. U.S. Pat. 1,154,171 and 1,154,173. See VII.

Process for removing hydrogen sulphide from gases. Ger. Pat. 286,374. See VII.

Process for extracting fats of every kind, hydrocarbons, sulphur, or the like. Ger. Pat. 284,410. See XII.

Apparatus for analysing gases. U.S. Pat. 1,154,792. See XXIII.

Apparatus for the continuous analysis of gases. Ger. Pat. 285,781. See XXIII.

IIB.—DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

PATENTS.

Coal; Low temperature distillation of — and apparatus therefor. F. Lamplough, London. Eng. Pat. 15,892, July 2, 1914.

THE charging hopper for a series of retorts is provided with a cylindrical chamber having a pair of continuously rotating segmental blocks, which are operated by cranks so as to recede from one another when taking in a charge of coal, and approach one another after discharging the coal. The blocks are rotated by a ratchet wheel operated at variable speed by a special arrangement of linkwork.—W. F. F.

Coal and other carbonaceous substances; Destructive distillation of —. S. N. Wellington, London. Eng. Pat. 20,457, Oct. 2, 1914.

VERTICAL retorts are arranged between series of horizontal heating chambers, operating in pairs, which communicate at one end. A gas conduit

enters at the other end, each row of conduits being connected to a single supply pipe, and a flue leads from each heating chamber to a regenerator below the level of the retorts. The flues are used alternately as air inlets and waste gas outlets.—W. F. F.

Fuels; Carbonising —. A. McD. Duckham, Ashted, Surrey. Eng. Pat. 8183, Jan. 5, 1915.

COAL or the like is continuously carbonised at a low temperature by feeding it under pressure through horizontal or inclined retorts of the kind described in Eng. Pat. 13,934 of 1914 (this J., 1915, 1044), and fractionally collecting the volatile products. (See also Eng. Pat. 17,502 of 1914; this J., 1915, 787.)—W. F. F.

Peat; Apparatus for obtaining [products from] —. E. Bartholomew, Toledo, Assignor to The National Peat Refining Co., Cleveland, Ohio. U.S. Pat. 1,156,387, Oct. 12, 1915. Date of appl., Dec. 22, 1913.

AN apparatus for separating peat products consists of two vertical bins joined hermetically to a separator placed between them, conveyors transporting the contents of the upper bin to the separator, and from the latter to the lower bin. The separator contains an inner shell provided with a stirrer and terminating at its lower end in a hopper, through which the material is fed on to a grate of electrodes situated immediately below it. The electrodes are so arranged that they form a clear annular space in which the gases collect, and from which they are led away between the two walls of the separator to the upper bin.—E. H. T.

Incandescence [tungsten] lamps; Drawing refractory materials for —. H. C. G. Remané, Berlin, Assignor to General Electric Co. U.S. Pat. 1,156,492, Oct. 12, 1915. Date of appl., May 22, 1912.

TUNGSTEN wire is coated with a greasy, decomposable sulphide of a metal of the chromium group, e.g., with tungsten sulphide; the wire is drawn and the sulphide decomposed, thus leaving an adherent coating of tungsten.—B. N.

Electrode [for arc lamps]. C. R. Krueger, Schenectady, N.Y., Assignor to General Electric Co. U.S. Pat. 1,156,696, Oct. 12, 1915. Date of appl., June 28, 1913.

SEE Eng. Pat. 18,820 of 1912; this J., 1913, 692.

III.—TAR AND TAR PRODUCTS.

Distillation of mineral oils and liquid hydrocarbons of all kinds, fatty acids, and similar substances. Singer. See IIA.

Range of applicability of the sulphur dioxide method of determining aromatic constituents in hydrocarbon mixtures. Rittman and Moore. See IIA.

Use of coal tar in [ore concentration by] flotation. Mueller. See X.

PATENTS.

Isoquinoline; Process for obtaining — from crude quinoline from coal tar. Ges. f. Teerverwertung m. b. H., Duisburg-Meiderich, Germany. Ger. Pat. 285,666, Jan. 29, 1914.

THE crude quinoline is partially neutralised with acid, or completely neutralised and then treated with a quantity of alkali insufficient to liberate the whole of the bases. The crude material is thus separated into two fractions, and the more strongly basic fraction is further treated, for

example by crystallisation of its acid sulphate, to yield a salt of pure isoquinoline. Isoquinoline is of value for therapeutic purposes and in the preparation of perfumes.—A. S.

Dianthraquinone-oxides; Manufacture of —. A. G. Bloxam, London. From Akt.-Ges. f. Anilinfabr., Berlin. Eng. Pat. 24,347, Dec. 19, 1914.

1-NITROANTHRAQUINONE and its substitution derivatives form 1.1'-dianthraquinone-oxide or a substitution derivative on heating with a substance which absorbs acid, such as an alkali carbonate. The new products are employed in the manufacture of dyestuffs or of pharmaceutical preparations.—F. W. A.

Sulphur derivatives of aromatic amino-compounds; Preparation of —. Kalle und Co. Ger. Pat. 285,501, Dec. 31, 1913.

ONE mol. of a *p*-hydroxy- or an amino-azo dyestuff reacts with 2 mols. of an aromatic sulphonic acid to give a product containing two arylsulphone groups. The new products are employed in the manufacture of dyestuffs or of pharmaceutical preparations.—F. W. A.

6-NITRO-3-amino-1-hydroxybenzene and its methyl ether; *Preparation of* —. Farb. vorm. Meister, Lucius, und Brüning. Ger. Pat. 285,638, May 5, 1914.

4-NITRO-1-ACETAMINOBENZENE-3-SULPHONIC acid (nitro-acetylmethanilic acid) is heated to a high temperature, under pressure, with a solution of alkali in methyl alcohol. The acetyl group is saponified and the sulphonic group is replaced by hydroxyl or methoxyl.—A. S.

Sulphomethylbenzophenone-o-carboxylic acids and substitution products; Preparation of —. Farb. vorm. Meister, Lucius, und Brüning. Ger. Pat. 285,700, Oct. 21, 1913.

CHLORIDES of benzoic acid and its substitution products are condensed with *m*-xylene, the products are sulphonated, and the resulting *as*-dimethylbenzophenonesulphonic acids, having the sulpho group in the xylene residue, are oxidised. The products are converted into anthraquinone derivatives on treatment with concentrated sulphuric acid.—A. S.

Hydroxytriarylmethanecarboxylic acids; Preparation of —. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 286,433, July 4, 1914.

A MIXTURE of 2 mols. of an aromatic *o*-hydroxycarboxylic acid and 1 mol. of an aromatic aldehyde is treated with zinc chloride in presence of phosphorus oxychloride. Reaction occurs without heating, but the temperature may be raised to 70° C. The phosphorus oxychloride may be recovered by distillation, preferably *in vacuo*. *o*-Chlorobenzaldehyde and *o*-cresotic acid yield chlorotriphenylmethanedimethyldihydroxydicarboxylic acid.—A. S.

1.2-Di[hydr]oxybenzene-4.6-disulphonic acid; *Production of* —. Saccharinfabr. A.-G., vorm. Fahlberg, List und Co., and A. Klages, Magdeburg, Germany. Eng. Pat. 15,275, June 25, 1914.

SEE Ger. Pat. 276,273 of 1913; this J., 1914, 1044.

Apparatus for distilling derivatives of petroleum, tar, and the like under vacuum. Eng. Pat. 20,353. See 11A.

Determination of benzol in gases. Ger. Pat. 285,920. See 11A.

Impregnation [rot proofing] of yarn, fishing nets, canvas, wood, etc. Eng. Pat. 7275. See V.

IV.—COLOURING MATTERS AND DYES.

Indican (potassium indoxyl sulphate); Preparation of —. A. Jolles and E. Schwenk. Monatsh. Chem., 1915, 36, 83. Chem.-Zeit., 1915, 39, Rep., 333.

CHLOROSULPHONIC acid is added slowly to well-cooled pyridine, *N*-acetylindoxyl dissolved in pyridine added, and the mixture heated for 2 hrs. at 38° C. and allowed to stand for about 40 hrs. until a drop diluted with water does not give the colour of indigo on shaking with caustic soda solution. The pyridine is distilled off *in vacuo*, caustic potash added, and the potassium sulphate filtered off. After passing in a current of carbon dioxide, the solution is filtered and evaporated to a small volume, when indican crystallises. The finely powdered crystals are treated with boiling 96% alcohol and re-precipitated from the solution as quadratic laminae with the lustre of mother-of-pearl, which decompose at 179°–180° C., and may be preserved for a long time even in presence of light.—F. W. A.

Pyranol dyes; Conversion of natural flavone colouring matters into —. E. R. Watson, K. B. Sen, and V. ram Medhi. Chem. Soc. Trans., 1915, 107, 1477–1489.

PYRANOL dyes of deep colour have been obtained from the natural flavone colouring matters, quercetin, morin, luteolin, and apigenin, by the action of organo-magnesium compounds on their ethers, and partially or completely de-ethylating the products (compare this J., 1914, 305). The dyeings obtained with the completely de-ethylated 3.5.7-triethoxy-2-*mp*-diethoxyphenyl-4-ethyl-1.4-benzopyranol anhydrohydriodide, the product of the reaction of quercetin and magnesium ethyl iodide (*loc. cit.*), were not fast, but it is now found that the triethyl ether, obtained by partial de-ethylation with aluminium chloride or with moderately concentrated sulphuric acid, has equally strong tinctorial properties and produces shades fast to all agents. It dyes violet blue on alum, greenish blue on chrome, crimson on tin, and navy blue on iron, giving full shades with 2% of dyestuff. The dye obtained in a similar manner from quercetin penta-ethyl ether and magnesium *o*-methoxyphenyl bromide gave deeper shades than any other member of the series, producing greens on alum, chrome, and iron, and dark blue on tin. From morin penta-ethyl ether and magnesium methyl iodide a product was obtained which on de-ethylation gave a dye giving salmon and maroon shades on iron and chrome. From luteolin tetra-ethyl ether and magnesium ethyl iodide 5.7-dihydroxy-2-*mp*-dihydroxyphenyl-4-ethyl-1.4-benzopyranol anhydrohydriodide was obtained on de-ethylation. It gave shades similar to the corresponding quercetin derivative but of much greater fastness. The corresponding dye from apigenin gave terra-cotta shades. (See also Eng. Pat. 1253 of 1915; this J., 1915, 709.)—G.F.M.

Azomethines; Influence of the sulphonic group and other radicals on the colour of —. P. Pooth. Schweiz. Chem. Ges., Feb. 27, 1915. Chem.-Zeit., 1915, 39, 508.

THE influence of the sulphonic group upon the colour of compounds of the azomethine series was studied in the case of two types of this series: (I.) $C_6H_5.CH:N.C_6H_4.SO_3Na$ and (II.) $C_6H_5.CH:N.C_{10}H_6.SO_3Na$, with the sulphonic group in the para position to the nitrogen. Comparisons were made with analogous compounds unsulphonated. With the simple members of type II., the presence of the sulphonic group intensified the colour. In other series, where nitro or hydroxyl radicals had been substituted in the aldehyde residue, the

presence of the sulphonic group weakened the colour of compounds of type I., while in compounds of type II., the sulphonic group deepened the colour of the nitro substitution derivatives and increased that of the hydroxylated derivatives.

—J. F. B.

PATENTS.

Disazo-dyestuff; Manufacture of a substantive —. Akt.-Ges. f. Anilinfabr., Berlin. Eng. Pat. 4072, Mar. 15, 1915. Under Int. Conv., Mar. 13, 1914.

ONE mol. of the tetrazo-compound of 4,4'-diaminodiphenylurea is combined with 1 mol. of 2-amino-8-naphthol-6-sulphonic acid in acid solution and with 1 mol. of resorcinol. The dyestuff obtained gives red-brown shades on cotton, which become fast to washing and to light on treatment with formaldehyde, differing in this respect from the dyestuff derived from benzidine.—F. W. A.

Trisazo-dyestuffs; Manufacture of green substantive —. Akt.-Ges. f. Anilinfabr., Berlin. Eng. Pat. 8996, June 18, 1915. Under Int. Conv., June 19, 1914.

THE 4-aminoazo-compound obtained from a diazonaphthalenesulphonic acid and an amino-compound of the benzene or naphthalene series, is diazotised and combined with a 1-aminobenzoyl-amino-8-naphtholsulphonic acid; the disazo-compound obtained is further diazotised, and combined with a pyrazolone derivative, α -methylindole, or other suitable substance containing the atomic grouping $\text{CO.CH}_2\text{CO}$. The dyestuffs produced give green shades on cotton.—F. W. A.

Anthraquinone derivatives [mercaptans]; Method of manufacturing —. A. G. Bloxam, London. From Chem. Fabr. Griesheim-Elektron, Frankfurt, Germany. Eng. Pat. 8254, June 3, 1915.

MERCAPTANS of the anthraquinone series are obtained by heating α -hydroxy- or α -amino-derivatives of anthraquinone with an alkali sulphide at 140° – 150°C ., with or without addition of sulphur, when the hydrogen atom in *ortho*-position to the α -hydroxy- or α -amino-group is replaced by an SH group, giving valuable dyestuffs or intermediate products.—F. W. A.

Phenanthraquinone dyestuffs; Manufacture of new —. E. R. Watson and K. C. Mukherjee, Dacca, India. Eng. Pat. 9311, June 25, 1915.

BROMO- or nitrobromo-derivatives of phenanthraquinone are treated with aromatic amines of the benzene or naphthalene series. The dyestuffs obtained give dark blue, violet, or greenish-blue shades, of good fastness, on chrome-mordanted or unmordanted wool, their fastness to light being increased by sulphonation. For example, 100 parts of 2-nitrobromophenanthraquinone is boiled for 2 hours with 1000 parts of aniline and 25 parts of copper powder, the solution filtered hot, and poured into an excess of dilute hydrochloric acid, when 2-nitroanilino-phenanthraquinone is precipitated.—F. W. A.

Indigoid dyestuffs; Preparation of —. Kalle und Co. Ger. Pat. 283,808, Oct. 16, 1913.

INDIGOID vat dyestuffs are prepared by the condensation of indoxyl or its derivatives with hydroxyazo dyestuffs, especially those having as one component an aminonaphthol or a hydroxycarbazole; the hydrogen atoms of the amino group may be replaced by other atoms or radicals.—A. S.

Vat dyestuffs; Preparation of —. Kalle und Co. Ger. Pat. 286,151, Dec. 21, 1913.

VAT dyestuffs are prepared by condensing α - or β -naphthoquinone or α -naphthoquinone-2- or β -

naphthoquinone-4-sulphonic acid or their heteronuclear derivatives, with indoxyl or oxythionaphthene or their substitution products, homologues, or analogues. The dyestuffs may be subsequently acylated or alkylated, or treated with amines.—A. S.

Nitrogenous condensation products [vat dyestuffs] of the anthraquinone series; Preparation of —. Farb. vorm. Meister, Lucius, und Brüning. Ger. Pat. 284,208, March 19, 1913.

α -ANTHRA-N-ARYLPYRROLECARBOXYLIC acids are treated with acid condensing agents, such as ordinary or fuming sulphuric acid, or chlorosulphonic acid. The products differ from the original substances by giving dark coloured vats; the simplest product is termed isatanthrone.—F. W. A.

Hydroxyanthrapyridones; Production of —. Farb. vorm. Meister, Lucius, und Brüning. Ger. Pat. 284,209, Oct. 18, 1913.

ARYLSULPHONEACETYL compounds of α -amino-anthraquinones are heated with alkali, giving hydroxyanthrapyridones.—F. W. A.

Anthraquinoneoxazoles; Preparation of —. Farb. vorm. Meister, Lucius, und Brüning. Ger. Pats. (A) 286,093, Oct. 23, and (B) 286,094, Oct. 28, 1913.

ANTHRAQUINONEOXAZOLES are obtained (A) by treating acylaminoanthraquinones with oxidising agents, or (B) by treating benzoylamino-*o*-nitroanthraquinones or their derivatives with condensing agents.—A. S.

2,3-Hydroxynaphthoic acid amide; Production of derivatives of —. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 284,997, Nov. 29, 1913.

HALOGENIDES of 2,3-hydroxynaphthoic acid, or the acid itself in presence of dehydrating agents, react with aminonaphthols to give the hydroxynaphthalides of 2,3-hydroxynaphthoic acid. Whereas the anilide, for example, is only soluble in lime water, and very sparingly soluble even in this reagent, the new arylides are readily soluble in warm dilute sodium carbonate solution, from which solution they are readily absorbed by unmordanted cotton, which then gives with a diazo solution very intense and clear shades of excellent fastness.—F. W. A.

N-Anthraquinonylisatins; Preparation of —. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 285,771, Apr. 7, 1914. Addition to Ger. Pat. 236,407.

THE vat dyestuffs obtained as described in the chief patent (this J., 1911, 1047) by the condensation of halogenated anthraquinones or their derivatives with isatin or its homologues or analogues, are not N-anthraquinonylisatins as there stated, but anthraquinoneacridones. According to the present patent, N-anthraquinonylisatins are obtained either by stopping the reaction before anthraquinoneacridones are formed or by removing the anthraquinoneacridones from the reaction product by suitable methods. The secondary formation of anthraquinoneacridones may be restricted by shortening the reaction period, operating at a lower temperature, and avoiding excess of the condensing agent. The N-anthraquinonylisatins may be used for the preparation of vat dyestuffs (see following abstract), and some of the more strongly coloured compounds dye wool in an acid bath.—A. S.

Anthraquinoneacridones; Preparation of—
Farbenfabr. vorm. F. Bayer und Co. Ger. Pat.
286,095, Mar. 3, 1911.

N-ANTHRAQUINONYLSATINS (see preceding abstract) or anthraquinonylsatic acids or their salts are treated with condensing agents. If condensation be effected in alkaline solution, vats may be prepared directly by adding hydrosulphite to the reaction product.—A. S.

Vat dyestuffs of the anthracene series; Preparation of—M. Kardos, Temesvar, Hungary. Ger. Pat. 286,096, Jan. 7, 1914. Addition to Ger. Pat. 275,220.

DYESTUFFS identical with those described in Ger. Pat. 278,660 (this J., 1915, 273) are prepared by treating with alkylating or aralkylating agents the dyestuffs obtained as described in the chief patent (this J., 1914, 827) by fusing anthracene-1,9-dicarboxylic acid imide with alkali.—A. S.

Vat dyestuffs of the naphthalene series; Preparation of—M. Kardos, Temesvar, Hungary. Ger. Pat. 286,098, Jan. 10, 1914. Addition to Ger. Pat. 276,357 (this J., 1914, 1045).

IN addition to naphthalenedicarboxylic acid imide and the condensation product of acenaphthenequinone and hydroxylamine, other nitrogenous derivatives of acenaphthenequinone or its oxidation or reduction products may be used for the preparation of vat dyestuffs by fusing with alkali hydroxide. The compounds may be treated with N-substituting agents before or after conversion into dyestuffs.—A. S.

Vat dyestuffs of the naphthalene series; Preparation of—M. Kardos, Temesvar, Hungary. Ger. Pat. 286,468, Jan. 10, 1914.

VAT dyestuffs are prepared by treating with alkaline condensing agents bi-acenaphthylidenedione, its halogen addition-compounds, or derivatives of these substances obtained by substituting nitrogenous groups for one or both of the carbonyl oxygen atoms.—A. S.

Azo dyestuffs for cotton; Preparation of—
Badische Anilin und Soda Fabrik. Ger. Pat.
286,147, Dec. 18, 1913.

BY combining tetrazotised *p,p'*-diaminodiarlylureas with 1-naphthol-3,8-disulphonic acid or 2-naphthol-8-mono- or 6,8-disulphonic acid and with 2-amino- or 2-arylamino-5-naphthol-7-sulphonic acid, substantive dyestuffs are obtained which give bluish-red to reddish-violet shades on cotton.—A. S.

Azo dye; Mordant-dyeing—C. Mettler.
Assignor to J. R. Geigy S.A., Basel, Switzerland.
U.S. Pat. 1,157,169, Oct. 19, 1915. Date of
appl., Nov. 3, 1911.

SEE Ger. Pat. 278,613 of 1913; this J., 1915, 273.

Vat dyestuffs; Manufacture of black—E. Wray, Assignor to Kalle und Co. A.-G., Biebrich, Germany. U.S. Pat. 1,157,485, Oct. 19, 1915. Date of appl., July 17, 1913.

SEE Ger. Pat. 241,997 of 1910; this J., 1912, 223.

Process for preparing pigments [colour lakes].
Ger. Pat. 285,883. See XIII.

Preparation of compounds of basic dyestuffs of the acridine and safranin series. Ger. Pat. 285,500. See XX.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Vulcanised fibre. C. Almy, jun. Met. and Chem. Eng., 1915, 13, 746—747.

AT the present time vulcanised fibre is prepared exclusively by the action of zinc chloride on a pure unized, unloaded cotton paper. The paper is passed over heated cylinders through a bath of zinc chloride at a density of about 70° B. (sp. gr. 1.854) at 40° C., varying slightly according to the quality of the paper and the atmospheric conditions. It is then rolled up over large heated drums to the desired thickness, the cellulose being gelatinised to such an extent that the layers of paper unite to a nearly homogeneous mass. Fibre tubes are prepared in a similar manner, using mandrels of the required size instead of the large drums. The treated fibre is then washed in zinc chloride baths of progressively diminishing concentration until it contains less than 0.15% of chlorine. This process is very slow and any attempt to hasten it is liable to lead to an inferior product or to produce blisters owing to excessive osmotic pressure. A fibre sheet $\frac{1}{4}$ in. thick requires 3—4 weeks for washing; one 2 ins. thick requires 6—8 months. The purified fibre is dried at 40°—60° C., pressed, and usually calendered. The finished product shows a shrinkage of about 50% in thickness. The mechanical and physical properties may be varied within fairly wide limits by manipulation of the chemical treatment and by varying the quality of the original paper; materials suitable for a large variety of purposes may thus be produced. In the following table the characteristics of two different types of vulcanised fibre are summarised:—

	No. 1	No. 2
Thickness.....	$\frac{1}{4}$ in.	$\frac{1}{4}$ in.
Sp. gr.....	1.100	1.480
Absorption of water in 24 hours.....	70%	25%
Chlorine.....	0.20%	0.03%
Hardness by scleroscope.....	25	50
Shearing strength, lb. per sq. in.	9,000	13,000
Crushing strength, " " ".....	33,000	43,000
Tensile strength, " " ".....	8,000	13,000
Breakdown voltage.....	12,500	50,000

—J. F. B.

Nitrocellulose solutions and solvents; Proximate analysis of—A. D. Conley. J. Ind. Eng. Chem., 1915, 7, 882—887.

A FEW rapid approximate methods for the analysis of commercial nitrocellulose solutions are given. Nitrocellulose is determined by precipitating 200 c.c. with chloroform, and if the solution contained more than a few ounces of gums per gallon, the wet precipitate is redissolved and reprecipitated. It is filtered off, transferred to a watch glass, dried, and weighed. From the concentration of the solution, the proportion of solvent may be approximately found from the following data:—4, 8, 12, and 16 oz. of nitrocellulose added to one gallon of solvent increase its volume by 2, 3.5, 5, and 6.6% respectively. Resins and oils are estimated by evaporating all or part of the filtrate from the nitrocellulose determination. The film of residue should be thin enough to ensure complete drying. Camphor is detected by the odour during evaporation, and oils by the appearance of the film and its manner of burning. Castor oil is insoluble in petroleum spirit. It is practically impossible to identify the resins present. Rosin is unsuitable for lacquers, but a synthetic product, "ester gum," said to be a glycerol ester and soluble in ethyl and amyl acetates, acetone, benzol, and chloroform, is largely used. The pigment in enamels is estimated by weighing the residue after ignition of the nitrocellulose precipitate, and the total solids in the original solution by evaporating

just sufficient to cover the bottom of a weighing bottle. The solvents may be separated by heating the solution in a paraffin bath to about 120° C., then adding water to the flask and continuing the distillation with a new receiver. The aqueous distillate is separated and the solvent layer dried, usually with calcium chloride. The water is redistilled to recover dissolved solvents. Amyl acetate and fusel oil are separated by adding potassium carbonate. Determinations of boiling point and specific gravity of the dried redistilled distillates, and considerations of solvent power and price, will then usually give sufficient information. The properties of fusel oil, amyl acetate, ethyl acetate, acetone, "methyl acetone" (an impure acetone), wood alcohol, ethyl methyl ketone, acetone oils, denatured alcohol, benzol, toluol, xylol, petroleum spirit, and diacetone-alcohol ("alco deo") are summarised, and the published methods of estimation criticised. The flash point of nitrocellulose solutions is usually below room temperature. A small amount of carbon tetrachloride will raise it, but turns the film dark. Acidity is estimated by precipitating 10—12 grms. with hot water free from carbon dioxide, washing the precipitate twice with 50 c.c. of water, and titrating the aqueous liquid plus washings with N/10 alkali, using phenolphthalein as indicator. The first appearance of the red colour must be taken as the end point, as the water may contain saponifiable solvents. Viscosity is roughly measured by comparing the time taken for a bubble to rise in the solution under examination in an inverted bottle and in a standard sample under the same conditions, but the viscosity of the standard sample may change in time. Acetone, wood alcohol, ethyl methyl ketone, and ethyl acetate give thinner solutions than amyl acetate, and two samples of nitrocellulose with the same viscosity in wood alcohol do not necessarily have the same viscosity in amyl acetate.—F. Sp.

PATENTS.

Farn, fishing nets, canvas, wood and the like; Impregnation [rot-proofing] of —. H. J. Bull, Bergen, Norway. Eng. Pat. 7275, May 14, 1915. Under Int. Conv., May 30, 1914.

AN impregnating compound is prepared by dissolving cupric hydroxide in wood-tar. The blue cupric hydroxide is more readily soluble than the brown variety. The materials may be stirred together, either dry or moist, with or without admixture of a volatile solvent, such as coal-tar naphtha; or the cupric hydroxide may be precipitated by the action of caustic alkali on a solution of copper sulphate in presence of wood tar or a distillate thereof. Example: To a solution of 100 kilos. of wood tar in 100 litres of 4% sodium hydroxide, 100 litres of a 12.5% solution of copper sulphate and 50 kilos. of solvent naphtha are added; the emulsion is stirred vigorously for some time and the tar-copper compound separated from the aqueous layer.—J. F. B.

Flax and like fibrous materials; Treatment and retting of —. G. C. Sallaway, Malvern East, Victoria, Australia. Eng. Pat. 10,018, July 9, 1915.

THE material is packed on a trolley with wire-work sides and wheeled into a chamber where it is washed with water and softened by steaming. It is next conveyed to a second chamber provided with a well at the bottom, a pump, distributing diaphragm, and spray-pipes. In this chamber it is exposed to the vapours from a solution boiling in the well and containing caustic soda, linseed oil, tallow, and soda ash. During the treatment the boiling solution is sprayed over the material by means of the pump. After about 30 minutes' treatment the trolley is

removed and the material thoroughly washed by means of a hose. The fibre, still on the trolley, is dried in a third chamber provided with heating pipes and ventilators. Sisal and phormium do not require scutching and breaking when treated by this method.—J. F. B.

Vegetable fibres; Process of softening and strengthening degummed —. G. D. Burton, Assignor to The Burton Co., Boston, Mass. U.S. Pat. 1,156,462, Oct. 12, 1915. Date of appl., July 5, 1913.

DEGUMMED vegetable fibres are treated with a solution of glycerin and sodium carbonate in hot water.—J. F. B.

Milling of animal fibres; Process for the —. Textiltech. Bureau A. Lehmann, Rheydt, Germany. Ger. Pat. 284,694, Nov. 4, 1914.

THE material is treated with a solution of malt, a malt preparation, e.g., diastafor, or glucose, alone or together with soap, soda, etc. Such solutions have powerful felting properties, tending to swell animal fibres; the use of diastafor reduces the duration of the milling process to one-third, and the product does not shrink so much, as the amount of alkali added need only be very small.—F. W. A.

Textile fibres and half-stuff for paper manufacture; Process for the simultaneous preparation of — from rushes, reeds, etc. B. von Ordrödy, and B. Schottik und Co. Ger. Pat. 285,539, June 14, 1914.

THE rushes, etc., are cut up, dried, retted for two or three weeks at 20° to 30° C. in many changes of water, washed, and dried. The material is then treated either in open vessels with the alternate layers at right angles to one another, or under pressure, with a petroleum-soap emulsion, to which caustic alkali is added. The next wash causes a separation into long and short fibres, which are centrifuged, washed with dilute acid and water, and dried. The product when broken and heckled forms fibres possessing considerable tensile strength and suppleness, and a moderately good gloss.—F. Sp.

Nitrocellulose; Process for dyeing —. Farbwerk. Meister, Lucius, und Brüning. Ger. Pat. 285,323, Feb. 4, 1914.

SUBSTANCES are added to the nitrocellulose solutions (lacquers), with or without catalysts or oxidising agents, which give the desired colour on oxidation, for example aminodiphenylamine, or *p*-hydroxyphenyl-*p*-aminotolylamine, in presence of copper chloride.—F. W. A.

Acetylcellulose; Process for the manufacture of threads of —. Knoll u. Co. Ger. Pat. 286,173, Oct. 10, 1912.

DRY acetylcellulose threads, especially those made from the primary acetylating solution, become easily electrified when unwound from the bobbin, and curve out from each other in the shape of a balloon, thus causing frequent breakages. This may be avoided by passing the threads through a bath of soap or soluble oil.—F. Sp.

Paper pulp; Electro-magnetic devices for extracting foreign substances from —. A. J. Newell, Holyoke, Mass., U.S.A., and R. J. Marx, London. Eng. Pat. 2865, Feb. 22, 1915.

AN electro-magnetic apparatus arranged in the conveyor trough between the beating engine and paper machine, has pole pieces with semicircular projections located within a depression in the floor of the trough, and a baffle-plate deflecting the flow of the pulp downwards into contact with the pole pieces. The cores and pole pieces are so arranged that two or more electro-magnets

may be joined together to act on the stuff. The coils are wound on copper spools, joined together midway in their length, and enclosed by a water-tight copper casing; a tube is attached to the upper end of the casing to receive the leading in wire and to provide a water-tight but not air-tight protection.—J. F. B.

Transparent air-tight and waterproof paper : Process for the manufacture of —. H. Oeser. Ger. Pat. 285,978, May 19, 1914.

PAPER is made transparent, air-tight, and waterproof by impregnating it with resin or wax melted in oil, with or without the addition of alcohol, fixing with a colloidal solution of gelatin, agar-agar, etc., and hardening if necessary with formaldehyde or alum. Either coating may be coloured by the addition of dyes, and in some cases the two coatings may be melted together. If gelatin or a similar substance is employed, it may be swollen in water and then melted by warming it in alcohol. Two lengths of the paper may be stuck together, with pigments or bronze powder between them.—F. Sp.

Sulphate-cellulose manufacture ; Process for removing the odour from waste gases from —. W. Schacht. Ger. Pat. 285,976, May 28, 1914.

FUMES and waste gases from sulphate-cellulose manufacture are freed from odour by bringing them into contact with water in pumps, centrifuges, disintegrators, etc. The gases may be previously cooled, and may be directed either with or against the current of water, which may be made either alkaline or acid.—F. Sp.

Straps and bands of fabric ; Process for the impregnation of — by means of asphaltum. Aktieselskabet Roulunds Fabriker, Odense, Denmark. Ger. Pat. 285,049, Nov. 4, 1913.

THE straps are impregnated with asphaltum solution either simultaneously with or subsequently to impregnation with a solution of balata, gutta-percha or similar material. The asphaltum penetrates into the fibres while the balata remains on the surface.—C. A. M.

Sulphite-cellulose lyes ; Process for treating waste — with alkalis. E. L. Rinnan. Ger. Pat. 285,752, Aug. 7, 1914. Under Int. Conv., May 6, 1914.

SULPHITE residues are boiled with alkalis, particularly calcium hydroxide, preferably under pressure, until they are transformed into a precipitate of lignin and calcium sulphite and a solution of organic calcium salts which is submitted to dry distillation with calcium hydroxide, with or without superheated steam. Organic materials such as sawdust and bark may be added, and the insoluble product, especially if freed from calcium sulphide, may be made into briquettes for burning, with or without admixture of other organic material. No mercaptans are formed in the dry distillation provided that the boiling with lime has been continued long enough and at a sufficiently high temperature. The distillate contains acetone, wood spirit, ethyl alcohol, ammonia and other nitrogenous compounds, and an oily mixture of higher alcohols, aldehydes, ketones, and hydrocarbons. By admitting sufficient air to the hot residue, it may be burnt to lime, which is used again, and the heat developed may be used for another dry distillation. The waste lye may be freed from sulphurous acid before treatment, and may also be previously fermented.—F. Sp.

Textiles used in aeronautics and aviation ; Process for treating —, and the aeroplane-framework produced thereby. J. Descamps, Assignor to Leduc, Heitz et Cie., Raizeux, France. U.S. Pat. 1,156,894, Oct. 19, 1915. Date of appl., Oct. 6, 1911.

SEE Eng. Pat. 6798 of 1912 ; this J., 1912, 1026.

Silk felleable ; Process of making —. G. Diesser, Zürich, Switzerland. U.S. Pat. 1,156,983, Oct. 19, 1915. Date of appl., May 20, 1914.

SEE Fr. Pat. 472,351 of 1914 ; this J., 1915, 418.

Method of producing tanning compositions from waste sulphite-cellulose liquors. U.S. Pat. 1,154,762. See XV.

Use of difficultly soluble or insoluble fatty soaps in sizing papers for photographic purposes. Ger. Pat. 285,562. See XXI.

VI.—BLEACHING ; DYEING ; PRINTING ; FINISHING.

Damage of vegetable fibres on bleaching with hypochlorite in presence of metals. P. Weyrich. Z. f. Text. Ind., 1915, 18, 176. Z. angew. Chem., 1915, 28, Ref., 399.

THE well-known catalytic action of metallic oxides, for example, of mercury, copper, cobalt, nickel, and iron, on bleaching powder solution has been found to lead to the production of oxy-cellulose when cellulose is present. None of the metals used technically resists this action, and the author has investigated the action of bleach liquor (1.4° Tw.) on a number of alloys. Borchers' alloy, a chrome-tungsten steel, offers the greatest resistance ; other alloys have no advantage over the metals composing them. Chromium, tin, lead, and bismuth are the most resistant metals, whilst aluminium is more vigorously attacked, although the decrease in the available chlorine was not so great as was the case with the other metals.—F. W. A.

PATENTS.

Bleaching by electrolysis ; Apparatus for —. J. F. Webb, Battersea, and W. W. Williams, Enham, Hants. Eng. Pat. 20,714, Oct. 8, 1914.

IN preparing bleaching liquor by the electrolysis of sodium or magnesium chloride solution, the gases evolved at the electrodes are collected by deflectors, which pass through openings in the electrodes. The deflectors carried by the negative electrode project only slightly on either side, and the hydrogen after passing through the opening to the opposite side of the electrode, bubbles up through the liquid. The chlorine passes through the openings to the opposite side of the positive electrode and is distributed throughout the electrolyte : for this purpose the deflectors project a considerable distance from the electrode, the bottom one being the longest, and the others progressively shorter as they approach more nearly the surface of the liquid. Highly compressed Acheson graphite is found to be most suitable for the positive electrode.—F. W. A.

Firing iron oxide on silk and similar fibres ; Process for —. W. Buschhüter and M. Voigt, Krefeld, Germany. Ger. Pat. 284,853, Feb. 7, 1914.

THE iron-mordanted fibres are soaked in boiled-off liquor or soap solution to which is added an albuminoid or glucose, steamed, and washed. For example, the mordanted silk is washed with

water at 50° C., and then impregnated at 40° C with a solution containing 50 grms. of Marseille soap and 5 grms. of gelatin or glue per litre; after steaming for 5—10 mins., the silk is washed with sodium carbonate solution or soft water.

—F. W. A.

Colours on woollen fibre: Production of —. G. G. Hepburn, Manchester. Eng. Pat. 21,052, Oct. 16, 1914.

WOOLLEN fibre is treated with a solution of free hypochlorous acid, and then immersed in a bath containing, for example, 3 grms. per litre of an amino-compound such as aniline, *m*-phenylenediamine, *p*-diaminodiphenylamine, α - or β -naphthylamine, benzidine, etc. Development of colour occurs in the second treatment without the aid of further oxidising agents.—F. W. A.

Woollen goods dyed with vat dyestuffs other than indigo: Process for improving the fastness to wearing of —. F. Reckberg, Hersfeld, Germany. Ger. Pat. 286,340, Dec. 14, 1913.

THE wool is treated with a chromate or bichromate and a suitable assistant, e.g., formic acid.—A. S.

Oxazine dyestuffs: Production of condensation products of — with phenols, amines, *amino-phenols, aldehydes, ketones, and their derivatives [on the fibre]*. J. Heilmann und Co., and M. Battegay, Mulhouse, Alsace. Ger. Pat. 284,877, Nov. 21, 1913.

THE condensation products are prepared directly on the fibre, deeper shades being obtained, for example, with Phenocyanine VS. Many of the condensation products cannot be isolated, but are readily prepared on the fibre.—F. W. A.

Aniline Black dyeings: Process and apparatus for chroming —. J. P. Bemberg A.-G., Barmen-Rittershausen, Germany. Ger. Pat. 284,887, Sept. 23, 1913.

THE chrome liquor is contained in a series of troughs each provided with a pair of squeezing rolls. From the rolls the material passes through an air passage above the trough, and then downwards into the next trough. The troughs are arranged in steps so that the liquor flows in the same direction as the material under treatment.—A. S.

Aniline Black: Production of ungreenable —. Chem. Fabr. Griesheim-Elektron. Ger. Pat. 285,955, Dec. 13, 1913.

THE material is impregnated with chlorates of aniline and its homologues at a higher temperature than usual, e.g., at 90°—100° C., then dried, and oxidised to a fully developed black. An absolutely ungreenable black is obtained, which is chemically different from ordinary Aniline Black.—A. S.

Indigo vat: Production of preparations for the fermentation —. Farbw. vorm. Meister, Lucius, u. Brüning. Ger. Pat. 286,338, Mar. 18, 1914.

MALT is treated with an alkaline substance and the product, with or without separation of the coarser particles, is concentrated or is mixed with a concentrated solution of a soluble carbohydrate or the like and then concentrated to a syrup or evaporated to dryness. The products may be preserved as such or may be incorporated with indigo, indigo-white, or a salt of indigo-white.—A. S.

Brown, olive to black shades on textile fibres: Production of fast —. Ges. f. Chem. Ind. in Basel. Ger. Pat. 286,410, Dec. 11, 1913.

AMINO-DERIVATIVES of carbazole or its homologues or derivatives, when oxidised on the fibre by the

usual methods, give yellowish-brown to deep brown, or brownish-olive to brownish-black shades, very fast to washing and light, and of satisfactory fastness to chlorine.—A. S.

Dyeing animal fibres; Process of —. K. Hofmann, Charlottenburg, Germany. Ger. Pat. 286,411, May 8, 1914.

WOOL, or other animal fibre is prepared with a solution of a copper compound and then treated with gaseous or dissolved acetylene. Dark shades, fast to washing and milling, are produced. The shades are rendered deeper by treating the dyed material with dilute acid and dilute ammonia solution or with warm ammonium chloride solution.—A. S.

Grey dyeings, giving a white discharge, on skins, hair, feathers, etc.; Production of —. Farbw. vorm. Meister, Lucius, und Brüning. Ger. Pat. 284,854, Jan. 3, 1914.

THE material mordanted with iron salts is dyed in the usual manner with pyrogallols acidylated in the nucleus, for example trihydroxyacetophenone. The grey dyeings obtained may be discharged to a white.—F. W. A.

Dyeing skins, hairs, feathers, and the like; Process for —. Farbw. vorm. Meister, Lucius, u. Brüning. Ger. Pats. (A) 285,769, Apr. 30, and (B) 286,339, May 5, 1914.

(A) THE material, mordanted or not, is treated with a solution of a derivative of 1,8-diamino-1,8-dihydroxy-, or 1,8-aminohydroxynaphthalene having another hydroxy- or amino-group in the ortho or para position. Suitable compounds are 4,8-diamino-1,7-dihydroxynaphthalene, 1,8-diamino-2,7-dihydroxynaphthalene, 1,2,5,8-tetrahydroxynaphthalene (leuconaphthazarin), and 1,2,5,8-tetra-aminonaphthalene. (B) The mordanted or unmordanted material is dyed with an aminohydroxynaphthalene in conjunction with a *p*-diamine, with the aid of an oxidising agent.—A. S.

Dyeing leather; Process for —. E. Weiler and O. Heublein, Frankfurt, Germany. Ger. Pat. 286,341, Nov. 30, 1913.

A DYE STUFF soluble in fats or in alcohol is used in conjunction with a chloro-derivative of the ethane or ethylene series or a solution of the chloro-derivative in alcohol. The leather is immersed in the dye solution or the latter is applied by brushing. The dyed leather remains soft.—A. S.

Dyeing or like frames. Klauder-Weldon Dyeing Machine Co., Assignees of J. Benosch, Amsterdam, N.Y., U.S.A. Eng. Pat. 24,028, Dec. 14, 1914. Under Int. Conv., Dec. 13, 1913.

SEE U.S. Pat. 1,120,644 of 1914; this J., 1915, 75.

Dyeing or the like machines or apparatus. Klauder-Weldon Dyeing Machine Co., Assignees of J. Benosch, Amsterdam, N.Y., U.S.A. Eng. Pat. 24,030, Dec. 14, 1914. Under Int. Conv., Dec. 13, 1913.

SEE U.S. Pat. 1,120,643 of 1914; this J., 1915, 75.

Dyeing, washing, or like apparatus. Klauder-Weldon Dyeing Machine Co., and J. Benosch, Amsterdam, N.Y., U.S.A. Eng. Pat. 3765, Mar. 9, 1915. Under Int. Conv., Mar. 9, 1914.

SEE U.S. Pat. 1,121,064 of 1914; this J., 1915, 76.

"Melange-like" dyed yarns, hosiery goods, woven fabrics and the like coloured mixture goods; Process for producing —. G. R. Pester, Wittensdorf, Germany. Eng. Pat. 254,338, Dec. 23, 1914. Under Int. Conv., Dec. 24, 1913.

SEE U.S. Pat. 1,145,846 of 1915; this J., 1915, 868.

Bucking [dyed] vegetable material; Process of —. R. Bohn, Mannheim, Assignor to Badische Anilin und Soda Fabrik, Ludwigshafen, Germany. U.S. Pat. 1,156,048, Oct. 12, 1915. Date of appl., Nov. 6, 1913.

SEE Fr. Pat. 392,858 of 1908; this J., 1909, 89.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Ammonia; Equilibrium of — at a pressure of 30 atmospheres. F. Haber, S. Tamaru, and C. Ponnaz. Z. Elektrochem., 1915, 21, 89—106.

THE equilibrium between ammonia and mixtures of hydrogen and nitrogen in the ratio 3:1 by volume, was investigated from both sides at temperatures ranging from 560° to 950° C. and under 30 atm. pressure; osmium in a quartz tube was used as catalyst. The results closely confirm those of Haber and Le Rossignol (see Haber, this J., 1911, 53). The equilibrium varies with temperature according to the equation

$$\log_e K_p = \frac{13200}{4 \cdot 571T} - 6 \cdot 134$$

in which T is the absolute temperature and K_p is defined by the ratio of the partial pressures at equilibrium, that is, $K_p = p(\text{NH}_3)/p(\text{N}_2)^{1/2} \times p(\text{H}_2)^{3/2}$. (See also this J., 1915, 1088.)—J. H. L.

Nitrogen compounds; Free energy of —. G. N. Lewis and E. Q. Adams. J. Amer. Chem. Soc., 1915, 37, 2308—2316.

CALCULATION of the free energy of formation (ΔF°_{298}) of nitrogen compounds (at 25° C., 298° abs.), based chiefly on existing data, gave the following values (in calories):— NH_3 (gas), —4740; NH_3 (liquid), —3190; NH_3 (aqueous), —7130; NH_4OH (aqueous), —63,750; NH_4 ion, —19,895; NO (gas), 20,850; NO_2 (gas), 13,250; N_2O_4 (gas), 25,300; NO_2 ion, —23,100; NO_2 ion, —7410; HNO_2 (aqueous), —11,980.
—F. SODN.

Formic acid; Free energy of formation of —. G. E. K. Branch. J. Amer. Chem. Soc., 1915, 37, 2316—2326.

THE decomposition of formic acid into carbon monoxide and water was found to be a reversible reaction which is catalysed by mineral acids, and equilibrium measurements were made at 156° and 218° C., with hydrochloric acid as catalyst. From the data obtained, together with the observed vapour pressure of formic acid over a solution similar to those used in the equilibrium experiments, and the known free energies of carbon monoxide and water, the free energy of formation of liquid formic acid from carbon (graphite), hydrogen, and oxygen was calculated to be —85,200 cal.—F. SODN.

Potash production in the United States. Oil, Paint, and Drug Rep., Oct. 25, 1915.

THE Secretary of the U.S. Interior Department announced on Oct. 18th that two tons of 99% potassium sulphate had been produced at the mill near Marysvale, Utah, from the alunite deposits in the neighbourhood, and that nearly 100,000 gallons of liquor was still awaiting evaporation.

Alkali nitrates from calcium nitrate; Preparation of —. H. Le Chatelier and B. Bogitch. Comptes rend., 1915, 161, 475—479.

THE preparation of ammonium nitrate by the double decomposition of ammonium sulphate and calcium nitrate is commercially impracticable

at temperatures up to 100° C. by reason of the physical condition of the precipitated calcium sulphate. By heating the mixture (molecular proportions) in a closed vessel to between 150° and 175° C., the calcium sulphate was rapidly transformed from the pasty to the crystalline form, which settled rapidly and from which the solution was easily decanted; 78 to 80% of the theoretical amount of ammonium nitrate was thus recovered by the initial decantation and 93% when the precipitate was washed once by decantation with boiling water in addition. The precipitated calcium sulphate obtained at 140°, 150°, 160°, and 175° C. contained 0.5, 0.46, 0.37, and 0.30 molecule of combined water per molecule, respectively; that produced at 150° C. showed no trace of re-hydration on being maintained for 5 hrs. in water at 100° C. As an additional advantage of high-temperature precipitation it is pointed out that at 150° C. the solubility of calcium sulphate in ammonium nitrate solution is practically negligible.—W. E. F. P.

Borates. The system $(\text{NH}_4)_2\text{O}-\text{B}_2\text{O}_3-\text{H}_2\text{O}$ at 60° C. U. Sborgi and F. Mecacci. Atti R. Accad. Lincei, 1915, [v], 24, i, 1225—1231. J. Chem. Soc., 1915, 108, ii, 686. (Compare this J., 1913, 230.)

THE compounds stable at 60° C. are: $(\text{NH}_4)_2\text{O} \cdot 5\text{B}_2\text{O}_3 \cdot 8\text{H}_2\text{O}$, which was obtained also at 30° C.; $(\text{NH}_4)_2\text{O} \cdot 4\text{B}_2\text{O}_3 \cdot 6\text{H}_2\text{O}$, of which no analogue exists at 30° C.; and $(\text{NH}_4)_2\text{O} \cdot 2\text{B}_2\text{O}_3 \cdot 4\text{H}_2\text{O}$. Each of these compounds is capable of existing unchanged in presence of pure water at 60° C., the solubilities, calculated in parts of anhydrous salt per 100 parts of water, being 23.25, 33.79, and 41.81 respectively.

Borate and perborate solutions; Anodic behaviour of alkaline —. W. G. Polack. Z. Elektrochem., 1915, 21, 253—267.

CONSTAM and Bennett (Z. anorg. Chem., 1900, 25, 265) state that on electrolysis a mixture of borax and caustic soda at 4°–6° C. with a current of 0.5 amp., no perborate is formed; they mention the presence of hydrogen peroxide but give little information as to electrode material, current density, etc. Riesenfeld and Reinhold (Ber., 1909, 42, 2977) found that with high alkali concentration, low temperature, and high current density no hydrogen peroxide is formed at the anode, and using potassium hydroxide and borax at 0° C., and electrolysis for 2 hours with a current density of 33 amps. per sq. dm. at the anode, a concentration of only 1/1000 mol. is obtained. The author describes experiments in which borate solutions of different concentrations were used, and the temperature, current density, etc., were varied. In many cases the anode was cooled, and some experiments were also made with a model of the apparatus described by Pouzenc in Fr. Pat. 411,258 (this J., 1910, 948). In all the experiments only traces of perborate were formed, and when perborate was added to the electrolyte it was decomposed. Apparently the final result depends on a condition of equilibrium between the formation and decomposition of perborate. The perborate is hydrolysed, with formation of hydrogen peroxide, and this lowers the anode potential, thus exerting an unfavourable influence on the formation of perborate, and is itself decomposed.—W. G. C.

Magnesium ammonium sulphate (cerboile). I. and II. Solubility, ice curve, and cryohydric point. C. Porlezza. Atti R. Accad. Lincei, 1914, [v], 23, ii, 509—513, 596—599. J. Chem. Soc., 1915, 108, ii, 688.

DIVERGENT statements have been made as regards the solubility of magnesium ammonium sulphate

or cerbolite, which is obtained as a by-product in the Tuscan boric acid industry, and the author has reinvestigated the question. The cryohydric point, determined by the intersection of the ice curve and the solubility curve, is -2.40° , the experimental value being -2.34° C.; the concentration corresponding with the cryohydric temperature, determined from the graphic representation, is 10.75 grms. of the anhydrous sulphate, $\text{Mg}(\text{NH}_4)_2(\text{SO}_4)_2$, per 100 grms. of water. The equation $S = 10.55 + 0.2215t + 0.000668t^2$ gives the solubility of the anhydrous sulphate per 100 grms. of solution between 0° and 100° C. to within 1%. In all the solubility measurements, the solid phase was found to consist of $\text{Mg}(\text{NH}_4)_2(\text{SO}_4)_2 \cdot 6\text{H}_2\text{O}$, so that no transformation point exists within the above limits of temperature.

Tri-mercuric-di-thio salts. G. Denigès. Bull. Soc. Chim., 1915, 17, 353—359.

TRI-MERCURIC-DI-THIO double salts of the type, $2\text{HgS} \cdot \text{HgR}'_2$ or $2\text{HgS} \cdot \text{HgR}''_2$ where R' and R'' are mono- and dibasic inorganic or organic acid radicles, are obtained in a pure crystalline condition by warming for some time on a water-bath a solution of the corresponding mercuric salt with somewhat more than the calculated quantity of carbon bisulphide, the reaction with mercuric sulphate, for example, proceeding according to the equation:

$3\text{HgSO}_4 + \text{CS}_2 + 2\text{H}_2\text{O} = \text{Hg}_3\text{S}_2\text{SO}_4 + 2\text{H}_2\text{SO}_4 + \text{CO}_2$.
The products probably have a structure similar to that of turpeth mineral, the sulphate being $\text{Hg} \left\langle \begin{smallmatrix} \text{S} \cdot \text{Hg} \\ \text{S} \cdot \text{Hg} \end{smallmatrix} \right\rangle \text{SO}_4$, and the nitrate $\text{Hg}(\text{S} \cdot \text{Hg} \cdot \text{NO}_3)_2$.

The sulphate and nitrate compounds are identical with the compounds obtained in a very impure state as the primary reaction products of hydrogen sulphide on mercuric sulphate and nitrate. The chloride, bromide, acetate, and propionate double compounds have likewise been prepared. All these compounds are white micro-crystalline compounds, insoluble in water, decomposed by caustic alkalis and by *aqua regia*, in the latter case with liberation of free sulphur. Carbon oxysulphide and isothiocyanic acid or its soluble salts react with mercuric salts to form the same tri-mercuric-dithio-compounds.—G. F. M.

Carbon bisulphide; Micro-reactions of —. G. Denigès. Bull. Soc. Chim., 1915, 17, 359—360.

THE formation of the insoluble crystalline dithio-trimercuric salts by the action of carbon bisulphide on a solution of a mercuric salt (see preceding abstract) may be utilised for the detection of this compound. A few drops in suspension in several c.c. of water is warmed for $\frac{1}{4}$ hour on a water-bath in a small sterilising tube with an equal volume of a solution containing 0.3—0.5 gm. of a mercuric salt. After cooling, the crystalline deposit is examined microscopically. The nitrate double compound forms hexagonal lamellæ, the bichloride compound fern-like crystalline groups, and the sulphate compound small prisms or lamellæ.—G. F. M.

Disposal of nitre cake. See Official Notice, p. 1121.

Manufacture of technical lactic acid (so-called leather lactic acid) by fermentation. Hoffmann. See XVIII.

PATENTS.

Hydrochloric acid; Manufacture of — and apparatus therefor. Soc. Italiana di Elettrochimica, Rome. Eng. Pat. 24,024, Dec. 14, 1914. Under Int. Conv., Oct. 30, 1914.

HYDROGEN chloride made by burning hydrogen in chlorine, or *vice-versa*, is either cooled and absorbed

in water, or dried with sulphuric acid or calcium chloride. The cylindrical combustion chamber has a dome-shaped roof through the centre of which passes a pipe leading to an aspirator, and a number of observation-windows made of transparent quartz. Hydrogen admitted through a pipe in the middle of the base, passes into a central box from the top of which it issues through eight burner nozzles arranged in a circle. Surrounding this is another box fitted with seven nozzles which supply the chlorine, the inlet tube for which passes into the chamber through a pipe in the side-wall near the base. The hydrogen is first ignited in the air initially in the chamber, the gaseous products are drawn off, and then the chlorine is admitted. The supply of both gases can be regulated, there is no risk of explosion, and if the temperature gets too high the chlorine may be diluted with air or with an inert gas.—E. H. T.

Sulphuric acid; [Continuous] process of concentration of — under reduced pressure. Norsk Hydro-Elektrisk Kvaelfstafaktieselskab. Fr. Pat. 474,995, July 11, 1914. Under Int. Conv., July 14, 1913.

THE acid is passed through a series of evaporators in which it is progressively concentrated under reduced pressure, preferably so that a diminishing percentage of water is expelled in each succeeding phase of the evaporation.—F. SODN.

Phosphoric acid and phosphates; Manufacture of —. D. McTavish. Fr. Pat. 474,380, Apr. 17, 1914.

PHOSPHATE rock, mixed with silicious material, such as sand, and carbon, is heated in an electric furnace, and the gases produced are passed into an oxidation chamber in which they are intimately mixed with air, and then into apparatus for absorbing the contained phosphoric acid. A gyratory motion may be set up in the oxidation chamber by introducing the oxidising gases through pipes arranged tangentially, and baffles are preferably fixed in the path of the hot gases, an injector serving to withdraw the gases from the furnace and further mix them with air or steam. The phosphoric acid is absorbed in towers by a counter-current of water or phosphoric acid solution, or in chambers containing solid absorbents; e.g., the system may include a rotary mixer in which the hot gases act on a phosphate. The suspended particles of phosphoric acid may also be precipitated by subjecting the gases to a high-tension electric discharge, and the finely divided product thus obtained, when treated with powdered calcium phosphate, unites to form a double superphosphate in a dry state. The concentrated phosphoric acid from the absorption towers may be saturated with ammonia at a high temperature and allowed to cool, when ammonium phosphate containing at least 25% NH_3 is precipitated, or it may be treated with phosphate rock so as to yield a non-hygroscopic double superphosphate.—F. SODN.

Ammonia from compounds containing carbon and nitrogen; Manufacture of —. H. Koppers. Ger. Pat. 285,354, Sept. 16, 1913. Addition to Ger. Pat. 257,188.

ACCORDING to the chief patent (this J., 1913, 424) ammonia was produced by the interaction of compounds containing nitrogen and carbon with a heated contact mass containing hydrated iron oxide. According to the present patent, the gases leaving the reaction chamber are freed from ammonia without appreciably diminishing their content of steam, and are then heated and again circulated through the reaction chamber.—A. S.

Ammonia; Manufacture of—*from the elements.* Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 285,698, Jan. 3, 1914.

THE decomposition products obtained by heating alkali or alkaline-earth ferro- or ferricyanides, with exclusion of air, are used as contact substances in the synthesis of ammonia from nitrogen and hydrogen. Combination takes place at relatively low temperatures and pressures, and a yield of 17% NH_3 by vol. can be obtained.—A. S.

Ammonium carbonate; Manufacture of solid—J. Bueb, and Deutsche Continental-Gas-Ges. Ger. Pats. (A) 285,498 and (B) 285,531, Mar. 22, 1914.

(A) AMMONIA and carbon dioxide are passed rapidly into water contained in the lower part of a sublimation chamber. The water becomes heated to such a degree that fumes of ammonium carbonate are evolved continuously from the surface. Solid ammonium carbonate is deposited in the cool upper part of the chamber. (B) A mixture of ammonia, carbon dioxide, and steam is led into a sublimation chamber which is cooled only in the upper part. The yield of ammonium carbonate is higher and the sublimate collects more rapidly on the walls than when the whole of the chamber is cooled.—A. S.

Base-interchanging substances [water softeners]; Production of—Permutit Akt.-Ges., Berlin. Eng. Pat. 20,145, Sept. 24, 1914. Under Int. Conv., Apr. 4, 1914. Addition to Eng. Pat. 20,144 of 1914, dated Sept. 23, 1913 (this J., 1915, 886).

THE gelatinous precipitate containing silicic acid obtained as described in the chief patent, is subjected to a high pressure, e.g., in a filter-press, during or after lixiviation, so that not only is the original solvent removed, but the material is rendered so hard and brittle after drying that treatment with water reduces it to a granular powder immediately available for filtering.—E. H. T.

Magnesium chloride; Manufacture of—W. S. Rawson, London. Eng. Pat. 21,261, Oct. 20, 1914.

MAGNESITE is dissolved in hot hydrochloric acid, and the settled liquor is run off, heated to boiling, and treated with very finely divided burnt magnesite, or magnesium oxide from another source, thereby precipitating the iron and other impurities. The clear liquor is separated and used together with burnt magnesite in the manufacture of cement; or it may be concentrated and magnesium chloride recovered by crystallisation.—E. H. T.

Titanium compounds; Production of—H. Spence, H. Wrigley, and P. Spence and Sons, Ltd., Manchester. Eng. Pat. 23,089, Nov. 26, 1914.

STABLE forms of titanium oxalate, containing TiO_2 and C_2O_3 in the approximate ratio of 1:1, are made by adding crystallised oxalic acid, or a neutral alkali oxalate, or a mixture of the two, to a double sulphate of titanium and an alkali metal of the type, $\text{TiO} \cdot \text{SO}_4 \cdot \text{X}_2 \cdot \text{SO}_4$.—E. H. T.

Zirconium carbide and titanium carbide; Manufacture of—O. Ruff. Ger. Pat. 286,054, July 10, 1914.

ZIRCONIUM carbide or titanium carbide is obtained in the form of a fine powder by heating the oxide of the metal, mixed with carbon, or in a carburising atmosphere, at a temperature below the melting point of the carbide. For example, a mixture of 1 kilo. of zirconium dioxide and 300 grms. of carbon is heated in a graphite crucible. At about 1900°C . gas is evolved copiously and the temperature is then slowly raised, e.g., to about 2100°C . till the evolution of gas ceases. Titanium

carbide is prepared in a similar manner from a mixture of 1 kilo. of rutile and 450 grms. of carbon; vigorous evolution of gas begins at about 1300°C .—A. S.

Formic acid compounds; Manufacture of—G. Bredig, Baden, Germany, and S. R. Carter, Oswestry, Shropshire. Eng. Pat. 801, Jan. 18, 1915. Under Int. Conv., Feb. 2, 1914.

FORMATES are obtainable on a commercial scale by the action of compressed hydrogen upon bicarbonates in the presence of catalysts. Thus a 75% yield of potassium formate is produced by passing hydrogen under 60 atmospheres pressure vigorously through 200 c.c. of a 5% solution of potassium bicarbonate containing 1.5 grms. of palladium-black, at 70°C .; a 20% yield of formate is obtained in 8 hours by passing simultaneously hydrogen and carbon dioxide, both under 30 atm., through a solution of borax of similar strength, in presence of the same amount of the catalyst, at 70°C . Calcium formate is prepared from the carbonate by mixing it with water and palladium-black at 70°C . and then passing in carbon dioxide under 20 atm. and hydrogen under 50 atm. for several hours.—E. H. T.

Alkali amides; Manufacture of—Deutsche Gold- und Silber-Scheide-Anstalt vorm. Roessler, Frankfurt, Germany. Eng. Pat. 1613, Feb. 1, 1915. Under Int. Conv., Feb. 2, 1914.

THE formation of alkali amides by the interaction of ammonia gas and alkali metals is greatly influenced by the presence of catalysts. Whereas silicon, calcium carbide, and certain other reducing agents retard the action, oxygen compounds like sodium hydroxide, sodium oxide, and chromium compounds accelerate it, and in some cases to a very marked extent. Thus in a series of experiments in each of which 2000–2200 grms. of sodium was heated to about 380°C . in a wrought-iron crucible and ammonia admitted at the rate of about 90 litres per 5 min., the gas was decomposed to the following extents in presence of the catalysts specified: 10 grms. NaOH, 65.7%; 40 grms. NaOH, 87.7%; 60 grms. NaOH, 97.2%; 5 grms. Cr_2O_3 , 89.2%; 5 grms. each of NaOH and Cr_2O_3 , 97.6%; 5 grms. Cr, 92.8%; when no catalyst was used, 50.3% of the ammonia was decomposed.—E. H. T.

Radioactive bodies; Porous—and process of producing same. R. J. Tugwood, London. From Radium Therapy Corporation, New York. Eng. Pat. 3277, Mar. 1, 1915.

A SOLID porous body is impregnated with a solution of a radium or other radioactive salt, and then a precipitant, e.g., a sulphate, is added, heat being applied to aid the deposition of the precipitate in the pores of the material. The process may be repeated if a higher degree of radioactivity be required.—E. H. T.

Radium residues; Production of concentrated—and the separation of radium compounds therefrom. Process of concentrating radium ores and residues. (A) O. P. C. Bredt, New York. (B) O. P. C. Bredt, Assignor to Radium Therapy Corporation. U.S. Pats. 1,154,230 and 1,154,231, Sept. 21, 1915. Dates of appl., June 26 and Dec. 30, 1914.

(A) SULPHATE residues are fused with an amount of alkali (preferably carbonate) insufficient to convert more than about 95% of the sulphate into a soluble form, and the soluble sulphate and acid-soluble constituents (e.g., BaCO_3) are then separated from the insoluble residue containing the radium. The process is repeated until the desired concentration of radium sulphate is reached.

(B) The material is boiled with concentrated sulphuric acid, so as to dissolve the radium as bisulphate, and the dissolved radium is then precipitated as sulphate by cooling the solution. In some cases a relatively small amount of sulphuric acid is used at first, to dissolve sulphates more soluble than radium sulphate, and the separated residue is boiled with a further quantity of acid to dissolve radium and other sulphates, which are subsequently precipitated with water.

—F. SODN.

Thorium; Separation of — from other rare earths. F. Jost and A. Weinert. Ger. Pat. 286,087, Mar. 10, 1914.

Pyrophosphoric acid or a soluble pyrophosphate is added to a solution of phosphates of the rare earths in dilute acid in order to precipitate the thorium. Thorium pyrophosphate, unlike the hypophosphate (U.S. Pat. 1,069,959; this J., 1913, 915), is not insoluble in dilute acids, but the solubility is so small that the thorium can be recovered in good yields.—A. S.

Mineral-water salts; Method of manufacturing radioactive —. Maglekilde Bröndanstalt, Radium Aktieselskab, Copenhagen. Eng. Pat. 6671, May 4, 1915. Under Int. Conv., June 5, 1914.

A SOLUBLE radioactive substance (e.g., 1 mgrm. of radium bromide) is dissolved in a solution (e.g., 10 litres of 1% solution) of one or more of the salts used for making the mineral water; no salts which precipitate the radioactive substance should be used. The solution is evaporated to dryness, and the residue is mixed with the other solid constituents of the mineral water, which should be free from water of crystallisation; the mixture must be kept dry until required for use.—E. H. T.

Hydrogen peroxide; Stable compounds containing — and process of making the same. F. W. Weber, Perth Amboy, N.J., Assignor to The Roessler and Hasslacher Chemical Co., New York. U.S. Pat. 1,153,985, Sept. 21, 1915. Date of appl., Dec. 9, 1913.

HYDROGEN peroxide is combined with a substance containing one or more amino groups, e.g., urea, in the presence of a gelatinous stabilising agent, such as an extract of carrageen moss, so as to form a solid product protected by a fine coat of the stabilising agent.—F. SODN.

Calcium hypochlorite; Process of making —. H. K. Moore, Berlin, N.H. U.S. Pat. 1,155,605, Oct. 5, 1915. Date of appl., Oct. 31, 1914.

BLEACHING powder is obtained in a dry, granular condition by cooling it to 0° C., or lower, immediately it is formed by the interaction of chlorine and powdered slaked lime.—E. H. T.

Cyanides; Process of making —. A. C. Spencer and K. P. McElroy, Washington, D.C. U.S. Pat. 1,156,108, Oct. 12, 1915. Date of appl., June 3, 1911.

AN ignited charge of a natural potassium silicate, slag-producing material, carbon, and a reducible iron compound, is caused to pass downwards, under producer-gas conditions, through a furnace shaped like a blast-furnace, wherein it meets an upward current of air. Alkali cyanide is extracted from the vapours and gases withdrawn from a certain zone of high temperature within the furnace, and the residual gas is returned to the furnace.—F. H. T.

Potassium chloride; Process of obtaining —. J. A. Bradburn, Syracuse, N.Y. U.S. Pat. 1,156,388, Oct. 12, 1915. Date of appl., July 2, 1915.

THE water of Great Salt Lake, or similar water, is

refrigerated to cause the crystallisation of most of the sodium sulphate, and when this is removed and the mother liquor concentrated by evaporation, the greater part of the sodium chloride separates out. The residual liquor is concentrated, magnesium chloride is added, and the temperature is raised, whereupon most of the remaining sodium chloride crystallises. On cooling the hot mother liquor, crude potassium chloride is obtained, and is separated and washed.—E. H. T.

Iodine and by-products; Process of treating seaweed to obtain —. H. E. J. Roussel and L. J. C. C. Thévenin. Fr. Pat. 474,722, Dec. 19, 1913.

THE weed is dried by direct or indirect contact with hot gases from the kelp furnace, and, after incineration, the kelp is subjected to systematic extraction with hot water. The saturated solution is allowed to crystallise, and the iodine contained in the mother liquors is then precipitated by treatment with sulphuric acid which has been saturated with nitrous fumes obtained by the action of sulphur dioxide on nitric acid. Traces of iodine are extracted from solution by agitating the liquor with a non-volatile hydrocarbon such as petroleum.—F. SODN.

Calcium nitrate and similar materials; Process for simultaneously scraping [from a drum] and pulverising —. Norsk Hydro-Elektrisk Kvaelfstofaktieselskab. Fr. Pat. 474,996, July 11, 1914. Under Int. Conv., July 16, 1913.

MATERIAL which has been allowed to solidify or dry on a drum is removed by a scraper and immediately reduced to a granular powder by contact with a strip of wood or metal, which may be adjusted at a desired distance from the drum and scraper, and at a suitable angle. A current of air or other gas is employed, when necessary, to prevent the particles from adhering to each other as produced.—F. SODN.

Kieselguhr; Process for removing iron from —. Verein. Deutsche Kieselguhrwerke Ges. m. b. H., Hanover, Germany. Ger. Pat. 286,240, Dec. 9, 1913.

KIESELGUHR is mixed with acid, e.g., hydrochloric acid, of 13° B. (sp.gr. 1.1) to form a fluid paste, which is heated to about 80° C., cooled, filtered, pressed, and the press-cakes dried and ignited.

—A. S.

Sodium oxalate; Preparation of — from sodium and carbon dioxide. K. Haupt, Niederwiesau, Germany. Ger. Pat. 286,461, Sept. 19, 1913.

MOLTEN sodium is atomised by means of a spraying device or injector operated by heated carbon dioxide. The finely divided sodium combines quantitatively with the carbon dioxide to form sodium oxalate.—A. S.

Nitrogen and carbon dioxide; Process of making —. R. H. Brownlee and R. H. Uhlinger. Assignors to American Nitro-Products Co., Pittsburgh, Pa. U.S. Pats. (A) 1,154,171 and (B) 1,154,172, Sept. 21, 1915. Dates of appl., Apr. 7, 1913, and Aug. 31, 1914.

(A) A MIXTURE of a carbonaceous substance and an excess of air is burnt in a combustion chamber, and then a sufficient amount of a carbonaceous substance to combine with the excess of oxidising gas is added and the mixture passed through a mass of highly heated refractory material so as to effect complete combustion. (B) Fuel gas is added to the products of combustion of a carbonaceous substance (for example, gases from an internal combustion engine), and the mixture is passed through a mass of highly heated refractory material with just sufficient air to ensure complete reaction. The carbon dioxide and nitrogen are then separated.—F. SODN.

Oxygen; Apparatus for producing —. B. H. Cram, Baltimore, Md. U.S. Pat. 1,155,045, Sept. 28, 1915. Date of appl., May 25, 1915.

AN oxygen compound is alternately decomposed and regenerated in a heated retort, or series of retorts, provided with means for the admission of heated air and of superheated steam alternately. The retorts are connected by pipes to an exhaust in direct communication with a condenser, and the currents of air and steam are controlled by automatic valves. The air admitted to each retort in turn passes finally into the external air; the steam and oxygen are led into a condenser, and the oxygen is compressed and refrigerated after compression.—E. H. T.

Hydrogen sulphide from gases; Process for removing —. J. Pintsch, H. Strache, and H. Hiller. Ger. Pat. 286,374, Jan. 20, 1914.

THE gas is freed from part of the hydrogen sulphide by passing it, at a high velocity, through an ordinary oxide purifier, and is then passed through a solution containing a metallic compound, e.g., copper sulphate, which will combine with the remainder of the hydrogen sulphide, the resulting metallic sulphide being subsequently oxidised to sulphate; oxidation may be effected with air or oxygen, in presence of a ferric compound, at a sufficiently high temperature to prevent separation of sulphur. Two vessels are used, one for absorption and the other for oxidation, and so connected together that the process may be worked continuously. Transference of the liquid from one vessel to the other is effected by means of the gas under treatment or air. When copper sulphate is used, it is continuously regenerated, and the solution becomes enriched in sulphuric acid and ammonium sulphate, derived from ammonia present in the gas.—A. S.

Lactic acid; Manufacture of pure —. M. Landau, Berlin. U.S. Pat. 1,157,402, Oct. 19, 1915. Date of appl., July 8, 1915.

SEE Eng. Pat. 7998 of 1915; this J., 1915, 1009.

Ammonia from its elements; Process for the manufacture of —. M. Pier, Berlin. U.S. Pat. 1,157,253, Oct. 19, 1915. Date of appl., Nov. 21, 1913.

SEE Eng. Pat. 213 of 1914; this J., 1915, 870.

Hydrosulphites; Production of anhydrous— from aqueous hydrosulphite solutions —. H. Specketer and G. Münch, Griesheim, Assignors to Chem. Fabr. Griesheim-Elektron, Frankfurt, Germany. U.S. Pat. 1,156,107, Oct. 12, 1915. Date of appl., July 3, 1913.

SEE Fr. Pat. 460,610 of 1913; this J., 1914, 76.

Titanium-oxygen compounds; Process of producing— from ilmenite or titaniferous iron ores and other materials —. P. Farup, Trondhjem, Norway. U.S. Pat. 1,156,220, Oct. 12, 1915. Date of appl., June 26, 1914.

SEE Ger. Pat. 276,025 of 1913; this J., 1914, 920.

Sodium aluminate; Solution of —. H. Spence and T. J. I. Craig, Assignors to P. Spence and Sons, Ltd., Manchester. U.S. Pat. 1,157,436, Oct. 19, 1915. Date of appl., Aug. 18, 1914.

SEE Eng. Pat. 29,970 of 1913; this J., 1914, 1153.

Boron nitride; Stable— and process of making the same —. G. Weintraub, Lynn, Mass., Assignor to General Electric Co. U.S. Pat. 1,157,271, Oct. 19, 1915. Date of appl., Feb. 3, 1913.

SEE Eng. Pat. 12,377 of 1913; this J., 1914, 255.

Process for separating water-gas or other gaseous mixture rich in hydrogen into its constituents —. Ger. Pat. 285,703. See IIa.

Process for extracting fats of every kind, hydrocarbons, sulphur, or the like —. Ger. Pat. 284,110. See XII.

Manufacture of Burton salts [for use in brewing] —. U.S. Pat. 1,156,448. See XV111.

VIII.—GLASS; CERAMICS.

Cast iron utensils; Preparation of— for enamelling —. H. Vogel. Keram. Rundschau, 1915, 23, 109. Z. angew. Chem., 1915, 28, Ref., 411.

ENAMEL adheres better to white than to grey cast iron, but as white cast iron is too brittle for utensils, grey iron on which a thin outer layer of white iron has been produced, is used. The moulds in which the iron is cast should not be dusted with graphite, as this prevents proper adhesion of the enamel. The walls of the utensil should be of uniform thickness, not less than 2.5–3 mm., and the bottom should be somewhat arched.—A. S.

PATENT.

Insulators for high-potential electric conductors —. F. M. Locke, Victor, N.Y. U.S. Pat. 1,156,163, Oct. 12, 1915. Date of appl., Jan. 19, 1915.

A VITRIFIABLE base, such as glass, is fused with material containing boron into a homogeneous body, and the fused mass is shaped into the desired form.—B. N.

IX.—BUILDING MATERIALS.

Government certification of cement intended for export —. Board of Trade J., Nov. 4, 1915.

THE Imperial Institute notifies that a laboratory for testing cement has now been added to the establishment of the Scientific and Technical Research Department of the Institute.

In certain countries, such as Argentina, the national Government has adopted an official specification for cement to which all cement intended for use in the construction of public works must conform. The Argentine Government also requires the certification of such cement by a laboratory recognised for that purpose by the Government of the exporting country.

H.M. Government has now recognised for this purpose the cement-testing laboratory of the Imperial Institute, at which analyses and tests will in future be conducted of British-made cement for contractors, engineers, manufacturers, and others desiring to export cement to the Argentine and other countries in which a Government certificate is required.

PATENTS.

Kilns; Cement and lime —. H. Walker, London. Eng. Pat. 20,972, Oct. 11, 1914.

IN continuous vertical shaft kilns, the clinker is kept constantly moving from the hot calcining zone to the point of discharge, and is discharged in a broken condition, at any desired rate, by continuously and mechanically driven rocking or revolving breaking and agitating bars, which form the kiln grate. The revolving or rocking bars may be provided at intervals along their length with removable or fixed stirrers or paddles, which may be arranged so that those of one bar work through intervals between those of another bar. The stirrers may be set regularly or at an angle to those of an adjacent shaft, and alternate bars may be rotated or rocked in opposite directions. The revolving or rocking paddles or stirrers may be arranged only at a certain part of the grate area,

for instance below a zone of dense clinker formation, while the remainder of the grate consists of revolving or rocking bars of square, prismatic, or other section suitable for breaking the clinker.

—W. C. H.

Kilns for burning lime, cement, or the like; Discharging device for —. Amme, Giesecke, und Konegen A.-G., Brunswick, Germany. Ger. Pat. 286,014, July 6, 1913.

BELOW the lower end of the kiln shaft is a pair of toothed breaking rolls disposed above a double shoot, with a middle ridge-like portion between the two rolls. The material is broken by the rolls and discharged towards the centre on either side of the ridge.—A. S.

Gypsum cement; Process for the production of —. A. Denny, Dumbarton, and D. G. Anderson, Glasgow. Eng. Pat. 21,987, Nov. 4, 1914.

ROCK gypsum is completely dehydrated by calcination and ground with from 1 to 10% of its weight of Portland cement. The product is intended more especially for use, with suitable filling material, as a composition for the decks of ships.—W. E. F. P.

Magnesia cement compositions. H. J. Guise and W. G. Perry, London. Eng. Pat. 23,345, Dec. 1, 1914.

THE cement is composed of burnt magnesite, burnt and ground china clay, quartz, asbestos, and wood meal, with magnesium chloride and paraffin oil, which latter ingredients are added separately. For concrete the above cement may be mixed with cork, glass, slag, shells, or silicon carbide. The cement may be used for uniting substances after the surfaces to be joined have been coated with a suitable liquid, e.g., a paste containing borax, kieselguhr, calcined magnesite, and magnesium chloride.—W. C. H.

Oxychloride cement; Manufacture of —. L. Pink. Ger. Pat. 285,369, Dec. 19, 1913.

CALCINED magnesite is mixed with strontium chloride, with or without the addition of magnesium sulphate and filling materials, and the mixture is stirred with water. By the use of strontium chloride instead of calcium chloride or magnesium chloride, the tendency of the cement to effloresce is diminished.—A. S.

Cement materials and fine fuel; Production of agglomerates of —. C. Schneider, Plau, Germany. Ger. Pats. (A) 285,602, May 11, 1913, and (B) 286,423, Jan. 6, 1914.

(A) THE agglomerates are prepared in the usual way but contain fuel only in the outer layer, in order to obtain clinker of close texture, free from discoloration. (B) Briquettes of cement raw materials are provided, on one side only, with an outer layer of a mixture of cement materials and fuel.—A. S.

Concrete, asphalt, and the like; Machines or apparatus for mixing or preparing —. W. H. Crook, Bolton. Eng. Pat. 2196, Feb. 11, 1915.

IN mixers of the fixed pan type, the blades are pivoted to arms depending from the rotating frame, and their free ends rest on the surface of the pan. The pivoted ends of the blades are shaped into a stop piece to limit the movement of the blades, and are provided with a projecting lip which takes the thrust of the blade, instead of the pivoting bolt, when the blade is in its operative position.—W. C. H.

Concrete mixers. K. R. Schuster, New York. Eng. Pat. 6207, Apr. 26, 1915. Under Int. Conv., Apr. 25, 1914.

THE ingredients of the concrete are thoroughly

mixed by the action of air, gas, or steam under pressure admitted into the container at the bottom. The container is stationary during the mixing operation and can be tilted into two positions, one for charging and the other for discharging the material. The agitating fluid, supplied through a pipe movable with the container, is automatically cut off when the container is tilted into the charging or discharging position. The inflow of the fluid is controlled by a valve which opens when the vessel assumes the mixing position. The vessel is mounted on trunnions, one of which is hollow for admitting the agitating fluid, and its open end is closed by turning that part of the vessel under a fixed cover during the mixing operation. The interior of the vessel is provided with baffles in the path of the agitating fluid to divert it in different directions within the vessel.—W. C. H.

Bricks; Process of manufacturing —. E. E. Trowbridge, Kansas City, Kans. U.S. Pat. 1,154,741, Sept. 28, 1915. Date of appl., April 1, 1915.

BRICKS are moulded with one or more grooves on one lateral face, and when dried are set in a kiln in a number of vertical rows, spaced slightly apart, the bricks in each horizontal row being set over the grooves of the row beneath, to form heat passages between the vertical and horizontal rows. The bricks of the horizontal rows are offset to overlap the rows beneath. The gases of combustion are made to travel through the passages between the bricks, both vertically and horizontally, to ensure uniform heating.—W. C. H.

Artificial stone from kieselguhr; Production of —. J. A. Ellgass. Ger. Pat. 285,350, July 22, 1913.

KIESELGUHR is mixed with cellulose xanthate, and the mixture, containing over 90% of kieselguhr, is dried. Granulated cork or other filling materials may be mixed with the kieselguhr.—A. S.

Artificial stone or the like from peat dust; Manufacture of —. K. Narr, Munich, Germany. Ger. Pat. 286,082, Jan. 17, 1913.

PEAT is frozen, reduced to dust, mixed with a suitable binding agent, such as cement, and water, and moulded into the desired shape. The cell walls of the peat fibre are broken as a result of the freezing, and hence the product is capable of withstanding the action of water without swelling.—A. S.

Covering for concrete and other floors; Production of a — from bituminous cork masses. E. Müller and E. Eichert. Ger. Pat. 285,368, Feb. 4, 1914.

A COMPOSITION containing cork and pitch is mixed with a sulphur-containing slag, ground to an impalpable powder, and the mixture is applied to the floor, which has been previously coated with an alcoholic solution of rosin to act as an adhesive. By the action of the slag the bituminous cork composition sets in about 10–15 minutes. The covering is specially suitable for concrete floors.—A. S.

Mica brick; Production of refractory, electrically insulating —. C. Ingvaldsen. Ger. Pat. 285,482, Oct. 8, 1913. Under Int. Conv., Oct. 8, 1912.

FINELY-DIVIDED mica and quartz are mixed with a small quantity of clay or similar binding medium, sufficient to form a plastic mass, the mixture is moulded to the desired shape, and burnt at a high temperature so as to fuse the mica. The refractory brick so obtained is specially suited for use in electric furnaces.—A. S.

Basic lining for kilns. U.S. Pat. 1,156,018. See I.

Impregnation (rot-proofing) of yarn, fishing nets, canvas, wood, etc. Eng. Pat. 7275. See V.

Manufacture of magnesium chloride. Eng. Pat. 21,261. See VII.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Cast iron; Influence of phosphorus on the mechanical properties of grey — F. Wüst and R. Slotz. *Ferrum*, 1915, 12, 89—96, 105—119. *Z. angew. Chem.*, 1915, 28, Ref., 437—438.

THE results of the examination of a series of test pieces are summed up as follows: The static mechanical properties of grey cast iron are improved by addition of phosphorus up to 0.3%; above 0.6% it has an unfavourable influence. The dynamic mechanical properties are adversely affected by 0.6% of phosphorus; a higher content does not materially increase the effect. The action of phosphorus is not appreciably influenced by the presence of other elements, such as manganese. The micro-structure is altered by the addition of phosphorus: graphite segregates, a ternary eutectic containing phosphorus appears, and pearlite separates into sorbite and coarsely lamellar pearlite.—W. R. S.

Steel; Macroscopic etching of — J. L. Jones. *Amer. Soc. Testing Materials*, June, 1915. Eng. and Min. J., 1915, 100, 727.

THE use of molten zinc is suggested for detecting porosity, lack of homogeneity, and other defects in steel which rolling or forging have rendered difficult to observe by ordinary optical inspection. Bars of various kinds of iron and steel were suspended by means of iron wires in a bath of molten zinc; on removing the bars from the molten metal, the dross was broken off whilst hot by blows from a hammer, and the coating of zinc removed by means of dilute sulphuric acid. The high-carbon areas were found to be rapidly acted upon by the molten zinc. Attempts to use molten tin for testing nickel steel were unsatisfactory.

Ferrous alloys of different composition and structure; Passivity in connection with — H. W. Moseley. *J. Amer. Chem. Soc.*, 1915, 37, 2326—2333.

IRON and steel of varying composition and structure could be made passive with a definite current density when functioning as anode in an electric circuit, but the current density causing transition from the active to the passive state was not related in any simple way to the composition or structure of the sample. Metal with a low solution tension generally became passive with a lower current density than metal with a high solution tension, and the nature and concentration of the electrolyte were factors in bringing about passivity. When the circuit was broken, the anode became active. Experiments to determine whether there is a gradual change from the active to the passive state as the current density approaches the transition point, gave inconclusive results, but the change is believed to be a progressive adjustment towards a new condition of equilibrium.—F. SODN.

Galvanising; Prevention of corrosion of iron pans used in — C. Diegel. *Z. Ver. deuts. Ing.*, 1915, 59, 362—363. *Z. angew. Chem.*, 1915, 28, Ref., 438.

THE solubility of iron in molten zinc was found to increase with the silicon, but not with the carbon content of the iron; manganese did not seem to affect it, nor phosphorus at the usual temperature of the zinc bath; in a superheated bath,

increased phosphorus content was detrimental. The most important factor was found to be the temperature of the bath. The solvent action of zinc on iron increases gradually up to about 490° C., above which it rises very rapidly, being 30 times greater at 530° than below 490° C.—W. R. S.

Platinums; Analysis of some Ural — I. Koifman. *Arch. Sci. phys. nat.*, 1915, [iv], 40, 22—38. *J. Chem. Soc.*, 1915, 108, ii., 693.

THE following are the average percentage results obtained in the analyses of specimens of the metal from various mines in the Ural district:—

Taguil.	Iss.	Omout-naya.	Kitlim.	Iow.	Kamen-outchka.
Os .. 1.44	4.47	10.88	0.79	20.13	4.98
Pt .. 77.55	85.10	77.61	83.50	60.53	82.46
Ir .. 2.56	1.38	6.39	2.74	6.72	1.79
Rh .. 0.52	0.30	0.43	0.62	0.74	0.69
Pd .. 0.26	0.30	0.32	0.28	0.19	0.18
Cu .. 3.27	0.63	1.95	1.14	0.52	0.54
Fe .. 14.46	7.86	2.60	11.05	11.38	9.49

Zinc; Recent processes for improving the physical properties of — E. H. Schulz. *Ges. Deuts. Metallhütten- u. Bergleute*, July, 1915. *Chem.-Zeit.*, 1915, 39, 547.

THE addition of about 6% of copper and 3% of aluminium considerably increases the hardness and toughness of zinc; the alloy is homogeneous, and does not shrink appreciably on cooling. A further improvement is effected by pressing the metal into rods or by rolling, which produce increased toughness and ductility.—W. R. S.

Zinc; Cathodic deposition of — in presence of organic bases. A. Mazzucchelli. *Atti R. Accad. Lincei*, 1914, [v], 23, ii., 503—508. *J. Chem. Soc.*, 1915, 108, ii., 670—671.

THE author has investigated the effect of small proportions of salts of quinine, cinchonine, quinoline, dimethylaniline, α -naphthylamine, lutidine, aniline, pyridine, and gelatin on the electrolytic deposition of zinc from a solution containing zinc and ammonium sulphates, a pure zinc anode and a brass cathode being used. With very small proportions of these additions, and when the current density is low, a homogeneous, uniform, fine-grained deposit is obtained. When either the proportion of the added compound or the current density is increased, the zinc separates irregularly in nodular masses. The first uniform deposit invariably dissolves only slowly in hydrochloric acid. It appears that the organic substance present in the neighbourhood of the cathode is absorbed by the metallic granules, which separate initially in a state of high dispersion, and so renders the deposit fine-grained. At a later stage, the organic compound tends to coat the cathode with a more or less impermeable varnish, and thus induces passivity. At certain points of the cathode which are accidentally favoured, deposition may continue at an increased current density, the crystalline, nodular masses being thus formed. The cathodic deposition of the zinc appears to be influenced more than the anodic dissolution, and it may therefore be supposed that, in a solution of one of these added substances, a zinc electrode would behave unipolarly, as is the case with copper in potassium cyanide solution, and would dissolve irreversibly. It is found, indeed, that passage of an alternating current between two zinc electrodes immersed in a 0.05% quinoline sulphate solution is accompanied by continual evolution of hydrogen, and, further, that the deposition potential of zinc exhibits supertension in presence of one of the above bases. Possibly

such addition of a base may render possible the electrolytic deposition of alloys which are not formed from the pure solutions.

Zinc; Measurements of the cathodic and anodic polarisation of— in presence of organic bases. A. Mazzucchelli. Atti R. Accad. Lincei, 1914, [v], 23, ii., 626—633. J. Chem. Soc., 1915, 108, ii., 671.

ORGANIC bases, such as quinine and quinine, which in the form of salts influence, usually unfavourably, the cathodic deposition of zinc (compare preceding abstract), exert a correlative action on the electrolytic potential of this metal, increasing both the cathodic and the anodic polarisability. Gelatin exhibits an analogous, but less marked, effect.

[Ore concentration by] flotation; Use of coal tar in —. W. A. Mueller. Eng. and Min. J., 1915, 100, 591—593.

By the partial substitution of coal tar for pine oil, satisfactory results were obtained in the concentration of silicious copper sulphide ore (1.6% Cu) by froth flotation. Although some of the coal tars employed were found to be useless and others only applicable to certain kinds of ore, the use of suitable tar (found by experiment) resulted in a considerable saving of pine oil, better results being obtained in many cases with mixtures of oil and tar, in proportions varying from 1:1 to about 1:4, than with the same quantities of the pure oil. The proportion of oil or oil-tar mixture necessary for the ore in question was less than 0.1% of the weight of the latter, the highest recovery obtained on the concentrates alone being 83%; within limits, the relative proportions of oil and tar in the mixture were immaterial. It was found most satisfactory to add the oil or mixture to the ore and then grind the latter wet to 48-mesh size, the amount of water used being 1.3 parts to 1 part of ore.—W. E. F. P.

Antimony. Chamber of Comm. J., Nov., 1915.

THE imports of antimony ore to the United Kingdom in 1913 and 1914 were as follows:—

From	1913.		1914.	
	Tons.	£	Tons.	£
Australia	2,039	29,297	2,711	38,704
British East Indies	486	6,706	274	3,440
China	2,166	24,452	4,367	33,911
Other countries	812	8,143	1,827	14,705
	5,503	68,598	9,179	90,760

The following table shows the imports of antimony, crude and regulus, to the United Kingdom in 1913 and 1914:—

From	1913.		1914.	
	Tons.	£	Tons.	£
Mexico	2,345	68,470	1,543	46,500
China	2,040	35,546	1,294	21,857
Japan	25	437	307	8,390
Other countries	421	9,122	371	8,627
	4,831	113,575	3,515	85,374

Other producing countries are France, Algeria, and Italy. For many years France was the chief

producer, but in recent years the first place has been taken by China, whose largest deposits now worked are situated in the far inland provinces.

Following are some notes of the principal deposits of the ores.

Foreign countries.—Antimony ore (stibnite) is obtained in Algeria in the Department of Constantine. The production in 1912 was 4661 metric tons, valued at £16,780. In Argentina the production was only 30 metric tons, value £226, in 1911. The production of antimony ore in Austria in 1912 was 4520 metric tons. In Hungary in the same year 65 metric tons of ore, valued at £305, and 859 metric tons of antimony, crude and regulus, valued at £20,954, was produced. In Bolivia, the Oruro district is the source of supply of antimony ore. In 1912, 91 metric tons, value £1827, was produced and exported, as compared with 312 tons, value £5473, in 1911. The most important workings of China are in Hunan, Kwangsi, Kwangtung, and Yunnan. The ore found is generally stibnite containing from 20 to 60% Sb. China exports about 15,000 tons of antimony a year, and can produce much larger amounts. The principal workings for antimony sulphide in France are in the Departments of Mayenne, Cantal, and Haute Loire. In 1912 the quantity raised was 11,018 metric tons, value £24,280, as compared with 29,267 metric tons, value £63,866, in 1911. In Italy, antimony ore is mined in Tuscany and Sardinia. The Tuscan mines were not worked in 1912. The Sardinian mines produced 1878 metric tons, valued at £4490. In Japan in 1912, 13 metric tons of crude antimony, value £207, and 63 metric tons of refined metal, value £1621, was produced. The production of the ore in Mexico in 1912 was about 4000 tons. It was reported in May last that an antimony smelter was in course of erection at San Luis Potosi with a capacity of 3000 tons per annum of refined antimony, which was to be shipped to the United States. The only antimony smelter hitherto operating in Mexico is at Wadley, whence the crude product has been exported to England for further refining. A deposit of lead-antimony ore of exceptional value exists near Zimapan, in the State of Hidalgo, Mexico. The formation and situation of the deposit appear to be favourable to mining on a large scale. The principal antimony mines of Portugal are in the commune of Goudomar, in the Porto district; the ore also occurs in the Braganza district. The production of ore in 1912 was 100 metric tons, valued at £689. The important antimony deposits in the Urals, at the Akhatochevsky mines, are now being carefully investigated. Antimony is found also in the Urals near the Verkh-Neivinsky works, and also at the Blagodats silver-lead mines, ten miles north of Berezov. Antimony is known in Siberia. In the Government of Yenissei it is found in gold placers on the River Isikium, in the Avginsky district, and also on the Rivers Malaya, Selba, and Amyl, in the Minussinsk district. Antimony ore is present in the Trans-Baikal province. It is found in the Algatchinsky mines, and near the Kadainsky mine. In this province there are large reserves of grey antimony ore at the Pokrovsky silver-lead mines. In the Amour Province, on Bakchan Hill, seven miles from the station of Zagibovoy, there are antimony deposits stretching along the crest of the mountains. Antimony ore in Serbia is principally worked at Krupanj and Zajaca, in the Department of Podrinje. The production of antimony regulus in 1912 was 297 metric tons, value £7022. The production of antimony ore in Spain in 1912 is given as 500 metric tons, valued at £2000. Antimony ores occur in the United States, but hitherto it has not been profitable to work the deposits owing to the high labour costs

in the mining regions. As a result, a large proportion of the antimony used in the United States has been imported from Europe, mostly from England. During the last few months, however, antimony of home production has been exported from the United States.

British Empire.—The smelting and refining of antimony ore and metal imported from abroad is an important industry in this country, but no antimony ore has been produced in the United Kingdom since 1902; in previous years small quantities were raised from veins in Scotland and North Cornwall. The chief production of antimony within the British Empire is at Costerfield in Victoria, Australia, where in 1913 the Costerfield Mining Company treated 6151 tons of ore and 3693 tons of tailings for a return of 2527 tons of concentrates assaying 47% Sb and 2½ oz. Au per ton. The concentrates were sold to a smelting company in England for £31,424. The quantity of antimony (metal and ore) exported from New South Wales during 1913 was 18 tons, valued at £407, as compared with 62½ tons, value £355, in 1912; it was obtained in the Hillgrove Division, where the ore is found in association with scheelite and gold. Antimony ores occur in several places in Queensland, and it is probable that the high prices now ruling will lead to the resumption of operations on some of the deposits in the Cairns hinterland. Antimony ore has been known for forty years to exist on the Carrick Range in New Zealand. In 1874 a lode was opened out and samples were found to contain 50–54% Sb. Several attempts have since been made to work the lodes, but, though some small quantities of ore have been exported, no systematic development work has been done. There are four occurrences of antimony in Canada which are regarded as valuable. (1) A deposit of auriferous stibnite at West Gore, Nova Scotia. (2) Native antimony and stibnite at Prince William, New Brunswick. (3) Remarkable deposits of argentiferous antimony ores in the Wheaton River district in Yukon territory, which district may before long become one of the principal antimony producing areas in North America. (4) In the Skeena River district of British Columbia, on Nine-mile Mountain, six miles north of Hazelton, where stibnite has been noticed in several silver-lead veins. A promising deposit of stibnite occurs in Newfoundland at Morton's Harbour on New World Island in Notre Dame Bay. An attempt to mine the ore was made several years ago and a few thousand tons was extracted. It is presumed that low prices for the product caused the cessation of operations. Antimony ore occurs at Zoodoest on the Komatie River, 30 miles south of Barberton in the Transvaal, and a company was formed in 1906 to work the ore. Other deposits are stated to exist in South Africa, but no production has been recorded recently. In 1904 a mining lease was obtained to work the antimony ores (stibnite with oxides), situated at an elevation of 13,500 feet, near the Shigri glacier in Lahaul, Kangra District, Punjab. In 1905, 15 tons of stibnite was shipped to England. The existence of an antimony deposit of considerable size in the Mong Hsu Slate, one of the southern Shan States, is indicated by the return amongst the mineral statistics of Burma for 1908 of an output, under a mining lease, of 1000 tons of antimony ore, of which 11 tons was sent to London for assay and valuation. Antimony in two or three forms is found abundantly on the Toba plateau in Afghanistan and has been reported from other localities. It has been observed in the Hazara district of the North West Frontier Province, and has been found with iron at Bakot in the same Province. A good ore is also imported from Bajour. Antimony has been found in Junani, opposite Hirakud, Sambalpur district, Orissa.

Roasting of pyrites and similar materials; The Bracc-Moritz furnace for the—. S. Barth. Chem. Apparatur, 1915, 2, 95–96, 105–107. Z. angew. Chem., 1915, 28, Ref., 433.

The hollow, air-cooled, cast-iron shaft of the furnace (see Fr. Pat. 390,838 of 1908; this J., 1908, 1111) is made either in one piece or in sections; it is rotated from below by means of a large circular rack engaging with a bevel wheel; the rack is constructed of easily replaceable segments. The furnace is built in three sizes, capable of treating respectively 2½–3, 4½–5, and 8–10 metric tons of pyrites containing 50% of sulphur, in 24 hours. The roasted product contains less than 1% of sulphur. The area of the hearths is very large in relation to the quantity of material under treatment at any given time, so that excessive rise of temperature is easily avoided, and when cupriferous ores are being treated, conversion of copper into insoluble compounds is minimised; 87% of the total copper in the roasted material is in a soluble form. Little dust is produced, and the power required is only 0.1 to 0.25 h.p. per furnace.—A. S.

Preparation of cast iron utensils for enamelling. Vogel. See VIII.

PATENTS.

Iron and steel; Process for effecting the surface oxidation of articles of—. B. Guerini, Brescia, Italy. Eng. Pat. 7097, May 11, 1915. Under Int. Conv., May 11, 1914.

The articles to be treated are immersed in a solution of one or more picrates, the temperature of which is gradually raised to 130°–150° C. The solution recommended contains 16 parts of picric acid and 84 of sodium hydroxide dissolved in 100 parts by weight of water.—W. E. F. P.

Scrap metal [iron]; Process of producing blooms from—. Metal-working furnace. W. C. Ely, Terre Haute, Ind. U.S. Pat. 1,155,409 and 1,155,410, Oct. 5, 1915. Date of appl., Dec. 21, 1911.

SCRAP iron is heated to a welding temperature in a closed furnace chamber having two vertical side walls and a number of flat longitudinal walls, and mounted to rotate about a horizontal axis. By the rotation of the chamber, the longitudinal walls form an endless series of inclined planes; the plastic metal is successively raised on one of these planes, rolled over, and dropped upon the next, and so on, the material being thus first compacted and then gradually rendered fibrous in structure by the alternate rolling and hammering actions to which it is subjected.

—W. E. F. P.

Steel; Manufacture of—. W. R. Walker, New York. U.S. Pat. 1,155,849, Oct. 5, 1915. Date of appl., Aug. 21, 1909.

MOLTEN iron containing* manganese is treated in an acid-lined Bessemer converter until the greater part of the silicon and carbon and a small proportion of the manganese are removed. The metal, containing not less than 0.1% Mn, is then transferred to a mixer and subsequently treated in a basic-lined electric furnace.—W. E. F. P.

Furnace; Reheating—. Eickworth und Sturm G. m. b. H., Dortmund, Germany. Eng. Pat. 5876, Mar. 7, 1914. Under Int. Conv., Dec. 11, 1913.

In a reheating furnace of the kind in which the gases of combustion pass above and below a horizontal hearth or partition disposed in the relatively cool zone, and are thus divided into two independently regulated streams, the space above the partition is fed with hot gases directly from the hot zone of the furnace, the space below serving

as a flue for the escape of the gases which have passed through the hot zone.—W. E. F. P.

Annealing furnace. H. Hillebrandt, jun., Werdohl, Germany. Ger. Pat. 285,372, May 14, 1912. Addition to Ger. Pat. 257,716 (this J., 1913, 540).

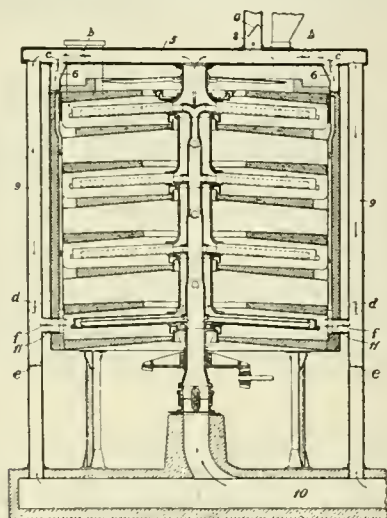
MECHANICAL improvements in the means for transferring the goods from the annealing chamber to the cooling chamber are claimed. The cylinder enclosing the goods during the transference is provided at the top with a plate, which serves as a disc valve and in its lowest position closes the opening in the cooling chamber.—A. S.

Furnace for roasting ores and metallurgical products with compressed air; Shaft—. W. Buddeus. Ger. Pat. 285,888, Oct. 12, 1913.

THE furnace is divided into an upper and a lower compartment by a grate, which is sealed against the outer air and is provided with an opening which can be closed. The material receives a preliminary roasting in the upper compartment and is then transferred, through the opening in the grate, into the lower compartment, into which compressed air is introduced, and in which the roasting is completed. Substances having a favourable action on the roasting process may be introduced into the upper part of the lower compartment.—A. S.

Ores; Roasting sulphur-bearing—. Nichols Copper Co., and H. H. Stout, New York. Eng. Pat. 9958, July 8, 1915. Under Int. Conv., July 31, 1914.

IN a roasting furnace (see fig.) of the superposed chamber type having an air-cooled, rotary rabbling system, the heated air from the latter is discharged



into a central shaft surrounding that from which the rabblers are actuated, and conducted thence to a transverse pipe, 5, extending across the top of the apparatus. The pipe, 5, communicates with a valved outlet, 8; with two or more external vertical conduits, 9; and with pipes, 6, located on the inside wall of the furnace and opening into the lowest chamber. The vertical pipes, 9, communicate with the conduit, 10, from which air is supplied to the central rabble shaft, and also, by short, lateral passages, 11, with the bottom chamber; the passage of air or gaseous products into or out of the furnace is determined and regulated by means of valves *a*, *b*, *c*, *d*, *e*, and *f*, with which the various conduits are provided.—W. E. F. P.

Furnace for smelting [lead] ores. C. J. Beaver, Hale, and E. A. Claremont, High Legh, Cheshire. Eng. Pat. 6675, May 4, 1915.

A HORIZONTAL furnace, for the continuous smelting of rich lead ores, has a long smelting chamber which is heated externally so as to form a hot and a relatively cool zone, and provided with a system of valved air inlets and exhausts whereby air is admitted to, and gaseous products removed from, each zone independently. Means are provided for feeding the ore into the cool end of the chamber, and for rabbling and gradually moving the charge to the hot end, the hearth being inclined and partitioned so that the molten metal and viscous slag are collected and discharged separately.—W. E. F. P.

(A) *Zinc; Extraction, purification, and electrolytic precipitation of metallic* — from smelter-fumes, zinc ores, and the like. (B) *Hydrometallurgy of zinc.* O. Best, San Francisco, Cal. U.S. Pats. (A) 1,154,601 and (B) 1,154,602, Sept. 28, 1915. Dates of appl., Sept. 16, 1911, and Mar. 26, 1913.

(A) ZINC fume is roasted in the presence of sulphates at a low temperature, and the product leached with sulphuric acid. The solution is mixed with zinc oxide and sodium sulphide, and a portion of the solution is treated with lime to form a mixture of zinc hydroxide and gypsum, which is washed with water. The remainder of the pure zinc sulphate solution is electrolysed, zinc being deposited on the cathode and sulphuric acid formed at the anode, and the acid solution is pumped over the mixture of zinc hydroxide and gypsum to neutralise the acid, the neutral liquid being returned to the cell. (B) The ore or other material, containing zinc in a form soluble in acids, is roasted, and whilst still hot is extracted with sulphuric acid of a strength to give a sulphate solution of sp. gr. 1.2—1.4. The solution, before separating the undissolved material, is treated with finely-divided unslaked lime, in amount insufficient to precipitate the zinc, filtered, the residue washed, and the solution treated with calcium permanganate, in the presence of lime, to precipitate any manganese as dioxide.—B. N.

Zinc ore or zinc-bearing material; Method for the treatment of—. S. Truax, Canon City, Colo., Assignor to Granadena Mining Co. U.S. Pat. 1,155,628, Oct. 5, 1915. Date of appl., Dec. 16, 1910.

THE material, mixed with appropriate fluxes if not originally slag, is melted and maintained in a fluid condition in a reverberatory furnace having a bed composed of a mixture of powdered coke and clay. Reduction of the zinc compounds is effected by the coke and by bubbling through the charge the carbon monoxide generated at the surface of the bed.—W. E. F. P.

Volatile metals, e.g., zinc; Manufacture of — from briquetted low-grade materials in a shaft furnace. E. Gellbach and M. Matt. Ger. Pat. 285,866, May 11, 1913.

THE fuel is introduced entirely, or in part, with the air blast.—A. S.

Briquetting ore concentrates. C. E. Herrmann, Scarsdale, N.Y., Assignor to Moose Mountain, Ltd., Sellwood, Ontario. U.S. Pat. 1,155,311, Sept. 28, 1915. Date of appl., Apr. 22, 1911.

THE wet concentrate is charged into a multiple-compartment mould resting on a temporary base which forms the bottom, then compressed and removed, with the mould, to a kiln car upon which the briquettes are discharged by plungers and subsequently heated in a kiln.—W. E. F. P.

Agglomeration of fine ores; Apparatus for the —. Selas A.-G., Berlin. Ger. Pat. 285,913, Apr. 24, 1914.

THE charge of ore and fuel is carried by a moving grate and is first ignited by a gas flame and then led over suction-boxes by which a current of air is drawn downwards through it. The burner nozzle is inclined so that the direction of the flame and of the products of combustion is opposite to that of the moving charge, and firebrick baffles are provided to cause the products of combustion to pass over and preheat the material before it reaches the gas burner.—A. S.

Protective coatings to metallic articles; Applying —. C. Mark, Evanston, and C. Mark, jun., Lake Forest, Ill. U.S. Pat. 1,155,317, Sept. 28, 1915. Date of appl., May 28, 1914.

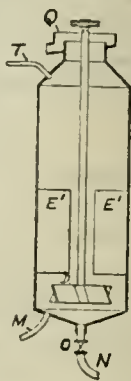
A PROTECTIVE coating is given to iron and steel articles by introducing them into a molten bath, between 650° and 760° F. (343°–404° C.), containing lead and small percentages of tin and zinc, the bath being practically saturated with the latter; zinc is added periodically to the bath to maintain the zinc content above the amount necessary to render the coating electropositive to iron, but below 3%. The bath is covered by a protective flux of ammonium chloride, containing iron and zinc salts. A coating of zinc-iron alloy is first formed, and on this an alloy of lead, tin, and zinc is afterwards deposited.—B. N.

Galvanising; Process for cleaning iron prior to —. E. Broemme, Petrograd. Ger. Pat. 285,923, Oct. 30, 1913.

THE articles are treated with a solution of alkali bisulphate and common salt, and dried in the air. The solution is submitted to fractional crystallisation to recover ferric and sodium sulphates, or evaporated to dryness and the residue ignited to obtain ferric oxide, which may be used as a pigment.—W. R. S.

Ores; Apparatus for the concentration of — [by flotation]. T. M. Owen, Broken Hill, N.S.W., Assignor to Minerals Separation American Syndicate (1913), Ltd., London. U.S. Pat. 1,155,836, Oct. 5, 1915. Date of appl., May 2, 1914.

THE apparatus (see fig.) consists of a vertical, cylindrical vessel having, at the bottom, inlets, M and O, for ore pulp and air, respectively; and, at the top, an outlet, T, for tailings, and a peripheral discharge, Q, for mineral-bearing froth. Four vertical plates, E¹, are attached to the sides of the vessel and disposed radially above the agitator, D, for the purpose of baffling the aerated mixture during its ascent to the upper, quiescent zone of the vessel.—W. E. F. P.



Tungsten; [Electrical] contact bodies of —. A. J. Liebmann and W. A. Megrath, Assignors to Independent Lamp and Wire Co., Inc., New York. U.S. Pats. (A) 1,155,426 and (B) 1,155,427, Oct. 5, 1915. Dates of appl., (A) Nov. 20, 1914, and (B) May 22, 1915.

(A) A TUNGSTEN plate is welded electrically to a supporting plate, with powdered tungsten metal and potassium nitrite as a resistance material between the two surfaces. (B) An electric make-and-break contact is made by electrically welding

a tungsten face plate to an iron or steel supporting base by means of resistance material.—B. N.

Concentrating minerals by flotation; Apparatus for —. G. C. Stone, Assignor to The New Jersey Zinc Co., New York. U.S. Pat. 1,156,041, Oct. 5, 1915. Date of appl., Nov. 16, 1914.

SUCCESSIVE charges of ore are introduced into the flotation liquid from a shoot attached to an overhead carriage which is reciprocated upon a partly horizontal and partly inclined track. By the reciprocating movement of the carriage the shoot is alternately completely immersed in the liquid while in an inclined position and completely withdrawn.—W. E. F. P.

White-metal casting and method of making the same. C. Pack, Assignor to Doehler Die Casting Co., New York. U.S. Pat. 1,156,093, Oct. 12, 1915. Date of appl., June 19, 1914.

AN alloy containing 80–91% Al and 20–9% Cu is poured under pressure into a metal mould which is maintained at a temperature below the m.p. of the material so that the surfaces of the casting are chilled. To avoid excessive contraction, the casting is withdrawn from the mould immediately on completion of the solidification shrinkage.—W. E. F. P.

Metals [silver] from ores; Process of extracting —. R. S. Towne, New York, and C. Robinson, Mount Vernon, N.Y., Assignors to Metallurgical Engineering and Process Corporation. U.S. Pat. 1,156,382, Oct. 12, 1915. Date of appl., July 14, 1910; renewed Mar. 8, 1915.

FINELY divided silver ore is agitated with a relatively strong solution of potassium cyanide and then with successively weaker solutions, the bulk (75%) of the liquid being removed after each agitation. The solutions are treated separately for the recovery of silver and afterwards returned to their original places in the system.—W. E. F. P.

Aluminium screenings, dross, slags, or analogous aluminous materials; Process of treating —. J. W. Lawrie, Aurora, Ill. U.S. Pat. 1,156,606, Oct. 12, 1915. Date of appl., Aug. 10, 1914.

THE material is agitated with a solution of caustic alkali in a closed vessel, at atmospheric pressure, until the bulk of the aluminium is dissolved, when the residual hydrogen is removed from the apparatus and external heat applied. The alkaline solution is then treated for the removal of zinc, copper, etc., and recovery of pure alumina, and the insoluble residue for the recovery of copper by means of acid.—W. E. F. P.

Steel; Manufacture of —. J. I. Bronn, Assignor to Rombacher Hüttenwerke, Rombach, Germany. U.S. Pat. 1,156,051, Oct. 12, 1915. Date of appl., Dec. 2, 1912.

SEE Fr. Pat. 455,399 of 1912; this J., 1913, 947.

Annealing magnetic material [silicon steel]; Process for —. W. E. Ruder, Schenectady, N.Y., Assignor to General Electric Co. U.S. Pat. 1,156,496, Oct. 12, 1915. Date of appl., Sep. 14, 1912.

SEE Eng. Pat. 25,902 of 1912; this J., 1913, 914.

Metals; Process of precipitating and separating from solution. R. S. Towne, New York, and C. Robinson, Mount Vernon, N.Y., Assignors to Metallurgical Engineering and Process Corporation. U.S. Pat. 1,156,383, Oct. 12, 1915. Date of appl., Sept. 12, 1912.

SEE Eng. Pat. 2807 of 1913; this J., 1914, 320.

Lead and zinc contained in the state of sulphides in ores; Process for the industrial separation of —.
G. de Bechi, London. U.S. Pat. 1,157,153, Oct. 19, 1915. Date of appl., Mar. 29, 1913.
SEE Eng. Pat. 4246 of 1913; this J., 1913, 540.

Sulphides from ores; Separation of metallic —.
T. M. Owen, Assignor to E. W. Culver, Sydney, N.S.W. U.S. Pat. 1,157,176, Oct. 19, 1915. Date of appl., Feb. 27, 1914.

SEE Eng. Pat. 22,145 of 1914; this J., 1915, 182.

Preparation of rust preventives easily removable by washing or rubbing. Ger. Pat. 285,708. See XIII.

XI.—ELECTRO-CHEMISTRY.

Electric furnace for general purposes; An —.
G. Oesterheld. Z. Elektrochem., 1915, 21, 54—60.

THE vacuum electric furnace described consists of a copper vessel provided with a removable cover through which the water-cooled conductors are inserted. These conductors are insulated through the cover and terminate in flattened ends in which split expansion sleeves are inserted. Between these sleeves a horizontal tungsten tube is gripped. To minimise loss of heat by radiation the tungsten tube is surrounded by a magnesite protector. In the outer casing and in the wall of the furnace itself, and in line with the tungsten tube, are two observation windows, which direct the heat rays on to an optical pyrometer. Carbon tubes may be used instead of tungsten, in which case any oxygen is rendered innocuous by the reducing action of the carbon, but the vacuum cannot be maintained so well with carbon or graphite. A table is given showing various strengths of current with tungsten and carbon tubes, temperatures varying from 1900° C. to 2500° C. being attained.
—W. G. C.

[Sludging of] switch and transformer oils. Digby. See IIA.

Anodic behaviour of alkaline perborate solutions. Polack. See VII.

Micro-electroanalysis. Riesenfeld and Müller. See XXIII.

PATENTS.

Electric arcs; Apparatus for improving the stability of furnaces with magnetically-extended —. E. Troye, Assignor to Norsk Hydro-Elektrisk Kvaestofaktieselskab, Christiania, Norway. U.S. Pat. 1,156,192, Oct. 12, 1915. Date of appl., Feb. 18, 1915.

THE portions of the furnace wall adjacent to the ignition points of the arc are partly separated from the outer portions of the furnace lining by means of ribs or shoulders, so as to maintain, adjacent to the foot points of the arc, a stationary portion of air or gas of comparatively high conductivity. An arc, burning steadily, is thus secured, enabling the electrode distance to be increased. The furnace wall at this highly-heated zone is much thinner than the remaining portion, and air is supplied to the outer surface of the thinner portion.—B. N.

Electrode. Process of making electrodes. W. H. Rowley, St. Louis, Mo. U.S. Pats. (A) 1,156,315 and (B) 1,156,316, Oct. 12, 1915. Dates of appl., Dec. 16, 1913, and Apr. 5, 1915.

(A) Two grid-like frames are covered by a body

of active material in the form of a porous veil of lead filaments, which are secured to the frames and shaped to the grids to form uneven surfaces. A body of active material, containing lead oxide, is supported and separated from the grids by each veil, and a screen of lead filaments is interposed between the bodies of oxide, the filaments of the screen being united with the frames. (B) A paste containing lead oxide is applied to a frame, and the moisture partly eliminated from the surfaces by pressure, the surfaces only being then treated in dilute sulphuric acid to render them more compact than the remaining material, thus preventing the paste falling away from the grid.
—B. N.

Negative-pole plate for secondary or storage batteries. G. M. Howard, Philadelphia, Pa. U.S. Pat. 1,156,686, Oct. 12, 1915. Date of appl., Feb. 16, 1910.

THE dry active material contains metallic lead, with sufficient lead sulphate for binding the metal, and is substantially free from oxide.—B. N.

Alkaline secondary batteries; Construction of —. L. Gräfenberg. Ger. Pat. 285,605, Mar. 7, 1914.

A NICKEL-CADMIUM alloy is used for constructing the support for the active material, the current leads, and other parts exposed to the action of the electrolyte.—A. S.

Mercury cathode. Hoesch und Co. Ger. Pat. 286,011, Mar. 30, 1913.

THE mercury rests on a horizontal or nearly horizontal support, provided with vertical baffles about 0.5 mm. high and 1—1.5 mm. apart, which ensure an intimate admixture of the mercury with the amalgam formed as a result of electrolysis.
—A. S.

Furnace; Electric —. E. F. Collins, Schenectady, N.Y., Assignor to General Electric Co. U.S. Pat. 1,156,668, Oct. 12, 1915. Date of appl., Apr. 17, 1914.

THE heating chamber of the furnace has a heater of granular carbonaceous conductive material on a refractory hearth, and refractory walls containing silicon and carbon enclosing it. The upper wall, consisting of a refractory frame, is provided with vertical channels containing refractory conductive carbonaceous material more finely-divided than that on the hearth, in which electrodes, movable transversely and connecting the electrodes to the heater, are embedded.—B. N.

Di-electric composition [from spent oil shale]. Eng. Pat. 4820. See IIA.

Apparatus for bleaching by electrolysis. Eng. Pat. 20,714. See VI.

Insulators for high-potential electric conductors. U.S. Pat. 1,156,163. See VIII.

Production of refractory, electrically insulating mica brick. Ger. Pat. 285,482. See IX.

[Electrical] contact bodies of tungsten. U.S. Pats. 1,155,426 and 1,155,427. See X.

XII.—FATS; OILS; WAXES.

Vegetable oil in animal fats; Detection of —. J. Marcusson and H. Schilling. Mitt. k. Materialprüfungsamt, 1915, 32, 506—509. Z. angew. Chem., 1915, 28, Ref., 377.

VEGETABLE oils may be detected by a simple combination of the digitonin reaction and phytosteryl acetate test. The oil or fat is shaken with

a hot alcoholic solution of digitonin, and the resulting digitonide separated, washed with ether, and converted into the acetate by heating with acetic anhydride. In the presence of pure vegetable oils the crude acetate will have a high m.pt. approximating that of phytosteryl acetate, whilst in the presence of animal fats the m.pt. of the cholesteryl acetate will be constant after two recrystallisations, and will not exceed 114° C. Should the m.pt. exceed 116° C. the presence of vegetable oil is certain. Mineral oil does not interfere with the test, and 0.5% of vegetable oil may be detected in mixtures containing mineral oil.—C. A. M.

Kukui oil from Hawaii. U.S. Comm. Rept. No. 240, Oct. 13, 1915.

THE total area of kukui in Hawaii is estimated to be about 15,000 acres, capable of producing about 75,000 tons of nuts annually. Assuming that only about two-thirds of the area is readily accessible, the probable production of oil is 2,375,000 gallons per annum. The oil is similar to linseed oil (see this J., 1914, 837), and is obtained by grinding the kernels and pressing, with or without previous roasting of the nuts. Boiling the ground kernels in water is not a practicable method of extracting the oil, since an emulsion is formed which cannot be separated by centrifuging. When extracted from the crushed kernels by ether or petroleum spirit, the oil is light yellow in colour, sp.gr. 0.92.

Oil of the seeds of Strychnos nux vomica. II. A. Heiduschka and R. Wallenreuter. Arch. Pharm., 1915, 253, 202—213. J. Chem. Soc., 1915, 108, i., 931. (Compare this J., 1915, 669.)

THE unsaponifiable portion of the oil was separated by the method of Matthes and Heintz (this J., 1909, 801) into a resinous portion, a phytosterol with m.pt. 158° C., and a saturated alcohol, $C_{35}H_{57}OH$ or $C_{35}H_{55}OH$. The latter crystallises from isobutyl alcohol in silky tufts, m.pt. 188° C., $\alpha_D^{25} = +90^\circ$, and forms an acetate, m.pt. 223° C., $\alpha_D^{25} = +74.47^\circ$, which was oxidised by chromic acid and glacial acetic acid to, apparently, oxyamyrin acetate, $C_{35}H_{50}O_3$. Another alcohol was isolated by dissolving the original substance in acetic anhydride. The impure acetate of the above alcohol crystallised first, followed, after a day or two, by the acetate, colourless leaflets, m.pt. 123°—124° C., of an unsaturated alcohol, $C_{35}H_{54}O$, $\alpha_D^{25} = +112^\circ$, m.pt. 99° C., which behaved like sycoceryl alcohol.

Iso-oleic acid from seeds of ivy. F. C. Palazzo and A. Tamburello. Atti R. Accad. Lincei, 1914, [v], 23, ii. 352—356. J. Chem. Soc., 1915, 108, i., 862—863.

THE unsaturated acid constituting, in the form of glyceride, the greater part of the fatty substance of ivy seeds, is identical with the petroselinic acid found by Vongerichten and Köhler (this J., 1909, 662) in parsley seeds. The fat constitutes 30—32% of the ripe, air-dried seeds, and has the following characters: m.pt. 25.2° C., solidif.pt. 21.4° C., $n_D^{20} = 1.462$, acid value (as oleic acid) 3.99, saponification value 190.5, iodine value 91.8. The petroselinic acid, m.pt. 29°—30° C., has the iodine value 89.85 and the acid value 200.1, and yields stearic acid quantitatively on reduction with hydrogen in presence of palladium black, and the dihydroxystearic acid, m.pt. 122° C. (compare Vongerichten and Köhler, *loc. cit.*), on oxidation with permanganate. The melting point, 33°—34° C., given by Vongerichten and Köhler for petroselinic acid, differs from its solidification point by so much (6°—7°) that it is probably inaccurate.

Distillation of mineral oils and liquid hydrocarbons of all kinds, fatty acids, and similar substances. Singer. See 11A.

Constituents of mace. Tschirch and Schklowsky. See XIXA.

PATENTS.

Fats of all kinds, hydrocarbons, sulphur, or the like; Process for extracting—. Chem. Fabr. von Heyden A.-G. Ger. Pat. 284,410, Dec. 3, 1913.

NEUTRAL phosphates of phenols or substituted phenols, especially tricresyl phosphate or its substitution products, are used as extracting agents. Liquid tricresyl phosphate may be prepared cheaply from crude cresol or chlorocresols.—C. A. M.

Wax-like substance from wool-fat and the like; Process for the preparation of a—. I. Lifschütz, Hamburg, Germany. Ger. Pats. (A) 286,244 and (B) 286,245, Nov. 26, 1913, and Jan. 28, 1914.

(A) THE saponified or hydrolysed fat is extracted at the ordinary temperature with a water-soluble solvent, especially alcohol or wood spirit, until the solid residue forms a wax-like product melting at about 65° to 68° C. The washings may be treated for the recovery of the fatty acids. (B) Wool fat is partially saponified until a sample has the properties of wax and melts above 50° C. The mass may then be extracted with alcohol or methyl alcohol as in (A) and may be treated with an acid.—C. A. M.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Colophony: Combination of— with solvents, especially with petroleum hydrocarbons. L. Paul. Seifensiederzeit., 1915, 42, 393—395, 412—413, 434—435. Z. angew. Chem., 1915, 28, Ref., 415.

THE property of colophony of forming unstable compounds with organic and inorganic substances, is shown in a very pronounced manner in its behaviour with petroleum hydrocarbons. Pure, anhydrous γ -abietic acid, separated from colophony, is also capable of absorbing benzene and higher-boiling petroleum hydrocarbons, and the same property is possessed by the salts of γ -pinic acid, especially the calcium salt. When sodium γ -pinate is heated with ten times its quantity of petroleum, water vapour is copiously evolved at 110°—120° C., and the solution solidifies to a colourless, translucent mass.—A. S.

Condensation products from phenols and formaldehyde; Detection of—. F. Steinitzer. Kunststoffe, 1915, 5, 109—111. Z. angew. Chem., 1915, 28, Ref., 460.

RESINOUS condensation products of phenols and formaldehyde are decomposed when boiled with sodium hydroxide solution or heated with soda-lime, with the liberation of phenols, which may be identified by their colour reactions. In plastic masses containing phenol-resins and starch or potato flour, the starch cannot be detected by the iodine reaction. The product should be boiled with water and the extract tested for dextrin with Fehling's solution. The condensation products of phenol, formaldehyde, and casein also yield phenol when boiled with sodium hydroxide solution, but the sulphur derived from the casein should be removed by means of lead oxide before applying the test for the phenol.—C. A. M.

Proximate analysis of nitrocellulose solutions and solvents. Conley. See V.

PATENTS.

Pigments; Process of preparing—. M. Loewe, Berlin. Ger. Pats. (A) 285,882 and (B) 285,883, Dec. 31, 1913, and Jan. 21, 1914.

(A) SUBSTANCES capable of interacting with metallic salts to form pigments, are treated with metallic compounds of base-exchanging substances. (B) Organic compounds capable of forming colour-lakes, especially mordant-dyestuffs, or their soluble salts are treated with metallic compounds of base-exchanging substances.—C. A. M.

Paint for preventing the growth of lower vegetable or animal organisms on ships or submarine structures. W. Schoeller and W. Schrauth, Berlin. Ger. Pat. 285,225, Dec. 10, 1913.

THE paint contains "mercurised" fats or resins or fatty or resinous acids, which have been obtained by treatment with mercury salts of organic acids.—C. A. M.

Paint to prevent the growth of lower animals or plants. B. Malenkovic, Vienna. Ger. Pat. 285,261, Dec. 23, 1913.

ETHERS or esters of naphthols or their homologues or derivatives, and especially their hydroxy- and amino-, but not nitro-derivatives, are incorporated with the paints to be applied to ships' bottoms, trees, etc.—C. A. M.

Rust preventives; Preparation of—readily removable by washing or rubbing. B. Zschokke, Zürich, Switzerland. Ger. Pat. 285,708, May 30, 1914. Addition to Ger. Pat. 276,122.

THE aqueous solution of chromic acid or its salts which is used to bring the iron into a passive condition as described in the chief patent (this J., 1911, 876), is mixed with an organic or inorganic adhesive substance, such as sodium silicate, tar, dextrin, rosin, water colours, etc.—C. A. M.

Condensation products [of phenols and formaldehyde]; Process for the manufacture of—. F. Pollak, Vienna. Eng. Pat. 20,977, Oct. 14, 1914. Under Int. Conv., Oct. 25, 1913.

SOLUBLE intermediate products obtained from phenols and aldehydes by the use of the smallest possible quantity of condensing agent, are repeatedly washed with water below 40° C., then with dilute solutions of substances capable of dissolving or oxidising phenols, and again with water. The residual insoluble condensation products are of a light colour and are not affected by light or air.—C. A. M.

Resinous cements or adhesives; Preparation of—. Cefka-Ges. m.b.H. Ger. Pat. 284,701, Nov. 28, 1913.

HARDENED resins or mixtures of such resins with colophony are fused with neutral resins or such resins as are saponified with difficulty, the relative proportions of the constituents being adjusted to give a product which softens somewhat above 100° C. Filling materials may be incorporated with the fused mass. The product is capable of withstanding the action of hot water and alkaline liquids.—A. S.

Polymerisation products [from vinyl esters]; Production and employment of new—. G. W. Johnson, London. From Chem. Fabr. Griesheim-Elektron, Frankfurt, Germany. Eng. Pat. 15,271, June 25, 1914.

SEE Ger. Pats. 281,687 and 281,688; this J., 1915, 623.

Process for dyeing nitrocellulose. Ger. Pat. 285,323, See V.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Rubber plantations of the Netherlands East Indies. Board of Trade J., Nov. 4, 1915.

Wild rubber.—*Ficus elastica* is indigenous to the Dutch East Indies and is the source of considerable but decreasing quantities both of wild and plantation rubber. The various species of *Dyera* are found in Borneo and Sumatra, and supply the product exported as jelutong. The decrease in prices and the competition of the plantation product has caused a considerable falling off in the export of wild rubber in recent years. The following are the export figures of jelutong in 1912 and 1913:—

Destination.	1912.	1913.
	Metric tons.	Metric tons.
Netherlands.....	703	439
United Kingdom.....	860	658
Germany.....	1,795	1,346
United States.....	4,730	1,264
Singapore.....	18,616	14,021
Other countries.....	1,130	404
Total.....	27,834	18,132

A large proportion of the exports to the Netherlands, and almost all those to Singapore, are transhipped thence to other destinations.

Plantation rubber.—The first plantations were formed of the indigenous *Ficus elastica*; *Castilloa elastica* and various species of *Manihot* have been cultivated, but are giving way before the more recently introduced *Hevea Brasiliensis*. The area planted at the end of 1913 was as follows:—*Hevea* alone, 231,538 acres; *Hevea* interplanted, 183,774 acres; total, 415,312 acres. In addition there were some 1,000,000 trees distributed throughout the Colonies. The Government plantations (included above) comprise 7678 acres, of which 6863 are in Java. The area planted does not appear to be capable of very great extension in Java, but in Sumatra the area could easily be doubled. *Ficus* only, 28,496 acres; *Ficus* interplanted, 3575 acres; total, 32,071 acres. In addition there were 202,000 trees distributed over the Colonies. *Castilloa* only, 164 acres; *Castilloa* interplanted, 5360 acres; total, 5524 acres. In addition 186,000 trees were planted on other estates.

The exports of plantation Para rubber during 1912 and 1913 were as follows:—

Destination.	Java.		East Coast of Sumatra.	
	1912.	1913.	1912.	1913.
	Metric tons.	Metric tons.	Metric tons.	Metric tons.
Netherlands.....	194	1006	35	284
United Kingdom.....	255	1000	102	750
Other countries.....	37	339	1185	1893
Total.....	486	2345	1322	3036

The total exports for 1912 from the other islands in the Netherlands East Indies were 536 metric tons.

Exports of *Ficus* and *Castilloa* rubber in 1912 and 1913 were as follows:—

Destination.	Ficus.		Castillon.	
	1912.	1913.	1912.	1913.
	Metric tons.	Metric tons.	Metric tons.	Metric tons.
Netherlands	225	107	12	25
Other countries	695	457	11	19
Total	920	564	23	44

In addition there are the following plantations of *Munihol*:—4580 acres; interplanted, 4703 acres; together with 46,000 trees distributed over various plantations. Exports amounted in 1913 to 11 metric tons.

PATENTS.

Rubber substance and process of making same. P. Schidrowitz and H. A. Goldsborough, London. U.S. Pat. 1,156,181, Oct. 12, 1915. Date of appl., Jan. 4, 1915.

SEE Eng. Pat. 1111 of 1911; this J., 1915, 621.

Caoutchouc or caoutchouc-like substances; Process for accelerating the vulcanisation of natural or artificial—. S. J. Peachey, Stockport. U.S. Pat. 1,157,177, Oct. 19, 1915. Date of appl., Feb. 12, 1915.

SEE Eng. Pat. 1263 of 1914; this J., 1915, 368.

XV. LEATHER; BONE; HORN; GLUE.

Paraguayan woods containing tannin. U.S. Comm. Rept. No. 243, Oct. 16, 1915.

AT the present time there is considerable activity in the quebracho-extract industry in Paraguay. There are, however, other woods in Paraguay containing high percentages of tannin, which are found in abundance. The following are the most important: *Yhva-poroitih (Eugenia brasiliensis)*. This wood contains about 35.4% of tannin in the adult bark, also about 12% in the dried leaves, and about 7.6% in the trunk wood. It contains little resinous or colouring matter. *Pakuri (Rheedia brasiliensis)*. Contains in the bark about 18% of tannin, with a small percentage of resinous and colouring matter. The bark is easy to extract. *Yhivihra Puibta (Peltophorum dubium)*. Contains about 21% of tannin and a considerable amount of colouring matter. *Nangapirih Guazú (Eugenia Micheli)*. Contains about 20% of tannin. The bark is smooth and easy to extract. *Kurupaih-Rá Moróto (Piptadenia Sp.)*. Contains about 20% of tannin. At present exploited for its wood only. *Kurupaih-Rá Puibta (Piptadenia rigida)*. Contains about 20% of tannin. At present worked for its wood. *Inga Guazú (Inga affinis)*. Contains about 17% of tannin in bark, which is smooth and easily extracted. *Kaatiguá Moróti (Trichilia hieronymi)*. Contains about 15% of tannin in the bark. The bark is used by natives to some extent in tanning, and is easily stripped from the logs. *Timbó (Enterolobium timbawa)*. Contains about 14% of tannin. The bark is used to some extent by the natives in tanning fine hides.

PATENTS.

Tanning compositions; Method of producing—from waste sulphite-cellulose liquors. J. J. Gross, Hamburg, Germany. U.S. Pat. 1,154,762, Sept. 28, 1915. Date of appl., Nov. 7, 1913.

THE warm liquor after treatment with hydrochloric and sulphuric acids and potassium chromate,

to remove lime, is concentrated to about 20° B. (sp. gr. 1.16), filtered, and further concentrated as desired.—F. C. T.

Tanning drum. B. Allen, jun., Buford, Ga. U.S. Pat. 1,155,866, Oct. 5, 1915. Date of appl., Oct. 6, 1913.

THE drum is constructed of longitudinal staves assembled to form a cylinder and having sockets near their ends to receive the drum heads; hoops are fitted over the ends of the cylinder to hold the drum heads in position. Each head is composed of a pair of panels, made up of planks placed closely side by side, and a sheet of tarred cloth is clamped between the panels. The drum heads are strengthened by circular plates and radial bars bolted to them.—A. S.

Glue or gelatin; Process for purifying bodies which yield—. Ges. für Elektro-Osmose, Frankfurt, Germany. Eng. Pat. 21,483, Oct. 21, 1914. Under Int. Conv., Mar. 2, 1911. Addition to Eng. Pat. 21,448, Mar. 2, 1914.

THE process previously described (this J., 1915, 971) can be used for freeing ossein from salts, lime, or acids, or for purifying hide or leather waste, etc. To convert the ossein, hide, or leather into glue, the heat produced by the passage of the electric current may be utilised, if necessary with the aid of external heat or chemicals.—F. C. T.

Bone material; Process for extracting glue from—by steaming. O. Ruf, Munich, Germany. Ger. Pat. 286,100, May 12, 1914.

THE bone material is removed from the steam once or several times during the steaming and pressed while hot, each time with gradually increasing pressure, until finally the residual material is compressed into cakes or briquettes.—C. A. M.

Adhesive aqueous solutions from proteins; Preparation of—. C. Beyer and F. Savels. Ger. Pat. 286,099, May 3, 1914.

THE protein (e.g., glue, casein, or albumin) is heated with at least 10% of its weight of resorcinol in an autoclave under pressure. The resulting brown mass is almost completely soluble in water, and the solutions when clarified by addition of alcohol are neutral, very adhesive, keep well, and do not gelatinise in the cold or form deposits when boiled.—C. A. M.

Formaldehyde condensation products adapted to precipitate glue and like substances; Manufacture of—. H. Wade, London. From Deutsch-Koloniale Gerb- u. Farbstoff-Ges. m. b. H., Karlsruhe, Germany. Eng. Pat. 8818, Apr. 7, 1914.

SEE Fr. Pat. 471,924 of 1914; this J., 1915, 438.

XVI. -SOILS; FERTILISERS.

Soil protozoa; Separation of—. N. Kopeloff, H. C. Lint, and D. A. Coleman. J. Agric. Res., 1915, 5, 137—140.

A CULTURE solution, prepared by adding 100 grms. of Penn clay loam soil to 1 litre of a 10% hay infusion and 0.5% of egg albumin, and containing flagellates, ciliates, and bacteria, was used to determine the effects upon the number and nature of the organisms of filtration through a single filter paper or two or more thicknesses of paper. Ten c.c. of the solution was filtered for one minute through the sterilised paper (S. and S. No. 589), the number of protozoa was counted, and then, to allow of the excystment of inactive

forms, the liquid was incubated for 5 days at 22° C. and the number again counted. The experiments showed that the large ciliates (25–60 μ) did not traverse the filter paper at all; that the number of small ciliates (12–20 μ) passing through diminished greatly when the thickness of the filter paper was increased from two- to four-fold, and that with four thicknesses they were completely stopped. The number of flagellates decreased progressively with each successive additional thickness of paper, and with five thicknesses they were completely retained by the filter. It was also found that 99% of the bacteria in the culture solution passed through five thicknesses of the paper, thus allowing a good, though not quite complete, separation of protozoa from bacteria.—E. H. T.

Alkali salts; Effect of — in soils, on the germination and growth of crops. F. S. Harris. J. Agric. Research, 1915, 5, 1–53.

To ascertain the effects of alkali salts upon the germination and early growth of wheat and other crops, over 18,000 determinations were performed. In the soil experiments, two distinct loam soils and sand were used. A solution of the salt or salts was thoroughly incorporated with 200 grms. (dry) of the soil the mixture put in a glass tumbler, and the moisture content made up to and maintained at 20% throughout. Ten seeds were planted in each tumbler, which was then covered with glass until germination took place, and the growth was continued for 2–3 weeks. Ten different concentrations were used for each kind of salt, 15 glasses for each concentration, and 24 tests were made in each series, making with controls 3696 separate tests. The combined effects of the sulphate, carbonate, and chloride of sodium were studied in another series. If the various salts be arranged according to their toxicity the order is sodium chloride (the most toxic), calcium chloride, potassium chloride, sodium nitrate, magnesium chloride, potassium nitrate, magnesium nitrate, sodium carbonate, potassium carbonate, sodium sulphate, potassium sulphate, magnesium sulphate. Sodium carbonate was found to injure the physical condition of the soil, and to be nearly as toxic as sodium chloride in sand cultures. Sodium chloride was about twice as detrimental in sand as in soil. Different crops exhibited very different powers of resistance to the same salt, the most resistant being barley, followed by oats, wheat, lucerne, sugar beets, maize, and Canada field peas in the order given. The percentage of germination, the heights and dry weights of the plants, and the number of leaves per plant were all affected in about the same degree. The period of germination was in all cases adversely influenced by the presence of soluble salts. The toxicity of alkali salts depends much more upon the nature of the acid radical than upon that of the base; chloride was the most harmful acid radical, and sodium the most detrimental base. No general relation was found between the osmotic pressure of the dissolved salt and its toxic action, but in the majority of cases salts with high molecular weights were more harmful than those with low molecular weights. Water culture experiments on similar lines gave results which were by no means always concordant with those in the soil experiments. The relative toxicity for water cultures was: sodium carbonate, sodium chloride, magnesium nitrate, sodium sulphate, magnesium chloride, sodium nitrate, potassium nitrate, potassium chloride, calcium chloride (least toxic), the criterion chosen being that of the relative heights of the plants after 21 days. Moreover, the mutual antagonism of certain salts was found to be far greater in solution cultures than in soils. The application of a dissolved salt has a greater effect than that of a dry one, and

generally, the toxicity is influenced by the moisture content of the soil. The presence of soluble alkali salts in soils is of especial importance to farmers in arid regions, and the following percentages indicate roughly the maximum amounts of salts which may be present in a soil without prejudice to its agricultural (arable) value: Loam soils—chloride 0.3, nitrates 0.4, carbonates 0.5, sulphates 1.0; Coarse sand—chlorides 0.2, nitrates 0.3, carbonates 0.3, sulphates 0.6.—E. H. T.

Humus in soils; Methods for determination of —. G. S. Fraps. J. Assoc. Official Agric. Chem., 1915, 1, 35–39.

THE Beam method of estimating humus in soils (this J., 1912, 695 and 1914, 153) might be made satisfactory if modified in certain respects. In the Smith method (this J., 1913, 151), the clear humus filtrate, obtained after extracting the soil with dilute ammonia, contains colloidal mineral matter which is precipitated by the ammonium carbonate subsequently added. The modification of this method proposed by Rather is recommended for official adoption. 10 grms. of soil which has been washed with 1% hydrochloric acid and water is digested with 500 c.c. of a 4% solution of ammonia, and shaken frequently during 24 hours. The unsettled liquor is then filtered through a double-fluted Schleicher and Schüll filter-paper (24 cm., No. 597), and the filtrate is poured back through the filter. The new filtrate is collected in a conical flask in the neck of which the funnel is supported. During the filtration, the funnel is covered with an inverted 9-inch evaporating dish to check evaporation, and the determination is completed on an aliquot portion of the filtrate according to the present official (U.S.A.) method. Experiments showed that not all the humus extracted from soils with dilute ammonia was precipitated by the addition of acid, a second and a third treatment with acid giving more humus. A single precipitation with acid is therefore apparently unsatisfactory; but probably a double treatment with acid would suffice if most of the lime present were removed by the first.—E. H. T.

Humus [in soils]; Determination of —. O. C. Smith. J. Assoc. Official Agric. Chem., 1915, 1, 46–48.

THREE soil samples, which had given poor results by the official (U.S.A.) method for humus determination, were analysed by the Smith method (this J., 1913, 151), the Rather method (see preceding abstract), and the official method, and in the case of one soil the results were compared with the figures obtained by J. B. Rather, who used his own method modified by adding 2 grms. of ammonium carbonate to the filtrate and heating for 1 hour on the water-bath. The results by the official method were quite different from those obtained by the other methods. For the first soil, the Smith and Rather methods gave fairly concordant results for humus, but discordant results for ash. For the second soil, these two methods gave practically identical figures. For the third soil, the figures were wholly discordant. The official and Rather methods were held to be quite unsatisfactory, and the modified Rather method was considered to introduce too many doubtful factors.—E. H. T.

Lime requirement of soils; Method for determining the —. C. H. Jones. J. Assoc. Official Agric. Chem., 1915, 1, 43–44.

The following method has been found extremely rapid; 50 determinations may be completed in a day. 5.6 grms. of soil and 0.5 gm. of pure calcium acetate are mixed in a 3-inch mortar, sufficient water is added to make a fairly stiff

paste, and then the mixture is stirred for 20 secs., and again for 30 secs. after the addition of another 30 c.c. of water. The contents of the mortar are washed into a 200 c.c. flask, the volume being restricted to 160 c.c., and allowed to stand with occasional shaking for 15 mins. The liquid is then made up to 200 c.c., mixed and filtered, the first 10–15 c.c. being discarded if cloudy. 100 c.c. of the filtrate is titrated with *N* 10 caustic soda in presence of phenolphthalein, and the titration number is multiplied by 2 to give the alkali required to neutralise the whole 200 c.c. The product multiplied by the factor 1.8 (a tentative figure deduced from a limited number of soils), and by 1000, gives the number of pounds of lime (CaO) required for 2,000,000 lb. of soil.—E. H. T.

Radium and its emanation; Action of—on the germination of higher plants. H. Agulhon and T. Robert. *Ann. Inst. Pasteur*, 1915, 29, 261–273. *J. Chem. Soc.*, 1915, 108, i., 925.

THE results of experiments with pea seedlings subjected to the action of radiations from radium bromide contained in sealed tubes showed a decided retarding effect. A solution of radium bromide containing 0.001 mgrm. was without effect. In another series of experiments, different plants were grown under bell jars, both without and with radium contained in a small ebonite box covered with a piece of mica, so as to allow the emanation to diffuse. Under the influence of radium, the development of the plants was considerably accelerated; the diameters of the stems at different points were somewhat diminished, whilst the distances between the knots were greatly increased. Examination of sections of the stems showed that the width of cells was greatly diminished and the length greatly increased by the action of the emanation, recalling the phenomenon of etiolation.

Plants; Action of stimulants on the development of—B. Schulze. *Landw. Versuchs-Stat.*, 1915, 87, 1–24. *J. Chem. Soc.*, 1915, 108, i., 926.

Pot experiments were made in which sugar beets were grown in a mixed soil of sand and loam with farmyard manure, ammonium nitrate, and minerals, and different manganese compounds. In every case, the application of manganese resulted in increased yields and in increased production of sugar. The greatest yield was obtained with the smallest amount of manganese nitrate (Mn=1.2 grms. per 20 kilos. of soil), whilst with larger amounts of manganese nitrate the increase was less. With other manganese compounds (except the sulphate) the yield increased with the increase in the amount of manganese. When aluminium sulphate was added to manganese sulphate, the yield rose with the increased applications. The most favourable forms of manganese seem to be the phosphate and (with aluminium sulphate) the sulphate. In a mixture of hydroxide and carbonate as much as 12.2 grms. per 20 kilos. of soil had no injurious effect.

The results of pot experiments in which oats, mustard, and peas were manured with "radio-actin" showed that the application of this substance resulted in increased yields, fruit production being especially increased. The results seem to be due to stimulation only, without increased assimilation of nutrients. "Radioactin" consists mainly of aluminium silicate, containing only a small amount of radium salt and relatively large amounts of thorium. The amounts employed were approximately 0.02 to 0.2 gm. per kilo. of soil. With the lowest and highest amounts the yields of oat grain were increased by 7.7% and 17.8% respectively. In practice, however, the cost would be considerable.

Perchlorate and cobaltinitrite methods for the determination of potassium. Jarrell. *See* XXIII.

PATENTS.

Manure; Manufacture of [phosphatic peat]—W. B. Bottomley, London. Eng. Pat. 20,789, Oct. 9, 1911.

PEAT is mixed with bone-meal or other form of insoluble phosphate, the mixture moistened with a solution containing aerobic micro-organisms as obtained from putrefying organic matter (Eng. Pat. 17,487 of 1912; this J., 1913, 878), which organisms are identical with or invariably accompany those described in Eng. Pat. 20,788 of 1911 (this J., 1915, 625), and the mass incubated at about 30° C.—C. A. M.

Calcium cyanamide; Process for hydrating commercial—K. F. Cooper, Buffalo, N.Y., Assignor to American Cyanamid Co., Nashville, Tenn. U.S. Pat. 1,155,797, Oct. 5, 1915. Date of appl., Dec. 1, 1914.

THE crude material, containing calcium cyanamide, oxide, and carbide, is well stirred with water, or with water and oil, sufficient in amount to hydrate the oxide and to decompose the carbide, the temperature being kept low to prevent the escape of ammonia. The oil serves to bind the particles of the fertiliser, and does not interfere with the hydration.—E. H. T.

Manufacture of phosphoric acid and phosphates. Fr. Pat. 471,380. *See* VII.

XVII.—SUGARS; STARCHES; GUMS.

Action of stimulants on the development of plants. Schulze. *See* XVI.

Use of raw [beet] sugar in distilleries. Windisch. *See* XVIII.

Complete fermentation of fairly concentrated solutions of raw [beet] sugar by addition of mineral salts without other vegetable nutriment for the yeast. Nagel. *See* XVIII.

PATENTS.

Sugar-beets; Process for making syrup from—H. C. Gore, Takoma Park, Md., and C. O. Townsend, Washington, D.C. U.S. Pat. 1,153,806, Oct. 5, 1915. Date of appl., May 19, 1915.

THE beets are topped, cut into small fragments, and heated with water at the boiling point. After the exhausted solid matter has been removed, the liquid is concentrated by boiling at first slowly and afterwards rapidly to eliminate the objectionable flavour of the beet.—J. H. L.

[Sugar solutions;] Process and apparatus for separating—F. E. Coombs, Natick, Mass. U.S. Pat. 1,156,060, Oct. 12, 1915. Date of appl., Apr. 22, 1909.

SUGAR juices are defecated by treating with lime and heating under pressure, the solid matters are separated by centrifuging at a temperature approaching 100° C., and the mud is again centrifuged after admixture with a washing liquor.—J. H. L.

Starch; Manufacture of—C. C. Moore, Washington, D.C., Assignor to F. C. Stevens. U.S. Pat. 1,156,891, Oct. 12, 1915. Date of appl., Jan. 20, 1913.

See Eng. Pat. 530 of 1911; this J., 1914, 1217.

XVIII.—FERMENTATION INDUSTRIES.

Malt; Chemistry of—especially of the lipoids. H. Lüers. Z. ges. Brauw., 1915, 38, 97—101, 106—111, 116—120, 123—125.

FINELY ground malt (30 kilos.) was extracted with 80% alcohol. The portion of the extract insoluble in ether contained bynlin, sucrose, invert-sugar, and aromatic and empyreumatic substances. The portion soluble in ether contained a substance allied to the phosphatides, besides fats (with free fatty acids) which yielded stearic, palmitic, oleic, and linolic acids on saponification, and unsaponifiable matters, including sitosterol, m.pt. 134° C., and parasitosterol, m.pt. 126° C. The phosphatide product was separated from the other substances mentioned in consequence of its insolubility in acetone. It contained 2.0% of nitrogen and 2.5% of phosphorus (atomic proportions 2N:1P), and also about 22% of sucrose. When hydrolysed with hydrochloric acid it yielded invert-sugar, stearic, palmitic, and oleic acids, choline, and glycerol. Similar products extracted from barley and malt with benzene, contained less than 2% of sucrose. Phosphatides from yolk of egg, when heated in benzene solution with powdered sucrose, were found to adsorb (and thus render soluble) considerable quantities of this sugar. The sucrose contained in the phosphatide product from malt was therefore not combined chemically, but had probably been adsorbed during the extraction of the malt; the original malt phosphatide had also probably undergone partial decomposition during extraction.—J. H. L.

Malt and barley; Formation and determination of acids in—, and their extraction. H. Lüers and L. Adler. Z. Unters. Nahr. Genussm., 1915, 29, 281—316. Z. angew. Chem., 1915, 28, Ref., 381—382.

ACIDS are produced during the extraction of malt with water, owing to the action of enzymes, notably of phosphatase which decomposes organic phosphorus compounds into acid phosphates. The optimum temperature for the production of acids during extraction is 53° C.; after three hours at this temperature the maximum acidity is almost attained. Concentrations of hydrogen ions beyond the limits 10^{-6} and 4×10^{-7} ($pH=5$ and 6.4) retard the formation of acids. The enzymes can be destroyed by boiling ground malt or barley with alcohol; malt so treated gives rise to acids if it is mashed with addition of malt extract. To determine the pre-formed acids in malt or barley, 40 grms. of the finely ground material is heated with 40 c.c. of neutral 96% alcohol on a water-bath at 70°—80° C., then cooled, mixed with 150 c.c. of distilled water and 10 drops of toluene, and allowed to stand for at least 3 hours at the ordinary temperature, after which the mash is made up to 240 grms. and filtered, and the filtrate titrated. To determine the total acidity of extracts of barley or malt, 40 grms. of the finely ground material is mashed for 3 hours at 53° C. with 150 c.c. of water and 0.5 c.c. of toluene, then quickly cooled, made up to 240 grms. and filtered, and the filtrate titrated.—J. H. L.

Malt; Enzymes of—which produce polypeptides and amino-acids. L. Adler. Z. ges. Brauw., 1915, 38, 129—131, 137—142, 146—149, 153—155.

IN the preparation of malt worts the most favourable conditions for the formation of proteolytic products determinable by formalin-titration, i.e., polypeptides, amino-acids, and ammonia (see this J., 1914, 367), are a temperature of 46° C. and a concentration of hydrogen ions between the limits $pH=4.3$ and 5.0 . Even in mashes in which bacteria are not allowed to develop, small quan-

ties of these products continue to be formed after 24 hours; the greater part is, however, produced within the first 8 hours, during which time the acidity increases owing to the production of acid phosphates by phosphatase. Mashes which are allowed to acidify spontaneously (by bacterial action) at 46° C. only attain the optimum concentration of hydrogen ions after about 12 hours. The formation of amino-acids, and still more that of polypeptides, is strongly retarded by hydroxyl ions. In malt extracts made and filtered at about 1° C. the subsequent formation of amino-acids relatively to that of polypeptides is less than in the case of malt mashes; the author concludes that the production of amino-acids is in part the work of an endo-enzyme.—J. H. L.

Yeast: Top-fermentation—and its capacity for decomposing sugar in brewery fermentations. F. Schönfeld. Woch. Brau., 1915, 32, 167—169.

THE different races of top-fermentation yeasts show much greater differences in properties than the races of bottom-fermentation yeasts. Whilst the proportion of the total nitrogen of brewery worts which is assimilated under practical conditions in bottom fermentations ranges from 12 to 18% for dark beers and 18 to 23% for pale beers, the total range for top fermentations is about 20 to 42% (cp. this J., 1914, 658; 1915, 441). The reproductive powers of the yeasts show corresponding differences. Top-fermentation yeasts in general possess a high attenuating power; no bottom-fermentation yeasts could produce the degrees of attenuation common in English brewing. Yet on the other hand, certain races of top-fermentation yeasts, employed in the preparation of the least attenuated German beers (*Karamelbier*, *Malzbier*), sometimes show a degree of apparent attenuation more than 10% lower than that of the most weakly attenuated bottom-fermentation beer (Munich). The yeasts suitable for this purpose are the flocculent ones which rise rapidly. The highly-attenuating, strongly reproductive yeasts remain longer in suspension. The formation of yeast head at an early stage of fermentation is favoured by the presence of a relatively large amount of readily fermentable sugar in the wort. By the use of weakly-attenuating, flocculent top-fermentation yeasts it is possible so to conduct the fermentation of worts containing sucrose, that a large proportion, and in some cases the greater part of the sugar remains unfermented.—J. H. L.

Yeast enzymes; Stability of some—. A. Bau. Woch. Brau., 1915, 32, 141—143, 151—154, 159—162. (See also this J., 1915, 1025.)

FOUR yeasts of the Froberg type (three of them bottom-fermentation yeasts) which had been kept in a dry state for 5—18 years, gave positive results when tested for the presence of invertase, maltase, melibiase (only in the bottom-fermentation yeasts), emulsin, amygdalase, carboxylase, lipase, and endotryptase. Tests for trehalase, oxydase, zymase, catalase, reductase, and yeast rennet gave negative results.—J. H. L.

Fermentation of carbohydrates by living and dead yeast cells. H. Euler. Z. Gärungsphysiol., 1914, 5, 1—4. Z. angew. Chem., 1915, 28, Ref., 384.

EULER and Kullberg observed that the fermentative activity of dried yeast, unlike that of Buchner's pressed juice, was diminished by toluene (this J., 1911, 973). This fact is now explained by the observation that yeast which had been dried *in vacuo* and treated with alcohol still contained cells which appeared living when viewed under the microscope and tested with staining solutions.

They were killed by toluene in the same way as fresh yeast but were found incapable of reproduction. The author designates them "zymatic cells."—J. H. L.

Fermentation; Acceleration of—by certain materials. E. Moufang. *Allgem. Brauer- und Hopfen-Zeit.*, 1915, 55, 605—607. *Z. angew. Chem.*, 1915, 28, Ref., 384. (See also this J., 1913, 303.)

FERMENTATION is accelerated by dead yeast (*loc. cit.*) and by ordinary dried yeast, and also, though to a smaller extent, by moist wort sludge, hops, and lupulin. Constituents of wort sludge (*e.g.*, phosphates or hop-resins) may perhaps be the real accelerating agents, for the dead yeast employed was a brewing yeast. It is suggested that the so-called nutrient yeast may stimulate certain enzymic processes within the animal body.—J. H. L.

[*Brewing.*] *Changes which occur in the fermenting vessel, storage vat, and cask.* A. R. Ling. *J. Inst. Brew.*, 1915, 21, 512—531.

THE author reviews the present state of knowledge of the composition of brewery worts, the nutrition and metabolism of the yeast cell, and the influence of different yeasts on the secondary fermentation. Emphasis is laid on the essentially anaërobic nature of fermentation, though aeration appears to be necessary at the early stages of multiplication (*cp.* H. T. Brown, this J., 1914, 1103). Fermentations as conducted in this country may be divided into two phases: in the first the yeast lives an aërobic life and multiplies rapidly. The second phase ("cleansing stage") commences when the wort has attenuated to about half-gravity; the yeast continues fermentation under anaërobic conditions, gradually ceases to produce buds, and brings about the greater part of those transformations of nitrogenous substances on which the character of the beer largely depends. The dropping system of fermentation tends to produce beers deficient in palate-fulness and character, possibly because it provides opportunity for aeration during the second phase of fermentation and also removes from the wort insoluble nitrogenous matters which the yeast enzymes might transform into soluble substances of value to the beer. The use of copper finings (Irish moss or tannin) sometimes gives rise to poor yeast crops and defective character in beers, probably in consequence of removal of nitrogenous matters. The conclusions of Claussen (this J., 1901, 721) as to the part played by torulae in secondary fermentation are confirmed by the author, who isolated from a deposit in bottled Burton ale a torula which, when seeded into new beers or added in small quantities to pitching yeast, brought the beers into condition and produced a "stocky" flavour in the course of a few weeks. Some particulars are given relating to another organism, found frequently in deposits of bottled ales to which it imparts a flavour suggestive of toasted bread and an unpleasant bitterness. Under certain circumstances it gives rise to stench in bottled beers and "fret" (excessive condition) in ales, and it is provisionally designated *Saccharomyces fecidius* II, having many characters in common with the *S. fatidus* I described by Frew and Morris (this J., 1898, 561, 995). The cells are pointed at one end, and as isolated from beer deposits they are quite discrete, but as a rule each contains a single large vacuole. They are generally somewhat smaller than *S. cerevisiae*, but this depends on the conditions of culture; in wort a number of long elliptical cells frequently appear. Sporulation tests indicated greater similarity to *S. cerevisiae* than to any of the well-known wild yeasts, and it is suggested that the organism may be a degenerate form of this yeast. —J. H. L.

Wine; Degree of acidity of—. T. Paul. *Z. Elektrochem.*, 1915, 21, 80—89.

THE degree of acidity of a wine is defined as the concentration of hydrogen ions expressed in mgrms. per litre; it is a far more accurate measure of the acid character (flavour) of a wine than is the content of acids determined by titration. Determination of the degree of acidity by the decomposition of esters and by the inversion of sucrose gave concordant results, but the second method is preferred as, if carried out at 76° C., it only occupies about 3 hours. Application of this method to 79 German wines led to the following conclusions, all of which are in conformity with the known laws governing the influence of concentration and salts on the electrolytic dissociation of weak acids. The content of acids is no measure of the degree of acidity of a wine; the ratio between the two values varies widely in different cases. In general, wines rich in salts have a low degree of acidity. Dilution affects the degree of acidity far less than it does the acid-content determined by titration; the latter is inversely proportional to the dilution, but the former is only reduced to about $\frac{2}{3}$ of its original value by ten-fold dilution. In one case dilution of a wine with an equal volume of water increased the degree of acidity slightly, doubtless owing to increased dissociation of the acids in consequence of the lowered concentration of salts. Similar results were obtained with artificial solutions of acetic and tartaric acids containing salts of these acids. The separation of acid potassium tartrate increases the degree of acidity of wines though it diminishes their content of acids as determined by titration.—J. H. L.

Lactic acid; Manufacture of technical—(so-called "leather" lactic acid) by fermentation. W. Hoffmann. *Chem.-Zeit.*, 1915, 39, 525—526.

FERMENTATION lactic acid is mostly employed in the tanning and dyeing industries; it must be free from sulphuric acid and iron. Some pure form of saccharine material should be employed, together with nitrogenous and saline nutrients, preferably of organic origin. The most usual material is potato starch saccharified by malt, the mash being composed of 1200 kilos. of 80% starch and 125 of distillery malt. The mashing vessels are of iron, 10,000 litres in capacity, fitted with heating and cooling coils and mechanical stirrers. The vessel is half-filled with water heated to 45° C. and one-sixth of the charge of malt is stirred in. The starch is then added and the mash heated to 70° C. in 30 mins. It is next cooled to 56° C. and the main portion of the malt (grist or crushed green malt) added; saccharification is conducted for 4 hours at 55—56° C. with continuous stirring. The temperature is raised to 80° C. and the hot mash, at a volume of about 6000 litres, containing 10—11% of maltose, is distributed between two fermentation vats. The most suitable ferment is *B. Delbrückii*, selected from wort spontaneously acidified at 40—45° C. and propagated according to the principles of pure cultivation at 50° C. The last culture is developed for 4 days in the same 10% maltose wort under the same conditions as the main fermentation. The fermentation tuns are of wood or iron, well insulated and not more than 2 m. in height. In each tun is placed 225 kilos. of finest levigated chalk, which is "pasteurised" by the hot mash; the concentration of the liquid is adjusted to 10% of maltose by cold water. The temperature is reduced to 50° C. and falls to 48° C. on the introduction of the ferment-culture. Visible reaction starts after 6—8 hours and alarm thermometers are so arranged that the temperature can be kept between 47° and 56° C. The mash is stirred for 15 mins. every 2 hours. Tests are made at intervals to make sure that sufficient chalk is present,

as an acidity of 0.75 % of lactic acid will stop the fermentation. The risk of foreign infection increases with the time of fermentation: this must be conducted quickly so as to be complete in 6—8 days; the residual maltose should not exceed 2 grms. per litre. When tests indicate that the mash is ready, slaked lime is added till the solution is faintly alkaline, and the precipitate allowed to settle. The clarified liquid is run off and the precipitate drained in presses. The decomposition of the calcium lactate is effected in wooden or lead-coated iron chests with pure sulphuric acid, and the liquid filtered in presses, all contact with iron surfaces being avoided. The solution, containing 8—10 % of lactic acid, is decolorised with charcoal and evaporated in vacuum pans of bronze or of iron coated with lead. The time of boiling must be curtailed as much as possible to avoid formation of anhydride and a vacuum of 680 mm. at 55° C. maintained. The acid is prepared in two strengths: 50 % by weight (sp.gr. 1.14), a colourless mobile liquid, and 80 % (sp.gr. 1.20), a darker, thicker product. The final operation is the removal of iron by stirring the quickly cooled liquor from the vacuum pans in wooden chests for several days with the addition of a little potassium ferrocyanide; calcium sulphate and dextrins also separate. The acid is warmed slightly, passed through filter-presses under air pressure, and stored in tuns, while the residues, containing about 40 % lactic acid, are returned to the decomposing vessels.

—J. F. B.

Distilleries: Use of raw [beet] sugar in —. K. Windisch. Z. Spiritusind., 1915, 38, 121, 129. Z. angew. Chem., 1915, 28, Ref., 386. (See also Reinke, this J., 1915, 442.)

THE sugar is dissolved at 75° C. to destroy organisms, and the mash is acidified with 1—1.5 c.c. of concentrated sulphuric acid, free from arsenic, per kilo. of sugar. The mash should contain not more than 17 % or preferably 16 % of extract immediately after pitching. When sugar alone is used, ammonium chloride, added at the rate of 20—60 grms. per 100 litres of mash, forms a very convenient source of nitrogen for the yeast, but it is doubtful whether it permits the same yeast to be used repeatedly. The mash when pitched should be so warm that the maximum temperature of 30° C. is rapidly attained, and this temperature should be maintained throughout the greater part of the fermentation.—J. H. L.

[Distillery] fermentation; Complete — of fairly concentrated solutions of raw [beet] sugar by addition of mineral salts without other vegetable nutriment for the yeast. C. Nagel. Z. Spiritusind., 1915, 38, 122. Z. angew. Chem., 1915, 28, Ref., 387.

SOLUTIONS containing about 16 % of raw sugar ("first products") were successfully fermented after addition of 0.9 kilo. of ammonium sulphate, 0.3 kilo. of ammonium phosphate, 0.6 kilo. of potassium sulphate, 0.4 kilo. of crystallised magnesium sulphate, and 0.3 kilo. of burnt gypsum per 1000 litres of solution; 58.44 litres of pure alcohol and 7.81 kilos. of pressed yeast were obtained per 100 kilos. of raw sugar.—J. H. L.

Activity of other enzymes present in emulsin during the biochemical synthesis of glucosides of alcohols by β -glucosidase. Bourquelot and Aubry. See XX.

PATENTS.

Wort; Method of and apparatus for hopping and boiling —. H. J. Worssam, London. Eng. Pat. 820, Jan. 18, 1915.

THE wort is boiled in a closed copper having suitable pipe connections with a hop-back

situated above it, in which the hops are extracted at atmospheric pressure by circulation of boiling wort from the copper. The two vessels communicate by a wide vertical pipe extending from below the level of the wort in the copper to the upper part of the hop-back. Boiling wort is forced into the hop-back by the pressure of steam in the copper, and after draining through the hops it flows back into the copper through a second pipe, which is preferably provided with a non-return valve. The hop-back has a perforated false bottom to retain the hops; it is either open to the air or provided with a steam vent so that the hops are extracted at a temperature of about 100° C., though the wort in the copper may be at a higher temperature.—J. H. L.

Yeast; Apparatus for handling, skimming, and pressing —. W. Scott, Birmingham. Eng. Pat. 4637 of 1915; date of appl., Dec. 9, 1914. Addition to Eng. Pat. 21,925 of 1913 (this J., 1914, 978).

PRESSED yeast obtained as described in the principal patent is washed with cold water, either in the filter-press or after removal therefrom, in order to remove soluble fermentable matters and avoid subsequent deterioration arising from bacterial or other action.—J. H. L.

Beverages; Manufacture of stone ginger-beer and other non-intoxicating fermented —. A. E. Taylor, Manchester. Eng. Pat. 6552, May 1, 1915.

LACTOSE is added at any stage of manufacture of the beverages, preferably at the rate of 4—10 grains per fluid oz.—J. H. L.

[Brewing:] *Manufacture of Burton salts [for use in —].* R. Wahl, Chicago, Ill. U.S. Pat. 1,156,448, Oct. 12, 1915. Date of appl., June 13, 1914. Renewed Apr. 12, 1915.

A PRODUCT consisting mainly of calcium sulphate and sodium chloride is made by mixing calcium chloride with fused Glauber's salt. The resulting liquor may be separated from the product. Magnesium sulphate may also form one of the constituents.—J. H. L.

Spirit; Process for rectifying — in periodically working apparatus. C. Schiller, Riga, Russia. Eng. Pat. 16,474, July 10, 1914.

SEPARATE rectification of fore-shots and faints is avoided by introducing them into the column at suitable stages during the rectification of the next charge of crude spirit. There are thus obtained at each distillation, "ethers," first and second fore-shots, rectified spirit, first and second faints, and fusel oil; the "ethers," rectified spirit, and fusel oil are not further treated. Two main methods of working are described in detail. With crude spirit of low aldehyde-content, the charge is introduced directly into the still and the fore-shots and faints from the preceding distillation are led into the column at the commencement and near the end of the distillation process respectively. With crude spirit containing high proportions of aldehyde, the amount of water necessary for diluting the charge is first raised to boiling in the still and then the crude spirit (previously heated) is introduced into the column, where it loses the greater part of its lower boiling constituents before it reaches the still; the fore-shots and faints from the preceding distillation are afterwards led into the column. The advantages claimed for the process are saving of time, steam, and material, and suppression of carbon filtration.

—J. H. L.

Spirit: Denaturing—by means of petroleum.
E. Simonsen, Sköien, Norway. Ger. Pat.
285,190, Aug. 17, 1913.

SPRIT is treated with a small quantity of the distillate obtained from crude petroleum below 300° C.—J. H. L.

Bacteria and similar micro-organisms: Preparation of dry cultures of—. R. Markus. Ger. Pat.
283,882, Mar. 8, 1913.

DRY cultures of bacteria and similar micro-organisms are prepared by mixing pure cultures with sterilised, pure, amorphous silicic acid.—A. S.

XIXA. FOODS.

Catalase reaction of milk. H. B. Taylor. J. Roy. Soc. New South Wales, 1911, 48, 319—332.
J. Chem. Soc., 1915, 108, i., 920—921.

THE catalysis of hydrogen peroxide by the catalase of milk is a reaction of the first order, but the velocity constants vary very greatly with samples

for although these substances decrease the activity of the enzyme (decrease in K), yet they increase its stability (decrease in K_E , the rate of inactivation), and hence more hydrogen peroxide is actually decomposed with increasing concentrations of cyanide. The effect in these directions of hydrogen cyanide was about ten times as great as that of the equivalent amount of potassium cyanide. The catalase of milk appears to be analogous to that obtained from the blood.

Feeding stuffs; Character of the water-soluble nitrogen of some common—. E. B. Hart and W. H. Bentley. J. Biol. Chem., 1915, 22, 177—183.

THE plant materials examined when harvested green were dried at 37°—40° C., and then allowed to stand a number of days to become air dried. The aqueous extract was made by extracting 25 grms. of the material with successive small portions of hot water and filtering the extracts through linen; when nearly 500 c.c. of filtrate had been obtained, it was acidified with acetic acid, boiled, filtered, and the filtrate diluted to 500 c.c. This solution was used for the analysis. The results obtained were:—

	Total nitrogen.	As percentages of total nitrogen.				
		Water- soluble nitrogen.	Ammonia nitrogen.	Acid-amide nitrogen.	Amino-acid nitrogen.	"Rest-" nitrogen.
	%	%	%	%	%	%
Alfalfa (in blossom)	3.70	27.9	0.87	1.74	17.7	7.6
Red clover (in blossom)	4.53	18.2	0.35	0.35	9.9	7.6
Sweet clover (before flowering)	4.11	33.3	1.09	6.81	16.0	9.4
Rape (young, 1 ft. high)	4.51	36.0	2.30	4.52	14.7	14.5
Maize (1 ft. high)	3.78	34.6	0.52	2.64	17.9	13.6
Peas (in flower)	3.26	36.0	0.48	2.12	23.4	10.0
Oats (not flowered)	2.81	36.8	0.54	2.26	20.7	13.3
Oats (milk stage)	1.28	45.3	0.78	1.72	25.2	17.6
Barley (milk stage)	1.35	24.4	0.58	1.80	16.5	5.5
June grass (in flower)	1.73	16.3	1.50	1.28	11.4	2.1
Timothy (headed green)	1.48	25.9	0.26	1.34	17.1	7.2
Sugar beet (tuber only)	0.87	49.5	Trace	None	18.3	31.2
Rape (autumn growth)	4.44	29.2	1.47	4.22	10.3	13.2
Cabbage (small head)	3.28	34.3	1.72	8.3	13.0	11.3
Clover hay (mature)	2.53	9.3	None	None	4.2	5.1
Alfalfa hay (mature)	2.28	23.5	None	7.3	10.0	6.2

of milk of different ages, K having a maximum value when the milk is about twenty-two hours old. The initial increase is probably due to the production of catalase in the milk by bacteria derived from the udder or from the air, and the subsequent decrease to the inhibitive action of lactic acid. A catalase solution prepared from milk by precipitating the caseinogen with acetic acid, and the enzyme by adding alcohol to the filtered solution, and subsequently treating it with water in the presence of chloroform, readily decomposed hydrogen peroxide, and the rate of decomposition was proportional to the concentration of the enzyme. The reaction was not a typical first-order reaction, as increase in the concentration of the hydrogen peroxide caused a decrease in the value of K , showing that it has an inhibiting influence on the action of the enzyme. The value of the temperature-coefficient for the range 0°—15° C. is 1.47, a figure which agrees with that found by Senter for blood catalase. The optimum temperature is about 25° C. Experiments on the effect of increase of temperature and increase in concentration of hydrogen peroxide showed that the rate of inactivation of catalase is two and a-half times as fast at 15° C., and two hundred times as fast at 50°, as it is at 0° C. The effect of potassium cyanide and hydrogen cyanide on a dialysed solution of milk catalase is quite different from that of hydrogen peroxide,

By "rest"-nitrogen is meant the nitrogen constituting the difference between the total water-soluble nitrogen and the sum of the other nitrogen fractions. In the case of rape and oats, the "rest"-nitrogen contained from 30 to 40% of peptide nitrogen. The ammonia-nitrogen was determined by the Folin aeration method in the presence of magnesium oxide (see Denis, this J., 1910, 1476); acid-amide nitrogen by hydrolysis with hydrochloric acid and subsequent separation of the ammonia by the aeration method, the result giving the ammonia derived from the amides together with that present as such; amino-acid nitrogen by Van Slyke's nitrous acid method (this J., 1911, 771).—W. P. S.

Mace; Constituents of—. A. Tschirch and H. Sehlowsky. Arch. Pharm., 1915, 253, 102—109. J. Chem. Soc., 1915, 108, i., 930—931.
(See also Power and Salway, this J., 1908, 89, 1119.)

FINELY powdered mace was exhausted by light petroleum, alcohol, chloroform, and, finally, water. The brown oil contained in the first extract gave a large deposit of crystals on cooling. These were obtained, after forty to fifty crystallisations from alcohol, in colourless leaflets, m.p. 70° C. The compound was recovered unchanged after boiling with potassium hydroxide, and was found to be an acid of the oleic acid series. It is designated maeilenic acid, has the formula $C_{14}H_{26}O_2$, the

iodine value 111.03, and forms well-defined silver, barium, and potassium salts. The remaining oil was mixed with a little potassium hydroxide and submitted to steam distillation for a week. The residual liquid consisted of two layers, the supernatant one containing a small amount of the potassium salt of (?) myristic acid. Special search was made for glycerol, but none could be found. The authors believe that mace does not contain a true fat. When distilled under reduced pressure, the oil, freed from macilenic acid, gave a fraction, b.pt. 280°—290° C., which solidified on cooling, and crystallised in pearly scales, m.pt. 68° C. This is a saturated acid of the lanopalmitic series, designated macilolic acid. It has the formula $C_{20}H_{40}O_2$, and forms a silver salt. The alcoholic extract contained much colouring matter, waxes, and a colourless substance, m.pt. 76°—77° C. The chloroform extract contained a phytosterol, m.pt. 131° C., insoluble in alcohol, and a fairly pure colouring matter with deep reddish-yellow colour. The aqueous extracts were still yellow, and contained an amyloextrin of the formula, $6C_6H_{10}O_5 \cdot 2H_2O$.

PATENTS.

Beverage extracts ; Manufacture of — J. L. Kellogg, Battle Creek, Mich., U.S.A. Eng. Pat. 2472, Feb. 16, 1915.

A STARCHY material such as cereal flour is mixed with a diastatic material such as malt, made into a dough, moulded into loaves, and heated at 110°—160° F. (60°—70° C.) for 2 hrs. The loaves are then dried, sliced, coarsely ground, and roasted until the maltose formed during heating is caramelised. The material is then extracted with warm water, and the extract is concentrated in a vacuum and forced through a spray nozzle. The spray produced is dried by an air blast at 150°—250° F. (66°—120° C.), thrown against a baffle plate, and collected as a homogeneous powder. The soluble extract may also be prepared by starting with a mixture of roasted wheat, roasted bran, and molasses, which is extracted in a percolator with water at 50°—60° C.—J. H. J.

Milk and cream ; Process of manufacturing churned products [butter] from — C. E. Gray, Eureka, Cal. U.S. Pat. 1,155,055, Sept. 28, 1915. Date of appl., Dec. 31, 1912.

BUTTER is prepared by heating and agitating milk and cream under reduced pressure to remove free oxygen, and then cooling and churning the material in absence of oxygen. After the heating the material may be pasteurised and diluted to compensate for the amount of liquid volatilised.

—J. H. L.

Coagulant for milk ; Preparation of a — [from yoghurt bacteria]. M. Piorkowski. Ger. Pat. 285,226, Jan. 12, 1913.

THE coagulant contains as essential constituents the products of the vital activity of yoghurt bacteria. It is prepared by cultivating the bacteria for several weeks on a suitable nutrient medium, shaking the warm culture with a small quantity of hydrogen peroxide, twice in succession, and then separating the liquid from the bacteria, preferably by centrifuging. In an alternative process, the active substances are precipitated by adding ferric chloride to the bacteria culture suspended in physiological salt solution, and the precipitate subsequently decomposed.—A. S.

Milk containing iron and glycerophosphate ; Preparation of — G. Hönsch. Ger. Pat. 285,725, Dec. 5, 1913.

SKIMMED milk is heated with iron glycerophosphate, filtered, neutralised with sodium glyce-

phosphate, and mixed with whole or skimmed milk.—A. S.

Coffee beans ; Process and apparatus for roasting, especially for roasting — F. Lehnhoff-Wild and E. Passburg. Ger. Pat. 285,072, Aug. 11, 1912.

ROASTING is effected in a horizontal cylinder heated externally, into which superheated steam is introduced under diminished pressure. The cylinder is mounted so that it can be rotated and is provided with an axial inlet for superheated steam and with a trough passing through one end and extending partly through the cylinder in the centre. Outside the cylinder the trough is connected with a pipe, which in turn is connected with an outlet for the roasted material and with a condenser and air pump. During the roasting the trough is inverted, but subsequently it is turned through 180° and the roasted material removed by means of a screw conveyor rotating in the trough and the pipe connected therewith. The cylinder may be provided with an inner perforated casing, and the superheated steam admitted to the annular space between this and the wall of the cylinder.—A. S.

Jam ; Preparation of a substitute for — F. Sauer. Ger. Pat. 285,152, Sept. 1, 1912.

A MIXTURE of malt, potatoes, and vegetable albumin, especially malt albumin, is saccharified and then subjected to lactic acid fermentation, and evaporated. Insoluble proteins which are precipitated are separated from the wort, partially converted into albumoses by means of glycerophosphoric acid or an acid glycerophosphate, the acid neutralised, and the product mixed again with the wort.—A. S.

Coffee substitutes ; Method of manufacturing — J. H. Kellogg, Battle Creek, Mich., U.S.A. Eng. Pat. 495, Jan. 12, 1915.

SEE U.S. Pat. 1,133,037 of 1915 ; this J., 1915, 507.

Method of manufacturing radioactive mineral-water salts. Eng. Pat. 6671. See VII.

XIXB.—WATER PURIFICATION ; SANITATION.

Lime-sulphur solutions ; Comparison of the iodine titration and zinc chloride methods for the analysis of — R. C. Roark. J. Assoc. Off. Agric. Chem., 1915, 1, 76—93.

LIME-SULPHUR solution is a complex mixture containing calcium tetra- and pentasulphides, thiosulphate, sulphite, sulphate, bisulphide, and trisulphide (probably), small amounts of hydrogen sulphide and calcium hydrosulphide, traces of free calcium hydroxide, and appreciable quantities of oxysulphide compounds of variable composition. In the zinc chloride method (see Haywood, this J., 1914, 99) for determining the various forms of sulphur present, all compounds that can interfere with the titration of the thiosulphate sulphur (excepting traces of sulphite) are precipitated by the addition of ammoniacal zinc chloride solution, or are rendered inert by neutralising the filtrate with hydrochloric acid. In the iodine titration method such compounds appreciably affect the results obtained in the determination, particularly the result for thiosulphate sulphur. The quantity of calcium oxide calculated from the results obtained by either of the above methods does not agree with that found by actual determination ; the discrepancy is probably due largely to the presence of the oxysulphide compounds noted above.—W. P. S.

Lime-sulphur solution : Method for the analysis of —, S. D. Averitt. J. Assoc. Off. Agric. Chem., 1915, 1, 95—96.

THE sulphur precipitated when the lime-sulphur solution is titrated with iodine is collected and weighed : its weight gives the quantity of sulphide-sulphur present. The filtrate is acidified with hydrochloric acid, treated with barium chloride, and the turbidity produced compared with that obtained with a standard sulphate solution. Sulphite- and sulphate-sulphur are thus determined together. The results obtained by this method for total sulphur, *i.e.*, the sum of the sulphide-, thiosulphate-, and sulphate-sulphur, agree within 0.15% of the amount of total sulphur determined directly.—W. P. S.

PATENTS.

Water ; Purification, clarification, and sterilisation of —, W. E. Evans, London. Eng. Pats. 19,722, Sept. 12, 1911, and 1499, Jan. 29, 1915.

THE water is treated with sodium or magnesium hypochlorite in the proportion of 0.5–6 parts of available chlorine per million ; contact is maintained for $\frac{1}{2}$ –1 hour. Any trace of chlorine remaining is removed by adding 5 parts of ferrous sulphate for each part of available chlorine and filtering the water through permutoite or other base-exchanging material containing manganese. A thiosulphate, bisulphite, or sulphite may be used along with the ferrous sulphate to lessen the amount of iron required. In the case of highly impure waters, a precipitating reagent, such as alumina-ferrous or alum, may be used before or after chlorination.—J. H. J.

Tanks ; Water or septic —, R. H. Annison, London. Eng. Pat. 20,604, Oct. 6, 1914.

A SHELL is formed by driving sheet piling into the ground, and the interior excavated and braced. A floor of cement and roof of reinforced concrete are provided, the walls are surfaced with cement or concrete, and cement grouting is forced between the shell and the soil.—W. F. F.

Refuse ; Furnaces for reducing and sterilising town —, H. J. Pocock, London. Eng. Pat. 5206, Apr. 6, 1915.

THE material is fed by a vertical shoot into a furnace, the lower end of which opens over a plumbago crucible, insulated by asbestos, the sides of which have the shape of a parabolic curve in longitudinal section. An exhaust gas chamber surrounds the furnace ; an annulus surrounds the middle portion of the exhaust chamber and supplies heated air under pressure to two sets of tuyères, inclined downwards and converging to a point above the focus of the parabolic curve of the crucible. Radial passages connect the interior of the furnace with the exhaust chamber, and the upper part of the furnace is water-jacketed.

—J. H. J.

Disinfecting and fire-extinguishing : Manufacture of preparations for —, R. Zimmermann. Ger. Pat. 286,271, June 25, 1914.

DIAZO-DERIVATIVES of aromatic sulpho-compounds are partially dried at a low temperature, upon an inert support, and then mixed with an inert, non-volatile substance ; or the wet diazo-compound may be mixed with a non-volatile substance and the mixture dried ; or the partially dried diazo-compound may be mixed with an inert, volatile substance, which will volatilise when the diazo compound is subsequently decomposed. For example, 600 grms. of 1,4-diazonaphthalene-sulphonic acid containing 3% of water is mixed

with 100 grms. of kieselguhr also containing 3% of water ; or kieselguhr may be added to a solution of naphthionic acid, the latter diazotised, the liquid removed with the aid of suction, and the residue washed, centrifuged, and dried at 45 °C. The products burn quietly and yield gases and vapours possessing disinfecting and fire-extinguishing properties.—A. S.

Sewage, garbage, and the like ; Process and machine for treating —, J. J. Smith, Brookline, Mass., U.S.A. Eng. Pat. 24,738, Dec. 29, 1914.

SEE U.S. Pat. 1,123,411 of 1915 ; this J., 1915, 197.

Refuse organic matter ; Apparatus for the production of valuable products from —, T. Craney, Bay City, Mich., U.S.A. Eng. Pat. 4922, Mar. 30, 1915.

SEE U.S. Pat. 1,140,502 of 1915 ; this J., 1915, 732.

Production of base-interchanging substances [water softeners]. Eng. Pat. 20,145. See VII.

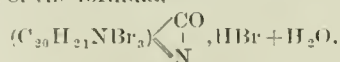
Paints for preventing the growth of lower vegetable or animal organisms. Ger. Pat. 285,225. See XIII.

Paint to prevent the growth of lower animals or plants. Ger. Pat. 285,261. See XIII.

XX. —ORGANIC PRODUCTS ; MEDICINAL SUBSTANCES ; ESSENTIAL OILS.

Strychnine and brucine ; Derivatives of —, R. Ciusa and L. Vecchiotti. Atti R. Acad. Lincei, 1914, [v], 23, ii, 180–183. J. Chem. Soc., 1915, 108, i, 893.

THE compound, $C_{23}H_{23}O_2N_2Br_4$, obtained by the action of bromine on isostrychnine in acetic acid solution and treatment with boiling alcohol of the perbromide thus formed (compare Ciusa and Scagliarini, this J., 1913, 840) is now shown to be the hydrobromide of a base. The free base, $C_{20}H_{21}NBr_3 \cdot (NH) \cdot CO_2C_2H_5$, forms minute, colourless needles, and decomposes without melting. Its aurichloride, $C_{23}H_{21}O_2N_2Br_3 \cdot HAuCl_4$, forms slightly soluble, yellow needles, and its hydrobromide exerts a physiological action similar to that of strychnine. Decomposition of isostrychnine perbromide with dilute sodium carbonate (*loc. cit.*) and then with dilute ammonia yields a hydrobromide of the formula,



which forms yellow scales.

Emulsin ; Activity of other enzymes present in —, during the biochemical synthesis of β -glucosides of alcohols by β -glucosidase. E. Bourquelot and A. Aubry. Comptes rend., 1915, 161, 163–166. (See this J., 1915, 159.)

THE emulsin of almonds contains β -glucosidase, lactase, β -galactosidase, gentiobiase, and cellobiase or cellase, and in the synthesis of β -glucosides by means of emulsin the main reaction is probably accompanied by the synthesis of gentiobiose and cellobiose. In a series of experiments, aqueous dextrose solutions containing from 10 to 70 grms. per 100 c.c. were treated with emulsin and left at the ordinary temperature until no further change in optical rotatory power occurred. The magnitude of the change varied directly with the original concentration of the sugar solutions ; for the solution containing 70 grms. per 100 c.c. it corresponded to the conversion of 19.5% of the dextrose into gentiobiose or 40.9% into cellobiose, but probably both reactions took place. In similar experiments with dextrose solutions containing

acetone, the change in rotation was found to depend only on the relative proportions of sugar and water, the acetone having no influence. It is probable that alcohols are also without influence on the equilibria produced by gentiobiase and cellobiase. In employing emulsin for the synthesis of β -glucosides, especially those of the polyhydric alcohols, which crystallise with difficulty, it is advisable to work with solutions in which the proportion of dextrose, relative to the volume of dextrose and water, irrespective of other substances, does not exceed 15–20 grms. per 100 c.c.

—J. H. L.

Calotropis gigantea: The root bark of —. E. G. Hill and A. P. Sirkar. Chem. Soc. Trans., 1915, 107, 1437–1442.

FOUR kilos. of the root bark of *Calotropis gigantea* was thoroughly extracted with boiling 98% alcohol and the extract concentrated and cooled, when an oil and a white nodular solid separated, whilst the residue on evaporation to dryness yielded a substance like guttapercha and a small quantity of a yellow bitter principle, soluble in water. The white substance on fractionally crystallising from hot alcohol was separated into mudarol isovalerate, white nodular crystals, m.pt. 140° C., and akundarol isovalerate, white needle-shaped crystals, m.pt. 210° C., which gave on hydrolysis two new monohydric alcohols, respectively, mudarol, $C_{30}H_{48}O_2$, m.pt. 176° C., crystallising from a mixture of alcohol and ether in hexagonal plates, and akundarol, $C_{38}H_{62}O_2$, m.pt. 215° C., crystallising in needles. Mudarol and akundarol on oxidation with chromic acid are converted into mudaric acid, m.pt. 225° C., and akundaric acid respectively. Both these alcohols and their isovalerates give colour reactions very similar to those of cholesterol and phytosterol. No crystalline derivative could be isolated from the guttapercha-like substance and no alkaloid could be isolated, although the yellow bitter principle gave the usual alkaloidal reactions.—T.C.

Ginseng: Chemical composition of Korean —. H. Kondo and Tanaka. J. Pharm. Chim., 1915, 12, 292–293.

GINSENG yields 47.66% of aqueous extract, 25.66% of methyl alcohol extract, and 0.68% of ether extract. The aqueous extract contains a substance which, when oxidised with nitric acid, yields a considerable quantity of mucic acid. The ether extract consists of an oily substance which may be separated by steam distillation into two fractions; one of these is volatile, has an odour of ginseng, and contains a terpene, whilst the other is non-volatile and consists of a mixture of a phytosterol, m.pt. 133° C., $[\alpha]_D = +29.1^\circ$, and an amorphous acid, m.pt. 150°–156° C. The methyl alcohol extract contains sucrose, a small quantity of a nitrogenous substance, and a glucoside belonging to the saponin group. This glucoside, m.pt. about 220° C., yields dextrose, a pentose, and a saponenin on hydrolysis.—W. P. S.

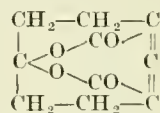
Toxins: Reaction of the medium and filtration of —. E. Aubel and H. Colin. Comptes rend., 1915, 161, 506–508.

EXPERIMENTS with diphtheritic toxin and dysenteric endotoxin showed that when the medium was alkaline during filtration, the filtrate was more active than that obtained when the medium was acidified and then filtered. Extracts prepared by allowing the bacteria to grow in alkaline media were also more active than those obtained from neutral or acid cultures.—W. P. S.

Anemonin: Constitution of —. Y. Asahina. J. Pharm. Chim., 1915, 12, 293–294.

ANEMONIN (see this J., 1914, 910) is a lactone;

it reduces ammoniacal silver nitrate solution and also Fehling's solution, and yields a condensation product with phenylhydrazine. Oxidation of the potassium salt of anemonic acid produces acetone-diacetic acid. It is concluded that anemonin is the dilactone of cyclo-octanonodienedicarboxylic acid:



By saponification of the lactonic nucleus, the two ketonic acids, anemonic acid and anemoninic acid, are obtained.—W. P. S.

Vaccines: Sterilisation of —. F. E. Taylor. J. Hygiene, 1915, 15, 163–168. J. Chem. Soc., 1915, 108, i., 922.

STERILISATION by heating is recommended; even boiling does not destroy the antigenic and immunising powers of staphylococcal vaccines. Less satisfactory results are obtained by the addition of antiseptics, and exposure to ultra-violet rays is not always effective.

Clove oil: Direct determination of — by distillation with steam. J. Hortvet. J. Assoc. Off. Agric. Chem., 1915, 1, 154–157.

A MODIFICATION of Reich's method (this J., 1909, 1165) is recommended. The apparatus used consists of a 350 c.c. flat-bottomed flask having an elongated wide neck into which is fitted a 75 c.c. cylindrical flask provided with a siphon-shaped side tube. The latter flask is fitted with a small tapped funnel and a delivery tube with a safety-bulb leading to a condenser. Two grms. of the spice is placed in the inner flask together with 25 c.c. of a 20% sodium chloride solution, and 250 c.c. of the sodium chloride solution is introduced into the outer flask. Heat is applied, a side tube on the outer flask being left open, until the solution begins to boil; the side tube is then closed and a current of steam is passed through the mixture of spice and sodium chloride in the inner flask. Distillation is continued until 250 c.c. of distillate has collected. The distillate is shaken with 35 c.c. of ether, the ethereal solution separated, the aqueous solution extracted with three further quantities (25, 15, and 10 c.c.) of ether, the united ethereal solutions are washed twice with water, then evaporated at ordinary temperature, and the residue of oil is weighed. The results obtained are lower than those obtained by the official (American) method, the difference varying from 0.24 to 2.78%.—W. P. S.

Cadier [Juniperus oxycedrus]: Preparation and physical properties of the essential oil of —. R. Huerre. J. Pharm. Chem., 1915, 12, 273–283.

THE essential oil is obtained by submitting the wood to prolonged steam distillation. The yield of oil appears to depend on the time of year the wood is gathered; in September it is 1.6%, and in March, 1.6 to 2.4%. The wood should be distilled soon after it is gathered, or loss of essential oil takes place. The physical properties of the oil have been recorded previously (this J., 1914, 940); the b.pt. is 260°–300° C. at 760 mm., not 330°–360° C., as previously stated. The oil is best rectified by steam distillation under reduced pressure. The distillate, amounting to 70% of the crude oil, consists of a clear yellow oil having a penetrating odour, whilst the residual oil is dark coloured, viscous, and has but a faint odour.—W. P. S.

Cymbopogon senaarensis Chiov.: The volatile oil of —, O. D. Roberts. Chem. Soc. Trans., 1915, 107, 1465—1470.

THE Sudanese grass, "Mahareb" (*Cymbopogon senaarensis* Chiov.), on distillation in a current of steam yielded 1.2% of a pale yellow oil having a pleasant odour resembling that of pennyroyal oil, and the following characters: sp.gr. at 15° C., 0.9122; $\alpha_D^{20} = +29^\circ 38'$; acid value, 4.2; ester value, 14.5; ester value after acetylation, 62.1. The oil consisted of terpenes, including *d*-limonene and probably pinene, 13.0%; ketones, chiefly or entirely Δ^1 -menthenone, 45%; a sesquiterpene-alcohol, $C_{15}H_{26}O$, b.pt. 280°—285° C., sp.gr. at 15° C., 0.9544, $\alpha_D^{20} = +10^\circ 48'$, 25%; an unidentified alcohol of rose-like odour, 3.0%; phenolic substances, 0.2%; acetic, octoic, and decolic acids, both free and as esters, and palmitic acid as ester, 2.0%; sesquiterpenes, 11.8%. The sesquiterpene-alcohol on dehydration with phosphoric oxide and then with sodium, gave a sesquiterpene, $C_{15}H_{24}$, b.pt. 150°—155° C. at 27 mm., sp.gr. at 15° C., 0.9114, $\alpha_D^{20} = +21^\circ 24'$. —T. C.

Eudesmin and its derivatives. R. Robinson and H. G. Smith. J. Roy. Soc. New South Wales, 1914, 48, 449—463. J. Chem. Soc., 1915, 108, i., 890.

Eudesmin, $C_{22}H_{36}O_6$, occurs in the kinos of eucalyptus species, the oils of which are characterised by the absence of phellandrene, and the presence of cineol and pinene. It was isolated by extracting a syrupy aqueous solution of the kino with ether, and purified by treatment with chloroform and crystallisation from methyl alcohol. It forms colourless, prismatic needles, m.pt. 107° C., $[\alpha]_D^{20} = -61.4^\circ$ (in chloroform solution). Eudesmin contains four methoxy-groups, and is unacted on by hydroxyl or ketone reagents. It dissolves in sulphuric acid to a red solution, and is converted by nitric acid into dinitro-eudesmin, colourless, slender needles, m.pt. 211° C. Boiling with concentrated nitric acid converts it into 4,5-dinitroveratrole (2 mols.). Dichloro-eudesmin, obtained by the action of chlorine on eudesmin in acetic acid solution, forms colourless, rectangular plates, m.pt. 163° C. Dibromo-eudesmin, prepared in a similar manner, forms colourless needles, m.pt. 172° C., $[\alpha]_D^{20} = +69.4^\circ$ (in chloroform), which on oxidation with permanganate gives 6-bromoveratric acid, m.pt. 181° C. Diiodo-eudesmin, prepared by the action of iodine monochloride, forms needles, m.pt. 175° C.

Ethyl bromide; Preparation of —. F. E. Weston. Chem. Soc. Trans., 1915, 107, 1489—1490.

YIELDS of ethyl bromide, amounting to 85% of the theoretical, calculated either on the alcohol or the bromide used, are obtained by the following modified method: To a mixture of 1 mol. of alcohol, 1 mol. + 5% excess of sulphuric acid (sp. gr. 1.84), and 5—10% of water, 1 mol. of sodium bromide in coarse powder is added. The mixture is carefully heated on a water bath, allowing the temperature to rise very gradually to 100° C., and when the evolution of ethyl bromide slackens at this temperature a sand bath is substituted and the temperature is once more slowly raised until nothing more distils. The ethyl bromide is collected as usual under water; 99% of the washed and dried crude product will distil between 38.5° and 39.5° C. —G. F. M.

Tri-mercuric-dithio salts. Denigès. See VII.

PATENTS.

Di(hydroxy)oxydiamino-arseno-benzene; Manufacture of preparations of —. O. Imray, London. From Farb. vorm. Meister, Lucius, und Brünig, Hoechst, Germany. Eng. Pat. 21,152, Dec. 16, 1914.

A SOLUTION of 47½ grms. of 4,4'-dihydroxy-3,3'-diamino-arsenobenzene in 200 c.c. of water, with 40 c.c. of 10N caustic soda is mixed with 17.2 grms. of mannitol in 100 c.c. of water, and precipitated with 8 litres of alcohol-ether (1:1). A yellow powder, stable if kept from air, is obtained, which is probably only an intimate mixture of the alkali salt of the arsenobenzene derivative and the mannitol. Other polyhydric alcohols, containing more than 3 hydroxyl groups, such as erythritol, give similar compounds.

—B. V. S.

Bismethylhydrazinotetra-aminoarsenobenzene; Preparation of a —. C. F. Boehringer und Söhne, Mannheim-Walldorf, Germany. Ger. Pat. 285,573, Dec. 12, 1912.

WHEN 3,5-dinitro-4-methylnitraminobenzene-1-arsinic acid is reduced with stannous chloride and hydrochloric acid, at a temperature not exceeding about 50° C., a hydrazine derivative, $NH_2.(CH_3)N.C_6H_2(NH_2)_2AS : AS.C_6H_2(NH_2)_2.N(CH_3).NH_2$ is formed, which exhibits a pronounced trypanocidal action. —A. S.

Amino-substituted arseno-compounds; Preparation of —. Farb. vorm. Meister, Lucius, und Brünig. Ger. Pat. 286,432, Oct. 23, 1913. Addition to Ger. Pat. 206,456 (this J., 1909, 328).

NITRO- or polynitroarylarinic acids or their derivatives, other than those mentioned in Ger. Pat. 271,894 (this J., 1914, 568), or the corresponding arsenoxides or arseno-compounds, are reduced by means of hypophosphorous acid and potassium iodide or hydriodic acid, if necessary with addition of acetic acid. —A. S.

2-Chloro-4-dimethylaminobenzene-1-arsinic acid; Preparation of —. C. F. Boehringer und Söhne, Mannheim-Walldorf, Germany. Ger. Pat. 286,546, Feb. 4, 1913.

2-CHLORO-4-DIMETHYLAMINO BENZENE-1-ARSEN-OXIDE, obtained by treating *m*-chlorodimethylaniline with arsenic trichloride, is oxidised to 2-chloro-4-dimethylaminobenzene-1-arsinic acid by means of hydrogen peroxide, potassium permanganate, or mercuric oxide. It possesses greater therapeutic activity than the corresponding non-halogenated compound, whilst it is less poisonous. —A. S.

Amino-substituted arylarsinic acids; Preparation of —. C. F. Boehringer und Söhne, Mannheim-Walldorf, Germany. Ger. Pat. 286,547, Jan. 14, 1914.

NITROARYLARINIC acids, in solution or suspension, are reduced by hydrogen in presence of metals or compounds capable of acting as catalysts, and if necessary, under pressure. After filtering off the catalyst, a solution of the pure amino-arylarinic acid is obtained. —A. S.

Cancer vaccine; Process for the preparation of a —. A. P. L. van Langeraad, The Hague, Holland. Eng. Pat. 8043, May 31, 1915. Under Int. Conv., June 15, 1914.

FRESH mammary gland or gland lobe, free from blood, connective tissue, etc., is disintegrated and thoroughly dried *in vacuo* at 45° C. It is then powdered, freed from fat, washed with 0.1% sodium phosphate solution, and dissolved in $\frac{1}{2}$ % caustic soda. This solution is filtered successively

through filter-cloth, cotton-wool, and filter-candles, and rendered slightly acid with $\frac{1}{2}\%$ phosphoric acid. The precipitate is drained off and pressed and again dissolved in $\frac{1}{2}\%$ caustic soda. From this solution, on standing about 3 weeks, fibrin separates, leaving a clear liquid; it is preferable, in order chiefly to avoid racemisation, to hasten this separation by further dilution, by heating at 56°C ., and by keeping in vessels with large inner surfaces. The resulting clear filtrate is a solution of nucleo-protein, free from impurities, such as trioxypurine, fibrin, etc., which interfere with the physiological action of the vaccine. After partial concentration *in vacuo* and careful neutralisation by hydrochloric acid, the solution may be used directly for injection purposes, or the nucleo-protein may be separated by aid of phosphoric acid, the powder being quite stable if kept dry.

—B. V. S.

Nicotine from tobacco material: Method and apparatus for extracting —. R. G. Mewborne, Louisville, Ky., Assignor to The Kentucky Tobacco Product Co. U.S. Pat. 1,156,609, Oct. 12, 1915. Date of appl., July 8, 1912.

THE finely divided material is caused to traverse a long, horizontal chamber through which superheated steam is passed in the opposite direction. The chamber is kept at a temperature sufficient to prevent condensation on the material, which is maintained in a suspended or cloud form by means of agitators. The steam issuing from the chamber is condensed and treated to recover nicotine and other constituents.—W. E. F. P.

Urethanes and diurethanes: Preparation of compounds of — with metallic bromides. Gehe und Co. A.-G. Ger. Pat. 284,734, May 14, 1913.

DOUBLE compounds are obtained by heating urethanes (4 mols.) for several hours with calcium bromide or strontium bromide (1 mol.) in a suitable solvent. The products, especially the double compound of calcium bromide and ethylurethane (ethyl carbamate), $\text{CaBr}_2 \cdot 4\text{CO}(\text{NH}_2)\text{OC}_2\text{H}_5$, are powerful hypnotics and useful for the treatment of nocturnal epilepsy, having no deleterious action on the heart or on respiration.—A. S.

Urethanes of phenol-glycerol ethers: Preparation of —. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 284,975, Sept. 2, 1913.

PHENOL-GLYCEROL ethers, in which the phenol group may be replaced by homologues or substitution products, are converted into simple or substituted urethanes by the usual methods. Suitable raw materials are phenol-glycerol ether, 2-chloro-4-cresol-glycerol ether, and *aa*-diphenol-glycerol ether. The resulting urethanes possess both analgesic and antipyretic properties.—A. S.

Acyl compounds of anthranilic acid, its homologues, and derivatives: Preparation of —. F. Hoffmann-La Roche und Co. Ger. Pat. 281,735, Sept. 2, 1913.

COMPOUNDS of value for therapeutic purposes, e.g., for causing an increased secretion of uric acid, are obtained by the interaction of salicylic acid chloride with anthranilic acid or one of its homologues or derivatives.—A. S.

Phosphorus compounds of derivatives of higher fatty acids: Preparation of —. F. Hoffmann-La Roche und Co. Ger. Pats. (A) 281,736, July 31, 1914, (B) 285,991 and (C) 286,515, Apr. 26, 1914.

(A) KETO-FATTY acids of high molecular weight or their derivatives are treated with phosphorus trichloride, and the products are saponified. The oxyphosphinic acids described in Ger. Pat. 281,801

(this J., 1915, 735) are obtained, in this way, in a shorter time, in a purer condition, and in higher yields than when phosphorous acid is used. (B) The oxyphosphinic acids prepared as described in Ger. Pat. 280,411 (this J., 1915, 452) are esterified by the usual methods. (C) The oxyphosphinic acids prepared as described in Ger. Pat. 281,801 (*loc. cit.*) are esterified.—A. S.

Cholic acid: Preparation of a [cobalt] salt of —.

Knoll und Co. Ger. Pat. 284,762, Oct. 21, 1913.

COBALT cholate is prepared by the interaction of an alkali cholate and a cobalt salt, or by other methods commonly used for preparing salts. It has the formula, $(\text{C}_{21}\text{H}_{35}\text{O}_5)_2\text{Co}$, is insoluble in ether, benzene, and chloroform, and soluble with difficulty in alcohol; it readily swells in water but dissolves with difficulty. It shows disinfecting properties when administered internally, and, in therapeutic doses, has no injurious action on the mucous membrane of the stomach.—A. S.

Cholic acid compound: Preparation of a tasteless —. Farbenfabr. vorm. F. Bayer und Co.

Ger. Pat. 285,828, Mar. 19, 1914.

A PRODUCT which increases the flow of bile in the same way as cholic acid does, and which also acts as a bile-disinfectant, is obtained by treating cholic acid with acetic-formic anhydride or a mixture of acetic anhydride and formic acid.—A. S.

Silver glycocholate compound, easily soluble in water: Preparation of a —. Farbw. vorm. Meister.

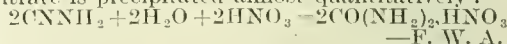
Lucius, u. Brüning. Ger. Pats. (A) 284,998, Jan. 30, 1914, and (B) 284,999, Feb. 15, 1914.

(A) SILVER glycocholate is converted, by treating with ammonia, into a readily soluble compound suitable for therapeutic use. (B) A compound, easily soluble in water, is obtained by the interaction of silver oxide and ammonium glycocholate or of glycocholic acid and an ammoniacal solution of silver oxide.—A. S.

Urea nitrate from cyanamide: Preparation of —.

Oest. Ver. f. chem. und metall. Produktion. Ger. Pat. 285,259, Jan. 11, 1914. Under Int. Conv., Mar. 19, 1913.

BY the interaction of cyanamide and nitric acid in concentrated solution below 20°C ., urea nitrate is precipitated almost quantitatively:



—F. W. A.

Esters of orthosilicic acid with polyhydric alcohols: Preparation of —. L. Knorr and H. Weyland.

Ger. Pat. 285,285, Mar. 22, 1914.

SILICIC acid esters of polyhydric alcohols are prepared by the interaction of simple esters of silicic acid, such as the tetramethyl or tetra-ethyl ester, with polyhydric alcohols. The glycol and glycerol esters of orthosilicic acid, in which all of the alcoholic hydroxyl groups are esterified, are insoluble in water, but the primary esters and the secondary glycerol ester are soluble. They are all quite stable when dry. Most of them, especially the primary esters, are very hygroscopic. Therapeutic experiments have shown that even the insoluble esters are resorbed to a considerable extent.—A. S.

Pyrimidine derivatives: Preparation of —. S. J.

Thannhauser. Ger. Pat. 285,286, Apr. 25, 1914.

DIAMINOPYRIMIDINES are treated with sugars or similar substances containing an aldehyde group or with the carboxylic acids obtained by oxidation of such sugars. Compounds similar to glucosides are formed, which are of value as intermediate products for the preparation of medicinal substances.—A. S.

Ether-like derivatives of barbituric acid; Preparation of —. Chem. Werke vorm. H. Byk, Oranienburg, Germany. Ger. Pat. 285,636, Sept. 17, 1912.

ALKYLALKOXYALKYL- or dialkoxyalkyl-malonic acids or their derivatives are converted into the corresponding CC-alkylalkoxyalkyl- or dialkoxyalkylbarbituric acids by the methods usually employed for the preparation of barbituric acid or its substitution products. For example CC-bis-[β -ethoxyethyl]-barbituric acid is obtained from ethyl malonate, sodium ethoxide, β -iododiethyl ether, and urea; and C-ethyl-C-[β -ethoxyethyl]-barbituric acid from ethyl malonate, sodium ethoxide, β -iododiethyl ether, ethyl iodide, and urea. The new products are less toxic than CC-diethylbarbituric acid.—A. S.

Carbonate of sodium 2-phenylquinoline-4-carboxylate; Preparation of —. Chem. Fabr. auf Actien. vorm. E. Schering. Ger. Pat. 285,499, Dec. 28, 1913.

A COMPOUND of the formula, $C_{16}H_{10}NO_2Na + C_{16}H_{11}NO_2 + H_2CO_3$, which possesses advantages over 2-phenylquinoline-4-carboxylic acid or its sodium salt, for therapeutic purposes, is obtained by the interaction of sodium 2-phenylquinoline-4-carboxylate and carbonic acid, of 2-phenylquinoline-4-carboxylic acid and sodium carbonate or bicarbonate, or of 2-phenylquinoline-4-carboxylates and sodium bicarbonate.—A. S.

ω -Aminoalkylquinolines; Preparation of —. Verein. Chininfabr. Zimmer und Co. Ger. Pat. 285,637, Dec. 9, 1913. Addition to Ger. Pat. 279,193 (this J., 1915, 303).

OXIMES of quinolyalkyl ketones of the general formula, $R_1R_2C:NOH$, where R_1 is a quinoline or substituted quinoline residue, and R_2 an alkyl or substituted alkyl group, are reduced by the usual methods to the corresponding ω -aminoalkylquinolines.—A. S.

Basic dyestuffs of the acridine and safranin series; Preparation of compounds of —. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 285,500, Feb. 7, 1911.

BASIC dyestuffs of the acridine or safranin series or their salts are converted into gallocarboxylic acid salts of the dyestuffs by the usual methods. The products are useful for the treatment of diseases caused by trypanosomes.—A. S.

Mercury compounds of the safranin series; Preparation of complex —. Saccharinfabr. A.-G. vorm. Fahlberg, List und Co., Magdeburg, Germany. Ger. Pat. 286,097, Mar. 10, 1911.

PHENOSAFRANINE and its homologues when treated with mercuric salts form complex mercury compounds, from which the mercury is not removed by treatment with alkalis, and which are of value for therapeutic purposes. The compound from "tryposafrol," a homologue of phenosafranin, possesses a greater trypanocidal action than "tryposafrol" itself.—A. S.

Mercury preparations; Manufacture of therapeutically active, colloidal —. Kalle und Co. Ger. Pat. 286,114, Feb. 5, 1911.

SOLID colloidal mercuric oxide is obtained by adding a mercuric salt and alcohol to a mixture of caustic soda solution and an aqueous solution of a protein (e.g. gluten), gum, dextrin, or vegetable mucilage. Colloidal mercury is obtained by reducing a mercuric salt with pyrogallol or other polyhydric alcohol in presence of a protein, gum, or the like as protective colloid, and then precipitating with alcohol. The products form colloidal solutions with water and are specially

suitable for intravenous injection and for the preparation of ointments.—A. S.

Purine derivatives; Preparation of salt-like double-compounds of the ω -methylsulphonic acid of the p -aminophenyl ester of salicylic acid with —. I. Abelin, E. Bürgi, and M. Perelstein. Ger. Pat. 285,579, May 18, 1913.

The compounds are obtained by treating basic purine derivatives, such as 1,3,7-trimethyl- or 1,3-dimethyl-2,6-dioxypurine, with an alkali salt of the ω -methylsulphonic acid of the p -aminophenyl ester of salicylic acid, or by treating the free methylsulphonic acid with an alkali compound of the purine derivative. They are easily soluble in water to neutral solutions and are of value for therapeutic purposes.—A. S.

3-Methylbutinol and its homologues; Preparation of —. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 285,770, Nov. 22, 1913.

3-METHYLBUTINOL and its homologues are obtained by the interaction of alkali compounds of acetylene or its homologues with acetone or its homologues in presence of an inert solvent.—A. S.

Esters of hydrazinemonocarboxylic acid; Preparation of —. E. Merck. Ger. Pat. 285,800, Feb. 12, 1914.

ESTERS of hydrazinemonocarboxylic acid are prepared by the interaction of equimolecular proportions of hydrazine hydrate and an ester of carbonic acid.—A. S.

Cannabis indica; Separation of the pharmacologically active constituents of —. F. Hoffmann-La Roche und Co. Ger. Pat. 285,829, Dec. 5, 1913.

AN extract prepared from *Cannabis indica* by the use of an organic solvent, immiscible with water, e.g., a mixture of petroleum spirit and ether, is treated with dilute alkali, with exclusion of air, and the constituents respectively soluble and insoluble in alkali are isolated separately. The portion soluble in alkali does not produce any pronounced symptoms similar to those produced by hashish, but in large doses acts as a narcotic. From the residue left on evaporating the petroleum spirit-ether solution, after treatment with alkali, a viscous oil, having properties similar to those of Fränkel's cannabinal, can be obtained by distilling at 220° C. and 1 mm. pressure.—A. S.

Ethyl acetate from acetaldehyde; Manufacture of —. Consortium für Elektrochem. Ind. Ges. m.b.H. Nürnberg, Germany. Ger. Pat. 285,990, Jan. 31, 1911. Addition to Ger. Pat. 277,111.

IN preparing ethyl acetate from acetaldehyde by the method described in the chief patent (see Eng. Pats. 26,825 and 26,826 of 1913; this J., 1914, 666), better results are obtained by using the catalyst in the form of a solution, preferably in ethyl acetate.—A. S.

Phenolphthalein and alkali carbonates; Preparation of compounds of —. A. von Sztankay and C. Geyer. Ger. Pat. 286,020, June 27, 1913.

PHENOLPHTHALEIN is treated at the ordinary temperature with a concentrated aqueous solution of an alkali carbonate. The phenolphthalein may be used in the form of a solution in alcohol or other organic solvent, or it may be dissolved in alcohol, reprecipitated by addition of water, and the suspension of finely divided phenolphthalein used. Compounds of the type, $2C_{20}H_{14}O_4 \cdot 6Na_2CO_3$, are formed; they are strongly alkaline and stable only in aqueous solution. For therapeutic use much smaller doses are required than of the known alkali salts of phenolphthalein.—A. S.

Lecithin in oils and fats; Preparation of high percentage solutions of —. Heirs of K. A. Fischer. Ger. Pat. 286,061, Feb. 2, 1913.

An alcoholic solution of lecithin is cooled in order to separate constituents soluble with difficulty in alcohol, and then mixed with oils or fats in presence of a fatty acid of high molecular weight, such as oleic acid, the alcohol being subsequently removed by heating.—A. S.

Thebaine; Preparation of a derivative of —. M. Freund and E. Speyer, Frankfurt, Germany. Ger. Pat. 286,131, May 15, 1914.

THEBAINE when treated in acid solution with hydrogen peroxide or potassium bichromate, is converted into a new base, $C_{20}H_{22}NO_4$, which decomposes above 275°C .—A. S.

Acylated diaminophenols and their derivatives; Preparation of —. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 286,460, Aug. 5, 1913.

N-MONOACIDYLDIAMINOPHENOLS or their derivatives are treated by the usual methods so as to introduce into the second amino group an acyl group different from that in the first. The products are of value as antipyretics and do not produce cyanosis as is the case with phenacetin and other monoaminophenol derivatives.—A. S.

Aluminium ethoxide; Preparation of —. Farb. vorm. Meister, Lucius, und Brüning. Ger. Pat. 286,596, Dec. 13, 1913.

ANHYDROUS alcohol is treated with aluminium in presence of a very small quantity of mercuric chloride and in presence or absence of alkyl halides or iodine, and the mixture is distilled *in vacuo*. By using only a very small quantity of mercuric chloride, merely sufficient to act as a catalyst, a distillate free from mercury is obtained.—A. S.

Acetaldehyde; Manufacture of —. G. W. Johnson, London. From Chem. Fabr. Griesheim-Elektron, Frankfurt, Germany. Eng. Pat. 15,669, June 30, 1911.

SEE Fr. Pat. 474,246 of 1914; this J., 1915, 735.

Norhydrohydrastinine; Process of producing derivatives of N-homologues of the —. H. Decker, Hanover, Assignor to Farbenfabr. vorm. F. Bayer und Co., Elberfeld, Germany. U.S. Pat. 1,156,131, Oct. 12, 1915. Date of appl. Jan. 2, 1913.

SEE Eng. Pat. 29,504 of 1912; this J., 1913, 990.

Process for obtaining isoquinoline from crude quinoline from coal tar. Ger. Pat. 285,666. See III.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

PATENTS.

Multi-coloured screen plates, wholly of glass, for the preparation of photographs in natural colours. E. Mohr and H. Wieland. Ger. Pat. 283,551, Oct. 28, 1913.

A GLASS plate is provided on one side with a single layer of contiguous globules of glass of suitable colours and size, and then heated until the grains run together and form an even surface to which the sensitive emulsion can be applied. The glass globules are produced by grinding the glass to a fine powder, and heating to melting point in a suspended condition so that the grains are melted individually to minute globules and do not coalesce.—B. V. S.

Blue tones; Process for the production of photographic pictures in —. Farb. vorm. Meister, Lucius, u. Brüning. Ger. Pat. 284,423, Feb. 24, 1914.

PICTURES are developed by means of a mono-alkyl-ether of 1,4-dihydroxynaphthalene, and then treated with a suitable oxidising agent, such as Howard Farmer's reducer. A blue image remains.—B. V. S.

Gelatin films on glass or other desired support, for hydrotype, pinatype, and similar photographic printing processes; Process for the preparation of —. Rotophot A.-G. für graphische Industrie. Ger. Pat. 284,805, Jan. 18, 1914.

THE support is covered with a chrome-gelatin paper which has been exposed sufficiently to render the gelatin insoluble in hot water, and the paper back then removed by treatment with hot water in the usual way. The amount of hardening sufficient to produce insolubility of the gelatin in water is too small to interfere with the subsequent use of the film in colour processes.—B. V. S.

Sizing of papers for photographic purposes; Use of difficultly soluble, or insoluble, fatty soaps in —. M. Roth. Ger. Pat. 285,562, Dec. 25, 1912.

DIFFICULTLY soluble or insoluble fatty soaps with, in some cases, substances giving insoluble silver salts, are added to the size for photographic papers. This is designed to prevent reaction between the silver emulsion and metallic impurities in the paper.—B. V. S.

XXII.—EXPLOSIVES; MATCHES.

Trinitrotoluene. M. Copisarow. Chem. News, 1915, 112, 247–248.

BESIDES the α - or 2,4,6-trinitrotoluene, m.pt. 80.8°C ., of which the commercial product (T.N.T., trotyl, trilit) is chiefly composed, the five other possible isomerides are known, namely, β (2,3,4), m.pt. 112°C ., γ (2,4,5), m.pt. 104°C ., δ (3,4,5), m.pt. 137.5°C ., ϵ (2,3,5), m.pt. 97.2°C ., and ζ (2,3,6), m.pt. 79.5°C .; all of them are of practically equal value as explosives. The other isomerides accompanying the α -trinitrotoluene in the commercial product are derived from *m*-nitrotoluene, which constitutes about 4.5% of the commercial mononitrotoluene. The various trinitrotoluenes give different colorations with acetone and ammonia, viz., α , deep red; β , greenish-yellow; γ , blue; ζ , orange-red; and ϵ , rose-red. To obtain a product of relatively high density for filling shells, the trinitrotoluene is melted, poured into the shells, and solidified under pressure or by rapid cooling. The nitration of toluene for the manufacture of the trinitro-compound is usually effected in two or three stages, with gradually increasing concentration of nitrating acid; the spent acid from the trinitro-stage is utilised for the mono-nitration of toluene. The colour of the final waste acid varies from yellowish to dark brown, being darker the lower the concentration of nitric acid and the higher the concentration of sulphonic acids and oxidised organic compounds. A yellowish waste acid, after filtration, contained: HNO_3 , 0.2; HNO_2 , 2.05; H_2SO_4 , 63.46; H_2O , 34.29; and $\text{R.S.O}_3\text{H}$, 0.0%; whereas a dark brown waste acid contained: HNO_2 , 0.0; HNO_3 , 0.0; H_2SO_4 , 58.0; H_2O , 37.28; $\text{R.S.O}_3\text{H}$ (calculated as toluenemonosulphonic acid), 4.72%. The chief difficulties in the nitration process are due to the presence of inorganic impurities, chiefly lead and iron salts,

derived from the sulphuric acid and from the action of the nitrating acid on the apparatus, and organic by-products formed by sulphonation, oxidation, and reduction. Among the by-products may be:—(1) Trinitrobenzoic acid or tetranitromethane owing to oxidation in case of overheating or pressure; the last-named may be recognised by its intense odour; metallic salts may act as catalysts in promoting oxidation. (2) Phenolic compounds, such as cresols, formed by reduction of the nitro-compounds by hydrogen produced by the action of the nitrating acid on the apparatus, the amino-compounds being then converted into diazo and hydroxy compounds; in presence of metallic salts, highly explosive salts of nitro-cresols may be formed. (3) Sulphonic acids owing to too low a concentration of nitric acid. To obtain good results the following conditions should be observed:—(1) The amount of nitric acid used should exceed the theoretical quantity by at least $\frac{1}{2}$ mol. (2) The degree of nitration should be controlled by the concentration of nitrating acid, temperature, and duration of reaction rather than by the actual quantity of nitric acid used. (3) The reaction product should be separated from the spent acid as quickly as possible. (4) The action of the nitrating acid on the apparatus should be reduced to a minimum by suitable choice of material and concentration of acid. A complex mixture of di- and tri-nitro-toluenes is recovered from the mother liquors after separation of the trinitrotoluene, and this when nitrated with a mixed acid containing only 15% HNO_3 , yields a "liquid trinitrotoluene" (16.6—17.2% N), which may be used for gelatinising collodion cotton.

Bibliography. Wilbrand, *Annalen*, 1863, 128, 178; Hepp, *Annalen*, 1882, 215, 366; Stadel, *Annalen*, 1890, 259, 208; Häussermann, this J., 1891, 1028; 1892, 235; Bichel, *Fr. Pats.* 357,925 and 369,371 of 1906; this J., 1906, 135, 1907, 115; Rudeloff, this J., 1907, 67; Escales, *Z. ges. Schiess- u. Sprengstoffw.*, 1908, 3, 21; Nobel und Co., *Ger. Pat.* 212,169, this J., 1909, 1065; Van den Arend, *Rec. Trav. Chim. Pays-Bas*, 1909, 28, 408; Vender, *Eng. Pat.* 18,281 of 1909, this J., 1910, 265; Comey, *J. Ind. Eng. Chem.*, 1910, 2, 103; Vasquez, this J., 1911, 1046; Yerola, this J., 1912, 152; Dautriche, this J., 1912, 153; Nobel und Co., *Fr. Pat.* 432,981, this J., 1912, 153; Langenscheidt, this J., 1912, 1147; Block, *Z. physik. Chem.*, 1912, 78, 385; Nobel und Co., *Ger. Pat.* 264,593, this J., 1913, 1088; Kast, *Z. ges. Schiess- u. Sprengstoffw.*, 1913, 8, 65, 88, 155, 172; Will, this J., 1911, 376; Molinari and Giua, this J., 1914, 686; Giua, this J., 1914, 687; Koerner and Contardi, *Atti R. Accad. Lincei*, 1914, 23, 11, 161; Holleman, *Rec. Trav. Chim. Pays-Bas*, 1914, 33, 1; Rintoul, this J., 1915, 60; Oberschlesische A.-G. f. Fabrik. von Lignose, *Ger. Pat.* 277,325, this J., 1915, 199; McHutchison and Wright, this J., 1915, 781; Giua, this J., 1915, 827, 984; Craig and others, *Eng. Pat.* 23,181 of 1911, this J., 1915, 985; Koerner and Contardi, this J., 1915, 1046; Soc. Ital. Prod. Esplosivi, *Eng. Pat.* 49,566 of 1911; this J., 1915, 1118; Marshall, "Explosives," their history, properties, and manufacture," 1915.—A. S.

PATENTS.

Cartridges for small arms and the like; Manufacture of compositions for —. E. R. von Herz. *Ger. Pat.* 285,902, July 14, 1911.

The normal lead compound of trinitroresorcinol, $\text{C}_6\text{H}(\text{NO}_2)_3\text{O}_2\text{Pb}$, is used either alone, or together with oxygen-carriers and other known constituents, for preparing compositions for cartridges in which the charge acts both as a primer and as a propellant. For this purpose it is superior to mercury fulminate, as it produces hardly any smoke and

causes less fouling of the barrel of the firearm. It may also be substituted for a considerable proportion of the mercury fulminate in charges for detonators, percussion caps, etc.—A. S.

Explosive priming charges. W. H. Buell, New Haven, Conn., U.S.A. *Eng. Pat.* 21,082, Oct. 16, 1911. Under Int. Conv., Oct. 21, 1913.

See U.S. Pat. 1,106,313 of 1914; this J., 1914, 944.

XXIII.—ANALYTICAL PROCESSES.

Vapour densities; Comparative method for determining —. P. Blackman. *Chem. Soc. Trans.*, 1915, 107, 1500—1503.

INTO the middle of a capillary tube about 100 cm. in length and sealed at one end a short thread of mercury is introduced, followed by a thread of the liquid, and the open end is then sealed, and the originally closed end opened. When atmospheric temperature has been attained the lengths of the thread of liquid, l_1 , and of the air thread, V_1 , between the mercury and the sealed end are measured. A liquid of known vapour density is then introduced into the open end of the capillary which is again sealed. When cold the tube is placed horizontally and the lengths of the air spaces, V_1 and V_2 , and of the second thread of liquid, l_2 , are determined. The tube is then heated to a temperature sufficiently high to vaporise both substances and the respective lengths of the air spaces, v_1 and v_2 , again measured. The specific gravities of both substances, s_1 and s_2 , the room temperature, t , and the atmospheric pressure, p , must also be observed. It can be shown that, if d_1, d_2 are the respective vapour densities,

$$\frac{31068 s_1 l_1}{d_1 v_1} = \frac{p(V-l_1)}{273+t} \left[\frac{V_2-l_2}{v_2(V_1-l_1)} - \frac{1}{v_1} \right] + \frac{31068 s_2 l_2}{d_2 v_2}$$

Since the central expression is very small the equation simplifies for most ordinary purposes to $s_1 l_1 / d_1 v_1 = s_2 l_2 / d_2 v_2$, from which expression the ratio d_1 / d_2 is readily determined, all that need be known in this case being the specific gravities, the lengths of the liquid threads, and the lengths of the air spaces when the liquids are vaporised. Results of considerable accuracy are obtainable. —G. F. M.

Cryoscopy; Application of — to chemical analysis. M. Drapier. *Comptes rend.*, 1915, 161, 461—463.

The constituents of mixtures, e.g., distillates, can in some cases be estimated by cryoscopic methods. If a binary liquid mixture be diluted with a known amount of one of its ingredients the amount of the other can be calculated from the depression of the freezing point of the added constituent. In more complex mixtures one constituent can be determined from measurements of the depression produced by the mixture (1) in an indifferent solvent, and (2) in the constituent to be determined. If Δ and Δ' are the depressions produced by π grms. of the mixture when dissolved (1) in P grms. of an indifferent solvent of molecular depression, k , and (2) in P grms. of the constituent to be determined which has a molecular weight, M , and a molecular depression, k' , then the weight, x , of the constituent to be determined present in π grms. of the mixture is given by the formulae

$$x = \frac{MP(k'\Delta - k\Delta')}{k(M\Delta + 100k')} \quad \text{or} \quad \frac{MP(k'\Delta - k\Delta')}{100kk'}$$

These expressions are derived very simply from the well known cryoscopic laws; the second is

valid only when x is very small compared with P . The author has obtained very promising results with these methods.—J. H. L.

Micro-electroanalysis. E. H. Riesenfeld and H. F. Möller. *Z. Elektrochem.*, 1915, 21, 137—143.

METHODS have been worked out for the micro-electroanalysis of copper, silver, and mercury which permit as little as 5 mgrms. per litre to be determined with an error of 0.5%, which is caused by inconstancy in the weight of the cathode due to superficial gas layers. The operation is conducted on 20 c.c. of solution in a glass cell with a rotating anode which serves as a stirrer, and a cathode weighing about 17 mgrms. consisting of 0.02 mm. platinum wire. The acids used in the electrolyte must be redistilled in glass vessels, and after completion of the deposition the electrolyte must be gradually displaced by distilled water until the current has fallen to at least 1% of its original value, before the cathode is removed, as otherwise adhering acid will dissolve considerable quantities of the deposit. The following conditions are recommended for each of the three metals in question:—For copper the solution should contain 10 c.c. of 2*N* nitric acid and be electrolysed at 90 C. with 2 volts and 10 milliamperes for at least 2 hours. For silver a solution containing 2 c.c. of 2*N* nitric acid and 1 c.c. of alcohol is electrolysed at 50—60° C. with 1.35 volts and 4 milliamperes for six hours. For mercury 2 c.c. of 2*N* nitric acid is added to the electrolyte, which is electrolysed at 0° C. with 3 volts and 10 milliamperes for six hours.

—G. F. M.

Potassium; Perchlorate and cobaltinitrite methods for the determination of—. T. D. Jarrell. *J. Assoc. Official Agric. Chem.*, 1915, 1, 29—32.

THE perchlorate method of estimating potassium (this *J.*, 1913, 100) gives low results because potassium perchlorate is distinctly soluble in the alcohol (containing perchloric acid) used to wash it. A source of error is also introduced with the excess barium chloride used for the precipitation of sulphates previous to the determination, since this compound is not properly removed from the potassium perchlorate by washing with alcohol. A series of tests on pure potassium chloride, comparing this method with the platonic chloride method, showed that the results differed by about 1%. The perchlorate method also demands more time. With the cobaltinitrite method (this *J.*, 1910, 1218) the most concordant results were obtained when 25 c.c. of the reagent was added to 10 c.c. of the potassium solution. Compared with the platinum chloride method the results were about 2% too low, the error being probably due to decomposition of the reagent by heating. The results of determinations on potassium chloride and on mixed fertilisers were very erratic, and the method in its present form is regarded as unreliable.—E. H. T.

Phosphorus; Nephelometric determination of—. P. A. Kober and G. Egerer. *J. Amer. Chem. Soc.*, 1915, 37, 2373—2382.

THE reagent of Pouget and Chouchak (this *J.*, 1911, 985) for the estimation of phosphorus has been modified by substituting hydrochloric for nitric acid, and in the new form it is stable, colourless, and applicable for the accurate nephelometric estimation of phosphorus in dilution as great as 1 in 2,000,000. The reagent is prepared by dissolving 1.5 grms. of sodium molybdate in 2.5 c.c. of water and adding 10 c.c. of hydrochloric acid prepared by diluting concentrated acid (sp.gr. 1.20) with an equal volume of water. To the clear solution 1 c.c. of 2% strychnine sulphate solution is then added and after standing over-

night the solution is filtered. The phosphorus estimation is carried out by adding to 30 c.c. of water, 5 c.c. of *N*/2 hydrochloric acid, 5 c.c. of the above reagent, and 10 c.c. of phosphate solution, either the standard or the unknown; after gently rotating in the flask and setting aside for three minutes, the degree of turbidity is observed in the nephelometer.—G. F. M.

Range of applicability of the sulphur dioxide method of determining aromatic constituents in hydrocarbon mixtures. Rittman and Moore. *See* IIA.

Proximate analysis of nitrocellulose solutions and solvents. Conley. *See* V.

Micro-reactions of carbon bisulphide. Denigès. *See* VII.

Detection of vegetable oil in animal fats. Marcusson and Schilling. *See* XII.

Detection of condensation products of phenols and formaldehyde. Steinitzer. *See* XIII.

Method for determining the lime requirement of soils. Jones. *See* XVI.

Methods for the determination of humus in soils. Fraps. *See* XVI.

Determination of humus [in soils]. Smith. *See* XVI.

Formation and determination of acids in malt and barley, and their extraction. Lüers and Adler. *See* XVII.

Determination of fat in food for infants. Chapman. *See* XIXA.

Comparison of the iodine titration and zinc chloride methods for the analysis of lime-sulphur solutions. Roark. *See* XIXB.

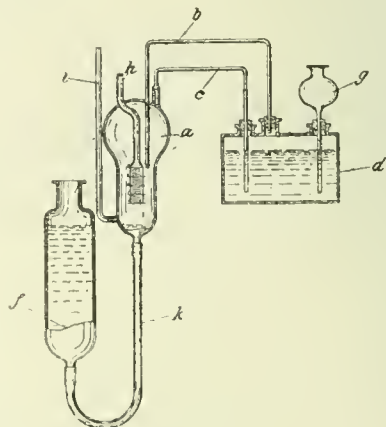
Method for the analysis of lime-sulphur solution. Averitt. *See* XIXB.

Determination of clove oil by distillation with steam. Hortvet. *See* XX.

PATENTS.

Gases; Apparatus for analysing—. O. Matzerath, Aachen, Germany. U.S. Pat. 1,151,792, Sep. 28, 1915. Date of appl., Oct. 9, 1914.

THE apparatus (see fig.) consists of a measuring vessel, *a*, connected by tubes, *b* and *c*, to an absorption vessel, *d*, provided with an open



funnel, *g*, and by a flexible tube, *k*, to a levelling vessel, *f*, by which gas can be transferred from the measuring vessel to the absorption vessel and

vice-versa. The measuring vessel has inlet and outlet tubes, *l* and *h*, and the lower end of the outlet tube is provided with a graduated scale the top mark of which coincides with the bottom of the tube, *h*.—W. E. F. P.

Gases: Apparatus for the continuous analysis of —. Allgem. Elektrizitäts-Ges. Ger. Pat. 285,781, May 30, 1914.

THE gas is brought into contact with a liquid reagent, and the content of a particular constituent is estimated from the thermal effect produced, which is measured by means of a thermo-element. The cold junction of the thermo-element is maintained at the same temperature as the liquid reagent and the gas under examination, by using the reagent as cooling liquid.—A. S.

Determination of benzol in gases. Ger. Pat. 285,920. See IIa.

XXIV.—MISCELLANEOUS ABSTRACTS.

Radium rays: Chemical action of penetrating —. A. Kailan. Monatsh. Chem., 1914, 35, 859—887. J. Chem. Soc., 1915, 103, ii., 663—664.

ETHYL acetate is decomposed by the action of the penetrating rays of radium, both when practically pure and when mixed with alcohol and water. The velocity of formation of acid under the action of the rays was measured under various conditions. In three tests, the first, in which 32.2 mgrms. of radium (element) was used, the second, a "blank" test in the same room where the radium was kept, both at 10° to 14° C., and the third, a "blank" test in a room away from radioactive preparations, at 25° C., the rate of formation of acid was four times as great in the second as it was in the third, and eight and a-half times as great in the first as in the second. In the second test, the increased rate is ascribed to γ -rays. The primary action of the rays is regarded as a decomposition of the ester molecule with formation of acid and an unsaturated hydrocarbon. The velocity of ester formation in acetic acid and alcohol is hardly measurably increased by the action of radium rays. Acetone exposed to radium rays forms acetic acid, as in ultra-violet light, but about a thousand times more slowly.

Trade Report.

Austria-Hungary: The chemical industries of — and the war. E. Donath and G. Ulrich. Chem.-Zeit., 1915, 39, 505—507, 526—528.

AFTER the disorganisation of the early days of the war, the industries rapidly recovered and those engaged in the production of war material are enjoying exceptional prosperity; the financial situation is described as "comparatively favourable." To overcome the difficulty in connection with the supply of imported raw materials: wool, cotton, metals, etc., controlling corporations and war-associations have been formed, to act in conjunction with a committee appointed by the Government. As regards fuel, transport difficulties have been most pronounced and still operate in some localities; the capacity of the railways generally, however, is now estimated to be about 75% of the normal. Sources of coal supply are ample, having been materially increased by the exploitation of the occupied territories, but there is a strong movement on the part of the authorities to encourage the substitution of coke for coal in industrial works,

in order to meet the intense demand for distillation by-products. The oxygen industry has been adversely affected by the war. The position of the inorganic heavy chemical industry is quite satisfactory, being only affected by transport difficulties: ample home supplies of salt, and of pyrites rich in copper, are available; some extensions of sulphuric acid plants are recorded. The nitrogen question, both from the agricultural and military points of view, has required serious attention, owing to the stoppage of imports from Chile, while the production of ammonium sulphate has not equalled that of former years, owing to the reduced activity of the blast-furnaces, the principal consumers of coke. Nitrogen products from the air are playing an important part in the present war: a factory near Innsbrück is operating Pauli's process. The glass, cement, and building materials industries have been adversely affected through restricted fuel, transport, and export facilities; the cement trade is particularly bad, many of the factories being closed down. The iron industry is now recovering from its early depression and the position is good, but its activities have been diverted in accordance with the special conditions created by the war. In connection with other metals the authorities are urging a closer and more intense working of existing ore deposits, while the high prices are favourable to the re-opening of old workings previously unprofitable. The wood distillation industry is extremely active, owing to the great demand for its products; iodine products are scarce: the requirements in fine chemicals and dyestuffs are amply covered by Germany. The position of the textile trades is dominated by the requirements of the army and the distribution of raw materials is under control: the scarcity of jute affords an opportunity for the extended use of paper yarns. The leather industry is also dominated by army requirements; home supplies of raw materials are being conserved. The fat and soap industries have suffered severely from lack of imported materials but the cultivation of oil-bearing crops is being strongly encouraged; the oil-hardening processes are being worked with great benefit in this connection. The mineral oil trade suffered by the Russian invasion but certain companies do not show heavy losses: some new wells have recently been opened. The sugar industry suffered heavily both from invasion and loss of export trade. Large stocks have accumulated and the present beet crop is reduced by 40%; the crisis is only temporary and the situation will be relieved by the cultivation of oil crops. In the spirit industry much of the cereal raw material has been required for food but has been partly replaced by the excess stocks of raw sugar; prices of spirit have risen and the demand is very active. In the brewing and malting industry the supply of malt and hops was very plentiful at the beginning of the war, owing to restriction of exports, but prices of barley soon rose and during the spring and summer malting of barley was prohibited. Consequently stocks of malt were conserved and sugar was largely used for brewing. The output of the breweries has been reduced by 30%, chiefly in export business.—J. F. B.

Prohibited exports. Order in Council, Nov. 3, 1915.

THE Proclamation, dated July 28th, 1915, as amended and added to by subsequent Orders of Council, is further amended as follows:—

The exportation of the following is prohibited to all destinations:—Cinchona bark, quinine and its salts; metal cylinders, such as are used for containing compressed oxygen or hydrogen.

The exportation of "aluminium, manufactures of aluminium, and alloys of aluminium," which is already prohibited to all destinations abroad other than British Possessions and Protectorates, is prohibited to all destinations.

The heading "Oil, blast furnace (except creosote and creosote oil)" in the lists of goods the exportation of which is prohibited to all destinations abroad other than British Possessions and Protectorates, is deleted, and there is inserted in the list of goods the exportation of which is prohibited to all foreign countries in Europe and on the Mediterranean and Black Seas, other than France, Russia (except through Baltic ports), Italy, Spain, and Portugal the heading "creosote and creosote oils (including blast furnace oil) except wood tar oil (the exportation of which is already prohibited to all destinations abroad other than British Possessions and Protectorates)."

Switzerland: Prohibited exports. Board of Trade J., Nov. 11, 1915.

By virtue of a Federal Decree of Nov. 5th, the exportation of the following from Switzerland is prohibited:—Ligneous cement and other tar products; nickel oxide; platinum and silver, unwrought, coined, and rolled; platinum, gold, and silver in the form of wire; tissues made from such wire; gold and silver leaf; gold and platinum salts; varnishes, lacs, and siccatives; and the following raw materials and intermediate products for the manufacture of colouring materials, pharmaceutical products, bleaching materials, pyrotechnical products, and for other technical use, so far as not covered by previous prohibitions:—Hydrogen peroxide; peroxides of sodium, calcium, barium, and lead; chlorates, perchlorates, and persulphates; perborates; nitrates of barium and of strontium; ammonia in aqueous solution; and ammoniacal salts; potassium and sodium; caustic potash and caustic soda, whether solid or liquid. Alkali salts—Chlorides; hypochlorites; iodates; sulphates and bisulphates; sulphites, bisulphites and hyposulphites; sulphides; bicarbonates; acetates; cyanide; sulphonyanide; oxalate and bioxalate; tartrate, bitartrate, and stibitate tartar; aluminate; hypophosphate; pyrophosphate. Calcium salts—Fluoride, crude (fluorspar) or purified; biphosphate, glycerophosphate, lactate, permanganate, oxalate; tartrate; bisulphite; borate, citrate, sulphide. Phosphoric acid; oxalic acid; boric acid; anhydrous acetic acid; monochloroacetic acid; lactic acid; titanous acid; molybdic acid and tungstic acid; vanadic acid; fatty acids not specially mentioned in the Swiss Customs Tariff. Compressed gases—Carbonic acid; acetylene lighting gas, oil gas; ammonia; oxygen, hydrogen, liquid air; sulphurous acid, and other compressed acids not specially mentioned in the Swiss Customs Tariff. Chromic acid; chromate, bichromate, and other chrome salts; salts of manganese. Wastes from soap and dye works, tin ashes, oxide of tin, and stannate of soda. Derivatives of tar oil; derivatives of benzol and of naphthalene.

Books Received.

PRACTICAL ORGANIC AND BIO-CHEMISTRY. By R. H. A. PLIMMER. pp. xii., 635. Longmans, Green and Co., London. Price 12s. 6d.

THIS work, intended chiefly for the medical student, aims at providing a general practical account of all those groups of organic substances which are of interest to the bio-chemist. The simple, fatty substances are first dealt with, then the more complex groups, the fats, lecithins, and

carbohydrates; these are followed by the cyclic compounds, including the nucleic acids, the terpenes, the anthocyanins, the indole derivatives, and the alkaloids. Next follow sections on enzymes and colloidal solutions, and on the proteins and the pigments of the blood and of leaves, the work concluding with very important sections on the analysis of urine and of tissues.

The treatment throughout differs from that which is usually characteristic of a book on practical organic chemistry since, along with the descriptions of preparations and reactions, a large amount of information is given on the constitution and chemical relationships of the compounds discussed. Not infrequently purely theoretical accounts are given without any practical details at all. This plan no doubt has some advantages, but it may be doubted whether in many cases the discussion of the subject is sufficiently full to be of use to the reader.

To the analyst the book should be of value, both directly and indirectly, particularly with regard to nitrogenous substances. In the first place, very valuable descriptions of the latest methods of analysis of urine, blood, and muscle are given. In addition to these, however, much useful information is collected concerning the individual proteins and their products of hydrolysis. The analytical treatment of the proteins of food is still notoriously very imperfect, and much remains to be done before it can be regarded as at all on the same footing as that of the carbohydrates and fats. The subject is, however, one of the greatest importance, as the modern researches on diet have shown that nothing short of a strictly quantitative estimation of the amino-acids derivable from the proteins present can afford the really essential information as to the efficacy of a particular nitrogenous food material. Under these circumstances it is rather to be regretted that the author did not include a connected account of van Slyke's method of determination of the approximate composition of a protein. Many of the separate estimations involved in this method are, however, given, the highly important van Slyke modification of the nitrous acid method for the estimation of amino-acids being well described in full detail.

For its immediate purpose as a laboratory companion for the student of bio-chemistry, the work is admirably adapted, but it contains a store of information which cannot fail to render it useful to a much wider circle.

A. H.

FIRST AID IN THE LABORATORY AND WORKSHOP. By A. A. ELDRIDGE and H. V. A. BRISCOE. Edwin Arnold, London. 32 pp., 7½ × 4½ in. Price 1s.

A PLACE should be found in every laboratory or works for this little book. Brief, but clear, directions are given for the treatment of various injuries such as are met with in chemical works, e.g., by acids, alkalis, halogens, etc., with notes on artificial respiration, fire, and cases of poisoning.

ELECTROPLATING WITH COBALT. By H. T. KALMUS, C. H. HARPER, and W. L. SAVELL. Canada Dept. of Mines, Mines Branch. Report No. 334. Government Printing Office, Ottawa. vii. + 69 pages, 10 × 6½ in.

THIS is the third of a series of researches on cobalt and its alloys, conducted at Queen's University, Kingston, Ontario, for the Mines Branch of the Department of Mines. An abstract of the report has already appeared in this Journal, 1915, page 619. The results of the first and second series of researches have been recorded in the Journal, 1914, p. 261; 1915, p. 180.

Journal of the Society of Chemical Industry.

No. 23, Vol. XXXIV.

DECEMBER 15, 1915.

No. 23, Vol. XXXIV.

Official Notice.

MEMBERS ON MUNITION SERVICE.

Dr. Addison furnishes a list of persons whom the Minister of Munitions has engaged and who are giving their services gratuitously. It does not include many Civil servants, military and naval officers, and railway officials who have been lent temporarily by their own departments or authorities, and whose remuneration therefore involves no additional burden on public funds. Among these are the following Members of this Society: Prof. P. P. Bedson, Dr. G. T. Beilby, J. F. Bell, J. Bond, Dr. Charles Carpenter, Dr. G. C. Clayton, Prof. J. W. Cobb, W. Cullen, A. Duckham, A. M. Duckham, Prof. Percy Frankland, Prof. T. Gray, Sir R. A. Hadfield, F. W. Harbord, T. Hardie, P. S. Hoyte, Prof. A. Lapworth, Prof. A. P. Laurie, A. E. Leighton, J. MacLeod, John Mann, F. Palmer, Prof. Perkin, Sir B. Redwood, J. Scott, A. T. Smith, Allen M. Smith, Prof. J. Thorpe, O. Thomas, Prof. R. Threlfall, Capt. Tulloch, W. F. Tulloch, J. Wilkinson, J. Wilson, and J. Young.

London Section.

Meeting held at Burlington House on Monday, November 1st, 1915.

PROF. H. E. ARMSTRONG IN THE CHAIR.

CONSIDERATION OF THE SUGGESTION THAT A CHEMICAL INTELLIGENCE DEPARTMENT SHOULD BE INSTITUTED BY H.M. GOVERNMENT AS A BRANCH OF THE BOARD OF TRADE.*

In opening a discussion on this subject, Dr. M. O. FORSTER said:—

It is not necessary for me on the present occasion to set forth the position of chemistry in its relation to the State prior to the war, because that subject is familiar to everyone of us. I assume we are all agreed that chemistry has been shamefully neglected by the general public and by our governments; that in consequence of this neglect the pursuit of chemistry in Great Britain has not kept pace with the general development of the science, particularly in its application to industry; that the outbreak of war found us at an enormous disadvantage as compared with Germany in respect of dyes, drugs, and explosives; and that unless definite and determined steps are taken to establish the position of chemistry so that this branch of science may be allowed to assume its proper place in the national economy, the restoration of European peace will be the signal for the restoration of British chemistry to its former ignominy.

I am now asking you to take one of those steps. British chemists of this generation are charged with a clear and grave responsibility, namely, to embrace the last remaining opportunity of convincing our fellow-countrymen that the Empire's future prosperity and stability depend on the substitution of

reasoned action for slipshod opportunism. Many of our leaders have preached this doctrine in the past, and happily some of them survive, notably Professor Armstrong, Sir William Ramsay, Sir Henry Roscoe, and Sir William Tilden, to mention a few. But manfully as they have striven for the cause, they have not yet reaped the harvest of their efforts, because circumstances were too strong for them. Now the pendulum has swung: the times offer such vivid object-lessons that if we fail to bring those object-lessons home to the public, and through them to the politicians, we shall deserve the obloquy which an enfeebled and attenuated future generation of chemists will heap upon us.

It is not pretended that the establishment of a Chemical Intelligence Department at the Board of Trade will do more than lay some stones in the edifice which we have to build, but I do believe that it may include the foundation stone of one wing. Assuming that it is conducted by chemists of the right type, directed by a chemist having the combined qualifications of an ambassador and a missionary cemented by inexhaustible patience and a sense of humour, it should work at least one miracle, namely, a Government Department peacefully penetrated by modern science. At the present moment, Government is making use of chemical advice to an extent hitherto unknown. As the war proceeds, this advice will become increasingly valued by the State, and one purpose served by the establishment of such a Department as is now proposed would be to preserve to the country this new tradition of State service by chemistry which we all know to be vital to its welfare.

One of the objections which have been raised against the proposal takes the form of an alternative suggestion, namely, that the money supplied by the State for the conduct of the organisation would be more usefully administered for the same purpose by the Society of Chemical Industry, or the Chemical Society, or a Joint Committee of the various bodies which have for their main object the advancement of chemistry in one or other of its branches. I do not share this view for two principal reasons. In the first place, the organisation would lack that authority and prestige which would naturally accrue to it from direct and official connexion with the Government; secondly, there would be lost to it an opportunity of leavening the whole lump of bureaucratic stolidity with a little leaven of chemical instinct. In fact, the Chemical Intelligence Department—it is perhaps not amiss that its initials are identical with those of the Criminal Investigation Department—would act as a catalyst, by the exercise of which the invaluable material, both human and documentary, which lies between Westminster Bridge and Trafalgar Square, might be assembled into a huge contact-plant for elaborating far-sighted and stimulating measures of government. It may be argued that the catalyst would become poisoned by the atmosphere of Whitehall. I admit the risk, but regard it as less important than the huge waste of energy incurred by bringing the mixed gases to Burlington House. Whatever may be said against the propriety of maintaining two establishments, I want to see chemistry set up house-keeping in the neighbourhood of St. Stephen's.

For the purpose of discussion, I laid the following scheme before the Society at the Annual Meeting in Manchester last July:—

* Compare this Journal, 1915, 763.

SUGGESTED SCOPE OF A CHEMICAL INTELLIGENCE DEPARTMENT TO BE INSTITUTED BY H.M. GOVERNMENT AS A BRANCH OF THE BOARD OF TRADE.

A. TECHNICAL.

(1) Classification of chemical discoveries at home and abroad as evidenced by (a) Patent Specifications, (b) Scientific Memoirs.

(2) Distribution of chemical information to scientific inquirers and to manufacturers seeking new developments or desiring to improve existing processes.

(3) Collection of information regarding the most suitable materials for constructing chemical plant and apparatus on a manufacturing scale, and the most convenient sources for supply of such plant and apparatus.

(4) Tabulation of the by-products arising in various chemical industries, and consideration of the most profitable ways of utilising these.

(5) Presentation of problems arising out of (3) and (4) to the numerous research chemists throughout the country, such problems to be offered under proper discretionary safeguards and with appropriate remuneration.

B. TECHNO-COMMERCIAL (by co-operation with the Board of Trade).

(1) Classification of foreign chemical products in respect of their distribution throughout the world, with ruling prices, tariffs, cost of transport, and where possible, cost of production.

(2) Classification of the resources of the Empire and friendly nations in raw materials, for the purpose of finding novel applications of these.

C. TECHNO-EDUCATIONAL (by co-operation with the Board of Education).

(1) Classification of data regarding opportunities for chemical instruction and research in various parts of the Empire, and comparison of these with those offered in foreign countries.

(2) Consideration of possible improvements and extensions in existing Imperial methods suggested by the information thus gained.

(3) Consideration and, where possible, application of methods by which wage-earners of good conduct and adaptability might be trained as technical foremen.

The ground covered by Section A. which deals with purely chemical matters, could be traversed only by trained chemists. The value of Clause (1), for instance, which might yield a detailed and properly cross-referenced index of chemical products and discoveries, would be seriously diminished if the subjects were not arranged in agreement with the general editorial practice of scientific journals. The number of such products is now so vast, and their inter-relationship so complex, that even with the best intentions, confusion would follow their attempted classification by laymen. A trustworthy compendium, on the other hand, would offer unrivalled opportunities for the operation of Clause (2), since it would place a potential inventor in the position of knowing exactly how his particular subject stood at the moment of inquiry. Not only would much valuable time be spared from making unnecessary experiments, but the knowledge that such an information bureau existed would itself encourage invention. Incidentally there would arise a library of a highly specialised and important character. Clause (3) should develop into an agency for bringing together the users of plant and the producers of plant, and by a systematic arrangement of the advantages and drawbacks of the various types, assist in the survival and evolution of the best types. Clause (4) offers the possibility of effecting wide economies in many existing processes, and by a successful utilisation of by-products rendering

new processes commercially practicable. There is general agreement that it is in this direction the German manufacturers have been pre-eminent, especially in the fine chemical industry, and a recent modest example of what might be accomplished towards this end has been furnished here by the many useful suggestions made regarding the disposal of nitre-cake. Clause (5) deals with a matter which is already receiving attention from the Advisory Council for Scientific and Industrial Research, recently constituted under the auspices of the Board of Education, but the aspect of it which most closely concerns this Society is the industrial one, and as a remark which was made in Manchester last July leads me to think that the clause is open to misapprehension, I desire to repeat here what I stated there, namely, that instead of conflicting with the operation of chemists in consulting practice, I believe that the administration of this clause would increase and facilitate their work. I am aware that the work of such chemists frequently represents research of a higher and more valuable character than is revealed by much that is published in the journals of unapplied science, and a judicious Director of the Department would administer Clause (5) as an instrument for bringing together the consultants and those manufacturers, large or small, who were not previously alive to the opportunities for assistance in difficulty which such consultants could offer. The Director would recognise that all chemical problems arising out of the previous clauses are divisible roughly into two classes: (a) Definite and urgent, with a distinct financial value attached, and (b) General in character, with an immediate interest more strictly scientific than commercial, although perhaps possessing a nucleus offering the possibility of profitable development. Those in class (a) should reach the consultants, trained to the rapid solution of such problems and naturally receiving suitable fees from their clients, whilst those grouped in class (b) might go to the colleges, subsidised according to circumstances from the fund administered by the Advisory Council for Scientific and Industrial Research, the Government Grant of the Royal Society, or the Research Fund of the Chemical Society.

Passing now to Section B, its value would lie in the occasion presented for confederating a knowledge of chemical processes and products with all the resources for collecting information which are possessed by the Commercial Intelligence Department of the Board of Trade. It requires but little imagination to visualise the many advantages which might follow this confederation, and I need not occupy your time longer than to mention one, namely, the establishment of a permanent exhibition or museum of chemical products and materials in which the application of chemistry is involved, together with photographs and diagrams illustrating and comparing foreign procedure with our own.

The proposal in Section C, also, does not require elaboration at the moment, offering, as it does, the opportunity to breathe the spirit of chemistry into the dry bones of another government department. It is hardly necessary to point out that the results accumulated under Clause (1) would provide material sufficiently startling even to arrest the attention of our legislators, some of whom might be thereby impelled to apply themselves to clause (2). The object of Clause (3) is to enable manual workers who have acquired technical skill in the factory to supplement it as far as possible by theoretical knowledge, and enable them to improve their own position by increasing their usefulness to the community.

Perhaps the strongest argument which can be used in support of the whole scheme is provided by asking you to imagine the benefit which such

an organisation might have conferred on this country and our Allies had it existed in full working order prior to 1914. For obvious reasons the point cannot be developed in public, but everyone present is probably in a position to fill in some details for himself, and would agree, I am convinced, that whilst the dye muddle and the drug muddle and the various other muddles could scarcely have been averted, they might at least have been mitigated. As to the cost, this might be roughly estimated at £5000 per annum, which would provide at the outset for the directing chemist, four or five assistant chemists, a librarian, and a clerical staff of six or eight, but this feature is more usefully postponed until the general principle is accepted.

One obstacle to the successful operation of the proposed department is, in my belief, more fancied than real, namely, the reluctance which some firms might show towards revealing information they would consider damaging to themselves or useful to their competitors. In the first place I would say that every respect and consideration for this perfectly natural feeling should be displayed by the Director; secondly, that there is a vast amount of information quite independent of trade secrets, already scattered abroad, the mere collation of which would usefully employ the staff during many years, and which, when systematically arranged, would be most valuable to the manufacturers and chemists of the country, especially the smaller manufacturers, who may not possess the financial and clerical resources themselves to collect this information. The larger concerns already have, in many cases, their own information bureau, and in such cases might be willing to offer valuable advice on the constitution and practice of the new department, provided always that the modest flower of national co-operation which has been fertilised by our extremity and watered by our tears be not allowed to wither and die when the most urgent requirements of the moment have been met.

I am aware that there must appear to be many imperfections in the scheme which has been brought forward, but I would venture to urge most strongly that the Council of the Society either alone, or through the General Committee of Chemical Societies which has been constituted to deal with the wider problems arising out of the war, should carefully frame a complete scheme. Although it is impossible to forecast the course of events, it is reasonable to suppose that before the actual restoration of peace, there will supervene a period when the military anxieties of the nation will have diminished from their present acuteness. The moment that period begins, the matured scheme should be brought to the attention of the Government, and the necessary authority secured for the foundation of the Chemical Intelligence Department, so that the connecting link between chemistry in war and chemistry in peace may not be broken.

The CHAIRMAN said that it was unfortunate that no notice had been given of the debate in the Journal in time to reach members of the Society; he would remind them, therefore, that it was now agreed that discussion might take place not only at the meetings, but also in the Journal, by correspondence and after a Paper had been published, in the way that was practised by the Institution of Civil Engineers, for example. He had no doubt the subject would excite interest all over the country; it was one that must be discussed by all the Sections, so that the Council might be put in full possession of the views of the members generally. The question was bound to exercise the attention of the Council at an early date; it was desirable that any discussion in the

Council should take place with some knowledge of should at any rate have the credit of it, and if profit the desire of the Society. The Secretary had addressed a number of letters to gentlemen who were likely to take an interest in the matter outside the Society; but he was afraid that, with the exception of Mr. Ashley, from the Board of Trade, and Dr. Heath, from the Board of Education, they would not be favoured by the presence of many outside their own ranks.

He would point out that, in some measure, the matter was already occupying the attention of the Council. Members who had read their Journal would know that the Society was at the moment seeking to organise itself, in the sense that it was seeking to find out what its various members were doing and were capable of doing. Cards had been sent out, with the request that they should be filled in with a variety of information; a Committee consisting of Professor Donnan, Dr. Keane, Mr. Baker, Mr. Tyrer, Prof. Hodgkinson and Mr. Morson, was at work sorting out and codifying the information. He believed they had considerable difficulty in putting members under their correct description, in a great many cases, owing to the indecisive character of the information which had been forwarded. No doubt, however, at no very distant date, they would be in possession of information which would be of real value to the Society.

Mr. WALTER F. REID said that the discussion had been commenced at the last Annual Meeting of the Society, and it seemed to him that the proposal was one which ought to have their support in every way. Apparently, even at the present moment, at this time of stress, there was very great difficulty in getting into the official mind the fact that when they wanted chemical products such as explosives made, chemists must be placed in a position to carry out the work. Hitherto nearly all the arrangements that had been made had made use of chemists in an advisory capacity, and had not put them in a position to carry out fully the ideas which they themselves were supposed to originate. It was something like taking children away from their mothers directly they were born and putting them to foster mothers. There were theorists who considered the result would be good, although he himself did not think that each individual baby would have the same care as under its own mother. So he was afraid it had been so with a great number of proposals which had been made recently. He was Chairman of the Institute of Inventors, and almost every day they were getting suggestions which contained the germ of good things. But one hesitated to consign children of such tender age to a cemetery directly they were born. One would like to have some Department, as Dr. Forster had suggested, whose duty it would be to work out ideas that might perhaps contain the germs of something of importance, and of very great value to the nation.

They met with certain difficulties. When a man had an idea, even supposing he were absolutely patriotic, he naturally wanted to know whether he was going to profit from it if he disclosed it; and one of the great difficulties they were up against at the present moment and had been for some time was, how an inventor who had an idea that might be a valuable one—although they could not tell until it was tried in some way or another—would derive benefit from it. A number of Committees were asking for suggestions, and inventors were not sure what would happen to those suggestions. If they had a Committee to collate different ideas that were brought to them, he thought one of the points that ought to be put very clearly to the public was that the information that was given by an individual

should be earmarked to his name, and that he resulted, something should be done for him. One met with many disappointed inventors who had had good ideas, but somebody else had reaped the benefit of them.

One of the greatest difficulties he foresaw in the commencement of a scheme of the kind suggested—not in the ultimate working of it perhaps—was that there was no Board of Trade. There used to be a Board and there used to be a Committee of men who were supposed to be connected in some way with trade, and originally had been connected with trade. But now they had to deal with a number of officials, very highly educated from their point of view, but not adapted in a way to appreciate the information that was brought before them. He therefore thought that the proposed Committee or office should have full power to act themselves. He again came back to the same thing; that those who were going to do the work should have the power to do it, and that they should not merely be an Advisory Committee of the Board of Trade. He spoke from a very long experience of what was called the Board of Trade. It had a few permanent officials who remained in the background but managed the whole thing. On the whole they did it very well indeed, and they learned their business quickly. But on the other hand it was very much better if they were carrying out intricate chemical researches and problems, that at the head there should be men who were really accustomed to that work, and that they should have more or less the power to do what was required. Another point that might be emphasised, and which he did not think Dr. Forster had mentioned, was the organisation of the Consular service. They were very far behind their cousins on the other side of the Atlantic. If they wanted to get any information on any industry, they had to go to some station, as they called it on the other side. There was a report available from an agricultural station, for instance, that they would not get in this country. It was the same with the Consular service. The United States Consular reports were most interesting reading, and they were drawn up by men who evidently had the education to appreciate what they were writing about. He was sorry to say that he had very rarely met an English Consul—he often was a German—who was competent to write upon the matters with which they were dealing in their discussion. He thought they ought to approach the Foreign Office and the Government officials, who should help them.

Referring to the Patent Office, he said the information there was fairly well classified already. There was a very good method of classification, and very good headings for the classifications. He thought under Clause 1, they had almost got the organisation that was required, but it certainly wanted brightening up a little.

With regard to the classification of scientific memoirs he would rather not say anything. It seemed a most difficult problem which had occupied Scientific Societies for many years; but he had no doubt that the help of a Government Department would facilitate it very much.

Personally he cordially supported the suggestion Dr. Forster had made, especially if Dr. Forster could see his way so to arrange it that the private work which was now carried out by consulting chemists should not be interfered with in any way. There had been a danger of that when the National Physical Laboratory was started; but that had been met, and the arrangement made with Technical Societies was loyally carried through. That was one of the cases where co-operation had been successful. The Technical Societies had been represented on the

Governing Board of the National Physical Laboratory, and he thought the results had been most happy. The National Physical Laboratory had been brought into touch with a great many industries, and if something could be done for chemistry as had been done for physics, it would be a very great acquisition for Great Britain.

Dr. ALEXANDER SCOTT (President of the Chemical Society) expressed his sympathy with the motion Dr. Forster had so ably put forward. Both the Royal Society and the Chemical Society, in their memorials to the Prime Minister, had expressed themselves very strongly in favour of an Intelligence Department. It seemed to him that there was no hope of any progress without something of the sort. It should be as complete as possible, and the only body which could make it complete was the Government, who had sources of information which they could obtain, and could insist on obtaining it in a way that no other body could. If such information were readily available to manufacturers and others, it would be of the greatest value. He heartily endorsed Dr. Forster's motion, although he was unable to criticise it in detail.

Mr. A. GORDON SALAMON said that he joined with those who had already spoken, in sympathising deeply with what Dr. Forster had said. He felt sure they would most heartily welcome the sympathetic co-operation of the Government in assisting in the development of the industrial work connected with chemistry which was absolutely essential to their welfare in the future.

There were points in connection with Dr. Forster's remarks to which he wished to call attention with a view to getting further information from him if possible. Assuming a Department such as he had suggested were formed, and were not kept up to date by freshly elected members, there was then a danger that Dr. Forster's paper would ultimately be known as the synthetic production of red tape. That was a danger to which he alluded, but in so doing he meant very respectfully to those interested in Government work. On the other hand he would suggest it was very desirable if such a Department were formed, that it should be in practical co-operation with the best work that could be put in by all the Societies respectively connected with it: that the members of the Committee should not be permanently there, but that the Societies should have the power of helping and stating their views to their representatives in the Department, and should also have the power of renewing those elections from year to year as they might think fit. They would then have not only a sympathetic body, but a body which would be in touch with the other Societies whose existence was of the utmost importance. If such a scheme were carried out, he thought it would very much assist the suggestions which Dr. Forster had put forward.

Mr. ASHLEY (Board of Trade) said that his function that evening was simply to listen, as he had done with very great pleasure, to Dr. Forster's paper, and the discussion on it, and convey the general character of that discussion to his President. They would not expect him to attempt to deal with the suggestions put forward, which must of course be settled by higher authorities; nor would they expect him to deal here with the criticisms of the first speaker on his Department, or on that service with which they worked in very active and hearty co-operation, namely, the Consular Service, except to ask that they might be favoured with definite concrete illustrations, not with the broad accusations which had been brought against the Consular Service. The mere repetition of formulæ which had been used over and over again, and had never been very well substantiated,

would not be of very much use to a Department. What a Department wanted was criticism accompanied by exact and concrete examples.

It was not his place to speak for the Board of Trade. He could only say he had listened with very great interest to Dr. Forster's paper, a portion of which he had heard previously; and he would not fail to convey to his President the sense of the meeting.

Dr. HEATH (Board of Education) said that he was afraid he could not speak in any official capacity. As it happened, he was not there as representing the Board of Education; but they had been kind enough to send him an invitation in connection with his relation to the new Advisory Council of Research. He had listened to everything which had been said, with great interest, and they could be sure he would report all he had heard. Even if it were otherwise possible for a permanent official to contribute to a debate of that kind, they would not expect so new a bantling as the Advisory Council of Scientific and Industrial Research to express any opinions now.

Professor F. G. DONNAN agreed with the remarks of Mr. Gordon Salamon. He thought that the Board of Trade, for example, was very much overburdened with work of all sorts, and had an enormous range of activity with regard to trade and commerce. He agreed that it was best not to form a new Government Department at all. He would like to see a number of men appointed, varying from year to year, who would form a sort of Advisory Committee to deal with all Government Departments (regarded as their servants, which they were). That Committee should make suggestions, and if those suggestions were not taken up the matter should be dealt with in Parliament. The scientific men of the country should have a more important position. He had a great respect for people who were called officials. He hoped Dr. Heath would not take that to be an opprobrious epithet. Their work was onerous, they did not get very much thanks for it, and they had to work quietly. One felt that the country had suffered from the administrator being asked to do too much. The administrator did his own work of administration exceedingly well; but it was only the framework of good government. Good government also consisted in seeing that the maximum material and intellectual wealth of the country was utilised in the best way. He felt that the scientific men of the country, including the Society of Chemical Industry, should form a sort of Advisory Committee to watch over the work of the country, to consider the activities, technical and otherwise, of the country in every sphere of life, and to bring such matters before the Government year by year. The Committee would not be a permanent Committee, and it would include young men as well as old men. Perhaps nobody should be allowed on it for more than three years. They should retire and perhaps come back after another three or four years. In that way the active people of the country who had technical and commercial knowledge would combine together to help the Government and to help the administrators (who were already overloaded with work) instead of asking them to do more.

Mr. JULIAN L. BAKER said that he thought Professor Donnan had put forward a somewhat Utopian idea. They had to take things as they existed now, and to see how they could weave in the result of their activities for the general welfare of the country. There were two propositions before them. The first which had been brought forward by Dr. Forster, and to an extent the ideal one, was that the Government should deal with the matter. On the other hand, could any department of the Government, such as the Board of Trade or the Consular Services, be fairly asked

to solve the problem in its present indefinite position. Clearly a move should come from the technical chemists, and probably the better course would be for the different chemical societies, through the medium of the Joint Committee, which now existed, to submit a definite scheme to the Board of Trade. Chemists should not, however, content themselves with submitting such a scheme, but should be prepared to carry out pioneer work. When some conclusions had been drawn from this work, the Committee would then be in a position to approach the Board of Trade, and make out a case for assistance from the State. As a matter of fact, the Council of the Society had some months ago formed such a Committee, and it had already carried out a considerable amount of work.

Mr. E. J. BOAKE said that he would give a concrete instance with regard to the Consular Service. Some years ago he was in Switzerland on a commercial visit, and called on the British Consul in a certain town, to give him a list of the manufacturers of a certain article. The Consul, with a very pronounced German accent, said he was not authorised to give that information; that if he (Mr. Boake) referred the inquiry to London to the Board of Trade, he would no doubt get the information he required. The Consul had beside him the directory from which the information he wanted could be obtained. What the British manufacturer wanted was that our Consuls should be British born, and not half-and-half English-speaking foreigners. He thought the present state of affairs had shown them how far they were behind in Consular matters. He took it Dr. Forster's paper had been provoked by the national situation, and therefore they were discussing the matter in a national atmosphere. He thought if a Department were set up, such as he suggested, it should be paid for by British capital, and reserved for British chemists. No provision of that sort was made. He did not think they had access to German or Austrian official scientific information. If they had, it was obtained secretly. He certainly thought that the information that might be collected for this Department should be reserved for Britishers only.

He supported entirely what Mr. Salamon had said, that the Committee under the Board of Trade should be appointed by the chemists of the country, and not by party politicians. It was they who should put those men in power. Their election and re-election was rather a different question. A man had to be in a post for a number of years before he acquired the information that would render him of real value. It would be necessary for them to have a highly scientific permanent staff which might be advised by a Committee appointed at intervals.

Dr. M. W. TRAVERS said he did not see how it was possible with only £5000 or £10,000 to advise the chemists of this country on their business. It was proposed to create a bureau with a distinguished chemist at the head of it, if such a chemist could be induced to give up his time to this work. The head chemist would be worth, say, £1000 a year, and his staff of younger chemists would be paid £500 a year. A library on the spot would cost upwards of £2000 a year. It was suggested that these chemists were going to advise the Directors of the vast variety of chemical works of this country. A well-managed works would probably have its own chemist and its own engineer. The smaller works living on rule-of-thumb methods, handed down from the past, and having no advisers, might be able to reap some assistance; but he could not conceive that the well-regulated works would derive any benefit whatever.

During the last few years he had been in a country where the Government was expected to do everything. In that country there were various bureaux, amongst others a bureau of commercial intelligence in Calcutta, which ran an index. It bought two copies of every journal, cut them up and pasted them into books which were card indexed. As this work was, of necessity, carried out by clerks, many absurd mistakes, an example of which he quoted, were made, and the references were often very misleading. The "ledger," as it was called, was really of very little use, and it did not seem to him that the catalogued information in the new bureau would be likely to be of much value. So far as he could see the only solution of the difficulty lay in co-operation. At present the profession was quite unorganised. In the course of the past few months he had been catalogued or classified four or five times. Many of his friends were in the same position. They had sent in statements giving their qualifications and what they were willing to do. Nothing had come of it. Many distinguished chemists, willing to help the country, found that their services were not required. At the moment there was no journal in which matters of interest to the whole profession could be discussed. Papers read before the Society, and the records of discussions, were published in their own Journal, but letters on matters of importance to the whole profession were not admitted. The chemical profession should be organised like the medical and engineering professions, and there should be at least one journal devoted to the interests of the profession as a whole. Until they organised themselves, and showed the Government that they had organised themselves: till they had a policy, and knew what they wanted, it was not in the least likely that Government would listen to them.

Mr. REID said that with regard to the suggestions made by Mr. Ashley, he did not intend to blame the Consuls. He was there to make suggestions to put things right. He did not wish to accuse a body of men who had been badly selected by those who had put them in the places in which they were. If a German were made Consul, he would look out for Germany before Great Britain. He could give concrete instances, but he thought it was a case where they should look at it impartially. He knew one Consul who had written one of the best handbooks on the small arms industry in Belgium, that was Sir Cecil Hertslet. He did not wish to blame them generally, but he blamed the system. He thought Mr. Boake had hit the nail on the head when he said they should have Englishmen.

Mr. ASHLEY said that he did not ask for concrete examples there. All he suggested was that when people had specific complaints against specific Consuls, there was an office always ready to hear them, and try to deal with them.

Mr. REID said that it was not the business of private individuals to bring specific examples with reference to their Consuls abroad. It was the business of the office that appointed those Consuls to see that the country was properly represented. He wished to give one illustration only from his personal experience. When in a large town in France, he had gone to the British Consul and tried to obtain some information which he thought it was the duty of the Consul to give him; but he could not get it from the English Consul, who said it was not his business to give it to him. He then went to the Consul of the United States, who not only gave him the information available in his office, although he was a British subject, but sent an assistant with him round the town to get the rest of the information.

Mr. GARLAND supported the view that chemists were not organised. The first criticism which would be offered to the excellent scheme Dr. Forster had outlined was, that they themselves had not put their house in order. He did not know how many bodies there were, each of which pretended to speak for the chemists of the country; but they had at least the Chemical Society, the Society of Chemical Industry, whose Journal in his opinion was the best English Journal of Chemistry, because it collected all the information with regard to patents, and was far more extensive in its abstracts than any other Journal, and the Institute of Chemistry. As a member of the Institute he supposed he ought not to criticise it, but it did not seem to him that it did a great deal for chemists. It was necessary for English Chemists to belong to it. Then there was the Society of Public Analysts, and an Institute of Brewing. It seemed to him that all those Societies might be very well run together, and have one Chemical Society embracing the whole; any member having the option of joining all the branches and receiving all the Journals, or of joining any particular branch and attending the meetings of, and paying the subscription to, that branch only. He would like to see the chemists organise themselves somewhat on those lines. Until they had done so, they could not hope to get for themselves the same position as the medical and legal professions. He pointed out to Mr. Ashley that one industry in the country dependent for its existence on chemical science had gone to great trouble to place certain facts before the Board of Trade with regard to the importation of manufactured goods, which the manufacturers knew to be of German origin, to this country. So far there had been no decrease in the amount of goods sent over, although the manufacturers at their own expense had sent over an expert to Holland to report to the Board of Trade on the decadent condition of the industry in that country. He did not wish to criticise the Board of Trade. There might be very good reasons why nothing had been done, but those reasons had not been given to the manufacturers. Although the Consul-General in Rotterdam was one of their best Consuls, he had been hoodwinked by a Dutchman, and misleading information had been given to the Foreign Office. He wished they, as chemists, could do something to organise themselves first. Dr. Forster's suggestions appeared to him to be excellent, but they should organise themselves first, so that they could speak to the Government with one voice.

Mr. W. J. A. BUTTERFIELD asked Dr. Forster if he had considered who were the people who were likely to take advantage of the scheme. It seemed to him that they would be divided into two classes; one, those of the prosperous manufacturers who were of a mean turn of mind, and hoped to get useful information without paying professional men for it. If the Department were conceived on the lines which had been indicated by most of the speakers, those manufacturers would get from it information of precisely the value which persons who sought professional advice gratis deserved to get. The other class comprised the impecunious inventor or manufacturer who looked to the State to help him with advice, so that he might become prosperous. If the Department were to be competent to give advice which would be useful to him, it would certainly have to be composed of technical men as a permanent staff; but those technical men must certainly fall back upon consultants and the practical men in the employ of the larger concerns for information which would be of real value. It was no use depending on men whose

primary work was that of education to advise on technical matters. The permanent staff obviously could not be well informed on every technical subject which was brought before them. Professor Donnan had struck the right note in saying they must have an Advisory Committee, and the members of that Committee should be changed from time to time. At the present time all consultants, professors, works chemists, and others were willing to give their experience to the Government; but when the war was over they could hardly be expected, without remuneration on the usual scale, to place their knowledge at the disposal of the Government, to be placed again gratis at the disposal of anyone who chose to seek it. If the Advisory Committee were going to tap the best class of technical men and consultants in the country, that is, men who were moderately well, but not too highly, paid by the more prosperous firms for their advice as consultants, it would certainly have to pay them on ordinary professional terms. So far as he had noticed, very few of the Committee schemes seemed to have taken any account of that fact.

Dr. MIALl said that he regarded the matter from the point of view of an obscure manufacturer who was only called upon at intervals to face the difficult problems of chemistry which were familiar to them all. So far as he was able to judge, it seemed to him the scheme which Dr. Forster had outlined presented many points with which he was most fully in sympathy; but he thought that although there would be great advantages to be gained from the scheme, there were some preliminary steps which might well be taken by chemists towards building the organisation which Dr. Forster contemplated. The latter had outlined a very far reaching and valuable project which would be of great assistance not only to the manufacturers but to consultants, and to the teaching staff, and all who were concerned with chemistry in one way or another.

Taking the manufacturers' branch, there was a great deal which they might do towards co-operating with each other in the way of co-ordinating their information and so on, which would be extremely valuable to them, and were the Government Department formed, would also be of very great value to such a Department. A great deal of the work which Dr. Forster had advocated, in his opinion, should be done speedily. He thought there was a good deal of it which they might do themselves with great cheerfulness, and with comparatively little expense. It was quite easy to see a number of the steps by which that could be done. Recently he had been in France in connection with some chemical manufactures and was astonished to find how much easier it was to get information there from the directories as to the products made by different chemical manufacturers. Comparing the French information on that subject with our own, he was struck at once with a great sense of the inferiority of our own information, and how remarkably easy it would be to collect the same sort of information which the French had diligently collected and made very accessible. There were a great many other points of the same sort which he felt sure they could tackle themselves; and while cordially agreeing with the desire to co-operate and obtain this useful information and have it properly collected and co-ordinated, he would very much like to hear opinions as to whether it would be possible to form perhaps some small Committee, or create some scheme for coping with a portion of the great problem which lay before them, and which earnestly required solution.

Dr. FORSTER said that in connection first with the remarks of the Chairman, he regarded the disability under which Mr. Ashley and Dr.

Heath were placed in respect of this discussion as a strong argument in favour of his proposal, inasmuch as the latter would place at the service of these gentlemen a variety of chemical information upon which they might draw at all times without any call to express their own views in public. The Chairman's fear that active chemists could not be spared for the Intelligence Department would be met in the future, he hoped, by increasing the number of such chemists. Dr. Forster endorsed Mr. Reid's appreciation of the Patent Office index, reminding him that chemists were employed in that office, a state of things which he desired to see at the Board of Trade; he fully agreed with Mr. Reid's demand that the organisation should have executive, and not merely advisory powers, but he deprecated the suggestion made by Mr. Butterfield and Mr. Sutherland that the proposed department would in any way diminish the activities of consulting chemists. A closer study of his explanatory remarks would show that, in his opinion, the contrary effect would be produced, and he repeated the statement that, in his belief, "a judicious Director would administer Clause (5) as an instrument for bringing together the consultants and those manufacturers, large or small, who were not previously alive to the opportunities for assistance in difficulty which such consultants could offer." Dr. Forster welcomed the suggestion, made by Mr. Salamon, supported by Professor Donnan, Mr. Boake, and others, that the Intelligence Department should be in close touch with an elective Advisory Committee, in order that the organisation should avoid the danger of becoming an agency for producing "synthetic red-tape," and he regarded this suggestion as the most useful constructive criticism which had been brought forward that evening, but he could not agree with Professor Donnan that such a Committee should take the place of a permanent staff. Nor did he agree with Dr. Travers that the work should be voluntary; such service was admirable in war, but when conditions again approached the normal, the old human peculiarity of attaching more value to something for which we had to pay would surely assert itself. He considered that the view of Dr. Travers and Mr. Sutherland regarding the insufficiency of the sum he had mentioned could be met very easily by increasing the sum, which he had named only as enough to launch the department, and he did not see how existing chaos would be resolved by publishing another journal, of which there are too many already. In reply to the several speakers who declared that chemists must first organise themselves, Dr. Forster said that he had stood in the pillory that evening with the sole object of helping chemists to organise themselves; this wail for organisation had been uttered at intervals ever since he was chemically born, but nothing came of it, and he begged the Council to take this proposal as a basis for discussion, and thereon construct a scheme which might, if adopted by the Government, benefit not merely chemists but the State.

The CHAIRMAN, in proposing a vote of thanks to Dr. Forster, said that they had had a very interesting and useful preliminary conversation; they were indebted to Dr. Forster for having brought the subject under their notice in so clear and sympathetic a way, and to the various speakers for their contributions. It was much to be regretted that manufacturing interests were not more fully represented; but they had to bear in mind, that London was not the centre of the chemical industries and they must look forward to the real expression of opinion coming more from the Northern Sections.

Mr. Ashley had told them he was there to report to the Head of his Department; he trusted that Mr. Ashley would be able to tell him that the

discussion was entirely in the preliminary stage at present. With regard to the attitude that had been taken up by Mr. Ashley and Dr. Heath, that they were present in an official capacity and not able to enter into the discussion, he ventured to deprecate their attitude. He thought that, at the present time of stress, when it was recognised that all classes in the country must come together and talk out the policy of the future, Government officials ought to unstarch and come forward and discuss things openly with them and tell them of their difficulties. They often criticised Government officials, but they did not know their difficulties. Being officials, they had said they could not reply; but on occasions such as that evening, it would be of very great advantage if the official mind were disclosed and it were known how these matters were regarded by them; they had been asked that evening for that purpose. The Section was not dealing with the matter in any serious official way, but in familiar conclave. Problems of the kind before the meeting must be discussed over and over again in the future; and he hoped the officials would descend from the official pedestal, become members of their body and talk openly. He thought the outcome of the discussion was an expression of opinion that in this matter charity must begin at home; that, as Mr. Gordon Salamon, Prof. Donnan and others had said, primarily it was one that must be taken up by their Society and related bodies. They must clearly make up their minds what the requirements were and sooner or later put those requirements, insofar as they required assistance from the Government, before the Government; the Government should not merely be asked but required to take the necessary steps; in fact when those concerned in industry were agreed what they could do and what they would do, they should instruct those who did not know and never would know so long as they were left to themselves, under present conditions, what they had to do in order to make the case complete. He thought Dr. Forster's proposition should have been put in a far more general form. His proposition ought to have been not that there should be a Chemical Intelligence Department instituted by His Majesty's Government as a branch of the Board of Trade but that the Board of Trade should be made an Intelligence Department. He had listened to the President of the Board of Trade in the House on the dye question; and in view of the action of the Department in that matter it was impossible to think of it as an Intelligence Department; the position had been so absolutely wrecked for a long time to come by their attitude and by their not taking proper action, that he was sure they could not recognise that Department as intelligent for their purposes.

The criticisms which had been made by Mr. Salamon and Professor Donnan seemed to him to be absolutely correct—that it would be impossible to have a Government Department formed which would do this work permanently, unless, as had been suggested, the members were subject to frequent renewal at regular intervals. In the first place, they could not afford to put good men on the shelf for such purposes for many years to come; the country was very deficient in chemists and could not spare a single one for ornamental purposes of that kind; they would want them all to do practical work in the factory; then, no man who was put in such an official position permanently could remain permanently in touch with the industries sufficiently to give efficient assistance. He felt very strongly on the matter himself and he thought the more strongly the fact was emphasised the better it would be—that unless the chemical industry could be organised from within and provide its own Intelligence Department, there could be no chemical industry in the future in our country.

Newcastle Section.

Meeting held at Newcastle-on-Tyne, on Wednesday, November 17th, 1915.

PROF. P. PHILLIPS BEDSON IN THE CHAIR.

SOME POINTS ON WATER SOFTENING BY THE LIME AND SODA PROCESS.

BY FREDERIC A. ANDERSON, B.SC. F.I.C.

In applying the lime and soda process for the treatment of a water, the chemist has to determine in the first instance what quantities of the reagents are to be employed, and when the plant is in operation his services are again required to ascertain whether the results are satisfactory, and if this is not the case, to decide what modification of the treatment is desirable. I propose to deal briefly with these points, and to describe some methods which are very valuable, and not yet to be found in every text-book.

In some cases it is well to have the fullest possible analysis of the water to be softened, but in general there are only four factors which it is indispensable to know. These are: The amount of free carbon dioxide. The alkalinity, or carbonate hardness. The total lime. The total magnesia.

Free carbon dioxide is rarely present in more than insignificant amount, and as a rule may be safely left out of account, but cases are occasionally met with in which the free carbon dioxide is considerable and must receive attention. The simplest method of estimation is that due to Seyler, and consists in titrating the water with standard dilute sodium carbonate, using phenolphthalein as indicator, until a slight permanent pink colour is developed. The method is not altogether satisfactory, as the end-point is often not quite sharp.

The *alkalinity* is always estimated by titration of the water in the cold with standard acid, usually hydrochloric acid, using methyl orange as indicator. It is generally expressed in degrees, each degree being the equivalent of 1 grain of calcium carbonate per gallon.

Total lime and magnesia may be determined by the ordinary methods, but these are rather laborious if much work is to be done. The soap test is of little or no service, as it is not sufficiently precise, at all events with very hard waters, and does not give definite information about the relative proportions of lime and magnesia present, although an approximation can often be arrived at by carefully watching for a "false lather."

A method which I have found exceedingly useful for this purpose is the Lunge-Pfeifer method, which enables both lime and magnesia to be estimated with considerable accuracy, and which does not involve any tedious separation. By this process the total hardness is estimated on one portion and the magnesia hardness on another, and the lime hardness found by difference.

A measured quantity of the water, say 100 c.c., is made slightly acid by addition of hydrochloric acid, concentrated to about 30 c.c., washed into a 100 c.c. measuring flask, a drop or two of methyl orange added, and the liquid exactly neutralised; 10 c.c. each of standard (N/10 or N/5) sodium carbonate and hydroxide solution are then added, and the liquid boiled for two or three minutes. The lime and magnesia are completely precipitated as carbonate and hydroxide respectively. The liquid is then cooled, made up to 100 c.c. with distilled water, and filtered through a dry filter. The excess alkali is then determined by titrating an aliquot part, say 50 c.c., of the filtrate, with the standard (N/10 or N/5) acid. The

amount of lime and magnesia precipitated is measured by the loss of alkalinity observed. If A is the number of c.c. of N/10 acid required by the 20 c.c. of alkaline solution in the blank test, and B the number of c.c. of acid required by the 50 c.c. of filtrate, 100 c.c. of water being taken for the test, the total hardness in degrees will be given by: $-(A-2B) \times 3.5$.

This method gives quite satisfactory results in the presence of magnesia. The proportions mentioned are sufficient for a water containing up to 30° of lime hardness and 30° of magnesia hardness.

The accuracy of the method is indicated by the fact that in thirteen consecutive tests, hardness calculated from gravimetric estimations of lime and magnesia differed from the hardness determined by the method just described by not more than 1°, the average difference being 0.2°.

Magnesia. For this purpose a modification of the method was devised by Pfeifer, and independently by myself. As the result of a large number of experiments it was found that magnesia could be precipitated practically completely, yet free from lime, from a dilute mixture of calcium and magnesium salts, by treatment in the cold with excess of caustic soda. It is only necessary to exclude access of carbon dioxide by employing a closed vessel and avoiding filtration.

The water is acidified and concentrated as described above, but is transferred to a stoppered 100 c.c. measuring cylinder instead of to a flask. It is exactly neutralised as before, and 10 c.c. of the sodium hydroxide solution added. The liquid is made up to the 100 c.c. mark and the cylinder stoppered. The magnesia is precipitated as hydroxide. When the supernatant liquid is quite clear (2 hours or more) 50 c.c. of the liquid is titrated with standard acid. A calculation similar to that given above furnishes the magnesia hardness in degrees. In comparative tests the following amounts of magnesia in grains per gallon were found: Gravimetric: 0.93, 1.66, 1.92, 10.96. By method described: 0.90, 1.62, 1.95, 10.80.

I have used the method for some years and am convinced that it is reliable.

The calculation of the quantities of reagents required is now a simple matter of chemical arithmetic, the principle involved being to convert all calcium salts to carbonate, and all magnesium salts to hydroxide.

The results obtained by the analysis are:—Alkalinity or temporary hardness, total hardness, and magnesia hardness. By some obvious subtractions and adjustments the total hardness of any water can be expressed as being made up of: temporary lime hardness; temporary magnesia hardness; permanent lime hardness; and permanent magnesia hardness, three out of these four being generally recorded.

The amount of lime required can be expressed either as percentage of saturated lime water (i.e., the volumes of lime water to be added to every 100 volumes of crude water) or as pounds of lime per 1000 gallons of water. The soda is expressed as pounds of soda ash per 1000 gallons, assuming the soda ash to contain about 98% of actual sodium carbonate.

The factors to use are as follows:—

Temporary lime hardness $\times 0.62$ = Per cent. lime water.

Temporary magnesia hardness $\times 1.24$ =

Permanent lime hardness $\times 0.15$ = lb. soda ash per 1000 galls.

Permanent magnesia hardness $\times 0.62$ = Per cent. lime water, and

$\times 0.15$ = lb. soda ash per 1000 galls.

The percentage of lime water found, divided by 5, gives the lime required in lb. per 1000 gallons, with an allowance for waste.

The proper proportion of reagents having been determined, and the softener having been adjusted to supply them in the right proportions, it remains to examine the results obtained, and if any fault

be found to correct the treatment suitably. The whole of the requisite information can be obtained from the results of two simple tests—the hardness, by the soap test, and the alkalinity to phenolphthalein and to methyl orange.

Having obtained the degree of hardness by the soap test, the alkalinity is next determined by means of a double test as follows.

A measured volume of the water (70 or 100 c.c.) is titrated with standard acid (using phenolphthalein as indicator. If N/10 acid has been used, the c.c. of acid used, multiplied by 3.5 (for 100 c.c. of water) or by 5 (for 70 c.c.), gives the phenolphthalein alkalinity in degrees. Two drops of methyl orange solution are now added, and the titration continued till the solution is neutral. The whole amount of the acid used is multiplied by the proper factor as before, and the result recorded as the methyl orange or total alkalinity.

The phenolphthalein figure is multiplied by 2, and total alkalinity subtracted from the result. If there is a positive remainder, caustic alkalinity is present, and the remainder is the caustic alkalinity in degrees. If there is no remainder, only carbonate alkalinity is present, whilst if the remainder is negative, the interpretation is that bicarbonate alkalinity is present to an amount, in degrees, numerically equal to the remainder.

If the amount of soda added in the softener has been correct, the hardness and the total alkalinity will be the same; if the soda is in excess, the total alkalinity exceeds the hardness, and if deficient, the hardness exceeds the total alkalinity.

If the quantity of lime added has been correct, the phenolphthalein figure will slightly exceed one-half the total alkalinity, i.e., a slight amount of caustic is present. If lime is deficient, the phenolphthalein figure is less than one-half the total, or bicarbonate is still present, and if excess of lime has been used, the phenolphthalein figure will decidedly exceed one-half the total.

The terms "slight" and "decided" are rather vague, but one cannot be quite precise upon the point, because it all depends upon whether the water contains little or much magnesia. With a chalk water, say, containing very little magnesia, it is often possible to soften satisfactorily with an excess of lime only corresponding to half-a-degree of caustic. But with such waters as are obtained from the dolomite in Durham—Sunderland water, for example—it is often impossible to reach the lowest point unless quite 2° of caustic is indicated, and this I am disposed to attribute to a slight amount of magnesium hydroxide in solution.

Any errors of treatment disclosed by these tests are also presented in a quantitative form, so that the exact alteration necessary can be calculated.

To illustrate these remarks I give results obtained by two different machines upon water from different wells in the same stratum, but substantially the same. The original water contained about 54° of hardness, and was highly magnesian. The two softened samples are both slightly above the minimum point, but the explanation in the two cases is different.

	No. 1.	No. 2.
Hardness	8.0°	8.1°
Alkalinity, phenolphthalein	2.5°	3.9°
Alkalinity, total	9.0°	6.0°

In No. 1, lime is deficient, 4° as bicarbonate being still present, doubtless mainly magnesium bicarbonate. Hence $4.0 \times 1.24 = 5\%$ additional lime water is required. No. 2 is 2° deficient in soda. The caustic indication is 1.8°, hence the lime is correct, as the water is magnesian, and

$2.0 \times 0.15 = 0.3$ lb. of soda ash per 1000 gallons additional is required.

The best result that I can find in the records of one of these machines is as follows:—

Hardness, 4.0° ; alkalinity (phenolphthalein), 3.0° ; total alkalinity, 4.0° ; caustic alkalinity, 2.0° . The average of 30 consecutive tests taken 5 times daily for 6 days gave: hardness, 4.8° ; alkalinity (phenolphthalein), 4.4° ; total alkalinity, 5.9° .

These indicate, on the whole, a trifling excess (1.1°) of soda ash, and caustic, 2.9° , also rather on the high side, but hardly so much so as to call for any alteration.

New York Section.

Meeting held at the Chemists' Club, on Friday, October 22nd, 1915.

DR. W. M. GROSVENOR IN THE CHAIR.

THE DYESTUFF SITUATION IN THE UNITED STATES.*

The CHAIRMAN said that while the dyestuff industry was primarily the subject before the meeting, yet actually it involved the question of national defence, since the United States must have an organised and developed coal-tar dye industry in time of peace in order to have at its disposal the facilities for the manufacture of high explosives in time of war. The preservation of peace, the very life of the nation was dependent on what they did in this matter of a dyestuff industry.

Prof. C. F. CHANDLER mentioned that the first coal tar colour, picric acid, was discovered in 1771, though it was not made from a coal tar product. It was obtained by Woulfe, by the treatment of indigo with nitric acid. Laurent prepared it from the carboic acid of coal tar in 1841.

Dr. Perkin published the account of the preparation of mauve in 1856. Later there was a great deal of litigation over coal tar colours and coal tar drugs in this country. The United States granted patents for products as well as for processes, and the consequence was that when differences arose among the manufacturers of Europe, they would bring their lawsuits in America. There were five lawsuits on artificial alizarin. More than forty years ago Poirrier and Co. brought lawsuits in America on Rousseau's patents for azo colours derived from sulphanilic acid and naphthionic acid.

In 1876, at the Centennial at Philadelphia, a full collection of specimens illustrating the coal tar colour industry was exhibited by the Bayer Company of Elberfeld. The exhibit consisted of about 160 specimens, including several specimens of coal, tar, and so forth.

The aniline works of the Bayer Company was equipped in 1862, and the alizarin works in 1871. In 1875 they had 11 chemists, 14 in the administration office, 16 master foremen, 3 engineers, 28 smiths, machinists, and firemen, 3 coopers, and 193 workmen. Ten years ago they had 8000 workmen and 300 chemists.

The first edition of Schultz and Julius' Catalogue of Colours, published in 1888, included 278 colours. The last German edition contained about one thousand. Dr. Bogert had informed him that fifty thousand different coal tar colours had been described up to the present time. One of the most interesting books on coal tar colours was that published by Friedländer, reviewing the

progress in the manufacture of dyestuffs from 1877 to 1912. It occupied thirteen volumes, and gave either the whole or the essential part of every important patent that had been taken out in that time. Another valuable work was No. 210 of the last U.S. census, containing a list of all the chemical patents down to 1902. All the dyestuff patents contained in that list had now expired. If the Government would complete that work down to date, it would greatly aid the chemical industry.

Hall's motor spirit, benzol, and toluol.

Professor Chandler then mentioned that he had conducted some experiments to ascertain the nature and results of W. A. Hall's process for producing motor spirit, benzol, and toluol from crude petroleum or petroleum by-product oil.

The raw material used was the "gas oil" or "petrolite" of the Standard Oil Company, selling at from $3\frac{1}{2}$ to 4 cents per gallon. Its specific gravity was 0.81 (44.5° B.) at 11° C. (52° F.), and boiling pt. 130° C. The products of the first passage of 18.97 litres of this material through the apparatus were motor spirit, sp.gr. 0.77 at 11° C., initial b.pt. 26° C., 10.60 litres; light residuum, 6 litres; heavy residuum, 0.65 litre; fixed gas, 46.5 cubic feet. The 6 litres of light residuum was passed through the coil again, yielding 2.7 litres of motor spirit, a total of 13.3 litres, or 70.6% of the original oil.

An efficiency test on an automobile engine, compared with a gasoline of sp.gr. 0.73, indicated that one gallon of Hall's Motor Spirit did the work of 1.18 gallons of gasoline at 1600 revolutions per minute; 1.34 gallons at 1400 revs.; and 1.31 galls. at 1200 revs. per min. There was no noticeable difference in the behaviour of the liquids either in ease of starting, absence of black smoke, or soot deposits in the cylinders.

The investigation was made before the outbreak of the war on the Continent, and consequently the importance of benzol and toluol was not realised, and no experiments were made to ascertain what percentages of these substances were contained in the products.

The process as claimed in Eng. Pat. 24,491 of 1913 (see Fr. Pat. 467,381; this J., 1914, 853. See also this J., 1915, 346, 414) was as follows:—

"A process of producing a motor spirit from heavy hydrocarbon oil consisting in cracking the hydrocarbon oil at a temperature upward of 600° C., separating by fractional condensation from the product of the cracking operation the gases and that portion of the liquid which is volatile at a temperature of approximately 200° C., and condensing together under pressure such vapour and gases to produce a liquid, substantially as described."

The following is a brief description of the process from the Scientific American of May 1st, 1915:—

"The oil is fed at a rate exceeding 70 gallons per hour through small tubes of a total of 300 ft. in length, at some 50 to 75 lb. pressure. The apparatus is so worked that the speed of the vapour is over 5000 ft. per minute. The oil is first vaporised in a coil preheated in the flue by the waste heat of the products of combustion from the furnace. The temperature in the centre of the tubular nest is about 550° C. The vapours then pass to a vertical pipe about 12 in. internal diameter and 12 ft. high, entering through a very confined space acting as a throttle and impinging upon a baffle. The speed of the vapour flow is thus reduced from nearly 6000 ft. a minute to a nominal rate. The temperature rises, notwithstanding the reduction of pressure from 50 to 75 lb. down to atmospheric pressure, and a large amount of cracking takes place. The vapours pass through dephlegmators and the

* Members can obtain a reprint of this series of papers on application to the General Secretary, Broadway Chambers, London, S.W., or to Dr. P. C. McIlhenny, 50, East 41st Street, New York City.

uncondensed vapours and gases pass then to a mechanical compressor, working under 70 to 100 lb. pressure per square inch, and then through a cooler at this pressure, where they are condensed to motor spirit, the uncondensable gas being passed on to a holder."

A plant has been erected in England with a capacity of 6000 gallons of motor spirit per day. This plant has been taken over by the British Government and is in full operation.

DO WE WANT A COAL-TAR CHEMICAL INDUSTRY?

BY DR. EDWARD EWING PRATT.

Chief of the U.S. Bureau of Foreign and Domestic Commerce.

The German coal-tar chemical industry is probably the most highly and completely organised industry in the world. Of the raw material—coal—Germany has practically an unlimited supply. The crude coal-tar products are less than a dozen in number. Then come nearly three hundred intermediate products, non-tinctorial derivatives, which are finally developed into more than nine hundred commercial dyestuffs and a host of pharmaceutical preparations, explosives, photographic materials, and other chemical products. Commercially, the coal-tar chemical industry of Germany is a unit. Prices, terms and conditions of sale, market competition, export policies, are determined and fixed by the industry as a whole. In addition, the industry receives from the Government the most favourable treatment in the matter of regulation, taxation, tariff protection, and conventional arrangements with other countries.

The industry as it stands to-day is a monument to the inventive power, technical skill, and keen business management of the German chemists. The 21 stock companies have a nominal capital of over \$53,358,000 (1913), on which the declared dividends (\$11,600,000) average 22%. The actual profits are much larger, but the surplus has been put back into the business in the shape of new plant, etc. It is the most remunerative industry in the German Empire and the one of which Germany is proudest as illustrating her combination of science and practice and her ability to capture the world's markets.

Up to the present time there has been no serious competition with the German coal-tar chemical industry. Germany has created and maintains a practical monopoly of the intermediate and finished products. Any attempt seriously to dispute its dominance in other countries is persistently checked and prevented by the united action of German producers by underselling and boycotts. The manufacture of finished dyes is permitted to exist on a small scale but is always kept dependent upon the supply of German crudes or intermediates.

The predominance of the German coal-tar dye industry may be realised from the fact that of the world's production of coal-tar dyes, valued at \$92,150,000, Germany produced \$68,300,000 worth, or 74%.

Countries.	Value.	Per cent.
Germany	\$68,300,000	74.1
Switzerland	6,450,000	7.0
Great Britain	6,000,000	6.5
France	5,000,000	5.4
United States	3,000,000	3.3
Austria	1,500,000	1.6
Russia	1,000,000	1.1
Belgium	500,000	0.6
Netherlands	200,000	0.2
Other Countries	200,000	0.2

Of the world's export trade, Germany has an even larger share:—

Countries.	Value.	Per cent.
Germany	\$48,130,000	88.2
Switzerland	5,450,000	9.9
Great Britain	990,000	1.8

The German dyestuff industry has had an even more complete monopoly of the crudes and intermediates. For example, there are about \$24,000,000 worth of dyestuffs produced outside of Germany. Over one-half of these dyestuffs are produced from German raw or semi-manufactured materials. In one class of colours, namely the alizarin colours, and for many minor groups of colours, Germany has been the sole source of supply. In short, Germany has been in a position to render practically impossible the production of intermediates or finished dyes in any other country.

Three factors are to be taken into consideration in considering the American dyestuff industry. These are: Raw materials, markets, and technical skill. The raw materials in the United States are ample. The coal supply of the United States is five times greater than that of Europe. Large quantities, far in excess of those mined in Germany, are required for illumination, for fuel, and for coking purposes in connection with our enormous iron and steel industry.

The value of the artificial dyestuffs consumed in the United States amount to about \$15,000,000 annually. This represents one-sixth of the world's output, and over one-fifth of Germany's output.

Perhaps in technical skill we are less well equipped, but it is probably on account of the small demand. There are plenty of schools turning out well-equipped chemists who will be available for this work.

We need not worry about capital. Capital can be found.

The first American plant was established in Buffalo in 1879. Others were established until the total was nine. The manufacture was based, however, on the use of imported intermediates. Attempts to use American raw materials failed, owing largely to the uncertainty of the raw materials. In 1883, five of the nine establishments were closed. Four have continued and flourished in spite of the keen competition from abroad. One of the largest German dye manufacturers has established a branch factory here in order to take advantage of a favourable turn in our tariff.

The experiences of American manufacturers in attempting to establish this industry are illustrated by the following quotation from a letter, now an official document, from the Benzol Products Co. to the Commissioner of Corporations, under date of January 2, 1915:—

"It may be of interest to recite the experience of the Benzol Products Company in attempting to inaugurate the Aniline industry in the United States of America.

"Up to the year 1910 European competition had prevented the successful manufacture of aniline oil, notwithstanding that attempts had been made by the Barrett Manufacturing Company at Frankford, Pa., and the Semet-Solvay Company at Syracuse, and the Schoellkopf Hartford and Hanna Color Works at Buffalo. With these exceptions, until 1910 the entire domestic consumption of both aniline oil and aniline salt was imported from Europe.

"The Barrett Manufacturing Company and the Semet-Solvay Company therefore in 1910 invited the co-operation of the General Chemical Company to strengthen their organisation and supply the

acids that represent so important an item of the cost of production.

"The Benzol Products Company was therefore organised in the State of New York for the manufacture of organic and inorganic chemicals, benzol and its homologues, their products and by-products. Although this Company started with a capacity of approximately only one-tenth of the United States consumption, the European Convention immediately announced their intention of putting us out of business as promptly as possible by underselling, regardless of cost. Accordingly they at once cut the regular net delivery market price of their exports to this country from 10·9 cents per pound to 9·9 cents per pound and made secret contracts for sales in large quantities at far lower prices. In the instance of one of the largest consumers of the United States a price for aniline oil of 8·5 cents failed to secure the contract. Similar reductions in price had not taken place in other countries, the reduction here being made in the face of a world-wide advance in the price of the materials entering into the manufacture of aniline oil, in addition to the well-known advance in the labour involved in its production.

"In the latter part of 1912 a British member of the Convention, representing the largest English manufacturer of aniline oil, called at the office of the Benzol Products Company and stated, in substance, that if the Company would go out of business the Convention would agree to sell aniline oil to them at a price that would enable them to make some profit out of their existing contracts, but if they were unwilling to accept this course, the Convention would again put down the price, as it had been determined that the American enterprise must be 'nipped in the bud.'

"It was believed by the three constituent companies involved in the enterprise that the Convention was fixing prices which netted the European manufacturers a loss, even when manufacturing on the gigantic scale on which they operate. The Benzol Products Company therefore withdrew from the market and limited its operations to the extent to which they were under obligation by contract."

Another American dyestuff concern reports a considerable list of colours, the continued manufacture of which was rendered commercially impossible by the prolonged underselling on the part of foreign competitors, at rates below the ordinary market prices of the wares in question. The principal colours were the following:—Cotton Scarlet 3B, Cloth Red, Fuchsine TR, Brilliant Red B, Eosine, Tartrazine, Brilliant Yellow S, Roccelline, Fuchsine Crystals, Cerise, Acid Magenta. Some 51 other colours, which were manufactured successfully in this country on the basis of current selling prices abroad for the same colouring materials, were exposed, shortly before the outbreak of the present war in Europe, to relentless underselling on the part of foreign competitors. This underselling had been carried to such a point that the American sales were rapidly decreasing. It was evident that in a very short time the continued manufacture of these colours would be totally impossible. The great European struggle naturally put a stop for the time being to this industrial war. The company manufacturing the colours in question counts, however, on being exposed to the same relentless attack, on the resumption of normal international relations, unless such unfair competition is in some way prevented.

This was the situation which faced us at the outbreak of the European war. For some weeks immediately following, we received no dyestuffs from Europe. Then some importers who were exceptionally enterprising and daring succeeded in getting out a very considerable supply. Since the middle of March last, however, no dyestuffs have reached this country (except one small shipment,

and one or two said to be now on the way). In spite of the large quantities of dyestuffs in warehouse in this country the supply is now practically exhausted. Many plants have been forced to close. Many others have seriously curtailed their output, and readjusted their mechanical methods at very large cost. The total loss, direct and indirect, now being borne by American users of dyestuffs and dyed wares, amounts to not less than \$1,000,000 per day.

Our users of colours have reverted to dyestuffs and methods long since obsolete and almost forgotten. They have found it necessary to restore the older methods used in connection with the natural dyestuffs and long since discarded. They have reverted to colours which are not so fast to light or washing, colours of less range and brilliancy, colours imperfectly standardised and less easy of manipulation. American dyers have resumed the use of the indigo and cutch of India, the madder of Turkey, the cochineal of the tropics, the logwood, fustic, and other dyewoods of Latin America, and a variety of mineral colours such as Prussian blue, chrome green, yellow, and orange, and iron buff.

Colour is a vital factor in many industries. Most important, perhaps, are the textiles—cotton, silk, wool, linen, jute, and other fibres. Then follow paints, varnishes, and pigments of all kinds, ink, leather articles, paper, feathers, artificial flowers and foliage, straw goods, wood and wicker work, horsehair, bristles, and felt, buttons, shoe blacking, glue and gelatin, celluloid, soap, wax, paraffin, stearine, and many kinds of oils, and so on. The annual output of the industries affected is probably not much less than \$3,000,000,000.

The United States is not the only nation suffering from this situation. Practically every other nation is seriously affected. This is particularly true of Great Britain, where strenuous efforts are being made to start a dyestuff industry. There, the national Government in co-operation with the users of dyestuffs has worked out a plan for the solution of the problem.

Similar movements with more or less of Government co-operation have been inaugurated in France and Italy. In Russia a national dyestuff enterprise has been organised and financed by the chief consumers of dyestuffs. Technical and administrative leaders have been supplied by a leading Swiss firm. In Japan the Parliament has passed a Bill subsidising dyestuff enterprises; the amount of subsidy will be sufficient to enable the companies to pay 8% dividends. Japan has been importing \$3,500,000 worth of dyes annually.

Since the outbreak of the European war, the American coal-tar dyestuff industry has made great strides forward. The factories in existence at that time have greatly increased their output. New establishments for the manufacture of intermediates have been brought into existence. Thousands of tons of benzol and coal-tar heretofore recklessly wasted are now being saved and utilised.

The census of manufactures taken in 1909 reported the total output of coal-tar dyestuffs manufactured in this country to be 5,890,000 lb., valued at \$1,813,000. The output was probably much increased over these figures at the time of the outbreak of the European war. Since that time the five domestic concerns manufacturing dyestuffs have doubled their outputs. Another factory, the branch of a large German firm, has greatly increased its output. Still another factory manufacturing aniline has quadrupled its output.

But the great need and the great demand for dyestuffs have also brought many new concerns into the field. There are now nine new plants making aniline and intermediates. Their total output is approximately 18,000 lb. daily. One new plant for manufacturing dyestuffs, capitalised

at \$2,000,000, is now in existence and is producing at the rate of 1000 lb. daily. Another plant will be ready for operation about November 1. Another company, capitalised at \$15,000,000, has started plans for extensive works in different sections of the country.

Our total production of coal-tar dyestuff materials at the present moment is probably over three times the production prior to the European war.

In July, 1914, we were saving a scant 10% of the coke by-products by means of by-product recovery coke plants. To-day we are saving not less than 20%. We are making progress, but there is still a long way to go.

There is one set of figures which the prospective manufacturer of dyestuffs in this country must have before he is ready to begin operations. Those are the amounts of the various dyestuffs imported into the United States. We have, it is true, a general knowledge of what is used, but we, and the manufacturer, must know definitely, so that he can lay his plans accordingly. For more than six weeks, Dr. Thomas H. Norton, of the Bureau of Foreign and Domestic Commerce, and a small staff of statisticians have been working on this problem and their work is nearing completion.

During the last normal fiscal year we imported the following amounts of the principal dyestuffs :—

	1914.	1915.
Alizarin and alizarin dyes	\$845,459	\$1,586,099
Artificial indigo	1,015,201	1,058,990
Other coal-tar dyes.....	7,241,406	5,851,887
Total	\$9,102,066	\$8,496,976

The report soon to be published by the Bureau of Foreign and Domestic Commerce will establish definitely the quantities and values of each of the many items comprised under "alizarin dyes" and especially under "other coal-tar dyes."

This report when completed will show exactly the amount of each of the many artificial dyestuffs now in current use in this country, consumed by our various textile and other industries during the fiscal year 1914. Such a census of dyestuffs has never been attempted in any country. The accomplishment of this task is absolutely essential for the establishment on our soil of a comprehensive, self-contained coal-tar chemical industry with proper correlation and co-ordination between its manifold divisions and subdivisions.

There is still, however, one serious obstacle in the way of the confident and determined development of a coal-tar dyestuff industry on American soil, and that difficulty is the possibility, or rather the certainty, that upon the resumption of normal international conditions, European manufacturers will endeavour by boycott, underselling, and other methods of competition, to win back this profitable market and put out of business a new and struggling dyestuff industry.

This does not mean "dumping" in the ordinarily accepted meaning of the word, the mere selling of a surplus product at a lower price, or giving a small discount to cover selling expenses which are carried by the American importer. Finally, and perhaps this is the most important fact, it does not mean lower prices to the American consumer. On the contrary it means higher prices, monopoly prices, in the long run.

The thing we have to guard against is persistent, determined, unfair competition in its most virulent form under the guise of dumping.

It will be a kind of unfair competition which is prohibited in the United States under the recently enacted anti-trust laws.

The Clayton Act, so-called, expresses the matter in no uncertain terms, "that it shall be unlawful for any person engaged in commerce, either directly or indirectly, to discriminate in price between different purchasers of commodities." This provision, however, probably applies only to the United States, but it expresses clearly what we in this country are inclined to call "unfair competition." (Clayton Act, Public—No. 212—63rd Congress.—Section 2.)

The measures which our foreign competitors will use are the ones they have used before. They will send in their goods at prices lower than the cost of production either at home or in this country and lower than the selling prices in other foreign countries. They will sell here at those prices until the American manufacturers are driven out of business. Then the former prices will be put back and will be advanced enough to recoup the losses incurred in the meanwhile.

With regard to crude material but little difficulty may be expected. American coke plants and tar works are rapidly making provision for all prospective needs. Annual imports heretofore averaged in value \$600,000. About one-third of the quantity has come from Germany; the remainder was largely of British origin. In connection with the supply of intermediate products, the case is quite the contrary. Our small group of American dyestuff works at the outbreak of the present war was almost entirely dependent upon foreign sources for its stock of half-manufactured products, ready to convert into finished dyes. The value of the annual import has been about \$1,500,000, including \$340,000 for aniline oil and salts. Most of this supply came from Germany. Should our existing dyestuff works make any serious attempts to enlarge the scope of their manufacture and their future consumption, foreign firms would have it in their power at the return of normal relations to cut off entirely this supply of intermediate products—about sixty in number. This would cripple indefinitely the American plants seeking to re-establish their former lines of manufacture, now largely interrupted, until the domestic production of the compounds in question is perfected. In the meantime, the dyestuffs ordinarily furnished by the American works must be secured from Europe. At present these works are concentrating their efforts on a few staple dyes which can most easily be manufactured from available domestic material.

The price to be paid for any restoration of the *ante bellum* relations would undoubtedly be long time contracts for supplies of intermediates, and abstention from any enlarged scheme of output. Foreign interests would thus hold at their mercy, to a certain extent, the existing domestic plants, the logical nuclei for the expansion of the genuine national industry, unless the latter are ready to enter upon a relentless industrial warfare for a year or longer. In the case of any effort by new firms to establish in the United States on a large scale the production of coal-tar colours made from American raw material, the tactics of our foreign competitors would, in the opinion of competent authorities, probably be as follows :—All supplies of intermediates to newly established works would be rigidly withheld, and the task of building up a new industry would be rendered doubly difficult during the initial stages. At the same time, prices on all dyes liable to prospective competition, would be lowered below the cost of manufacture in the new works, and all American consumers would be refused supplies of dyes except on iron-clad contracts to purchase fixed amounts for a term of years from foreign makers. These same terms would be enforced against the various firms importing dyestuffs for

distribution to small customers or occasional buyers.

Practically four-fifths, if not all, of the multitude of American textile and other plants depending upon colour as an indispensable factor in production, would be forced to face the problem of choosing between two alternatives:—

(A) Continuance in the undisturbed assurance of a regular and uninterrupted supply of dyestuffs at lower prices than formerly, using the dyes to which they have been accustomed for years, to which their complex methods of manufacture and entire organisation are adjusted, by refusing to purchase products of American colour works.

(B) A struggle for one or two years with a fraction of customary colour supplies, by adjusting processes temporarily to the use of mineral and vegetable dyestuffs and undergoing all the strain and loss incident to widespread dislocation of technical operations and merchandising routine, until the American industry can meet the bulk of demands for staple dyes. A still longer delay before the domestic industry can furnish the variety of more complex and more expensive, although less abundantly used, colours which complete the cycle of tinctorial products in current demand.

The most powerful weapon, however, in the hands of the foreign manufacturer is the power to throw out of gear our enormous textile industries and all dependent interests, during the period inevitably necessary to create an American coal-tar industry. Under the most favourable auspices this could not be accomplished for the bulk of staple dyes under two years, and a couple of years more are required for the class of minor dyes. The possibility of sinking large sums of money in the requisite plan for a self-contained dyestuff industry and then finding the domestic market practically mortgaged by a foreign rival for, say, five years, forces capital to hesitate in committing itself to what would otherwise seem a safe, certain, and naturally patriotic investment.

In Washington this matter has had serious attention because its importance merits the most careful and painstaking study. Action should not be based on impulse or sentiment, but on hard facts and experience wherever we can get them. Action should then be fast and certain. This matter has been thoroughly discussed by the officials of the Department of Commerce and the Federal Trade Commission, and they have agreed substantially on these points, namely:—

(1) That foreign concerns should be permitted to exercise no privileges in this country or against concerns in this country which are prohibited to domestic concerns. In other words, what we call unfair competition shall not be permitted any more to foreign concerns than to domestic concerns.

(2) That this or any new industry which aims to place us in an independent position industrially among the nations of the world shall be given a fair chance.

Recommendation will be made by the Department of Commerce that Congress, in whose hands this matter ultimately rests, shall pass such legislation as will, beyond the peradventure of a doubt, accomplish these objects.

The pertinent question which at once arises, is *how*. By what method, by what legislation, can this be accomplished? In answering the question we have the experience, brief it is true, of three other countries, Canada, South Africa, and Australia. Their legislation may be briefly summed up as follows:—

Legislation against dumping appeared first in Canada, probably because the Dominion was a favourite field for dumpers and because the nascent Canadian industries were quick to cry out against the periodical flooding of their market with foreign merchandise sold at prices so low

as to make competition ruinous. In 1904 the first anti-dumping law became effective, and in 1907 the present law was embodied in the Canadian customs tariff. Under it articles from abroad of a class or kind made or produced in Canada are subjected to a dumping duty equal to the difference between the actual selling price of the imported merchandise and the fair market value in the country of exportation, when the fair market value exceeds the export or selling price by more than five per cent. The dumping duty applies to free goods without any exemption allowance.

In 1914 the South African customs tariff carried an anti-dumping provision, modelled closely on the Canadian law. As in Canada, the special or dumping duty may not exceed 15 per cent. *ad valorem*. But differing from the Canadian law, the South African anti-dumping legislation does not specifically apply to articles which are exempt from the ordinary customs duties.

In Australia the anti-dumping legislation is included in the Industries Preservation Act of 1906, which is directed against monopolies and deals with the general subject of unfair competition. The comptroller-general upon due cause certifies cases to the courts, where the question of whether there is or is not dumping is judicially considered. If dumping is proved importation of the commodities in question may be prohibited or restricted.

In Australia the anti-dumping legislation is a part of the general law against unfair competition, while in Canada and South Africa, possibly for ease in administration, it is a part of the customs law.

Legislation to attain the desired result should certainly comprehend certain important features, which are outlined below:—

(1) Unfair competition should be so defined as to comprehend the practice of sending goods into the United States at prices lower than those current at the point of production for similar qualities and quantities, and under similar conditions of sale.

(2) The market price in the country of production should serve as a guide and standard of price.

(3) A small leeway of say 5% should be permitted in order to cover differences in the conditions which are always present in the commerce between two countries.

(4) The sporadic sale of certain goods during a brief period when clearly not intended to undermine American industry, should be excluded from the operation of the law.

(5) The law might be made enforceable in several ways: (A) A consul may refuse to certify the invoices of wares sold in contravention of the law. (B) The difference between sale price and actual market value may be assessed as a fine. (C) The wares from foreign concerns which refuse to show their books for authorised inspection may be denied entry into the United States. (D) Any American importer or merchant who becomes a party to a proceeding of the character in question shall be amenable to the provisions of the Clayton Act. (E) The United States customs officers would be charged with the duty of discovering such undervaluations.

The question of the tariff has been raised in connection with the building up of this new industry. I think it has been raised more energetically by those who have neither the capital nor the intention to embark in the industry than by those who are actually going forward with their plans. The tariff question can be left out of our discussion. We are not likely to reach any final conclusion in such a discussion. To bring in the tariff simply means to divide those who are interested into two groups, most of whom will not be guided by the few pertinent facts as to the

merits of the question, but will form their judgments on other irrelevant and often hereditary grounds. I prefer, therefore, to stick to matters which in this instance at least seem to me to be of greater importance, and on which we may be able to reach a conclusion.

In this particular matter, however, the proposition as to whether or not we can compete with European manufacturers after the close of the great European war is a pertinent one.

The whole problem rests on the cost of production, whether we will be more or less able to meet European costs after the war. It is important in discussing this point to consider such important facts as interest, wages, and taxes. It can scarcely be argued that taxes will be less in Europe after the war. It is evident that the tremendous debts that are being piled up will not be paid off within the next fifty to one hundred years, and that during their existence they will constitute a heavy tax on European industry. Labour, at any rate able-bodied, efficient labour, is likely to be scarce at the end of the war because the best mechanics of Europe are now in the front ranks to the fighting armies. It has been the universal experience that immediately after the great wars of the last century interest rates have become higher. It seems to me logical that as a sequel to the vast destruction of capital which is going on in Europe and the diversion of capital from productive uses, it will be scarce in quantity and largely in demand at the close of hostilities.

The development of the coal-tar dyestuff industry in the United States has greater significance than the mere evolution of a single industry. The existence of such an industry in this country means the development of a number of other industries directly dependent upon it, such as the manufacture of pharmaceutical preparations, of artificial perfumes, of photographic chemicals, of high explosives, etc. The establishment of this one industry has the indirect effect of assisting and promoting a score of other industries which are dependent upon the use of its products in their processes of manufacture.

Chemistry has been truly called the intelligence department of industry. It is, therefore, particularly important that we should develop a comprehensive chemical industry in the United States, of which the coal-tar industry is perhaps the most important and the most essential part. It is not merely a matter of a single industry, or the matter of attaining increased efficiency or a wider variety of products in one industry, but applied chemistry is largely the successful utilisation of by-products. Therefore, the development of a chemical industry in the United States means increased efficiency and increased economy in every industry in this country. It is also pertinent to point out that perhaps the fundamental reason for the peculiar success of the German coal-tar chemical industry has been the willingness to devote years and years of effort to careful scientific experimentation or the development of a new process or of a new product. It is this long time investment for the future, the method of unceasing experimentation, that American industry must learn.

The prospective development of any industry—and this is particularly true of the chemical industry—parallels the development of science and knowledge. The nations whose natural products are the most intensely studied and the most thoroughly utilised are those which attain industrial supremacy.

It is our desire that the United States shall have independent and self-sufficing industries. I hope that the time has arrived when we can cast off industrial, commercial, or financial allegiance to any nation or any group of nations. I hope that

the time has arrived when we can do away with our industrial crutches, and go forward into the world's markets, man for man, industry for industry, and compete fairly and squarely at home and abroad, and win.

THE ANILINE INDUSTRY FROM A MANUFACTURER'S VIEWPOINT.

BY J. F. SCHOELLKOPF.

Of all industrially prominent countries the United States is, doubtless, the one which has been most successful in the manufacture of products of universal use. For articles of this class the large home market, cheap transportation, and great consuming capacity of the American people, permit the construction of manufacturing plants on an enormous scale, where machinery takes the place of hand labour, so that in spite of high wages, the actual labour cost of such articles is frequently less than that of the same articles when produced in countries with a more limited consumption. At the last revision of the tariff, the Steel Corporation stated that they had no objection to a lowering of the duty on their products; the automobile industry, which manufactures on a scale unheard of in any other country, even before the present war, was exporting its products to every corner of the globe; other articles in point are agricultural machinery, sewing machines, typewriters, leather, boots and shoes, and to mention a few chemical products, wood alcohol, acetate of lime, caustic soda, etc.

Unfortunately, the manufacture of synthetic dyestuffs does not lend itself to such mass production. The estimated annual consumption in the United States is about 40,000,000 lb. of an approximate sales value of \$15,000,000. While this amount is quite large when considered by itself, it is small when compared with the products enumerated above, and from the manufacturer's viewpoint, dwindles to small proportions indeed.

According to Schultz and Julius' Tables, 1914, there were on the market at that time not less than 930 synthetic dyestuffs, being chemical individuals, not mixtures, or 1000 in round figures, as there are a number, the constitution of which the colour factories refuse to divulge. Assuming that the American trade demands all of the 1000 products now on the market, this would necessitate, so to speak, 1000 individual miniature factories, each having a capacity of about 40,000 lb. This, of course, would not actually be the case, for among all colours used, there are a dozen or so, which constitute about 75% of this country's consumption, including such colours as Sulphur Black, Direct Black, Acid Black, Chrome Black, Nigrosine, Indigo, Auramine, Benzopurpurin, Patent Blue, Paper Blue, Alizarin, Fuchsine, and Phosphine. Assuming this to be approximately correct, that would leave 10,000,000 lb. for the remaining 988 dyestuffs, or an average of about 10,000 lb. for every little factory. It is obvious that to produce so small a quantity, the manufacturer could not run his factory the whole year round, and he is compelled, therefore, to manufacture a number of different colours in the same installation in succession, each change necessitating extra labour in clearing and altering the apparatus. The monster European factories, having a very much larger production, do not suffer from this disadvantage to nearly the same extent.

Their larger output of individual colours is also an advantage in other respects. According to their latest report, the Farbwerke Hoechst had in their employ more than 300 chemists. Allowing one hundred of that number for their inorganic, analytical, and research work, that would leave

two hundred to look after the manufacture of about 500 colours, as the concern mentioned probably does not make more than 500 of the dyestuffs mentioned in Schultz's Tables. One chemist, therefore, has on the average no more than two or three colours in his direct charge, and this continuously during the whole year.

Every chemist who has had actual manufacturing experience will realise that only by being in daily contact with the product of his manufacture can he attain that efficiency which enables him to detect at once the slightest inaccuracy in his processes, and to turn out a product always uniform in quality and yield. On the other hand, when called upon to change from one product to another every few months, as is the rule in American colour factories, slight details in the processes may have escaped his mind or other conditions may have changed, causing loss in yield and increasing generally the cost of production.

Corresponding to the variety of processes that are carried out in a dyestuff factory, a great variety as well as a great quantity of chemicals, inorganic as well as organic, are used. Almost all of these can be obtained in this country in normal times in sufficient quantities and at fair prices.

A very important part in our industry is played by the so-called intermediate products, most of which have been imported from Europe, principally Germany, and I must confess that at recent tariff revisions, I have sought to have these placed on the free list. This has, doubtless, created the impression in some quarters that the manufacture of these products was particularly complicated and difficult. Nothing, however, is further from the truth. Many of our most important intermediates, such as nitrobenzene, aniline, α - and β -naphthylamine, β -naphthol, metanilic acid, sulphanilic acid, naphthionic acid, benzidine, are made by simple processes. In fact, before the war, and while these intermediates were on the free list, we have found it cheaper to manufacture several of them in our own works rather than import them, duty free, from abroad. However, in other cases, some of these derivatives consume such large quantities of chemicals, mostly mineral acids, which in part cannot be obtained at all, or partly at a materially higher price than in Germany, and furthermore, the yield is comparatively small, so that we had to import those materials.

Even the large German factories do not manufacture all of their own intermediates; some of them constitute only a very small part of a given dyestuff, and I am sure, can only be made successfully by factories that specialise in them, and do not entirely depend on their own consumption.

In a recent issue of the "Daily Trade Record," Dr. Norton states that an American company has for some time been manufacturing aniline oil on a large scale and supplying it to New England textile works for use in the production of Aniline Black. It is now engaged in putting up small aniline plants for the use of textile houses and dye houses where there is an extensive application of Aniline Black; these plants are put up at a cost of \$1000 and require the attention of a single skilled labourer for operation. It is found that, in practice, the aniline produced in these small plants, at the current rate of benzol, costs about 30 cents per pound.

We are seriously considering the advisability of following this example and putting on the market a small aniline colour plant, which with a few skilled men, will enable every textile mill to produce its own colour.

Since the process of making dyestuffs is in no two cases exactly the same, a large variety of complicated machinery is required. Following is

a partial list of apparatus which is installed in our works, and we manufacture only about 136 out of a possible 1000 dyestuffs:—Boilers, steam engines, steam pumps, vacuum pumps, rotary pumps, air compressors, ice machines, electric motors, filter presses, wash presses, suction filters, presses for recovery of volatile substances, plain stills, vacuum stills, pressure tanks, autoclaves, nitrating and sulphonating kettles, centrifuges, shelf driers, vacuum driers, kiln driers, incinerators, rotary driers, drum driers, evaporating pans, ball mills, disc mills, mixers of every description, vats of all sizes, tanks, and a lot of special apparatus which is designed for every individual case by our own engineers.

Another peculiar feature of the dyestuff industry is the fact that it is subject, to a great extent, to changes in style, more so if it depends only on the home market. It is thus confronted with the falling off of sales of certain shades, while others enjoy a particular boom, necessitating a constant shifting of manufacturing and a correspondingly great flexibility of apparatus.

From what has been said, it will be seen what an important position falls to the engineering force of a colour factory. The Badische factory in Ludwigshafen alone is said to employ over two hundred engineers with college training.

We must not forget that Germany is by far in the lead, and there are a number of colours which German manufacturers have patented in this country, which consequently are beyond competition, but the inventions in this line, of the last few years, have had by no means the revolutionising effect of the older inventions like the Ponceaus, which replaced cochineal; of Alizarin, which replaced madder; of Indigo, which put the natural product out of business, or of Acid and Direct Blacks, which compete successfully with logwood. In spite of these latest inventions, however, the consumption of the older colours seems to increase steadily. I also doubt if there is any great invention to be expected, which would interfere materially with the older colours. This does not mean that research in the hope of discovering new products should be abandoned altogether. With due co-operation between Universities and industry, as has been the case in Germany for many years and to which is due, to a large extent, the greatness of the German dyestuff industry, there are many promising problems yet to be solved, but just as much, or perhaps more, has been accomplished by working in the older field, in consequence of which our industry has been able to lower prices from year to year in contrast with almost all other industries, which in proportion to the rise in wages, have had to raise their prices if they did not choose to lower the standard of their goods instead.

Viewed from a manufacturer's standpoint, the present condition of the aniline colour industry in America is a most trying one, owing to the difficulty in securing adequate supplies of all kinds, even the ordinary heavy chemicals, such as sulphuric and nitric acids.

In conclusion, I may summarise the needs of the industry after we return to normal conditions:—We shall require, first, a plentiful supply of all chemicals, including so-called heavy chemicals. All of these will, doubtless, be obtainable from American sources. Second, all basic raw materials derived from coal tar in practically chemically pure form. Some of them are obtainable now; in fact, the war has greatly stimulated the manufacture of a number of these products, unfortunately mostly for use in explosives. But, as the manufacturers are reaping enormous profits on these products during the war, they will be able to write off their plants and after the war should be in a position to furnish an ample supply of these chemicals for colour purposes.

Thirdly, we need intermediates. Very few of these are made at the present time in this country for reasons I have outlined before. But even the many that are missing present no serious problem from the manufacturer's viewpoint, always keeping in mind the fact that a way must be found to offset the higher manufacturing costs. In frequent conferences with large chemical concerns intending to take up the manufacture of intermediates, we usually found no willingness to enter into their manufacture if we could not guarantee to take, say, over 50 tons or so annually of each product.

Fourthly, we need the co-operation of the American consumers, which, I regret to say, was extended to us in the past only to a very limited extent. I believe, however, the war has taught them a lesson, which the present generation will hardly forget.

Fifthly, and most important of all, we need legislation, which will help to create the industry by first creating conditions that will make it profitable, since every manufacturer is entitled to a reasonable return on his investment.

If these conditions are fulfilled, I venture to say that American mills will soon be using "American aniline colours," and any possible slight increase in cost will be more than offset by the assurance that they will be protected absolutely against any future recurrence of the present calamitous situation.

THE DYESTUFF SITUATION IN THE UNITED STATES.

BY DR. THOMAS H. NORTON.

U.S. Bureau of Foreign and Domestic Commerce.

At the outbreak of the present European war, the textile and other allied interests of the United States were threatened by a shortage in the supply of dyestuffs. For some weeks shipments were entirely suspended. Gradually, as the result of the most strenuous efforts on the part of leading representatives of the textile industries and of the firms engaged in importing artificial colours of foreign origin, the movement was restored to nearly normal figures. The possibility of a complete cessation in shipments was, however, constantly present as a menace; the threatened danger arrived seven months ago, when an embargo on the shipments of dyes of German origin to neutral countries came into effect.

Since March 15, no wares in this category have been received, until on October 13, fifty tons of German dyestuffs was unloaded in the port of New York—nearly enough to meet the industrial needs of the nation for a single day.

During nearly all of this period of seven months there has been in force a permit issued by the British Government allowing free passage to the United States of two steamer loads of artificial colours of German origin. Thus far the German Government has refused to allow this supply to pass out of the Empire unless a *quid pro quo* were accorded in the form of a shipment from the United States to Germany of an equivalent amount of cotton or of nitric acid. This deadlock still exists. During the past seven months small quantities of coal-tar dyes of Swiss origin have reached the United States. The amount has been very limited, but it has been most welcome.

Action of the Department of Commerce.

On February 20th of this year, pursuant to a resolution of the Senate, I placed in the hands of the Secretary of Commerce a full report on every phase of the dyestuff situation. Attention was forcibly drawn to the serious risks involved in so complete a national dependence upon foreign sources for a class of products vitally essential to

the very existence of our textile interests. On May 1st, I was instructed by the Chief of the Bureau of Foreign and Domestic Commerce to study carefully the conditions existing in the dyestuff industry. An exhaustive report on this subject appeared on May 17th. In the concluding paragraphs of this report, it was shown that the available stock of dyes of German origin would probably be exhausted before the close of the summer. Strong emphasis was laid upon the imperative necessity of making timely provision for such a blow to the country's textile and allied industries. The prompt use, on an extended scale, of vegetable dyes was urged and the pressing need of economy in the employment of colouring materials was fully demonstrated.

The present situation.

As a matter of fact, the warning was heeded. Every possible device was called into play to reduce the quantity of dyestuffs used. The average textile mill has husbanded its stock of colours so as to make them reach until about October 1st. Since then the pinch of a widespread "dyestuff famine" has been increasingly felt. One mill after another has been forced to close entirely or in part.

A single instance is typical. The largest hosiery mill in the United States (and in the world) employs 2500 operatives. Ordinarily it requires 500 lb. of dyestuffs daily to cover the needs of its dyehouse. Four weeks ago its stock of colours had sunk to half a barrel. Some 160,000 dozen pairs of hose were stacked up awaiting dyes. Over 1000 operatives were enjoying an unwelcome vacation. With considerable difficulty the manager has secured a ton of aniline oil to use for Aniline Black at a cost per pound of \$1.50. Similar conditions exist in all branches of industry involving the factor of colour. The occasional arrival of small lots of Swiss colours, or of other artificial colours, secured in out-of-the-way corners of the world, serves only to accentuate the acuteness of the situation.

What the Government is doing.

The question naturally arises in every quarter: What has the Government done to alleviate the hardships of such a famine, and what is it now doing?

The reply may be briefly formulated. Two Departments only of the Government come into consideration in this connection. The Department of State has exerted every possible effort to secure the free passage of German dyestuffs to our ports. It is continuing its efforts without relaxation. The Department of Commerce since last February has done all in its power to inform consumers of colours how they can most easily lessen the hardships incident to a shortage in dyes. It has inculcated economy in the use of dyestuffs generally. It has pointed out the desirability of employing natural dyestuffs on the most generous scale. It has encouraged and stimulated every undertaking promising to add even the smallest amount to the available dyestuff supply. It has done all in its power to enter the field of coal-tar chemistry, to increase the supply of coal-tar "crudes," to multiply the production of intermediates, to broaden and intensify the output of American-made, finished dyestuffs. It has brought together inventors and capitalists, the producer of colours and the consumer of colours. It has recognised the fact that all industries dependent upon the factor of colour, must suffer more or less from the existing conditions, and has urged a mutual spirit of conciliation and compromise between the consumers of coloured fabrics and articles and the producers of these wares.

The spirit and purpose of the efforts made by the Department of Commerce, in connection with the dyestuff situation, have been most clearly and forcibly presented by the Chief of the Bureau of Foreign and Domestic Commerce, who also has portrayed its plans to ensure in the future the most complete and effective protection of a comprehensive and self-contained American dyestuff industry, against all possible unfair methods of competition on the part of foreign rivals.

It remains for me to outline briefly what has actually been accomplished towards a material alleviation of the hardships of this period of famine through which we are passing, and to what extent the foundations are being laid for an independent American coal-tar chemical industry.

Increase in output of American coal-tar dyes.

In the first place, the few existing American establishments devoted to the manufacture of artificial dyestuffs have notably increased their production. Prior to the war, their annual output was about 3000 short tons, from imported intermediates, and the industry employed not more than 400 workmen.

With the nearly total cessation in the importation of intermediates, came the necessity for a complete revolution in the organisation of the limited American industry. Prompt and resolute decisions were made. Great sums of money were invested in new plants. Before the war was twelve months old, the output of American coal-tar colours had doubled. Too much praise cannot be given to the men who accomplished this *tour de force*. This involved a notable increase in the production of coal-tar crudes. It also called into existence a number of new companies engaged in the manufacture of intermediates, especially of aniline.

The domestic supply of benzol has assumed large proportions. The output now is five times what it was before the war. It has naturally been accompanied by the production of an equivalent amount of toluol. Unfortunately, the demand for both benzol and toluol, to be used in the manufacture of explosives, is now so abnormally high that there has been some difficulty in securing enough for the makers of coal-tar intermediates. The manufacture of these latter, especially of aniline, has suddenly grown to considerable proportions, and is constantly increasing. There are now a dozen firms engaged in this branch, and others are entering the field. The Edison Company is producing 6000 lb. of aniline daily.

There are seven firms now busily engaged in making finished coal-tar dyestuffs. As stated, the output is double what it was in July, 1914. It will soon be trebled.

I have repeatedly emphasised the eminent desirability of increasing the output of aniline, rather than to branch off into the manufacture of a varied list of dyes. In no other way can plant, time, and effort be made as effective in lessening the hardships of the current famine. Four-fifths of our hosiery is dyed black, and the extent to which black is used for both men's and women's apparel is evident to all.

An interesting feature in the evolution of this aniline industry—in the narrower sense of the term—is the introduction of small plants for making the oil, particularly for installation in textile works. A Rhode Island firm, itself manufacturing considerable quantities of the oil, is now installing in various textile mills standard plants, capable of producing 100 lb. daily of aniline. Such a plant costs from \$1500 to \$2000. The services of a single operative are needed to carry on the transformation of benzol into aniline, with occasional assistance in the moving of heavy objects. The operations, and the application of the requisite tests, can be intrusted to a man of

ordinary intelligence, without chemical education. The ordinary output is 85 lb. of aniline for each 100 lb. of benzol employed. At current rates for benzol, it is found possible to make aniline at a net cost of from 20 to 40 c. per lb. This compares favourably with the daily quotations of \$1.20 for immediate delivery, and of \$0.70 to \$0.85 for early contract delivery. Within the past few days, two textile mills have contracted for larger plants, capable of furnishing 500 lb. of aniline daily. The large works of the Benzol Products Company, at Marcus Hook, Pa., has received notable additions. It is now the leading source of supply for aniline oil.

The seven companies engaged in the direct manufacture of finished dyestuffs have wisely restricted the range of dyes which they attempt to put on the market, as the best means of enlarging the volume of the output; at the same time there is a corresponding simplification in organisation and plant.

How easily this can be done, without involving any serious hardship to consumers of dyestuffs, can be illustrated from the practice in the silk branch. Ordinarily, silk dyers in the vicinity of New York are accustomed to carry a very large variety of colours. One of the leading dyers in the neighbourhood has made the following list of dyes which were absolutely necessary, with the quantities of each colour required during the year.

Yellow: Auramine, 1200 lb.; Azo Yellow, 14,000 lb.; Quinoline Yellow, 1200 lb.; Chrysoidine, 3600 lb.; Chrysophenine, 1000 lb.; Orange, 3000 lb. *Green:* Brilliant Green, 1000 lb.; Direct Green, 1000 lb. *Red:* Alizarine Claret, 1500 lb.; Fast Red, 7000 lb.; Rhodamine B, 2000 lb.; Alizarine Red SX, 2500 lb. *Purple:* Hofmann's Violet N, 600 lb.; Methyl Violet 5B, 1000 lb.; Fast Acid Violet 10B, 5000 lb. *Grey and Black:* Induline, 2500 lb.; Developed Black, 10,000 lb.; Sulphur Black, 15,000 lb.; Direct Black, 1000 lb. *Blue:* Alkali Blue 2B, 4000 lb.; Charge Blue 0B, 2500 lb.; Methylene Blue, 10,000 lb.; Patent Blue, 1000 lb.; Victoria Blue B, 12,000 lb.; Sky Blue, 1000 lb. He added that the following colours were very helpful:—Direct Yellow, 1000 lb.; Pure Blue, 1000 lb.; Fraise, 1200 lb.; Direct Red, 1000 lb.; Malachite Green, 800 lb.; Wool Green 3, 1500 lb.; Brilliant Violet 6B, 1000 lb., and various Alizarin, Algal, Ciba, Helindon, and Indanthrene colours.

Thus the actual needs of a leading silk dyer narrow down to 25 different colours. With an adequate supply of these 25, he claimed that his business would suffer no material hardship. Similar statements, regarding the variety of dyes needed, would undoubtedly hold good in the cotton and woollen branches.

Two well-equipped works are now about to manufacture Sulphur Black on a large scale. Two other works engaged in the production of intermediates have perfected their arrangements to make ample supplies of the dinitrochlorobenzene required in this branch of manufacture.

The manufacture of synthetic indigo has recently been taken up by one of the older American chemical companies with success. The output will be steadily increased. Naturally all that can be made is sold for a year ahead. Three other powerful firms are carefully studying the possibilities of manufacturing this most important dyestuff. It is noteworthy that the Badische Company expended \$5,000,000 on its indigo plant and on the necessary research, before a single pound was placed upon the market.

Extended use of natural dyes.

While the output of artificial dyes of domestic origin is thus increasing at a rapid rate, it is necessarily far removed from meeting even a quarter of the national demand under normal conditions. Here, the existing equipment in

half a dozen large American works, organised for the production on a large scale of natural dyes, has proved to be a national asset of pronounced value.

The methods for using natural dyestuffs such as logwood, fustic, cutch, etc., have been notably perfected of late. In nearly all branches of the textile manufacture it has been found practicable to introduce their use. The current output of dyewood extracts is now about three times as great as it was before the war, and it is constantly increasing. Logwood blue is now in widespread use, instead of indigo, for dyeing denims and similar fabrics.

The silk industry is already accustomed to the use of large amounts of logwood. Dyers of silk fabrics are now attentively studying the availability of other dyewood extracts under existing circumstances. A welcome addition to the domestic supply of natural dyestuffs is the handsome yellow, obtained from the osage orange of the Mississippi Valley. The dye is the same as that present in fustic. It is, however, a pure compound, free from the varying admixture of a reddish colouring matter, which renders the use of tropical fustic somewhat uncertain.

Co-operation of manufacturers and consumers.

Even with the aid of a vastly increased employment of natural dyestuffs, we are far removed from meeting even the half of our customary requirements of organic colours. It has become evident that a serious dislocation in the whole organised system of retailing and using textile fabrics, involving the factor of colour, can be avoided only by a genuine spirit of sympathy and co-operation between the two final links in the chain joining the producers of raw material and the consumers of finished products.

Manufacturers, for example, are practising a most rigid economy in the use of colour compounds. This is exemplified in the use of pencil lines for heavy stripes, in the substitution of outline designs for conventional patterns requiring extravagant quantities of colour, and in analogous directions. There is also a pronounced tendency to urge the wearing of white garments.

In order, however, to limit to the utmost the hardships incident to such a pronounced shortage of dyes, the ultimate consumers must recognise and accept these existing conditions in a considerate manner, adjusting themselves to limitations in variety of shade, as well as in fastness.

Such, in brief outline, are the salient factors in the current struggle to meet the pinch of the dyestuff famine, now felt throughout the land.

The promise for the future.

As a rule, the firms now engaged in the production of intermediates contemplate the manufacture later of finished dyes. Mr. Edison, who has so rapidly organised the production on an extensive scale of synthetic carbolic acid and of aniline, does not plan to continue the output of the latter after the close of the current war. With this exception, all of the firms now occupied with the manufacture of coal-tar compounds are planning to continue their production along the lines already taken up, and to enlarge such production, or to manufacture additional intermediates or finished dyes, as circumstances dictate.

Quite recently capital has been enlisted to an unusual extent in the development of the dyestuff industry. The past month has witnessed the incorporation of the Federal Dyestuffs and Chemical Co., with an authorised capital of \$15,000,000; the plans of this company include plants in several States. The Pearse Company, with an authorised capital of \$2,000,000, entered recently upon the active manufacture of dyestuffs

in its large factory at Cannel City, Kentucky. Several smaller companies, lately incorporated for active work in this field, reveal a wide-spread tendency on the part of many investors to enter vigorously upon a campaign to build up the dyestuff industry.

The United States possesses all the needed raw materials in abundance, in such amount that it could meet the demands of the world's dyestuff industry. It offers the largest existing market for the consumption of dyestuffs. Enterprise, inventive talent, and technical ability are present to an almost unlimited extent.

The time is eminently propitious for the establishment of a national industry. All indications point to the continuance for a year or two of conditions—most deplorable in themselves—which favour a period of construction, free from the disturbing element of foreign competition. Capital is ready to embark in the new field in ample amount, and is daily being invested. It demands simply that measure of statutory protection against unfair competition on the part of foreign rivals which we now have every reason to hope for, since the policy of the national government in this connection has been outlined by a preceding speaker with such force and emphasis.

It is most refreshing to note the utter indifference to minor side issues manifested by the men who are determined to build up this new industry. But a few years ago discussion would have centred about the tariff. To-day the men who are ready to finance a colour industry, or to throw into it the best of brain and nerve, are asking simply for laws to prevent unfair competition.

Possible Swiss co-operation.

There is possibly one factor lacking to bring rapidly into existence a comprehensive American coal-tar dyestuff industry. That is the co-operation of a few men possessing highly developed capacity for organisation, combined with a perfect experimental command of the exceedingly complex and intricate field of colour chemistry in all its ramifications—men such as created in the past the great works on and near the Rhine, and are now directing them.

I have thought that it might be possible to secure such needed co-operation from the large and well-equipped staffs of the five colour works at Basle, in Switzerland. These highly specialised staffs include scores of men of wide experience in the manufacture of the whole range of coal-tar dyes. Most of these have enjoyed in earlier days the advantages of the "Polytechnic" of Zürich, one of the best-equipped institutions in Europe for the training of colour chemists. Many have served a more or less extended apprenticeship in the gigantic German chemical works.

It is not difficult to imagine a union of forces in this field, a consolidation of interests between the Swiss companies and the American firms now striving to expand, but forced, as it were, to grope in the dark at times. The transfer of a sufficient corps of Swiss expert colour chemists to the United States at this critical moment would be of untold value in furthering the rapid evolution of the American industry.

It would be possible, by their aid and direction, to attain, as regards time and money, the maximum of economy, in constructing new plants, in adopting the most practical and effective mechanical devices, in applying the most economical methods, in co-ordinating the diversified features of a complicated branch of manufacture, so as to avoid loss of material and restrict the dependence upon highly skilled and expensive labour. At every step in the organisation of new plant, and in the initial months of its operation, directive co-operation of practical experts would ensure

the establishment of a self-contained coal-tar colour industry on American soil, with a minimum of outlay and a maximum of efficiency, in the shortest possible period of time. It would probably enable the industry, in its broader phases, to become so thoroughly rooted in the economic life of the country that, upon the return of normal international exchanges, legitimate competition of foreign rivals could be easily and effectually met.

How Swiss chemists are solving the Russian problem.

A striking example of how the dyestuff problem of a great nation can be solved by the co-operation of Swiss intelligence and experience is now seen in Russia. The textile and allied interests of the Empire depended chiefly upon Germany for colour materials. The largest dyestuff company of Germany conducted a branch factory in Russia prior to the war. Dependence upon Germany for semi-manufactured material, and for finished dyes, was quite as pronounced as in our own country or in Great Britain.

The sudden interruption in current supplies of dyes, consequent upon the outbreak of hostilities, was a heavy blow to Russian textile works. A way out has been found by the organisation of a strong company, of which the leading dyestuff house of Basle is a constituent member, and furnishes an administrative and technical staff. Capital is supplied by a group of prominent Russian textile manufacturers, who at the same time are the chief consumers of the dyes produced. The requisite factories have been erected at a considerable distance from the present line of military operations.

What has been done so easily and simply in Russia to meet present emergencies and lay the foundation for a future national dyestuff industry, can serve admirably as an object lesson to the United States.

A less complex and perhaps more feasible method of accomplishing the end in view would be found in establishing a comparatively close organic connection between individual Swiss companies and individual American companies already engaged in the active manufacture of dyestuffs, but limited hitherto to a very narrow range of products.

It is well to note in this connection the relations of the Swiss colour industry to both the American and the international markets. The average annual value of the Swiss exports of artificial colours to the United States during the five years ending June 30, 1914, was \$815,911, as follows: Alizarin and alizarin colours, \$1777; synthetic indigo, \$48,904; other coal-tar colours, \$765,230; total, \$815,911. In 1913-14, Switzerland supplied 7% of our imports of indigo and 10.6% of the imports of aniline dyes. The import of alizarin was insignificant. Since the outbreak of the war, and the resultant scarcity of artificial colours, the Swiss import has been of great assistance to American textile interests.

The normal production of the Swiss dyestuff works available for export purposes has an annual value of about \$5,500,000. It is equivalent to one-ninth of the German export, and could cover alone nearly 60% of the average annual imports into the United States of artificial colours.

Few realise the rôle which Switzerland has played in the evolution of the artificial dyestuff industry, despite the entire absence in the land of coal and of raw material for the manufacture of chemicals, with the exception of salt. Immediately prior to the war, Switzerland, on the basis of population, was supplying twice as much as Germany to the world's market for synthetic colours.

Necessity of unity.

The chief cause of the past dominance of German colour chemistry in the world's markets lies in the solidarity of the German industry as a whole. The question arises, is it not eminently desirable that a comprehensive, American coal-tar industry, striving to supply nearly all American tinctorial needs, with products made from American raw materials, should possess a higher degree of unity—financial, technical, commercial—than now is the case? Is it not of prime importance that all unnecessary overlapping and duplication of effort be excluded, at least in the formative stage?

It is economically important, during the initial period, that the industry should be characterised by that unity and solidarity which contribute so largely to the might and effectiveness of the German rival; and yet it must be free from any tendency towards monopolistic power.

A movement in this direction has been recently outlined by Mr. I. F. Stone, in the proposal to establish Government-owned factories for the production of coal-tar intermediates. The various admirable features of the plan, including the well-organised preparedness for the speedy manufacture of explosives and munitions generally, in case the nation be menaced by invasion, render the project worthy of the most careful study.

Standardisation of dyestuffs and of the methods of their application.

A very distinct element of protection to a growing domestic colour industry would undoubtedly result from the establishment of a Bureau of Standards for Dyestuffs. Such a Bureau could be modelled after the Division of Chemistry in the Bureau of Standards, of the Department of Commerce. Its function would be to formulate the physical and chemical criteria of purity for all dyestuffs, exactly as is now done for the drugs listed in our pharmacopœia. Such principles of standardisation would likewise be applied to the varied methods of application on the different fibres and other wares. A single, fully-equipped Bureau could advantageously replace the multitude of laboratories now maintained by rival firms or in textile works. Such an institution could effectively protect a half-grown American industry against attempts to depreciate the quality and value of American-made dyes, and could ensure a far greater degree of economy in cost of production than otherwise would be possible.

Organisation of consumers.

Logically, the complete standardisation of existing dyestuffs, and of all additions to their numbers, as well as of the methods by which they can be most effectively and advantageously employed, should be a prelude to a vastly simpler and more economical method of merchandising than is now the rule.

It would not be a difficult matter to organise into a compact body the consumers of colours of all forms. Such a corporation would have for its object the purchase in quantities, at lowest wholesale rates, of all required dyes, and the distribution of such wares at cost price to the individual members. The actual expense to each member of such an organisation would be almost negligible. Constituent members would be free to buy any dyes in current use. The only restriction would be the absolute requirement that all purchases of colours should be made through a central agency, or one of its branches. Such an agency would be backed up by the National Bureau of Dyestuff Standards in all current questions regarding purity, ease of application, etc. It would ensure the delivery to members, of dye-

stuffs of standardised strength and purity, at wholesale rates.

Consumers of colours would thus be freed to a large extent from all uncertainty and anxiety regarding the price and character of their dyes, whilst a powerful weapon is put into the hands of those who collectively represent the consumers of colours, to rule out rigidly from the sources of supply any manufacturer, foreign or domestic, who would deliberately make an attempt to undersell his American rivals, or who would resort to any other method of unfair restriction of trade. Such an organisation would be one of the most powerful bulwarks to ward off the dangers of persistent and determined efforts, on the part of European rivals, to crush and stifle an American dyestuff industry.

And such an industry we are bound to have. Our textile and other allied interests demand that they shall never again be exposed to the disasters accompanying such a dyestuff famine as we now face. Such a powerful national organisation as the Association of Hosiery Manufacturers unanimously resolved that it would willingly bear the burden of increased tariff duties on dyes of foreign origin, if that be necessary, to ensure the establishment upon American soil of a domestic, self-contained industry.

Before the advent of this deplorable war, we imported annually about 2500 short tons of aniline oil and aniline salts. In 1916, over 5000 tons will be manufactured on American soil, from American coal-tar crudes. In 1913, our American colour works produced 3000 short tons of coal-tar colours, made chiefly from German intermediates. We imported 25,600 tons of these colours, of which 22,000 tons came from Germany. To-day we are making nearly 9000 tons of these colours. January, 1917, should see an American production of at least 16,000 tons. Am I too optimistic in confidently looking forward to the year 1920 as a date when the great bulk of artificial dyes, consumed in this country, will be made in our own works?

COMMON SENSE ON THE DYESTUFF QUESTION.

BY J. MERRITT MATTHEWS, PH.D.

(Abstract.)

The person the most interested in the dyestuff question is, probably, the textile manufacturer, and yet it is a rare exception to find a textile manufacturer who is at all acquainted with the nature of the dyestuff problem, even in its simplest form. At first many textile manufacturers placed considerable confidence in the propaganda advanced by certain experts in the daily papers, and they were lulled into a sense of security in the belief that in a short time all the dyestuffs needed in American industry would be manufactured in this country by new processes much in advance of the antiquated German methods. So radical and preposterous, however, were many of these schemes advanced, that even the most hopeful manufacturers began to realize that the dyestuff problem was not to be solved by any such method of procedure. Fortunately, most of the textile trade journals preserved a sane poise in the matter, and their editorial criticisms exposed the fallacy of many of the irrational schemes advanced. In this connection I might mention a proposition, which was communicated to me privately, to extract the red dyestuff from the cranberry without interfering with its edible qualities. This dyestuff was to be known as Cranberry Red, and is doubtless destined to take a place of equal rank with Osage Orange.

The only safe way to proceed in the manufacture of dyestuffs is to select carefully those products which it is considered desirable to make, determine the various intermediate materials which it is necessary to use, and to proceed with the intelligent manufacture of these. At the present critical time it is folly to endeavour to prepare dyestuffs by new and untried methods of procedure. From a chemical point of view the making of the actual finished dyestuffs themselves is not in general a difficult or complicated problem, provided the proper so-called intermediates are available. In my opinion, the crux of the entire question as to the establishment of an American dyestuff industry lies in the economical production of the intermediates. The development of our by-product coal-tar industry, both from gas tars and coke-oven tars, apparently assures us a good supply of raw materials or crudes. All these products are at a very abnormal price at present owing to the demands for high explosives, but when this demand lessens these prices will re-adjust themselves to the conditions of the dyestuff and pharmaceutical industries. But what the dyestuff business needs is a supply of the proper intermediate products; their production must be undertaken by organisations capable of commanding large supplies of the coal-tar distillates, as well as sulphuric acid, oleum of high strengths, nitric acid, caustic soda, chlorine, acetic acid, etc., and by those conversant with the technique of such processes as sulphonation, nitration, caustic fusion, reduction, methylation, steam and vacuum distillation, and other related operations. The production of intermediates will be a profitable outlet for the coal-tar distillates and for the acid and caustic soda plants; it will also, on the other hand, furnish the possibility for the economical production of dyestuffs and related pharmaceutical products in this country in time of peace and for the production of high explosives in time of war.

Any scheme for the establishment of an American dyestuff industry with a view of making us independent in this respect of other nations, in my opinion will be futile if it does not first of all insure the firm and permanent establishment of the manufacture of the various intermediates needed.

The problem of the proper means of fostering and protecting these industries in their infancy and upbuilding is worthy of the closest study. Most certainly a tariff protection in one form or another will have to be given. Personally, I am inclined to favour a high specific duty on both intermediates and on the dyestuffs derived therefrom, with more or less *ad valorem* duty to meet the conditions of each case. It would be foolish to place a high tariff on the dyestuffs alone. Unless our government in some manner or other develops a well established and extensive industry in the coal-tar intermediates, all our schemes for military preparedness will be of no avail. The supply of high explosives is based in very large degree on the coal-tar intermediates.

The time factor in starting the manufacture of these chemicals is an important one—at the present moment it is far more important than the efficiency factor. At the present time the factories starting up for the production of coal-tar products are in reality emergency measures, and their very foundation is based on the fact that they are taking advantage of a very abnormal trade situation. Many textile manufacturers feel that these factories are forcing out of the situation all the profit they can. But these factories, as well as others, which are under construction or projection, are paying abnormally high prices for all their raw materials, apparatus, machinery, and labour. The financial interests involved are taking grave

risks, for no one positively knows when the war will cease and just what protection the new industries will have after the war, and, even if sufficient protection is obtained, its continuance for any length of time is a grave uncertainty.

There is also another factor from a manufacturer's point of view—and one which the layman is apt to overlook. In the manufacture of any article, and especially in the foundation of a new enterprise, there is always an involved manufacturing organisation and technique to be built up before the article in question can be produced efficiently and perfectly. There is not only a *science* in manufacturing, but there is also an *art*, and this latter is only evolved out of many years of practical experience and in the handling of large quantities of materials on a commercial basis. It involves the training of workmen and foremen to do the right thing at the right time—to keep processes and operations moving along continuously with the minimum expenditure of labour and materials. Under present conditions, of course, dyestuffs can be produced at absurdly high costs and will find ready buyers, so the enterprise is sufficiently attractive to lead both money and manufacturers into the field. Given a couple of years of continuous manufacturing of staple products, our American factories will have acquired, no doubt, as fine an art of manufacturing such dyes as the German or Swiss factories, and *other things being equal* should be able to sell on a competitive basis. It is in the equalising of the other factors, the labour, raw materials, methods of selling and competition, etc., that our political economists, our business men, and our Government must help.

THE CONSUMERS' INTEREST IN DYESTUFFS.

BY JOHN P. WOOD.

Briefly, the attitude of the industry which I represent with respect to this very vital question, at the present time, is that having itself been created by means of the protective policy, it would be untrue to the principle which made possible its existence, if it were not favourable to a like protection for any other useful industry that would be similarly developed. The question as to how that can be done is largely technical. If a protective tariff is essential for building up an American dyestuff manufacture, advocate the necessary import duties and don't be content with the partial protection of an anti-dumping clause that exists already. Under the present law, in the case of undervalued imports, penalties are provided to the extent of 1% additional duty for each per cent. of under-valuation above an allowable margin.* If goods come into this country appreciably undervalued it is because the Federal Government is not doing its duty. It may be said this would not apply to some articles which are on the free list; but it would only be necessary to place a small revenue duty on such products to make them subject to the penalties for under-valuation. One thing I have to suggest. If you become convinced that a protective tariff is necessary to permit of the development of a native dyestuff industry adequate to the requirements of the country; and if the difference between the cost of production here and abroad is not too great to bridge with a protective duty, then by all means ask Congress to make that duty in specific form.

I also want to urge strongly the fact that it is not possible to protect the dyestuff industry unless there is a duty on the dye which comes into this country on dyed materials.

Then I would suggest that due consideration must be given to the needs of the consuming industries while a new dyestuff industry is in its beginnings, and until we shall become chemically independent of the rest of the world. Dr. Norton thought this might require five years. I, being less sanguine, have put this time at not less than ten years. During this intermediate period we must get from somewhere the dyes which are not yet made here, and it must be with due recognition of that necessity that proposals for a tariff are made. Unless there are customers here for dyes, it will not avail anything to be able to make them, and there will be no customers here if the duty is so arranged that it will keep out the foreign dyes, but will not keep out the foreign dyed goods.

DISCUSSION.

MR. JOHN ALDEN said that the consumers' interest in dyestuffs, as applied to the textile industry, amounted to about fifteen million dollars a year, on the ante-war basis. Further it was determined by the cost of colours as related to the value of the finished product. Thirdly, the consumer's interest depended on his ability to get the class of colours that he needed. Dyestuffs might be divided into seven or eight classes, according to their uses. The impossibility of obtaining the more important colours in any one class would seriously interfere with the successful production of one or more varieties of goods. The remark sometimes made that all the dyer needs are the seven primary colours, was not true, and the discovery of a new class of colours, for cotton especially, almost always meant the production of a new class of fabrics.

The present sources of colour supply of the United States were, roughly speaking, five in number. (1) A very small remnant of old stock still in the hands of the original importers. (2) A few colours from Switzerland, shipped through France and Italy. Also a few from England, as e.g., the 50 tons of colour from the Levinstein Colour Works recently brought into New York. (3) Certain colours, chiefly synthetic indigo, originally sold in the Chinese market but resold by them to brokers in this country. (4) Colours owned by mills, who find they have a larger stock than they need of certain colours, and are willing to exchange them for other colours which they are short of. Also stocks of colour in the possession of mills, that have shut down on account of the lack of important colours which they need. (5) Colours now being made in this country.

The country was practically dependent on the last three sources of supply. The supply from China, however, was very uncertain as to variety and rather limited as to amount. America had received since the early summer about a million and a half pounds of synthetic indigo from China, costing between 90 cents and \$1.00 per lb. That would mean about a cent a yard more for the cost of colour on medium shades. The amount of colours offered by mills in exchange was not very large. The old stock, held by mills that had stopped running on account of general shortage of colours, was generally put into the hands of brokers, for sale, and after being diluted to one-half strength, perhaps in the majority of cases to one-fifth, sometimes to one-tenth, it was offered for sale at anywhere from two to ten times the original price. Very few mills except silk mills could afford to purchase those colours.

A great many large mills would have been shut down if it had not been for the Direct Blacks, Acid and Chrome Blues, Oranges, and Yellows, as well as the aniline oil and β -naphthol now being supplied by the American makers, from intermediates made in this country. The cost of these

* See sub-sections d, g, i, of Section 3, Tariff Act, Oct. 3, 1915.

products was generally from two to ten times the cost before the war, but they had enabled the mills to keep running. The increased cost of dyeing Aniline Black amounted to about 1 cent per yard, whilst the increase in cloth dyed with American μ -nitroaniline and β -naphthol was more than 1 cent per yard and there was an extra cost of 3 to 4 cents per yard in dyeing with a mixture of Mchola Blue and Methylene Blue. Manufacturers had tried to protect themselves by increasing the price of their goods, but generally with very little success.

Mr. W. H. CHILDS said that in 1899 the Barrett Manufacturing Company had started in a very small way the manufacture of aniline. This attempt had soon been abandoned owing directly to the attitude of the foreign cartels. In about 1910 it was proposed to renew the manufacturing, and the companies who supplied their raw materials, viz., the Somet Solvay Company and the General Chemical Co., had co-operated with them, forming the Benzol Products Co. At the first attempt to put aniline upon the market by that company, the foreign trade had immediately dropped their price much below a remunerative basis, but the Benzol Products Company had proceeded to develop their process and improve their plant, which produced at the time only 20% of the amount of aniline then consumed in the country. At a meeting of the Company on July 1st, 1914, it was shown that they had lost money every year, but it was decided to continue working. Within a month they were practically the only producers of aniline deliverable in the American market. On January 1st, 1915, this company had begun the erection of up-to-date plant at Marcus Hook, Pa., now in operation and producing more than the total amount of aniline consumed in the United States prior to the war.

In order to make a complete dyestuff industry in the United States, it was necessary to protect not only the finished products but the intermediate and crude materials to such proper extent as might be determined by expert investigation. It was quite impossible to found a satisfactory tariff upon the labours of committees and sub-committees of the Senate and the House, as was done at present. He was greatly in favour of the appointment of a scientific non-political Tariff Commission. The U.S. Chamber of Commerce was strongly in favour of the idea, and a powerful organisation, known as the National Tariff Commission League, had been formed to urge upon Congress the necessity for such a Commission.

Dr. W. H. NICHOLS referred to the great difficulties which stood in the way of the successful

establishment of an American dyestuff industry, but he believed those difficulties would be satisfactorily overcome.

Dr. Wm. BECKERS said that the present tariff contained certain unexplainable facts. For example, why were quite a few of the dyestuffs manufactured in Germany, such as alizarin, indigo, and derivatives of these colours, on the free list? Those products were on the free list apparently because the law in olden times ruled that products grown by agriculture, and which could not be grown in America on account of climatic conditions, should not be taxed with a tariff. In addition to the red alizarin colours there were yellows, greens, blues, and even blacks; those products coming in free would soon displace the aniline colours. They were faster and better in every respect. The carbazole products were among the latest of this class, and it was only a question of a few years before those products would be so developed that probably the larger part of the colours would come into the country duty free. That was a great injustice to the dyestuff industry.

All the necessary raw materials were obtainable in the country, and the dyestuff industry must be fostered by every possible means.

Mr. H. A. METZ said that he was a manufacturer and also a consumer, but his primary interests were with the consumers and the textile industry. He has always advocated duty on all imports. Alizarin was not made in America when it was put on the free list, and he did not believe it would be made. It was a complicated manufacture, so it was admitted free of duty. There were more people employed to-day in the marketing of dyestuffs and selling them than in their manufacture. Everyone wished to see the industry started, but the colours were wanted now, not ten years hence, if the mills were to be kept going. The difficulty of obtaining aniline, phenol, etc., and their high prices, stood in the way of starting new dyestuff manufactures.

Dr. M. T. BOGERT said that America was just awakening to the fact that civilisation unprotected by science was in a very serious situation, and it was beginning to call very largely upon its universities, technical schools, and colleges for the necessary men to carry on new industries; these men could not be trained at short notice any more than plant could be put up at short notice. Chemical schools were being swamped by numbers of men who wanted to prepare themselves for that kind of industry, and they could not adequately handle them. They needed assistance in the shape of grants to the universities and colleges.

Journal and Patent Literature.

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I.—GENERAL; PLANT; MACHINERY.

PATENTS.

Grinding mills. H. C. Strack, Owego, N.Y., U.S.A.
Eng. Pat. 20,201, Sept. 25, 1914.

The grinding surface or pestle is mounted on a vertical, hollow shaft within which a screw conveyor elevates the ground material to the upper

part of the apparatus and returns it to be ground a second time.—W. H. C.

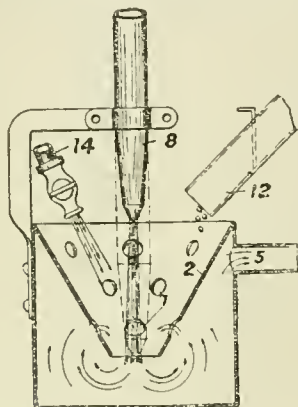
Disintegrating, pulverising or mixing apparatus; Rotary—J. W. Spensley, Manchester.
Eng. Pat. 1331, Jan. 27, 1915.

In disintegrating or mixing apparatus having rotating discs with intercalating pins projecting therefrom, the pins are formed with heads and are

driven in from behind into holes formed in the discs, so as to give a tight fit. A plate provided with grooves to fit the heads of the pins is fastened to the back of each disc.—W. H. C.

Mixer and disintegrator. C. T. du Bell, Los Angeles, Cal. U.S. Pat. 1,157,092, Oct. 19, 1915. Date of appl., Jan. 5, 1915.

THE materials are fed through the conduits, 12 and 14, into the perforated cone, 2, which is attached by its edge to the outer casing. The



materials are mixed by the vortex jet, 8, and are discharged through the outlet pipe, 5.—W. H. C.

Filters. F. P. Candy, Cheam, Surrey. Eng. Pat. 21,120, Oct. 17, 1914.

THE filter is divided into sections, which are washed separately and successively by return flow. The sections are connected, by pipes, with a casing which serves as a receiver for the filtered water and as a distributor for the wash-water. The distributor is provided with openings corresponding to the pipes leading to the filter, and all of these openings except one are fitted with non-return valves. When the filter is being washed, the wash-water can flow only through the opening not fitted with a non-return valve, and by means of a rotating plate or cylinder this opening is successively put into communication with each of the pipes leading to the filter.

—W. H. C.

Filtering process and apparatus. D. J. Kelly, Assignor to Kelly Filter Press Co., Salt Lake City, Utah. U.S. Pats. 1,158,055 and 1,158,056, Oct. 26, 1915. Date of appl., Oct. 22, 1913.

THE filter cakes are formed between alternate filtering elements of the vertical open-leaf type contained in a pressure tank, and are washed by conveying a washing liquid to the filtering elements not in operation and passing it through the cakes in the same direction as the flow of filtrate. The liquid is drawn off from the interior of the filtering elements on which the cakes are formed. The spaces for the cakes are wider at the bottom than at the top, so that the cakes may be discharged by applying fluid pressure to the interior of the filtering elements to detach them. Alternatively the cakes may be discharged by moving the filtering elements laterally to form wider spaces.

—W. F. F.

Heat insulating compounds. Beindorff and Co.'s Fabr. van Ketselbekleding en Isolatiestof "Isola," The Hague, Holland. Eng. Pat. 21,437, Oct. 23, 1914. Under Int. Conv., Jan. 6, 1914.

A LAGGING for boilers, steam pipes, and the like is composed of alum 18% by weight, wood pulp

paper 36%, fine chalk 15%, sawdust 11%, resin 2%, infusorial earth 18%. The wood pulp paper or other form of wood pulp is finely ground, but not sufficiently to destroy the fibre. The chalk and alum may be omitted, and no pressure is necessary to bind the mixture.—W. F. F.

Separating dust from air; Apparatus for —. T. Robinson and Son, Ltd., C. J. Robinson, and T. J. Stevenson, Rochdale. Eng. Pat. 1560, Feb. 1, 1915.

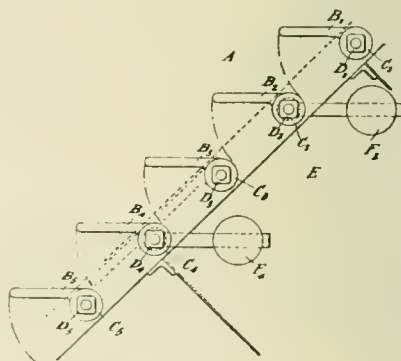
CYCLONE separators are arranged in series alternately with dust-depositing chambers, and each separator is provided with a separately driven fan. Recessed pockets are arranged round the conical bodies of the separators, forming dead air spaces where the dust may settle.—W. F. F.

Separating substances of different specific gravities, such as fine coal or ores and the like; Apparatus for —. J. M. Draper, Manchester. Eng. Pat. 1849, Feb. 5, 1915.

THE material is fed into a hopper at a point about halfway from the top and passes downwards through the conical perforated lower end, which enters the top of a vertical tubular chamber to which water is supplied through an inlet just below the conical end of the hopper; the water rises through the material in the hopper and flows away over an adjustable sill approximately at the level of the inlet for the material. The water column is balanced by connecting the lower part of the tubular chamber to an open tank in which the water is maintained at the level of the discharge sill, over which the lighter material is carried by the water. The heavier material is discharged from the lower end of the tubular chamber through a conical nozzle, or if too coarse, the nozzle is omitted, and it falls into an enclosed water chamber from which it is raised by a conveyor working in a tube in which water is maintained at its level in the hopper.—W. F. F.

Grading or screening materials. A. McD. Duckham, Ashtead, Surrey. Eng. Pat. 2469, Feb. 16, 1915.

THE screen consists of a stepped series of rows of fingers, B_1, B_2 , etc., mounted on axes, D_1, D_2 , etc., and provided with counterpoises, F_1, F_2 , etc., the



spaces between the fingers being increased from row to row. The material is fed on to the uppermost row of fingers; the finer portions pass through the spaces, and when a sufficient weight of the larger particles has accumulated it overbalances the counterpoise and is tipped on to the screen next below.—W. H. C.

Cooling towers. F. C. Schmidt, London. Eng. Pat. 6496, Apr. 30, 1915.

A SERIES of inclined boards overlapping one

another, or shallow trays arranged in stepped relationship, are provided immediately below the cooling hurdles to collect the liquid.—W. H. C.

Cooling towers and the like. F. C. Schmidt, London. Eng. Pats. (A) 7809, May 26, and (B) 8965, June 17, 1915.

(A) IN cooling towers of the enclosed type in which liquid delivered from a spraying device trickles down over parallel vertical hurdles, the liquid is prevented from falling freely through the spaces between adjacent hurdles, by means of inclined planes above the hurdles, each having its lower edge in the same vertical plane as a hurdle, so that the descending liquid is guided on to the top of each hurdle. Alternatively, series of superposed planes may be provided, the lowest plane of each series being situated as above. (B) A cooling tower or the like of the drip type is provided with a series of parallel supporting bars across which drip bars are supported so that their ends engage in notches in the upper edges of the supporting bars, the upper edges of both sets of bars being in the same plane.—W. F. F.

Carboys and the like; Containers for —. H. H. Gaden, Caulderan, France. Eng. Pat. 7837, May 26, 1915. Under Int. Conv., May 29, 1914.

A METAL container is provided with a conical removable cover which fits into the container and is maintained in position by a bail attached to the container by means of links engaging with pivoted claws. When the bail is raised over the cover the pivoted claws clip the latter and fix it in position. The top part of the bail is fixed to the top of the cover by a spring clip which fits into slots.

—W. H. C.

Heating and evaporating liquids; Apparatus for —. O. K. Zwingenberger, Perth Amboy, N.J., Assignor to The Roessler and Haaslaeher Chemical Co., New York. U.S. Pat. 1,156,338, Oct. 12, 1915. Date of appl., Dec. 6, 1912.

HOT gases from industrial sources are collected in a main and distributed to several primary evaporators. The gases leaving the primary evaporators are again collected in a main and are delivered to a boiler system, with which a secondary boiler system may be connected.—W. H. C.

Retort-furnace. W. E. Fletcher, Tamaqua, Pa., Assignor to Altas Powder Co., Wilmington, Del. U.S. Pat. 1,156,595, Oct. 12, 1915. Date of appl., Jan. 3, 1914.

THE retort is placed in an enlargement of the furnace above and between the inlet and outlet for the products of combustion. The space in the enlargement below the retort forms an expansion chamber which extends around the retort.

—W. F. F.

Catalysers; Process of making —. C. Ellis, Montclair, N.J. U.S. Pat. 1,156,674, Oct. 12, 1915. Date of appl., June 30, 1915.

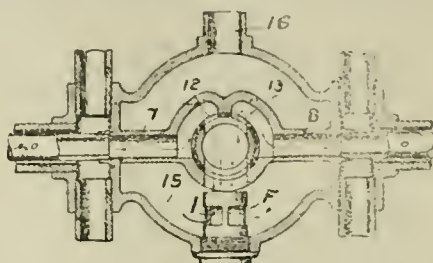
PURE nickel hydroxide is dissolved in ammonia and the solution mixed with pure, finely-divided charcoal. The mixture is evaporated to dryness, dried, and the nickel reduced in a current of hydrogen.—W. H. C.

Chemical compounds; Apparatus for the manufacture of —. C. J. Brockbank, Assignor to The Carborundum Co., Niagara Falls, N.Y. U.S. Pat. 1,157,293, Oct. 19, 1915. Date of appl., Jan. 7, 1914.

IN the manufacture of chemical compounds by a catalytic process, the catalyst is contained in the interstices of a compacted mass of carborundum which is heated electrically.—W. H. C.

Mixing gases. A. C. Clark, Assignor to A. C. Clark and Co., Chicago, Ill. U.S. Pat. 1,156,975, Oct. 19, 1915. Date of appl., Apr. 1, 1914.

TWO gases entering by the tubes, 7, 8, and ports, 12, 13, pass through the end of the hollow member, F, and are mixed by a screw fan mounted axially



within. The gases are discharged through the side openings, I, into the annular chamber, 15, and thence to the outlet, 16. A transparent window is provided in the base of the member, F.

—W. F. F.

Drying granular materials; Apparatus for —. J. G. Cross, Assignor to R. W. Fenn, Seattle, Wash. U.S. Pat. 1,157,087, Oct. 19, 1915. Date of appl., Mar. 25, 1915.

THE material is fed into the uppermost of a stepped series of cup-shaped vessels, which are rotated in a horizontal plane upon vertical axes, and are provided with wings on the under-side, extending from the periphery down to the plane of the bottom of the vessel. The vessels are rotated by suitable gearing in a casing or furnace chamber, and the material passes from one vessel to the next lower one.—W. H. C.

Desiccating liquid substances; Method of and apparatus for —. C. E. Gray, Eureka, Cal. U.S. Pat. 1,157,935, Oct. 26, 1915. Date of appl., June 14, 1915.

THE liquid to be desiccated is atomised and brought into contact with finely divided suspended matter, the particles of which become coated with the liquid. The coated nuclei are dried whilst freely suspended, and the dried material is graded to separate the desired product. The larger particles of the remainder are pulverised and used to form nuclei in the repetition of the cycle of operations.

—W. F. F.

Fillerling medium, applicable also as a medium for finely dividing or distributing liquids, as a vehicle for catalytic substances, and as a heat-insulating medium. J. E. Porter, Rochester, N.Y., U.S.A. Eng. Pat. 22,080, Nov. 5, 1914.

SEE U.S. Pat. 1,118,441 of 1914; this J., 1915, 69.

IIa.—FUEL; GAS; MINERAL OILS AND WAXES.

Coal; Spontaneous ignition of —. R. Nübling and H. Wanner. J. Gasbeleucht., 1915, 58, 515. J. Gas Lighting, 1915, 132, 260.

THE ignition temperature of the coal and of the residue after extraction with solvents was determined by heating it in a stream of oxygen in a copper tube in a paraffin bath. Volatile solvents were first driven off by heating the coal in a current of dry carbon dioxide to 10° above the boiling point of the solvent. To obtain a sufficient quantity of the pyridine extract for examination, 50–100 grms. of coal was digested with 200–400

c.c. of cold pyridine, the solution filtered, and the residue washed first with a little pyridine and then with ether. The combined filtrate and washings were precipitated with ether, and the precipitate washed with ether and dried at 80° C. *in vacuo*. The bromine absorption of the coal and of the pyridine extract was determined by agitating 5 grms. with 10 c.c. of chloroform and adding standard bromine solution. A narrow strip of filter paper dipped into the solution turned yellow at the edge when the absorption was complete. The results of experiments on three samples of coal are given in the annexed table.

Class of coal.	Westphalian.	Yorkshire.	Saar (Heintz).
Ash in coal, %	12.06	4.18	4.61
Carbon in ash-free coal, %	80.62	79.45	82.10
Hydrogen in ash-free coal, %	4.87	5.30	5.39
Cold pyridine extract, %	6.50	9.40	5.82
Carbon in pyridine extract, %	81.40	79.75	79.14
Hydrogen in pyridine extract, %	5.06	6.06	6.20
Temperature of ignition min stream of oxygen of: 20 grms. of the coal ...	152° C.	138° C.	165° C., 132°
20 grms. of the residue from pyridine extraction	187° C.	173° C.	172° C.
6 to 9 grms. of pyridine extract	138°, 151° C.	146° C.	—
Bromine absorption of 5 grms. of: Coal, grms.	0.7	0.6	1.0
Residue from pyridine extraction, grms.	1.9	0.3	2.6
Pyridine extract, grms.	0.0	0.0	0.0

—W. H. C.

Benzol in gas: Determination of — C. Neubeck, *J. Gasbeleucht.*, 1915, 58, 616. *J. Gas Lighting*, 1915, 132, 264—265.

The method of absorbing benzol in washing oil and distilling the resulting mixture up to 120° C. was found to be unreliable, and a modification of St. Claire Deville's method is recommended. A measured volume of gas, dried by passing it through a calcium chloride tube, is passed into a cooling coil, having a small bottle containing paraffin oil at its lower end, and immersed in a freezing mixture of solid carbon dioxide and ether contained in a Dewar vacuum vessel; a temperature of -78° C. is thus attained. The paraffin oil serves to absorb any benzene vapour given off during the subsequent manipulation. The increase in the weight of the apparatus, including the paraffin oil, on being removed from the freezing mixture and allowed to attain the normal temperature, represents the benzol contained in the volume of gas used. The benzol can be afterwards tested by distillation. The results obtained by this method from a known quantity of benzol

volatilised into air proved the accuracy of the method.—W. H. C.

Coke production in the United States. U.S. Geol. Survey, 1915.

THE production of coke in the United States in 1914 amounted to 34,555,914 short tons, valued at £17,667,000, compared with 46,299,530 short tons, valued at £25,785,000, in 1913. Of the coke made in 1914, 23,335,971 tons was beehive coke, valued at £10,051,000, and 11,219,943 tons, valued at £7,616,000, was by-product coke. The decrease in the production of retort coke in 1914 was 1,494,757 short tons, or 11.8%; the beehive output decreased 10,248,859 tons, or 30.5%. With the exception of two years, 1908 and 1914, the production of by-product coke has increased each year since the first ovens were completed in 1893. The percentage of by-product coke to the total in 1901 was 5.4; in 1910 17.1; in 1912 25.3; in 1913 27.5; and in 1914, 32.5.

In 1913 there was a net increase of 420 in the total number of ovens, although 2833 ovens, all of the beehive type, were abandoned during that year. There were 779 ovens constructed during the year, of which 192 were retort ovens and 587 of beehive type. The total number of ovens of all kinds in operation in the United States decreased in 1914 from 102,650 to 99,755, a net loss of 2895. In addition to the number of ovens abandoned during 1914 there were 45,117 idle, of which 667 were retorts and 44,450 were beehive ovens. The new ovens in course of construction at the close of 1914 numbered 1249, of which 644 were retorts and 605 were beehive ovens.

The first ovens of the retort type constructed in the United States comprised a plant of 12 Semet-Solvay ovens with recovery apparatus at Syracuse, built in 1893, primarily for the recovery of by-products for use in connection with the chemical works of the Solvay Process Company. These ovens had a charging capacity of 4.4 tons of coal, and the time required for coking was 74 hours. The present-day by-product ovens have capacities ranging from 10 to 16 tons of coal, and make furnace coke in 16 to 18 hours. These developments have been accompanied by marked improvements in by-product recovery and in the manufacture of ammonia. Still another marked development in by-product oven practice is in the adaptation of the surplus gas to the illumination of cities and towns. In the earlier days the ovens produced only a small and irregular quantity of surplus gas, which was also irregular in quality. To-day by-product ovens in the United States are selling over 50,000,000 cub. ft. of gas a day for domestic purposes. Almost the entire supply of gas in some cities is from retort ovens.

The total value of the coke, gas, tar, ammonia, and other products produced at by-product recovery ovens during the last two years is shown in the following table:—

Product.	1913.		1914.	
	Quantity.	Value.	Quantity.	Value.
Gas	64,553,941	\$5,664,691	61,364,375	\$6,009,583
Tar	115,145,025	2,830,158	109,901,315	2,867,274
Ammonia, sulphate or reduced to equivalent in sulphate lb.	173,342,349	5,324,444	170,763,906	4,696,590
Ammonia liquor	4,102,448	537,413	5,938,233	658,497
Anhydrous ammonia	*28,663,936	*2,135,656	*25,370,509	*2,300,137
Other by-products	—	403,579	—	†997,007
Total value of by-products	—	\$16,925,941	—	\$17,529,088
Coke	12,714,700	48,637,852	11,219,943	38,080,167
Grand total	—	\$65,563,793	—	\$55,609,255

* Mainly ammoniacal liquor sold on pound basis of NH₃. † Mainly benzol.

Acetylene, ammonia, and isobutane: Vapour pressures of—at temperatures below their normal boiling points. G. A. Burrell and L. W. Robertson. J. Amer. Chem. Soc., 1915, 37, 2182—2186. (Compare this J., 1915, 895.)

THE vapour pressures of acetylene, ammonia, and isobutane were determined at low temperatures, using the method previously described. The substances were purified by repeated distillation, and the thermometers employed were standardised to the melting points of ice and mercury. The following values are taken from the tables given: For acetylene, 189.1° abs., 760 mm. pressure; 183.6°, 500 mm.; 161.9°, 100 mm.; 129.9°, 1 mm.; for isobutane, 259.7°, 760 mm.; 245.4°, 500 mm.; 211.7°, 100 mm.; 158.3°, 1 mm.; for ammonia, 238.5°, 760 mm.; 230.7°, 500 mm.; 206.5°, 100 mm.; 159.8°, 1 mm. The average heats of evaporation over the temperature range studied, in calories per gram.-mol., are for ammonia 6271, for acetylene 5152, and for isobutane 4828. —G. F. M.

Petroleum hydrocarbons: Thermal reactions of—in the vapour phase. W. F. Rittman. J. Ind. Eng. Chem., 1915, 7, 945—953.

THE author gives detailed results obtained in experiments on the cracking of different kinds of petroleum oils. Most of the tests were made with a Pennsylvania refined burning oil, an Oklahoma fuel oil, and a California crude oil, but some also with Mexican and Russian oils. From 400 to 600 grms. of the oil was passed through an electrically heated furnace in which a constant temperature (up to 1000° C.) and pressure (from 0.3 to 30 atmospheres) could be maintained. The oil was vaporised before subjecting it to cracking conditions, as temperature and pressure are thereby more readily controlled, the formation of gas at the expense of liquid products is diminished, and the process is rendered less dangerous as only a small quantity of oil is in the reaction zone at any one time. In the present investigation the influence of varying conditions on the liquid products was studied, the effect on the gaseous products having been considered previously (see this J., 1914, 626, 682). The detailed results are tabulated and show that with the exception of the formation of carbon, the products of the cracking reactions depend almost entirely upon the experimental conditions, being affected only in minor degree by the chemical and physical properties of the original oils. The production of carbon is greater the higher the carbon content of the original oil; with the Mexican oil much heavy tarry matter was deposited with the carbon. The most favourable conditions for gasoline production are temperature about 500° C. and pressure higher than 6 atmospheres. The highest yields of low-boiling aromatic hydrocarbons are obtained at 600°—700° C. and pressure higher than 4 atmospheres. Under the experimental conditions the highest yield of gasoline (b.pt. up to 150° C.) obtained in a single run was 17.3% at 550° C. and 18 atmospheres pressure. The highest yield of aromatic hydrocarbons (b.pt. up to 150° C.) was 13.1% at 600° C. and 18 atmospheres pressure.—A. S.

Normal nonane. L. Clarke and R. Adams. J. Amer. Chem. Soc., 1915, 37, 2536—2538.

n-NONANE was synthesised from cenanthal (from castor oil) by converting this aldehyde by the action of magnesium ethyl bromide and subsequent decomposition of the organo-magnesium derivative into ethylhexylecarbinol. By treatment with phosphorus and iodine the corresponding iodide resulted, which on boiling with alcoholic potassium hydroxide yielded *n*-nonylene, a colourless mobile liquid boiling at 149.4°—149.9° C. On reduction with hydrogen over reduced nickel

at 160° C. nonane was formed. It is a colourless mobile liquid, b.pt. 150.4°—150.6° C. at 759 mm., sp.gr. 0.7219, n_D^{20} = 1.4025.—G. F. M.

Distillation of Douglas fir at high temperatures. Tremper. See 14b.

Manufacture and tests of silica brick for the by-product coke oven. Seaver. See IX.

Gas as a case-hardening agent. White and Hood. See X.

New direct-reading viscosimeter. MacMichael. See XXIII.

PATENTS.

Cohering mass [briquette]; Process for obtaining a—D. H. Bibb, Assignor to Continental Process Corporation, New York. U.S. Pat. 1,158,363, Oct. 26, 1915. Date of appl., Apr. 1, 1914.

DIVIDED material, e.g., flue dust, is mixed with a binder consisting of pyroligneous tar, the mixture subjected to pressure, and heated until the disagreeable fumes are driven off.—F. W. A.

Cohering masses [from waste sulphite liquor]; Process of making—Briquettes and other products composed of bonded divided material. D. H. Bibb, Assignor to Continental Process Corporation, New York. U.S. Pats. 1,158,364 and 1,158,365, Oct. 26, 1915. Dates of appl., May 9, 1914 (renewed Mar. 10, 1915), and Sept. 24, 1914.

GRANULAR material, e.g., flue dust, is mixed with waste liquor from the sulphite process, concentrated to 30° B. (sp.gr. 1.263), the mixture subjected to pressure and converted by the application of heat into a non-coked substance resistant towards water, e.g., by heating at 600° F. (316° C.) for 20 mins.—F. W. A.

Cohering masses [from waste sulphite liquor]; Process of making—D. H. Bibb, Assignor to Continental Process Corporation, New York. U.S. Pat. 1,158,366, Oct. 26, 1915. Date of appl., Apr. 1, 1915.

WASTE sulphite liquor is evaporated to give a residue of a soluble pitch, which is powdered and mixed with granular material and a solvent, e.g., water. The mixture is formed into briquettes and converted by the application of heat into a non-coked material resistant to water.—F. W. A.

Coke-oven. F. J. Collin, Dortmund, Assignor to Akt.-Ges. für Kohlendestillation, Düsseldorf, Germany. U.S. Pat. 1,157,368, Oct. 19, 1915. Date of appl., Feb. 21, 1912.

A NUMBER of parallel vertical heating flues are provided in the wall of a coking chamber. All the burner nozzles at the base of the flues in each half of the wall are supplied with gas from a common horizontal passage, leading from a gas chamber near the centre of the wall below the flues. Gas is supplied to this chamber through a passage parallel to the passage from which the burners are supplied, and air is supplied to each heating flue from a chamber below the coking chambers.

—W. F. F.

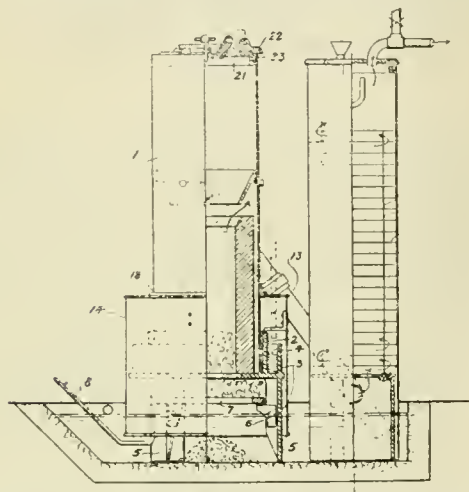
Gas-producers; Automatic working—B. Versen, Dortmund, Germany. Eng. Pat. 13,850 of 1914, date of appl., Oct. 27, 1913.

THE gas producer described in Eng. Pat. 24,329 of 1913 (this J., 1915, 825) is provided with a vertical shaft carrying a rotating block with helical ribs surrounded by an eccentric member also having helical ribs. The descending cinder is broken up in the tapering space thus formed. The rotating block carries a stirring arm rotating within the water-seal and provided with an

inclined arm projecting upwards which breaks up the caking layer by alternately raising and dropping it.—W. F. F.

Gas generators. F. W. Baynes, London. Eng. Pat. 94, Jan. 4, 1915.

THE casing, 1, rests in the recess, 2, of the supporting casting, 3, 5, which is provided with a vaporising space, 4, filled with sand or the like



upon which water is dropped to generate steam. A fire-grate, 7, is supported on lugs, 6, and provided with an agitating handle, 8. A movable cowl, 14, with air inlet, 18, dips into a water-seal. The cover, 21, is provided with supporting lugs, 22, and a groove, 23, for caulking material. Gas is withdrawn by suction through the pipe, 13, and the scrubber.—W. F. F.

Water-gas and like gases; Process for carburetting —. P. Porges and H. Strache, Vienna. Eng. Pat. 1329, Jan. 27, 1915. Under Int. Conv., Apr. 27, 1914.

A MIXTURE of steam and vapour from heavy oil is passed over heated iron oxide or superficially oxidised cast iron, whereby it is converted into oil gas, benzine, and heavy hydrocarbons. The oil gas is added to water-gas, the benzine is condensed and used separately, and the heavy hydrocarbons are used as carburetting oil or for heating the distillation apparatus.—W. F. F.

Gas; Method of making —. S. M. Darling, Chicago, Ill. U.S. Pat. 1,157,089, Oct. 19, 1915. Date of appl., Oct. 5, 1912.

CARBONACEOUS material is dried in a closed chamber heated externally, then carbonised in another chamber also heated externally, and the incandescent carbonised material fed into a producer and gasified. A portion of the steam given off in the first stage of the process and the gases and vapours from the second stage are forced into the combustion zone of the producer.—W. H. C.

Illuminating gas; Method of manufacturing from liquid hydrocarbons. E. C. and L. B. Jones, San Francisco, Cal. U.S. Pat. 1,157,225, Oct. 19, 1915. Date of appl., May 23, 1912.

A HEAT-RETAINING chamber is first heated, the source of heat is shut off, and the combustion products are replaced by an "active" atmosphere of heat-producing gas and steam. A liquid hydrocarbon is then injected and is acted upon by the "active" atmosphere to produce a permanent gas.—W. F. F.

Tar extractor. F. Tschudy, Fairfield, Ala. U.S. Pat. 1,155,387, Oct. 5, 1915. Date of appl., Oct. 2, 1914.

AN outer shell, supported upon a sealing pot, contains a distributing chamber, in two parts, and above this a separating chamber filled with checkerwork. The distributing chamber has a gas inlet in its lower part, with a curved baffle-plate fixed vertically in front, and is provided above with a diaphragm pierced by apertures with upwardly extending flanges, whilst a tube, fixed to the diaphragm, depends into a central depression, with drain, in the seal pot below.—F. SODX.

Gas scrubber. R. Maclaurin, Stirling, Scotland. U.S. Pat. 1,158,066, Oct. 26, 1915. Date of appl., July 3, 1915.

A VERTICAL casing is divided into superposed compartments by partitions, each having a central hole, through which a rotating vertical shaft passes, carrying a small concentric vessel in each compartment. Brushes with short bristles inclined outwards project through the sides of these vessels. The scrubbing liquid passes down through the compartments and vessels in succession, meeting the ascending gas.—W. F. F.

Liquid fuel for internal combustion engines. G. E. Heyl and T. T. Baker, London. Eng. Pat. 21,738, Oct. 29, 1914.

TAR oil distilling between 170° and 230° C., from which the tar acids and naphthalene have been almost completely removed, is mixed with from 1 to 3 parts of petrol, paraffin oil, or like liquid fuel, and the resulting precipitate removed by filtration.—W. F. F.

[Liquid] fuel for kinetic engines. G. Blieberger, New York. U.S. Pat. 1,158,367, Oct. 26, 1915. Date of appl., May 8, 1914.

A MIXTURE of methyl alcohol, acetone, lead carbonate, and a resinous acid is distilled. A small amount of the distillate obtained up to 100°–110° C. is mixed with relatively high-grade products of crude oil distillation, e.g., the kerosene fraction distilling at 150°–300° C., with or without addition of gasoline, and the insoluble sediment separated.—F. W. A.

Hydrocarbon oils; Process of treating — [to produce fatty acids and esters]. T. T. Gray, Elizabeth, N.J. U.S. Pat. 1,158,205, Oct. 26, 1915. Date of appl., Dec. 3, 1913.

HYDROCARBONS are "debloomed" and transformed into fatty acids and esters by treatment with an oxidising agent in the presence of ultraviolet or active rays, with or without the assistance of heat, pressure, or a catalyst, such as finely divided metals or salts or porous material carrying such metals, etc.—C. A. M.

Gases; Purification of —. E. L. Hall, Portland, Oreg., U.S.A. Eng. Pat. 21,525, Oct. 26, 1914. SEE U.S. Pat. 1,120,475 of 1914; this J., 1915, 91.

Apparatus for purifying and filtering oils [e.g., lubricating oils] and other liquids. Eng. Pat. 192. See I.

Method of producing ammonium sulphate [from carbonisation gases]. Saturating apparatus. U.S. Pats. 1,155,385 and 1,155,386. See VII.

Process of dehydrating oils. U.S. Pat. 1,158,253. See XII.

Manufacture of chlorinated hydrocarbons [tetrachloro-ethane, from coal gas]. Eng. Pat. 780. See XX.

II.B.—DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Destructive distillation of some Western conifers; Yield of by-products from —. H. K. Benson and M. Darrin. J. Ind. Eng. Chem., 1915, 7, 916—918.

THE following table summarises the average results of experiments made in a plant erected by the United States Forest Service and the University of Washington; the distillation retort has a capacity of about $\frac{1}{2}$ cord.

Material.	Weight per cord.	Turpentine and light oil.	Tar.	Wood alcohol.	Acetate of lime.	Charcoal.
	lb.	galls. §	galls. §	galls. §	lb.	lb.
Douglas fir common mill waste	3330*	3.40	27.80	3.90	75.0	977
" selected resinous waste	4250†	10.86	46.37	5.71	74.3	900
" stump wood	3260†	5.59	19.83	2.60	55.8	675
Western yellow pine mill waste	2840†	4.91	24.80	3.25	73.4	478
" stump wood	2620†	6.06	23.05	1.83	60.8	520
Western hemlock mill waste	3270‡	2.76	21.60	5.00	94.0	938

* Based on 15 half-cords.

† Based on 4 half-cords.

‡ Based on 5 half-cords.

§ U.S. gallons.

The crude wood alcohol from Douglas fir contains about 20% of acetone.—A. S.

Distillation of Douglas fir at high temperatures. B. Tremper. J. Ind. Eng. Chem., 1915, 7, 926—927.

AN experimental plant for the manufacture of gas from wood waste has been in operation for several years in the Pacific North-West District, U.S.A., and recently several large-scale plants have been or are being erected. In a plant at Auburn, Washington, similar to a standard coal-gas installation, benches of four 9 ft. clay retorts are used, and the stand-pipes from mouthpiece to bridge-pipe are water-jacketed to prevent accumulation of tar in the pipes. The wood is used in 4 ft. lengths tied in bundles, and carbonisation is effected at 1400°—1600° F. (760°—870° C.). Douglas fir forest wood yields 25,000 cb. ft. of gas per cord of 3700 lb.; the average calorific value of the gas is 482 B. Th. U. Douglas fir mill waste yields 18,000 cb. ft. of gas, with a calorific value of 475 B. Th. U., per cord of 3300 lb. A typical sample of the gas, calorific value 509 B. Th. U., contained: CO₂, 17.1; illuminants, 6.0; O₂, 0.0; CO, 31.5; CH₄, 21.7; H₂, 18.3; N₂, 5.1%. From 14 to 22 U.S. galls. of tar per cord of wood is obtained, and the value of this covers the cost of wood at the plant. The tar after settling for 8 hours contains less than 5% of water and yields 1.5% of "wood spirits" below 100° C. and 2.5% of light oil below 150° C. on distillation. The aqueous liquor contains 1.0 to 2.5% of acetic acid, 0.2% of wood alcohol and acetone, and less than 1% of "soluble tar." The yield of charcoal is 700—800 lb. per cord, an amount more than sufficient for firing the retorts if regenerative furnaces be used. Trials on an industrial scale showed that the excess could be used for the manufacture of carburetted water-gas, the yield being 1000 cb. ft. per 25 lb. of charcoal.—A. S.

Acetone from pyroligneous acid; Production of —. M. Darrin. J. Ind. Eng. Chem., 1915, 7, 927—929.

IN laboratory experiments in which acetic acid vapours from solutions of 2—1% concentration were passed through an electrically heated quartz tube containing barium acetate as catalyst, about 86% of the acid decomposed was converted into acetone. With a large scale apparatus, in which the temperature could be more easily controlled and local overheating avoided, a nearly quantita-

tive yield of acetone should be attainable. When pyroligneous acid was used, under similar conditions, the yield of acetone was about 54% of the theoretical quantity, and a yield of 65% should be attainable in practice. The best results were obtained at 435° C. Compared with the usual process of making acetone from crude calcium acetate, the method described would give higher yields of acetone, the operating expenses would be lower, no lime would be required, and the apparatus would be simple and cheap, and easy to control. —A. S.

Photometry of different coloured light sources. M. Pirani. Deuts. Beleucht. Ges., Mar. 20, 1915. Chem.-Zeit., 1915, 39, 540.

THE comparison is made with a standard light source of known radiating properties, preferably a carbon filament lamp. The temperature of the filament is first determined by any suitable pyrometric method and from that the energy radiation for each wave-length is calculated. Then a filter is prepared which brings the colour of the standard lamp to that of the comparison lamp and the transparency of the filter is determined, throughout the visible spectrum, by the spectral-photometer. The eye-sensitiveness for different wave-lengths is obtained from a table published by Ives in 1912. The product of the energy and eye-sensitiveness, and that of the energy, eye-sensitiveness, and transparency of the filter, are both plotted against wave-lengths. The areas enclosed by the curves over the region of the visible spectrum are measures of the relative brightness of the standard lamp with and without the filter; if these are called *f* and *F*, and if *K* be the candle power of the standard lamp without the filter, then $\frac{Kf}{F}$ is its candle power with the filter. The

comparison lamp is then measured against the standard lamp with filter. A method for comparison of high temperatures is based on similar considerations, a yellowish-green filter being used which has very little effect on visual brightness in comparison with the effect on colour; the results obtained are accurate to within 1% or 2% for a temperature difference of about 500° C.

—B. V. S.

Artificial light sources in photography. Lux. See XXI.

PATENTS.

Destructive distillation of wood; Process for the —. B. R. and M. J. Lyster, Whitefield, N.H. U.S. Pat. 1,157,316, Oct. 19, 1915. Date of appl., Dec. 11, 1913.

THE retorts containing the wood are heated externally in such a way that different retorts or sets of retorts are in different stages of the distilling process. The non-condensable gases rich in oxides of carbon from retorts in an early stage are passed into retorts in a later stage of the distillation process, thereby increasing the yields of the desired products.—W. F. F.

Heat producing and cleaning compound. E. C. R. Marks, London. From W. F. McNabb. Pittsburgh, Pa., U.S.A. Eng. Pat. 22,242, Nov. 9, 1914.

SEE U.S. Pat. 1,143,295 of 1915; this J., 1915, 827. Tartaric acid and potassium nitrate may also be added to the mixture, suitable proportions being sodium hydroxide, 15 parts; oxalic acid, 5; tartaric acid, 3; potassium persulphate, 5; aluminium, 0.5; and potassium nitrate, 0.5 part.

Filaments, rods, and other bodies consisting of or containing graphite-like carbon; Manufacture of —. Siemens und Halske A.-G., Siemensstadt, Germany. Eng. Pat. 4776, Mar. 27, 1915. Under Int. Conv., Mar. 28, 1914.

A THICK layer of carbon is deposited on a tungsten filament or rod, and heated, in the absence of air, in an electric furnace to or slightly above the melting point of the metal, so that a uniform, flexible, and ductile body is produced. It may be made more compact and homogeneous by high pressure or by mechanical treatment.—B.N.

Method of producing ammonium sulphate [from carbonisation gases]. Saturating apparatus. U.S. Pats. 1,155,385 and 1,155,386. See VII.

Manufacture of fine refractory-metal [tungsten] wires. U.S. Pat. 1,157,288. See X.

III.—TAR AND TAR PRODUCTS.

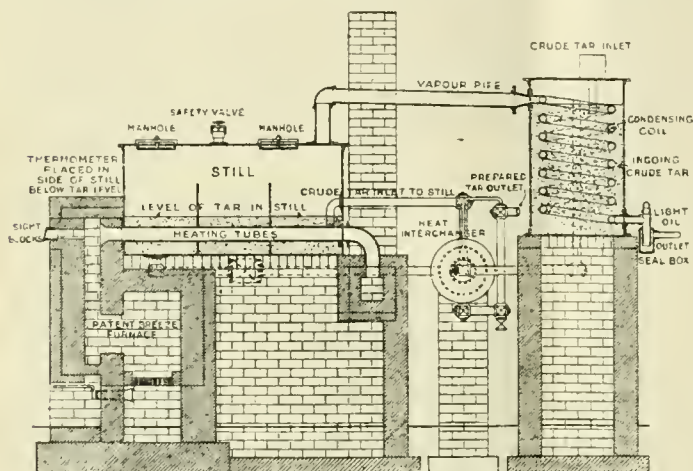
Tar dehydration. E. V. Chambers. Manchester Dist. Inst. Gas Eng., Oct. 30, 1915. J. Gas Lighting, 1915, 132, 261—264.

THE processes in use for the dehydration of tar may be divided into two main classes, (1) the centrifugal process, and (2) the distillation process. The distillation process may be either intermittent or continuous. By means of a centrifugal machine it is possible to reduce the water content of the tar to 1%, and to reduce the free carbon, but neither the volatile low-boiling hydrocarbons (benzene and toluene) nor the tar acids are removed. The distillation process is free from the above objections. Compared with the continuous distillation process, the intermittent process has the disadvantage that it requires skilled attention and that there is considerable danger of the tar frothing and boiling over during the earlier part of the distillation.

distilling tar until the residue has the temperature specified below:—(1) For road spraying, 230° C.; (2) for tar macadam, 260°; (3) for pitch grouting, 288°. Following are the approximate yields of tar products, but the figures vary slightly according to the quality of the tar.

Road Board specification.	Working temperature.	Quantity distilled, gallons.	Gallons of crude tar acids per ton of tar.	90% benzol per ton of tar.	90% toluol per ton of tar.
No. 1.....	230° C.	25	4	3	2
No. 2.....	260° C.	29	5	3	2
No. 3.....	288° C.	34	5	3	2

Ten tons of crude tar if dehydrated will produce 300 gallons of light oils, giving, on rectification, 25 gallons of crude carbolic acid, 25 gallons of cresylic acid, 30 gallons of 90% benzol, 20 gallons of 90% toluol, 40 gallons of solvent naphtha, and 150 gallons of light creosote oil. The Hird, Chambers, and Hammond continuous dehydration plant shown in the figure is stated to get over the difficulty of removing the water from crude tar. The danger of boiling over can be obviated by having only a shallow layer of tar in the still, and a large vapour space above it. The tar enters by the crude tar inlet into the condenser and serves to cool the vapours from the still. It then passes through the heat interchanger and thence into the still, through which it passes in a tortuous course and, having been deprived of its water and light oil, overflows through the heat interchanger to the dehydrated tar store. The still is heated by producer gas from the patent breeze furnace, which is burned in the heating tubes which pass through the still. The plant is said to require very little attention and to produce no nuisance. The following statement of working charges per ton of tar relates to a still having a capacity of one ton of tar per hour: Fuel, 67 lb. coke breeze at 10s. per ton, 3.6 pence; labour, 6.0 pence; 5% int. and 10% depreciation, 2.6 pence; rent, rates, and taxes, office and management, 1.2 pence; total, 13.4 pence. Products obtained: 160 galls. prepared tar at 3d. per gallon (at works), £2; 30 galls. naphtha and light oils at 5d. per gall. (at works), 12s. 6d.; 10 galls. liquor, 1s. 0d.; total, £2 13s. 6d., less working costs, 1s. 1½d. Net value of products from 1 ton of tar, £2 12s. 1½d.—W. H. C.



Three qualities of prepared tar are specified by the Road Board and may be obtained by

Friedel and Crafts' reaction; Dynamics of —. S. C. J. Olivier. Rev. Trav. Chim. Pays-Bas, 1915, 35, 109—123.

It has been found that the rule stated for *p*-bromo-benzenesulphonic chloride (this J., 1915, 217) is general, namely that 1 mol. of aluminium chloride can only convert 1 mol. of a sulphonic acid chloride. The view that the formation of *p*-bromodiphenylsulphone is due to the interaction of the compound $\text{BrC}_6\text{H}_4\text{SO}_2\text{Cl} \cdot \text{AlCl}_3$ and not the free sulphonic chloride with benzene, has been proved experimentally; on dissolving pale yellow crystals of $m\text{-NO}_2\text{C}_6\text{H}_4\text{SO}_2\text{Cl} \cdot \text{AlCl}_3$ in benzene, a red solution is produced, but the colour disappears immediately on addition of an equivalent of a sulphone, for example *m*-nitrodiphenylsulphone, and the reaction of the sulphonic chloride and benzene stops immediately, due to the fact that the sulphone combines with the aluminium chloride, the compound produced and the free sulphonic

chloride not giving red solutions in benzene. The catalyst is paralysed almost equally by various sulphonic chlorides and sulphones. Those addition compounds of the type, $\text{RSO}_2\text{Cl} \cdot \text{AlCl}_3$, which are most easily formed, react most readily with benzene.—F. W. A.

Creosoles; Application of the Davis spot test in the preliminary examination of—. H. Cloukey. J. Ind. Eng. Chem., 1915, 7, 923—924.

Tests were made with various samples of creosote and oils used for wood preserving, and with creosote to which increasing quantities (up to 0.5%) of lampblack were added. Six drops were allowed to fall on to white blotting paper, and the spot observed after several hours (see this J., 1910, 341). It was found that 0.005% of free carbon can be easily detected, and the character of the outer zone affords information as to the nature of the oil. Illustrations of the spots produced by some of the samples tested are given.—A. S.

Benzene derivatives; Replacement of substituents in—. A. F. Holleman, W. J. de Mooy, and J. Ter Weel. Rec. Trav. Chim. Pays-Bas, 1915, 35, 1—66. (See also this J., 1915, 542.)

On treating chloronitro- and dichloronitrobenzenes with sodium methoxide or diethylamine, only the chlorine atoms in *ortho*- or *para*-position to the nitro-group are replaced. The velocity of reaction varies considerably with the position of the halogen atoms in the nucleus, and is increased by the introduction of a second chlorine atom or nitro-group. The reaction velocity of nitro-compounds is greater than that of corresponding chloro-compounds, but there does not appear to be any definite relation between the two.—F. W. A.

Determination of benzol in gas. Neubeck. See IIa.

Thermal reactions of petroleum hydrocarbons in the vapour phase. Rittman. See IIa.

PATENTS.

Toluene; Manufacture of [chlorine] substituted products of—. R. B. Ransford, London. From L. Cassella and Co., Frankfort, Germany. Eng. Pat. 16,317, July 8, 1911.

TETRACHLOROTOLUENE is obtained by passing dry chlorine over dry toluene and anhydrous iron chloride at 12° — 15°C ., the mixture being stirred; when trichlorotoluene crystallises out, the mass is melted by heating to 45° — 50°C ., then cooled to 35°C ., and chlorine again introduced, gradually increasing the temperature to 50°C ., until the necessary increase in weight has occurred. Only traces of pentachlorotoluene should be shown by precipitation on dilution of a sample with an equal volume of carbon bisulphide. On fractional distillation a yield of 90% of the theoretical quantity of tetrachlorotoluene is obtained. Further chlorination at 100° — 130°C . in presence of light, particularly ultraviolet rays, gives tetrachlorobenzal chloride.—F. W. A.

Chloroanthraquinones; Manufacture of—. Akt.-Ges. f. Anilinfabr., Berlin. Eng. Pat. 5182, Apr. 6, 1915. Under Int. Conv., Apr. 21, 1914.

CHLORINE compounds of phosphorus are found to substitute chlorine for hydroxyl groups in anthraquinone derivatives without attacking the ketonic groups or exchanging chlorine for hydrogen atoms of the nucleus. *Example*. 1 part of 1-hydroxyanthraquinone is boiled with 10 parts of nitrobenzene for half an hour to remove traces of moisture, the mixture is cooled to 150°C ., 1 part of phosphorus pentachloride is introduced, and the whole boiled for 3 hours under a reflux condenser. The nitrobenzene is distilled with steam,

and the 1-chloroanthraquinone recrystallised from glacial acetic acid.—F. W. A.

IV.—COLOURING MATTERS AND DYES.

Indigo in India.

THE forecast issued by the Indian Department of Statistics estimates the total area in British India under indigo for the 1915-16 crop at 258,100 acres, compared with 116,500 acres in 1914-15. In Bihar and Orissa the area is estimated at 60,800 acres, against 38,900 acres, and in Madras at 126,000 acres compared with 38,500 acres last year. These two districts were responsible last year for 70% of the total area under indigo. In the United Provinces, Bombay and Sind, and Bengal, the area under indigo has also increased. It is considered that the present development will prove to be only temporary.

Alizarin and certain other dyestuffs; Quantitative estimation of—. E. Knecht and E. Hibbert. J. Soc. Dyers and Col., Dec., 1915.

ALIZARIN, Anthrapurpurin, or Flavopurpurin is dissolved in alcohol, the alcoholic solution run into a 20% solution of sodium tartrate, and an excess of titanous chloride solution added to the boiling solution. The solution obtained is titrated with iron alum until the intense bluish-green colour changes to yellow. One mol. of Alizarin requires four atoms of hydrogen, corresponding to its reduction to desoxyalizarin. By similar treatment Alizarin Orange is only reduced to the corresponding β -aminoalizarin; Alizarin Black (dihydroxynaphthoquinone) behaves as a true quinone, requiring two atoms of hydrogen for its reduction; and Gallocyanine and Prune require the same number of hydrogen atoms. Primuline is not reduced by titanous chloride under any known conditions, but the red formed by diazotising and combining with β -naphthol is easily reduced, and may be titrated on the cotton fibre.—F. W. A.

PATENT.

Colour lakes; Manufacture of—. A. E. Gessler, New York. U.S. Pat. 1,157,525, Oct. 19, 1915. Date of appl. Feb. 9, 1912.

LAKES of the disazo-dyestuff obtained by combining tetrazotised dianisidine and 2,6-naphthol-sulphonic acid, for example the copper lake, are characterised by their insolubility in water, oil, benzol, and varnish.—F. W. A.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Plant cell-membranes; Chemistry and structure of—. J. König and E. Rump. Z. Unters. Nahr. Genussm., 1911, 23, 177. Chem.-Zeit., 1915, 39, Rep., 257.

THE difficultly-soluble portion of vegetable cell membranes consists chiefly of three classes of substances, viz., pentosans, hexosans (including mannan, galactan, and glucosan), and lignins, together with cutin. In each of these classes one part, termed *proto*-pentosans, etc., is rendered soluble by enzymes or by water at 2—4 atmospheres pressure, a second larger part, termed *hemi*-pentosans, etc., becomes soluble on boiling with 1—3% acid at 2—4 atmospheres pressure, whilst a third still greater part, termed *ortho*-pentosans, etc., is only dissolved by strong acids or by dilute acids under high pressure. The

ortho-group, to which cutin and suberin also belong, can be further resolved by treatment with weak oxidising agents, when all lignins are oxidised and *ortho*-cellulose and cutin remain and can be separated by dissolving the *ortho*-cellulose with ammoniacal cupric oxide solution. When the *ortho*-group is treated with 72% sulphuric acid, *ortho*-cellulose and "colourless" lignin dissolve, whilst "coloured" lignin, cutin, and suberin remain undissolved and can be separated by oxidation. *Ortho*-cellulose is also completely dissolved by heating with 1% hydrochloric acid solution for 5 to 6 hours at 6–7 atmospheres pressure, whilst *ortho*-lignins are only slightly attacked by this treatment. Cutin and suberin are wax-like substances which cannot be oxidised or hydrolysed; they have a similar carbon content to the lignins (69%–70%) but contain more hydrogen (9%–12%). Lignins on oxidation give carbonic, formic, and acetic acids, and when distilled with phosphorus and hydriodic acid give variable quantities of methyl iodide, so that they are probably methyl, methoxy, or acetyl derivatives of cellulose. Microscopic evidence indicates that the substances accompanying cellulose are not chemically combined with the latter, but are structurally intimately mixed.—T. C.

Banana; Field of paper from green stem of—C. Beadle and H. P. Stevens. Chem. News, 1915, 112, 235.

IN the utilisation of certain crop plants, such as varieties of banana, for paper-making purposes, the proportion of dry fibre in the green material is so small that the handling of the green crop forms a serious item in the cost of the commercial pulp. Plants of this type must either be treated on the field with crushing rollers and the isolated fibre dried for transport, or else must be baled whole, after drying in the sun, like hay. The former is by far the more satisfactory process from the technical point of view. Fibre isolated by crushing and washing the green plant yielded 50–60% of paper pulp calculated on the dry weight, with a consumption of 6% of alkali on the weight of paper produced. Entire stems of the same material, dried on the field, yielded only 32% of paper pulp, with a consumption of 18% of alkali on the paper produced. Taking an average of several varieties of *Musa* it was established that for the production of 1 ton of dry dressed fibre, 68 tons of green crop material would have to be handled, or 132 tons per ton of paper produced.—J. F. B.

Manufacture of ethyl alcohol from wood waste. Kressmann. See XVIII.

PATENTS.

Textile fabrics or fibres; Treatment of—[to remove dressings]. A. Boidin, Seclin, France, and J. Effront, Brussels. Eng. Pat. 1411, Jan. 28, 1915. Under Int. Conv., Feb. 21, 1914.

TEXTILE materials are freed from dressings by subjecting them for a short time to the action of bacterial diastases from the species *subtilis* and *mesentericus* added to water containing a small amount of a suitable alkali. The bacterial diastases may be obtained with the aid of a wort or mash prepared from pure soya cake (see Fr. Pat. 471,546 of 1913; this J., 1915, 444), or a mixture of 10 to 20% of rye with 80 to 90% of soya cake, the best results being obtained by preparing worts containing 12 to 15% of cereals.—F. W. A.

Wearing apparel and other objects; Process for cleaning—O. Röhm, Darmstadt, Germany. Eng. Pat. 2151, Feb. 10, 1915.

A SMALL quantity of a tryptic enzyme, e.g.,

pancreatin, is added to the water in which clothes, etc., are steeped, for the purpose of breaking down albuminous or fatty impurities present on the goods; it may also be used for toilet purposes. Reference is directed, in pursuance of Sect. 7, Sub-sect. 4, of the Patents and Designs Act, 1907, to Eng. Pat. 4323 of 1886 (this J., 1886, 428).—J. F. B.

Coated fabrics [imitation leather]; Manufacture of—W. G. L. H., and G. R. Ayres, Philadelphia, U.S.A. Eng. Pat. S202, June 2, 1915.

MATERIAL adapted for use as imitation leather is obtained by coating with a colloidal body, preferably waterproof and of the nature of cellulose, either or both sides of a fabric of which the core is open-mesh burlap, through which the fibrous material has been pricked to give a thick layer on the one side and a thin layer on the other side; the material so obtained is subjected to pressure whilst wet, and a finishing coating afterwards applied, and stamped, pressed, or "pebbled" in such a manner as not to injure the elasticity.

—F. W. A.

Flax straw; Process of treating—J. E. Lappen, Assignor to Union Fibre Co., Winona, Minn. U.S. Pat. 1,158,245, Oct. 26, 1915. Date of appl., June 30, 1910.

FELTED heat-insulating sheets are made by immersing whole flax straw, without previous treatment, in a degumming solution, circulating the straw freely in the solution and subjecting it, while immersed, repeatedly to a beating and hackling action, whereby breakage of the fibre is prevented and the degumming facilitated, the fibre and a portion of the shives being commingled in one operation.—J. F. B.

Artificial filament and other product. W. A. Beatty, Assignor to G. W. Beadle, New York. U.S. Pat. 1,156,969, Oct. 19, 1915. Date of appl., Jan. 3, 1913.

THREADS suitable for weaving into fabrics are composed of a mixture of dihydroxydiphenyldimethylmethane and cellulose acetate as an essential element.—J. F. B.

Celluloid or the like; Manufacture of moulded—J. R. Craig, jun., London. Eng. Pat. 21,002, Oct. 15, 1914.

A THIN sheet of celluloid is pressed against a matrix, e.g., a photographic carbon negative, on a heated base-plate, by the pressure of liquid or air pumped into a rubber bag, applied in such a manner that exudations of liquid or gas from the celluloid can escape laterally without marking the sheet.—J. F. B.

Waterproof paper and process of manufacturing same. J. Kindleberger, Kalamazoo, Mich., U.S.A. Eng. Pat. 1231, Jan. 26, 1915.

PAPER parchmentised preferably by the sulphuric acid process is treated with a solution containing 65–75% of glycerin, dried, rolled up, and allowed to stand until the glycerin has thoroughly permeated the fibres; it is then waterproofed by coating with paraffin wax.—J. F. B.

Impregnating woven belts and conveying bands; Method of—Aktieselskabet Roulunds Fabr., Odense, Denmark. Eng. Pat. 21,874, Nov. 2, 1914. Under Int. Conv., Oct. 31, 1913.

SEE Ger. Pat. 285,049 of 1913; this J., 1915, 1139. Elaterite is specified as the asphaltic substance.

Plastic compound and process of making same. W. A. Beatty, Assignor to G. W. Beadle, New York. U.S. Pats. 1,158,960 and 1,158,961, Nov. 2, 1915. Date of appl., Apr. 30, 1912. Renewed Mar. 5, 1913.

SEE Fr. Pat. 447,615 of 1912; this J., 1913, 283.

Process of making cohering masses or briquettes [from waste sulphite liquor]. U.S. Pats. 1,158,364 to 1,158,366. See II.A.

Casing for sausages. U.S. Pat. 1,158,400. See XIX.A.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Catalytic decomposition in bleaching kiers. W. Kind. Seifensieder-Zeit., 1914, 41, 670. Chem.-Zeit., 1915, 39, Rep., 256.

THE rapid decomposition of hydrogen peroxide and sodium perborate by condensed water is attributed to the catalytic action of the copper, iron, or lead content of the water.—F. W. A.

Waterproofing of military cloths and garments. G. A. Le Roy. Comptes rend., 1915, 161, 601–603. (Cp. this J., 1914, 1153).

THE material is thoroughly impregnated by immersion in a solution containing sodium aluminate and ordinary soda soap, together with adjuncts such as casein, gelatin, or resinous substances if necessary. After being dried it is immersed in a dilute solution of formic or acetic acid or of a salt with acid reaction, such as aluminium acetate. The concentration of the baths varies in different cases. For woollen cloth of normal military type ("bleu horizon") a charge of 20 grms. of aluminium precipitate per metre of cloth is sufficient. The process gives much better results than immersion first in an alum bath and then in soap solution.—J. H. L.

PATENTS.

Dyeing; Processes for—E. E. M. Payne, Naborough, and W. H. Staynes, Leicester. Eng. Pat. 21,087, Oct. 16, 1911.

KUAKI and other shades, practically insoluble and unfadable, are obtained by treating fibre or fabric of animal or vegetable nature with a solution containing humus, e.g., from peat moss litter, and a mordant. The shade may be altered by the addition of a colouring matter, such as logwood. The material so treated is rinsed with water, with or without the addition of a neutralising agent, such as borax, and is then treated with a solution containing oil and soap, or a superfatted soap.—F. W. A.

Dyeing process. P. A. Newton, London. From Farbenfabr. vorm. F. Bayer und Co., Leverkusen, Germany. Eng. Pat. 2396, Feb. 15, 1915.

RESISTS on silk and (mercerised) cotton goods are obtained by preliminary treatment with tanning substances, which are fixed by means of tartar emetic, formaldehyde, etc.; on subsequently dyeing with sulphurised dyestuffs, the silk threads remain uncoloured.—F. W. A.

Aniline Black dyeing; Process of—J. Steynis, Assignor to Steynis Ozone Co., New York. U.S. Pat. 1,157,908, Oct. 26, 1915. Date of appl., Dec. 14, 1911.

SEE Ger. Pat. 259,823 of 1912; this J., 1913, 651. The concentration of ozone should not be more than 5 grms. of ozone per cubic metre of ozonised air.

Fireproofing and bleaching of fabrics. T. J. I. Craig, and Whipp Bros. and Tod, Manchester. Eng. Pats. 22,617, Nov. 17, 1914, and 4448, Mar. 22, 1915.

FABRICS which have been rendered less inflammable by the process described in Eng. Pat. 16,153 of 1914 (this J., 1915, 868) are readily bleached by means of a comparatively dilute solution of sodium hypochlorite or a solution of hydrogen peroxide preferably containing sodium bicarbonate, thus saving a number of operations which are necessary when the material is bleached before being fireproofed.—F. W. A.

Prints; Production of fast-coloured—II. Levinstein, Assignor to Levinstein, Ltd., Manchester. U.S. Pat. 1,157,705, Oct. 26, 1915. Date of appl., Feb. 7, 1914.

SEE Eng. Pats. 3427 and 4316 of 1913; this J., 1914, 309, 350.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Sulphuric acid in Germany. Chem. Trade J., Nov. 27, 1915.

THE Federal Council has issued an order which aims at the unconditional guaranteeing of the needs of trade and agriculture in sulphuric acid during the period of the war in addition to the assured supply of the requirements of the army and navy. For this purpose full preparations have been undertaken for the production of sulphuric acid from raw materials, which are said to exist in sufficient abundance in the country. The preliminary work is claimed to have yielded the result that sulphuric acid can be produced from gypsum or kieserite at a price which does not exceed the price of acid obtained from foreign pyrites. It will be necessary in order to produce on a manufacturing scale to erect large works at a cost of £175,000, which sum has been placed at disposal by the Imperial Treasury for this purpose. At the same time the Government order contemplates the establishment of a uniform price for sulphuric acid, and in this connection the cost of production in the case of the most expensive method of manufacture must be the determining factor. Such a price level would, however, imply an unjustified enrichment of the industries which produce the acid cheaply. In order to exclude this possibility, producers with low prime costs are to be required to pay an equivalent levy to the administrative organisation for private sulphuric-acid management, and the proceeds of the levy will be devoted to the redemption of the sum of £175,000 provided by the Treasury for the establishment and equipment of the works. Existing contracts for the army and navy and for agriculture can be rendered exempt from the imposition of the levy. The hope is expressed that the scheme will also lead to the complete independence of Germany from foreign supplies in times of peace.

Hydrogen- and hydroxyl-ion activities of solutions of hydrochloric acid and sodium and potassium hydroxides in presence of neutral salts. H. S. Harned. J. Amer. Chem. Soc., 1915, 37, 2460–2482.

MEASUREMENTS with the hydrogen electrode indicate that the hydrogen- and hydroxyl-ion concentrations in 0.1-molar solutions of hydrochloric acid and sodium or potassium hydroxides respectively are increased by the presence of neutral salts. In the acid-salt system the increase in activity differs but little with different salts, but this does not appear to hold in the hydroxide-salt system. The fact that sodium bromide

produces the same effect as sodium chloride on the hydrogen-ion activity of hydrogen chloride solution is shown to be in accord with the law of mass action. The hydrogen-ion concentration of a 0.1-molar solution of hydrochloric acid is increased from 0.092 to 0.1765 by the presence of 3*N* potassium chloride, the solution behaving as if it had contracted, or the volume of the solvent had decreased.

—G. F. M.

Chlorous acid and chlorites. G. Bruni and G. Levi. *Gaz. Chim. Ital.*, 1915, **45**, 161—179.

THE authors have prepared other chlorites in addition to the known potassium, silver, and lead salts. Barium chlorite was obtained by a reaction suggested by Reyehler (*Bull. Soc. Chim.*, 1901, **25**, 659) for the preparation of sodium chlorite. A saturated solution of barium hydroxide is treated cold with hydrogen peroxide, the liquid decanted, and the residual hydrated barium peroxide treated with a small quantity of hydrogen peroxide and then cooled with ice, and a current of chlorine dioxide mixed with carbon dioxide but free from chlorine (prepared by heating to 60° C. a mixture of 150 parts of oxalic acid, 40 of potassium chlorate, and 20 of water) is passed in. When the barium peroxide has dissolved, the orange-yellow solution is treated with three volumes of alcohol and a large excess of recently distilled ether, and the barium chlorite filtered off and washed with ether. From the pure barium chlorite thus obtained, other chlorites may be prepared by double decomposition. The following reactions of chlorites, in addition to those already known, are given. A red precipitate is produced with mercuric nitrate in neutral solution; a yellow precipitate, becoming white with excess of the reagent, with mercurous nitrate. With a neutral solution of ferrous sulphate, a yellowish-brown coloration is produced; on heating a yellow precipitate separates and chlorous vapours are evolved. In acid solution chlorites oxidise potassium ferrocyanide to ferricyanide. A reaction similar to that given by chlorates is obtained with brucine and diphenylamine. Chlorites respond to many of the colour reactions of nitrites. They exhibit pronounced explosive properties, and the dangerous character of certain kinds of potassium chlorate prepared electrolytically has been attributed to the presence of chlorite (see this *Journal*, 1908, 806; 1909, 21, 89). Silver and lead chlorites explode when heated above 100° C., and when mixed with sulphur, red phosphorus, carbon, or sugar give mixtures capable of exploding with great violence by percussion. Potassium chlorite decomposes violently into chloride and oxygen when heated, the reaction being accompanied by the development of heat and light. Mixtures of barium chlorite with red phosphorus and with potassium thiocyanate ignite spontaneously.—A. S.

Carbon dioxide in carbonates decomposed by ammonium chloride solution; Determination of —. A. Cavazzi. *Annali Chim. Appl.*, 1915, **4**, 137—144.

It is known that very finely ground calcium carbonate when boiled with ammonium chloride solution is converted into the chloride, ammonia and carbon dioxide being evolved. The author has found that the carbonates of Ba, Sr, Mg, Zn, Pb, Cd, Bi, Cu, Li, Na, and K behave in a similar manner, and recommends the use of the reaction for determining carbon dioxide in carbonates, the carbon dioxide being absorbed in an ammoniacal solution of calcium chloride (this *J.*, 1915, 1068). The method has been applied successfully to the determination of carbon dioxide in argillaceous limestones, cements, hydraulic lime, soils, white lead, and bismuth carbonate.—A. S.

Oxy-acids of sulphur; Determination of the — in admixture. O. Billeter, Berthoud, Pistorius, and B. Wavre. *Schweiz. Chem. Ges.*, Feb. 27, 1915. *Chem.-Zeit.*, 1915, **39**, 500.

THE aqueous solution of the autoxidation products of dimethylxanthogenamides (dimethylthiour-ethanes) contains thiosulphate, sulphite, trithionate, and sulphate, together with the salts of a new acid, $H_2S_3O_3$, trithionous acid. For the determination of sulphite in presence of thio-sulphate, use is made of the reaction: $Na_2SO_3 + Na_2S_2 = Na_2S_2O_3 + Na_2S$. The titration is carried out with normal (yellow) bisulphide solution at the boil in a current of carbon dioxide; a yellow coloration indicates the end-point, which is obtained best in presence of ammonia. Acetic acid is added to the solution obtained, the hydrogen sulphide removed *in vacuo*, and the total thiosulphate determined by means of iodine. The trithionite behaves towards bisulphide as a mixture of sulphite and thiosulphate, and is oxidised to trithionate by iodine. According to Chancel and Diacon, trithionate is converted quantitatively into thiosulphate by means of potassium sulphide, and hence can be estimated. The sulphate present is determined by difference, the total sulphur being found after oxidation with bromine.—F. W. A.

Thionyl chloride; Action of — on sulphides. H. B. North and C. B. Conover. *J. Amer. Chem. Soc.*, 1915, **37**, 2486—2490.

IN sealed tubes at temperatures from 150° to 200° C. thionyl chloride reacts with metallic sulphides according to the equation: $MS + 2SOCl_2 = MCl_2 + SO_2 + S_2Cl_2$, where M is a divalent metal. In the case of ferrous sulphide, ferric chloride is formed: $6FeS + 16SOCl_2 = 6FeCl_3 + 8SO_2 + 7S_2Cl_2$. The reaction requires some days for completion in most cases, but with the sulphides of copper, iron, and mercury it proceeds more readily, and decomposition is complete after several hours' heating.—G. F. M.

Polash from wood and plant ashes. H. Bradley. *Met. and Chem. Eng.*, 1915, **13**, 841—846.

THE author gives a description of the earlier methods used in preparing potassium salts from wood ashes, together with statistics of production, and analyses of some American products. Analyses of the ashes from a number of woods and plants are tabulated. It is recommended that the waste from Western (U.S.A.) sawmills be utilised. At least 750,000 tons of actual waste, apart from that sold for fuel purposes, is produced annually, capable of yielding 1000 tons of potassium carbonate. The furnace in which the wood is burned should be provided with a downcomer flue, with means for separating floating ash from the gases, and the heat of the waste gases should be utilised for preheating the liquor obtained by leaching the ashes. The leaching vats should be arranged in batteries, similar to beet sugar diffusion batteries, and the liquor should be evaporated in an apparatus of the Enderlein type provided with a rotary roaster, as used for the recovery of soda in soda and sulphate cellulose factories. This apparatus consists essentially of an open wrought iron evaporator, 16 ft. long, 7 ft. deep, and 14 ft. wide, enclosed in a brick chamber. Two shafts, 7 ft. apart, extend across the vessel, each carrying 32 wrought iron discs, 5 ft. 6 in. diam., which dip into the liquor so that one-sixth of their surface is submerged. The shafts revolve at 9—10 revs. per minute. The liquor flows continuously through the evaporator and out over a weir into the inclined rotary roaster, 16 ft. long by 8 ft. diam., where it is evaporated nearly to dryness. It then passes to the calcining furnace.—A. S.

Barium industry in the United States since the European war. M. Toch. J. Ind. Eng. Chem., 1915, 7, 993—995.

Prior to August, 1914, three unsuccessful attempts had been made to establish a barium industry in the United States. The author's firm had made successfully one particular barium salt, in small quantities, for nineteen years, and shortly after the outbreak of the European war, a tract of land containing barytes was purchased and a plant erected at Sweetwater, Tennessee, and since October, 1914, the plant has been working night and day. Only a 70—75% yield of barium sulphide is obtained, in practice, by heating barium sulphate with coal, and the presence of calcium fluoride or of certain iron compounds is prejudicial. At present great difficulties are encountered owing to the impossibility of obtaining adequate supplies of acids for making the different barium salts, and also new apparatus and machinery. The industry is at a disadvantage also owing to the high railway freight rates in the United States. In the author's view the continuation of the industry, after the war is over, depends entirely upon whether adequate protection against underselling by foreign competitors is afforded by the Government.—A. S.

Marine algae; The biochemistry of —. H. Kylin. Z. physiol. Chem., 1915, 49, 337—425.

MICROCHEMICAL tests with the diphenylamine reagent indicate that the *Florideæ* usually contain nitrates, the species *Ceramium rubrum*, *Lomentaria clavellata*, *Polydora rotundus*, *Purcellaria fastigiata*, and *Callithamnion corymbosum* being able to accumulate appreciable amounts, whilst the *Fucoeideæ* usually contain slight traces or none. All the algae examined contained traces of ammonium salts and of phosphates. In *Ascophyllum*, *Fucus*, and *Laminaria* species phosphates are readily detected in the new growth and in the old stem by microchemical tests. In a number of *Fucoeideæ* examined, the iodide was largely present as alkali iodide, whilst in certain *Florideæ* (*Bonnemaisonia asparagoides* and *Spermothamnion roscolemum*) it was present in such unstable combination as to react directly with starch. Calcium occurs in the cell-walls of practically all marine algae in the form of calcium salts of various pectic acids. The cell content of the *Fucoeideæ* is either neutral or very faintly acid to litmus, whilst that of the *Florideæ* is faintly alkaline. Free organic acids are never present, but calcium oxalate could be detected in certain varieties in very small amount. All the *Fucoeideæ* investigated, but not the *Florideæ*, contained mannitol. *Ascophyllum nodosum*, *Fucus serratus*, and *Laminaria digitata* contain 5.2%, 6.5%, and 6.8% of their dry weight of mannitol respectively. The *Florideæ* examined contained exceedingly small amounts of dextrose and, in most cases, also trehalose. The *Fucoeideæ* contain insignificant traces of dextrose, no trehalose, but probably a new lævo-rotatory disaccharide, laminarose. They also contain laminarin, a mixture of closely related polysaccharides formed by the condensation of variable numbers of dextrose molecules. *Laminaria saccharina* contains up to 35% of its dry weight of laminarin. The *Fucoeideæ* contain considerable quantities of a viscous, gummy substance, fucoidin, the calcium salt of fucoidic acid, $[a]_D = -220^\circ$, which on hydrolysis gives a methylpentose, fucose; algin, the calcium salt of alginic acid $[a]_D = -136^\circ$, and in many cases also fucin, the calcium salt of fucinic acid. These latter compounds, which are closely related compounds to pectic acid, together with cellulose, form the cell walls of the algae. The cell walls of the *Florideæ* also consist of cellulose together with the calcium salts of various pectic acids —T.C.

Isothiocyanates; New reaction for —. G. Deniges. Bull. Soc. Chim., 1915, 17, 380—381.

THE formation of a dithiotrimercure salt when a soluble isothiocyanate is boiled with a solution of a mercuric salt (see this J., 1915, 1142) constitutes a very sensitive test for isothiocyanic acid. A few c.c. of the solution is mixed with twice its volume of mercuric sulphate solution, the mixture filtered if necessary, and then heated to boiling for one or two minutes. A micro-crystalline deposit consisting of radiating prisms indicates the presence of the isothiocyanic ion, which can thus be detected at a dilution of 1 in 4000.—G.F.M.

Vapour pressures of acetylene, ammonia, and isobutane at temperatures below their normal boiling points. Burrell and Robertson. See IIA.

Action of metallic magnesium on the sulphides of tin, antimony, and arsenic. Pertusi. See XXIII.

PATENTS.

Formic acid; Production of —. G. Bredig, Karlsruhe, and S. R. Carter, Oswestry. Eng. Pat. 9762, July 5, 1915. Under Int. Conv., Aug. 15, 1914. Addition to Eng. Pat. 801 of 1915 (this J., 1915, 1143).

FREE formic acid is obtained directly by reducing carbonic acid with hydrogen under high pressure in presence of a catalyst and water. Thus if 150 c.c. of water and 3 grms. of palladium-black are vigorously agitated by the injection of a mixture of hydrogen (61%) and carbon dioxide (36%) under a pressure of 110 atm., the temperature being maintained at 20° C., a 1% solution of formic acid is obtained. Under higher pressure, the yield is considerably greater. Instead of water, such solvents as ether, alcohol, esters, ketones, paraffin, or liquid acids, may be employed.—E. H. T.

Oxalic acid; Process for producing —. E. von Portheim, Prague-Smichow. Austria-Hungary. U.S. Pat. 1,157,348, Oct. 19, 1915. Date of appl., Oct. 3, 1914.

A SOLUTION of carbohydrates is treated with nitric acid and a catalyst. The liberated nitrogen oxides are oxidised to peroxide and passed back into the reaction mixture.—E. H. T.

Ammonia; Production of —. C. T. Thorssell, Gothenburg, Sweden. Eng. Pat. 11,485, Aug. 9, 1915.

THE method of making ammonia from barium cyanide (produced by heating baryta and coal in nitrogen) has lately been improved by agitating the cyanide with water, and then heating it at 150°—200° C. in an autoclave under a pressure of about 15 atmospheres, to produce ammonia and barium formate. In the preliminary stage of the process the conversion of the baryta into cyanide is incomplete, and it is now proposed to economise the baryta by cooling to about 40° C. the liquid obtained on treating the crude cyanide with water, thereby precipitating a part of the excess baryta as hydroxide, and using this directly in the production of the cyanide.—E. H. T.

Ammonia [from calcium cyanamide]; Process of producing —. W. S. Landis, Niagara Falls, N.Y., Assignor to American Cyanamid Co., Nashville, Tenn. U.S. Pat. 1,151,640, Sept. 28, 1915. Date of appl., Feb. 4, 1915.

COMMERCIAL calcium cyanamide is fed into a vessel in which it is agitated with water, and, after removing the liberated acetylene, the mixture is subjected intermittently to the action of steam, the reaction proceeding exothermically in the intervals, and the evolved ammonia being withdrawn before admitting fresh steam.—F. SODN.

Ammonium sulphate [from carbonisation gases]; Method of producing—F. Tschudy, Fairfield, Ala. U.S. Pat. 1,155,385, Oct. 5, 1915. Date of appl., Sept. 21, 1914.

CARBONISATION gases are cooled to 75°–85° F. (24°–29° C.) to free them from tarry matters and water vapour, and are then compressed so as to raise their temperature to about 100° F. (38° C.), and passed through one compartment of a saturator (see following abstract), whilst the vapours of distillation of the weak ammoniacal liquor obtained by condensation are passed through a separate compartment of the same saturator, in such manner as to raise the temperature of the gas in the saturator to about 105° F. (41° C.). The gas is then passed to the distributing mains and the waste gases from the vapours are allowed to escape to the atmosphere. Sulphuric acid is supplied to the saturator as a spray, admitted in counter-current to the waste gases emerging from the acid bath.—F. SODN.

Saturating apparatus [for making ammonium sulphate]. F. Tschudy, Fairfield, Ala. U.S. Pat. 1,155,386, Oct. 5, 1915. Date of appl., Sept. 21, 1914.

A CASING, having a liquid seal at its periphery, encloses means for separately supplying vapour and gas to different portions of the same acid bath, three concentric tubes, open at their lower ends, extending downwards through the top of the casing, so as to form an inner (vapour) cracker pipe, an intermediate chamber, and an outer (gas) cracker pipe respectively. The inner tube terminates farthest from the bottom and the intermediate tube nearest the bottom of the vessel, and the lower ends of the inner tube and of wedge-like extensions of the outer tube are serrated. The upper ends of the inner and outer tubes are provided with supply connections, whilst the outer shell and the outer end of the intermediate tube are connected with outlet pipes. There are also means for spraying acid into the upper part of the intermediate chamber, for withdrawing the salts formed, and for returning liquor drained from the ejected salts to the liquid seal.—F. SODN.

Radioactive; Process for rendering liquids—S. Saubermann, Berlin. Eng. Pat. 7385, May 17, 1915. Under Int. Conv., May 18, 1914.

THE liquid is brought into contact first with a relatively large amount of a protective substance and then with the radio-active material. The protective substance is of a similar chemical nature to the other, but more soluble, and tends to prevent the radium salt from dissolving. For example, barium sulphate is used in conjunction with radium sulphate and calcium carbonate with radium carbonate.—E. H. T.

Double nitrides [from atmospheric nitrogen]; Process of forming—S. Peacock, Chicago, Ill., Assignor to Agricultural Research Corporation, New York. U.S. Pat. 1,154,800, Sept. 28, 1915. Date of appl., May 31, 1913.

A MIXTURE of an oxide and a higher carbide (which may be formed *in situ*) is heated in a current of atmospheric nitrogen, so as to form a double nitride. Calcium oxide, silica, and carbon, for example, give a double nitride of calcium and silicon, a higher carbide of silicon being formed as an intermediate product.—F. SODN.

Aluminium compounds [carbonitride] and process of producing same; Volatile—S. Peacock, Philadelphia, Assignor to Agricultural Research Corporation, New York. U.S. Pat. 1,154,801, Sept. 28, 1915. Date of appl., Apr. 18, 1914.

A MIXTURE of alumina and carbon is heated in an atmosphere containing free nitrogen (producer gas, for example), whilst the partial pressure of

carbon monoxide is maintained below 400 mm., and the volatile carbonitride produced is collected in a medium free from chemically active oxygen. Aluminium carbonitride, thus obtained, is volatile at 1550° C. and forms a white powder; its "hydrolytic product" gives a white precipitate with soluble silver and lead salts, and reacts with water at 200° C., yielding ammonia.—F. SODN.

Fullers' earth; Process of treating—R. Claus, East Orange, N.J. (I. Claus, executrix, Montague, N.J.). U.S. Pat. 1,156,466, Oct. 12, 1915. Date of appl., Dec. 27, 1913.

CRUDE fullers' earth is formed into bricks which are partially dried in the atmosphere and then subjected to the prolonged action, in a closed chamber, of gases heated to 120°–300° C. The bricks are then powdered.—W. F. F.

Lime; Apparatus for hydrating—M. H. Avram, New York. Assignor to Standard Silica Brick Machinery Co., Wilmington, Del. U.S. Pat. 1,157,281, Oct. 19, 1915. Date of appl., Sept. 16, 1913.

A JACKETED drum mounted on hollow trunnions and rotated about a horizontal axis, is charged with predetermined quantities of quicklime and water through one trunnion, and the steam generated passes through the other trunnion into the jacket and thence to the atmosphere. Means are also provided for supplying boiler steam to the jacket.—W. E. F. P.

Polash; Process of recovering—A. C. Spencer, Washington, D.C. U.S. Pat. 1,157,437, Oct. 29, 1915. Date of appl., Jan. 6, 1912.

A FINELY-DIVIDED mineral containing potassium and silica, e.g., a felspar, is mixed with lime, and heated to and maintained at such a temperature that the potassium compounds are volatilised. The amount of lime used is sufficient to combine with the alumina and ferric oxide to form tri-calcium aluminate and ferrite, but insufficient to yield any considerable quantity of tri-calcium silicate.—E. H. T.

Manganese dioxide; Process of producing—F. D. Harper, Everett, Mass. U.S. Pat. 1,157,530, Oct. 19, 1915. Date of appl., Dec. 5, 1913.

DRIED precipitated manganese dioxide is pressed in a mould until its density is equal to that of the native mineral; it is then ground.—E. H. T.

Chromium oxide; Manufacture of—A. E. Gessler, Clifton, N.Y. U.S. Pat. 1,158,379, Oct. 26, 1915. Date of appl., Feb. 13, 1913.

THE chromate or bichromate of an alkali metal is mixed with a reducing agent, such as sulphur, and an oxidising agent, such as sodium chlorate; the mixture is ignited, and the product lixiviated.—E. H. T.

Oxygen; Improved process of manufacturing—H. Wade, London. From The Permutit Co., New York. Eng. Pat. 24,558, Dec. 23, 1914.

CHLORINE, from any source, is converted into alkali hypochlorite, and the solution is brought into contact with a base-exchanging silicate, or reactive zeolite, containing a very small amount of a catalytic oxide, e.g., an oxide of cobalt, nickel, manganese, or copper. The catalyst may be introduced into the zeolite by immersing granules of the latter in a solution of a salt of the metal, or by running the solution, in a continuous stream, through a thick layer of the mineral. The catalyst is in a very active state, and the decomposition of the hypochlorite is quantitative.—E. H. T.

Air; Process of liquefying—and separating it into oxygen and nitrogen. J. F. Place, Glen Ridge, N.J., Assignor to American Air-Liquefying Co., New York. U.S. Pat. 1,157,959, Oct. 26, 1915. Date of appl., Nov. 13, 1911.

Air is compressed and cooled; part is then liquefied under pressure, and the remainder, together with the unliquefied residue from the first portion, allowed to expand and do external work. The liquefaction is assisted by the cooling effect due to the expansion of the gaseous part. The liquid air is further cooled by partial evaporation, and the cold vapours are utilised to cool the incoming supply of compressed air.—E. H. T.

Carbon articles; Method of cementing—. J. W. Brown, Lakewood, Assignor to National Carbon Co., Cleveland, Ohio. U.S. Pat. 1,158,171, Oct. 26, 1915. Date of appl., June 6, 1912.

THE carbon article is impregnated with a binding material, such as tar, and then subjected to pressure and heated by the passage of an electric current, until the carbon becomes plastic, whereby seams and laminations are removed.—E. H. T.

Nitric acid; Process of concentrating dilute—. E. Collett, Assignor to Norsk-Hydroelektrisk Kvaestofaktieselskab, Christiania. U.S. Pat. 1,158,181, Oct. 26, 1915. Date of appl., June 15, 1915.

SEE Eng. Pat. 7597 of 1913; this J., 1914, 482.

Ammonia; Production of—. C. Bosch and A. Mittasch, Assignors to Badische Anilin u. Soda Fabr., Ludwigshafen, Germany. U.S. Pat. 1,158,167, Oct. 26, 1915. Date of appl., Nov. 18, 1911.

SEE Fr. Pat. 436,472 of 1911; this J., 1912, 432.

Chromium salts; Producing—. J. H. Boner, Assignor to Badische Anilin und Soda Fabr., Ludwigshafen, Germany. U.S. Pat. 1,157,668, Oct. 26, 1915. Date of appl., Jan. 12, 1914.

SEE Fr. Pat. 466,478 of 1913; this J., 1914, 864.

Zirconium oxide free of iron; Method of producing white—. P. Askenasy, Karlsruhe. Assignor to Chem.-Metall. Ind.-Ges. m.b.H., Berlin. U.S. Pat. 1,158,769, Nov. 2, 1915. Date of appl., Apr. 30, 1913.

SEE Ger. Pat. 262,009 of 1912; this J., 1913, 910.

Electric furnace intended chiefly for the manufacture of nitrides. G. Coutagne, Lyons, France. U.S. Pat. 1,158,899, Nov. 2, 1915. Date of appl., May 21, 1914.

SEE Fr. Pat. 469,554 of 1913; this J., 1915, 80.

Hydrogen; Process of producing—. C. Bosch and W. Wild, Assignors to Badische Anilin und Soda Fabr., Ludwigshafen, Germany. U.S. Pat. 1,157,669, Oct. 26, 1915. Date of appl., Apr. 19, 1913.

SEE Eng. Pat. 26,770 of 1912; this J., 1914, 22.

VIII.—GLASS; CERAMICS.

New direct-reading viscosimeter. MacMichael. See XXIII.

PATENTS.

Glass-drawing furnace; Regenerative—. W. L. Monro, Assignor to Window Glass Machine Co., Pittsburgh, Pa. U.S. Pat. 1,157,246, Oct. 19, 1915. Date of appl., June 23, 1913.

IN a glass-drawing furnace, a drawing pot is supported on the upper part of a vertical well into which a current of hot air is delivered from an adjacent recuperator through an upwardly inclined

connecting passage, the latter being provided with a gas-supply pipe the nozzle of which projects into the well.—W. E. F. P.

Chinaware or glassware; Process of plating or decorating—. F. Moench, Rushville, Ill. U.S. Pat. 1,157,569, Oct. 19, 1915. Date of appl., Apr. 8, 1915.

THE surface or portion of the ware to be plated or decorated is treated with hot hydrofluoric acid, heated to redness, rubbed with molten aluminium, and allowed to cool.—W. E. F. P.

Fireproof utensils from refractory oxides; Process for the manufacture of—. H. Arnold, Charlottenburg, Assignor to O. Knöfler und Co., Berlin. U.S. Pat. 1,157,662, Oct. 26, 1915. Date of appl., Oct. 5, 1914.

A PASTE of rare-earth oxides is treated with a small quantity of mineral acid and a colloidal hydroxide of at least one of the metals of which the oxides are present in the paste, or a dilute, colloidal solution of at least one of the corresponding metals; it is then moulded, and the product calcined.—W. E. F. P.

Brick, terra-cotta, and other objects; Process for glazing and hardening—. L. R. Dennison, South San Francisco, Cal. U.S. Pat. 1,158,417, Oct. 26, 1915. Date of appl., Jan. 9, 1915.

THE surfaces to be glazed, etc., are heated by means of an oxy-acetylene flame, after the application of a suitable glazing or colouring preparation; the latter may be incorporated with the body mixture before moulding.—W. E. F. P.

IX.—BUILDING MATERIALS.

Building materials; Influence of the prolonged infiltration of brine on—. S. Camilla. *Annali Chim. Appl.*, 1915, 4, 145—150.

THE collapse of a vault in a large warehouse in Turin was found to be due to the effect of prolonged infiltration of brine on the mortar and brickwork. The warehouse had been used for more than 40 years for the pickling of anchovies in brine and storage of the barrels of preserved fish. The affected mortar and brickwork was found to be soft and to contain considerable quantities of chlorides and organic matter, viz., up to 5.25% (calculated as sodium chloride) and 8.36% respectively, referred to the dry material.—A. S.

Silica brick for the by-product coke oven; Manufacture and tests of—. K. Seaver. *Amer. Inst. Min. Eng.*, Sept., 1915. *Met. and Chem. Eng.*, 1915, 13, 861—866.

PRACTICALLY all high-grade silica brick is made from true quartzite or metamorphosed sandstone. The most important United States deposit is in Pennsylvania, others, arranged in order of relative importance, being found in Wisconsin, Alabama, and Colorado. Representative samples of Pennsylvania, Wisconsin, and Alabama quartzites gave the following results on analysis: SiO_2 , 97.80, 97.15, 97.70; Al_2O_3 , 0.90, 1.00, 0.96; Fe_2O_3 , 0.85, 1.05, 0.80; CaO , 0.10, 0.10, 0.05; MgO , 0.15, 0.25, 0.30; R_2O , 0.40, 0.10, 0.31%. The coarsely crushed material is ground wet, 2% of lime by weight being added, in the form of milk of lime, during grinding. With less than 2% of lime the strength of the finished brick is diminished, whilst with larger additions the resistance to abrasion and refractoriness are reduced. The resistance to abrasion increases with the fineness of grinding. Moulding is effected in steel moulds with "loose sides," the material being rammed in

by means of heavy plank beaters covered with metal. The moulded shapes are dried on a steam-heated hot floor or in a tunnel dryer, and burned in a round, down-draught kiln, of 30 ft. or more diameter, fired with soft coal. Firing is continued slowly, with slight acceleration, for 9–12 days, and the kiln then kept at the required temperature (cone 26, 1650° C., directly in front of the fire-box) for one day, after which the fire-boxes are sealed for 24 hours; cooling usually occupies about as long a period as the burning. In absence of a flux or catalyst, direct conversion of quartz into cristobalite takes place at 1000° C. and is very rapid at 1300° C., and there is no intermediate formation of tridymite (compare Fenner, this J., 1913, 22); this change is accompanied by an increase of volume of 13.4%. In practice the permanent expansion produced by burning is about $\frac{3}{8}$ in. per foot. If the firing be too rapid in the early stages of burning, an abnormally great expansion is produced, as the result of the formation of minute fissures in the brick. In tests with silica bricks and pieces of quartz rock, these were burned under ordinary conditions, the maximum temperature of 1540° C. being maintained for about 40 hours, and then the amount of cristobalite was estimated by optical examination of the powdered material. It was found that in the case of silica brick burned once, twice, and thrice, the percentages of cristobalite were 77, 83, and 84 respectively, whilst in the case of quartz rock burned once and twice, the percentages were 49 and 69. In the reburned silica brick the grains consisted essentially of cristobalite with quartz as an inclusion. The strength of the brick was increased by reburning. It is concluded that in burning as practised at present, the quartz-cristobalite inversion is effected to the greatest degree economically possible. —A. S.

Wood; The development and the present position of the impregnation of — with salts. F. Moll. Z. angew. Chem., 1915, 28, 317–322, 328–331.

A HISTORICAL survey is given of the use of impregnating solutions for preserving wood used for structural purposes, and there is appended (1) a list of the salts which have been recommended, with short notes as to their value, and (2) a list of patents, articles, and books, bearing on the subject. Of the many that have been recommended, the only salts used to an important extent at the present time are mercuric chloride, copper sulphate, zinc chloride, and fluorides. —T. St.

PATENTS.

[Cement.] *Process of calcining and clinkering. Clinkering furnaces.* A. Carnie, North Branch, Mich. U.S. Pats. 1,158,371 and 1,158,372, Oct. 26, 1915. Dates of appl., Mar. 6, 1911, and Feb. 13, 1915.

A CONTINUOUS stream of the mixture to be treated is fed into the top of a narrow stack having a distributor at the upper part; a side flue near the bottom for the escape of gaseous products; and a burner, inserted at a point a little above the flue, from which a vertical flame is projected towards the top of the stack. The material is thus sintered whilst falling slowly through the stack in a suspended condition. —W. E. F. P.

Lumber; Process of preserving and improving —. J. W. Illingworth, Wilkes-Barre, Pa. U.S. Pat. 1,158,404, Oct. 26, 1915. Date of appl., May 28, 1913.

GREEN wood having a sap containing "gums and acids" is stripped to expose the wood fibre and immersed in a bath of lime slush until it is completely saturated with lime; by this treatment the gums and acids are fixed and the sap prevented from oozing and fermenting. —W. E. F. P.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Iron; Passivification of — by nitric acid. S. W. Young and E. M. Hogg. J. Phys. Chem., 1915, 19, 617–649.

EXISTING theories regarding the passivity of iron are briefly outlined and discussed, passivity being defined as that state of iron in which the metal is not immediately attacked by dilute nitric acid. In the present investigation, duplicate determinations were made of the velocity of reaction between pure iron and nitric acid of 16 different concentrations (sp. grs. 1.025 to 1.400) at 0°, 10°, and 20° C., in addition to many isolated observations at higher temperatures. It is concluded that the passive state is the result of an equilibrium between iron and nitrogen peroxide; but owing to the reversibility of the reaction, $\text{N}_2\text{O}_3 = \text{NO}_2 + \text{NO}$, in aqueous solution, it is impossible to state whether the actual passivating agent is nitrogen peroxide, nitrous acid, or both these compounds. Iron is capable of absorbing nitrogen peroxide from any solution in which the gas is being generated, with the result that the rate of reaction is retarded or solution practically inhibited. The degree of inhibition is determined by the concentration of nitrogen peroxide which the reaction itself is capable of maintaining, this concentration being great in strong, but small (or perhaps zero) in weak acid. In the determinations made with acid of successively increasing strength, progressive passivification was found to begin, and the rate of reaction to decrease rapidly, at a concentration corresponding to the sp. gr. 1.260. According to the authors' view, this point—termed the "passive break"—marks the concentration at which relatively large amounts of nitrogen peroxide are developed. A much greater degree of passivity is produced in iron by exposure to dry nitrogen peroxide gas than by treatment with nitric acid; and it is considered probable that the amount of nitrogen peroxide absorbed by the metal from even the strongest nitric acid is relatively quite small. In no case was any indication obtained of the existence of a true gas film on the metal. —W. E. F. P.

[Iron and steel.] *Gas as a case-hardening agent.* A. H. White and H. T. Hood. Michigan Gas Assoc., Detroit, U.S.A., Sept. 24, 1915. J. Gas Lighting, 1915, 132, 312–315.

THE general principles governing, and conditions affecting, the carburisation of steel by cementation are considered in some detail, and the results given of tests made on mild, machine, and nickel-chrome steels with coal gas and coal gas containing 6% NH_3 as carburising agents. The objection to the use of coal gas—viz., that the resulting case is too hard and sharply defined—was found to be obviated by carburising at a high temperature, for a comparatively short period, then turning off the gas, and allowing the metal to "soak" in the furnace for a time sufficient to produce (by diffusion of the surface carbon towards the interior of the piece) the particular type of case required. The use of ammonia was found to cause the formation of a brittle nitride in the case, and is not recommended. —W. E. F. P.

The world's platinum production. U.S. Geol. Survey, 1915.

NOTWITHSTANDING the lower price received for crude platinum in 1914 than in 1913, the production of both California and Oregon shows an increase. In 1914 California produced 463 oz. of crude platinum, which was about 80% fine; and Oregon produced 107 oz. of crude platinum, considered 70% fine. The production of gold ore carrying

platinum and palladium in 1911 added to the domestic production 110.5 oz. of platinum and 168.16 oz. of palladium. Reports received from the refiners of platinum sands, gold bullion, and copper matte indicate that 3430 oz. of new refined platinum was recovered by them. Of this quantity, 525 oz. came from domestic crude placer platinum, and probably at least 2500 oz. in all was derived from domestic sources. The 930 oz. unaccounted for was obtained from foreign material which is treated in the States and not reported elsewhere. Besides the refined platinum obtained from new material, 40,698 oz. of refined platinum was derived from scraps, sweepings, and like material.

The world's output of new platinum, 1911-1914, in troy ounces, is given approximately in the following table:—

Country.	1911.	1912.	1913.	1914.
Russia, crude	300,000	300,000	250,000	241,200
Canada, crude	30	30	50	30
New South Wales and Tasmania, crude	470	778	1,275	1,248
Colombia, crude	12,000	12,000	15,000	17,500
United States, domestic crude	628	721	483	570
United States, refined from foreign and domestic matte and bullion	1,200	1,300	1,100	2,905
Borneo and Sumatra and other crude	—	200	200	•
Total	314,323	315,029	263,108	263,453

* No basis for estimate.

Kilns; Rotary—for desulphurising and agglomerating. S. E. Doak. Bull. Amer. Inst. Min. Eng., Sept., 1915. Eng. and Min. J., 1915, 100, 601-602.

ROTARY kilns are used for desulphurising and agglomerating pyrites cinder and fine iron ores for blast-furnace smelting, the sulphur content being reduced to less than 0.5% in the roasted material if the kiln is not forced beyond its capacity. The feed-end of the kiln should not be hotter than a barely perceptible red, so as to complete the roasting before nodulising begins; this occurs over a length of 15 ft. near the discharge end, where a bright yellow heat prevails and the ore gets sufficiently pasty to ball up. The obstacle to continuous operation is the formation of rings in the hottest part, caused by the hardening of the sintered ore against the lining; they have to be removed by cooling with water and cutting out with picks and bars. The fuel consumption in a 60 ft. kiln averages 12% of the ore treated, but with larger kilns the fuel cost is lower. The capacity is 1500-4500 tons of low-sulphur, or 730-2500 tons of high-sulphur material per month, according to the length of the kiln (60-100 ft.); the output is also dependent on the speed of rotation and the diameter. The cost of production depends chiefly on labour; two men per shift are sufficient for a well-designed plant producing up to 100 tons in 24 hours.—W. R. S.

Furnaces; Materials adapted for lining electric [smelting]—O. Peterson. Min. and Eng. World, 1915, 43, 695.

ACID furnaces may be lined throughout with silica but with basic furnaces the roof should be made of silica and the walls lined with silica, magnesia, or chrome brick, the material chosen being dependent on the working conditions. Magnesia brick, the most expensive, has the longest life; chrome brick may be used successfully if an impurity of chromium in the product of the furnace is not objectionable; silica brick, the cheapest form,

is attacked by lime fumes, and may be melted if the furnace becomes overheated.—B. N.

Tellurium and lead; The alloys of—M. Kimura. Mem. Coll. Sci., Imp. Univ., Kyoto, 1915, 1, 119-152.

THE system tellurium-lead yields only one compound, $PbTe$, melting at $901^{\circ}C$. There are no solid solutions. The liquidus runs down from $441^{\circ}C$, the melting point of tellurium, to an eutectic point at 24% Pb and $412^{\circ}C$; up to a maximum at 61-89% Pb ($PbTe$) and $904^{\circ}C$; and then down to the melting point of lead, $326^{\circ}C$.—T. St.

Antimony and tellurium; Metallographic investigation of the system—Y. Kimata. Mem. Coll. Sci., Imp. Univ., Kyoto, 1915, 1, 115-118.

THE melting point of antimony is $627^{\circ}C$, that of tellurium is $442^{\circ}C$. Only one compound exists, Sb_2Te_3 , the melting point of which is $620^{\circ}C$. This compound forms with antimony an eutectic melting at $540^{\circ}C$ and containing 27-28% Te; and with tellurium an eutectic melting at $420^{\circ}C$ and containing a little under 90% Te. No solid solutions are formed.—T. St.

Tellurium and selenium; Metallographic investigation of the system—Y. Kimata. Mem. Coll. Sci., Imp. Univ., Kyoto, 1915, 1, 119-121.

TELLURIUM and selenium form two series of solid solutions. The liquidus passes from the melting point of tellurium, $441^{\circ}C$, on the one hand, and that of selenium, $197^{\circ}C$, on the other, to a minimum at Se 95% and $130^{\circ}C$; at this point the crystals have the same composition as the melt. Selenium and the selenium-rich reguli have a strong tendency to solidify to glassy masses.—T. St.

PATENTS.

Black finish [on iron]. M. A. Atuesta, Assignor to General Electric Co., Schenectady, N.Y. U.S. Pat. 1,157,283, Oct. 19, 1915. Date of appl., June 9, 1915.

To produce a rust-proof, black finish on iron articles, the latter, previously sherardised or not, are heated to a temperature below the m.p. of zinc in a mixture of charred bone dust and coal tar, and then quenched in boiled linseed oil.

—W. E. F. P.

Coating metal [e.g., iron or steel]; Method of—J. A. Hanlon, Assignor to Hanlon-Gregory Galvanizing Co., Pittsburgh, Pa. U.S. Pat. 1,156,995, Oct. 19, 1915. Date of appl., Sept. 18, 1912.

METAL strips are passed through a bath of molten metal at a speed of more than 50 ft. per minute, and then through edged scrapers which apply pressure to both sides, scrape off the excess of molten metal and dross before it solidifies, and press the remaining coating into the pores of the strips.—W. R. S.

Roasting furnace; Mechanical ore—J. Harris, Sheffield. Eng. Pat. 22,688, Nov. 18, 1914.

IN mechanical furnaces in which additional heat is supplied to the last hearth or hearths, it is desirable to avoid admixture of the roaster gases from the upper hearths with the fire gases from the lower hearths, and this is effected by working the upper hearths under the natural draught of the furnace and the lower hearths under an independent chimney draught. The openings leading from an upper to a lower hearth for the passage of the ore, are connected with an air-passage, extending to the atmosphere, so that air may be drawn in on both sides of the hearth and the passage of gases from one side

of the hearth to the other prevented. The rabble-shaft carries a perforated disc extending over each outlet, and a scraper which deflects the ore towards the aperture of the disc.—W. R. S.

Lead heating pots and the like. W. Kirkham, Sheffield, and W. Shepard, Ecclesfield, Yorks. Eng. Pat. 23,148, Nov. 27, 1914.

IN a furnace employed for reheating files, cutlery, etc., by means of molten lead, for hardening and tempering, a deep iron pot or container for the lead, built into the structure after the manner of a copper, is supported at the bottom on a bed of firebrick disposed above the grate, and surrounded by flues to ensure uniform heating of the metal.—W. E. F. P.

Zinc; Process of smelting—. S. Peacock, Philadelphia, Pa., Assignor to Agricultural Research Corporation, New York. U.S. Pat. 1,154,802, Sept. 28, 1915. Date of appl., Apr. 18, 1914.

A MIXTURE of a carbide with several equivalent proportions of zinc oxide (*e.g.*, 1 of silicon carbide to 3 of zinc oxide) is heated to effect a smelting reaction.—F. SODN.

Spelter; Process for the manufacture of—*from ferruginous and admixed lead and zinc blende ores.* J. J. Findlang, Kaslo, British Columbia. U.S. Pat. 1,157,375, Oct. 19, 1915. Date of appl., Sept. 10, 1913.

A MIXTURE of crude ore, roasted ore, and lime is heated so as to form litharge, which is volatilised. The temperature is then raised and maintained at about 1500° C. until a liquid zinc matte containing lime is produced. This is cooled, crushed, and heated together with a reducing agent to volatilise the zinc. The residue from the distillation is freed from coke by screening and from iron by magnetic separation, and the remaining calcium sulphide is roasted to sulphate and returned to the process.—W. R. S.

Refractory-metal [tungsten] wires; Manufacture of fine—. F. Blan, Charlottenburg, Germany. Assignor to General Electric Co. U.S. Pat. 1,157,288, Oct. 19, 1915. Date of appl., Jan. 31, 1912.

To reduce further the cross-sectional area of fine wire prepared from tungsten which has been rendered fibrous by repeated hot working, the wire is subjected to successive stages of electrolytic corrosion in a suitable electrolyte and drawn after each stage.—W. E. F. P.

Ore separator; Magnetic—. A. F. Jobke, Wilkesburg, Pa., Assignor to J. G. Burns, D. Bingham, K. Cramay, T. Higgins, and H. P. Gazzam, Pittsburgh, Pa. U.S. Pat. 1,157,543, Oct. 19, 1915. Date of appl., Feb. 9, 1911.

THE material is fed on to an inclined conveyor surface which throws it upwards intermittently against an electromagnet by means of rapid pulsations produced by electro-magnetic mechanism.—W. R. S.

Tin; Electrolytic refining of—. R. L. Whitehead, Perth Amboy, N.J., Assignor to American Smelting and Refining Co., Maurer, N.J. U.S. Pat. 1,157,830, Oct. 26, 1915. Date of appl., May 4, 1915.

PURE tin is deposited on the cathode from an impure anode of tin and lead, by passing a current of suitable voltage and amperage through an electrolyte containing hydrofluosilicic acid and sulphuric acid, the latter being present in amount sufficient to form lead sulphate from the anode lead.—B. N.

Detinning tin-scrap. K. Goldschmidt and J. Weber, Essen, Germany. Assignors to Goldschmidt Detinning Co., Jersey City, N.J. U.S. Pat. 1,158,128, Oct. 26, 1915. Date of appl., Aug. 1, 1906.

SEE Fr. Pat. 368,618 of 1906; this J., 1907, 22.

Ores; Treatment of—*by the cyanide process.* H. M. Leslie, Glasgow. U.S. Pat. 1,158,513, Nov. 2, 1915. Date of appl., Dec. 30, 1911.

SEE Eng. Pat. 27,879 of 1911; this J., 1912, 930.

Metals; Extraction of—*from their ores.* H. M. Leslie, Glasgow. U.S. Pat. 1,158,514, Nov. 2, 1915. Date of appl., Dec. 30, 1911.

SEE Eng. Pat. 28,235 of 1911; this J., 1912, 729.

Alloys of light metals with heavier metals; Apparatus for the electrolytic manufacture of—, and the continuous treatment of such alloys for obtaining final products. E. A. Ashcroft, London. U.S. Pat. 1,159,154, Nov. 2, 1915. Date of appl., Mar. 12, 1912.

SEE Eng. Pat. 1001 of 1912; this J., 1913, 199.

Process for obtaining a cohering mass. U.S. Pat. 1,158,363. See IIA.

Process of making cohering masses or briquettes [from waste sulphuric liquor and flue dust]. U.S. Pats. 1,158,364 to 1,158,366. See IIA.

XI.—ELECTRO-CHEMISTRY.

New electrolytic method of sewage disposal. Olsen. See XIXB.

Electrolytic determination of copper without platinum electrodes. Guzman and Ulzurum. See XXIII.

PATENTS.

Insulation; Moulded compositions for electrical and the process of making the same [from Chinese wood oil]. British Thomson-Houston Co., Ltd., London. From General Electric Co., Schenectady, N.Y. Eng. Pat. 24,419, Dec. 21, 1914.

CHINA wood oil is thickened by heating, then mixed with a mineral filler, *e.g.*, asbestos, and ground marble, kneaded, disintegrated, moulded, and baked at 180°–220° C. to polymerise the oil.—B. N.

Insulating wire; Process of—. O. T. Hungerford, Belleville, N.J. U.S. Pat. 1,157,694, Oct. 26, 1915. Date of appl., Aug. 17, 1907.

AN insulating compound is applied to fabric-covered wires in a chamber under pressure, the wire being drawn through a die from the chamber and through the compound.—B. N.

Electric batteries. H. G. C. Thofehn, Pittsburgh, Pa., U.S.A. Eng. Pat. 5395, Apr. 9, 1915.

AN insoluble radioactive substance, *e.g.*, radium-barium sulphate, is mixed with the paste forming the active material of the electrode.—B. N.

Ozone generator. W. O. Freet, Hackensack, N.J., Assignor to Steynis Ozone Co. U.S. Pat. 1,157,859, Oct. 26, 1915. Date of appl., Sept. 9, 1912.

A STATIONARY electrode, with a spirally-grooved surface, is surrounded by a removable tubular electrode, which has a portion of its walls cut away and contains a substance adapted to absorb moisture. A dielectric tube, surrounded by a cap provided with an orifice and transparent cover, is arranged around the inner electrode, and the whole is enclosed in an air-tight box.—B. N.

Electric furnace. S. Guggenheim, Berlin-Wilmersdorf, Germany. U.S. Pat. 1,157,691, Oct. 26, 1915. Date of appl., Feb. 18, 1911.

SEE Fr. Pat. 463,233 of 1913; this J., 1914, 426.

Electric furnace. E. Stassano, Turin, Italy. U.S. Pat. 1,157,819, Oct. 26, 1915. Date of appl., Aug. 24, 1914.

SEE Eng. Pat. 22,721 of 1913; this J., 1914, 89.

Method of cementing carbon articles. U.S. Pat. 1,158,171. See VII.

Water-purifying device. U.S. Pat. 1,157,233. See XIXB.

XII.—FATS; OILS; WAXES.

Rape seed; Production and utilisation of——. Bull. Imp. Inst., 1915, 13, 452—460.

THE chief sources of supply of rape seed are India, European Russia, and China. In 1912-1913, India exported 4,356,589 cwt., value £2,403,453, and in 1913-1914, 4,980,100 cwt., value £2,851,711. Russia exported 2,400,640 cwt. (£1,137,142) in 1912, and 2,675,260 cwt. (£1,161,979) in 1913. The exports of rape seed (including a certain quantity of mustard seed) from China, including re-exports, were 959,563 cwt. (£382,600) in 1912 and 734,254 cwt. (£293,395) in 1913. The imports of rape seed, rape oil, and rape seed cake into the United Kingdom in 1911, 1912, and 1913 are shown in the following tables:—

Imports of rape seed to United Kingdom.

From	1911.		1912.		1913.	
	qtrs.*	£	qtrs.*	£	qtrs.*	£
India ..	132,710	256,045	70,123	166,077	96,497	221,231
Russia ..	84,485	140,026	90,456	151,074	116,440	194,617
China ..	12	20	8,916	20,849	32,880	69,866
Other countries	14,992	35,285	17,773	38,939	19,743	46,011
Total	232,199	431,376	187,268	376,939	265,560	531,725

* 1 quarter of rape seed = 416 to 424 lb., according to country of origin.

Imports of rape-seed oil to United Kingdom.

From	1911.		1912.		1913.	
	tons.	£	tons.	£	tons.	£
Germany	3,468	100,509	1,870	58,139	1,539	47,707
Netherlands	1,890	58,965	1,439	47,951	903	29,118
Belgium	1,907	55,054	2,743	81,636	1,884	55,441
France	265	8,019	431	13,101	366	10,770
Japan	185	5,308	1,184	33,661	2,786	75,791
Other countries	693	18,338	613	18,138	121	3,729
Total	8,408	246,193	8,280	252,626	7,599	222,556

Imports of rape-seed cake to United Kingdom.

From	1911.		1912.		1913.	
	tons.	£	tons.	£	tons.	£
Russia	43,481	183,043	14,293	72,551	25,839	139,711
Other countries	7,610	29,661	2,313	13,335	3,043	16,881
Total	51,091	212,704	16,606	85,889	28,882	156,592

Rape seed can be grown in the United Kingdom and in various parts of the Empire, and as the demand is fairly large and constant it would be

well worth while to attempt its cultivation in British territories where at present it is not grown —A. S.

Illipé nuts and the sources of Borneo tallow. Bull. Imp. Inst., 1915, 13, 335—344.

BORNEO tallow is derived chiefly from the seed kernels of *Shorea stenoptera*, Burck., but the seeds of a number of other species of *Shorea* as well as those of *Isoplera borneensis*, Scheff., *Hopca aspera*, De Vriese, and *Pentacme siamensis*, Kurz, all belonging to the *Dipterocarpaceae*, are also used. The kernels of these species come from Borneo, Java, and Sumatra, and occur in commerce under the name of "illipé" nuts, the grades most commonly met with being "large black Pontianac illipé nuts," and "large Pontianac or Sarawak illipé nuts without guarantee of colour," specimens of which were identified at the Royal Botanic Gardens, Kew, as a species of *Shorea* near *S. stenoptera*. "Siak illipé nuts" are smaller and yield a softer fat and are derived from a species of *Palatium* (N.O. *Sapotaceae*). Some illipé nuts are derived from species of *Bassia* growing in India. (See also this J., 1898, 161; 1909, 612; 1914, 147, 962.)

The trees yielding the seeds from which Borneo tallow is derived only fruit at irregular intervals owing to variable climatic conditions. The shells are removed by soaking for thirty or forty days, by which process the kernels are said to be rendered less liable to attack by insects. Borneo tallow is prepared locally to some extent, but the greater part of the kernels is now shipped to Europe. In 1913, 8277 cwt. of illipé nuts, valued at £5954, was shipped from Singapore; of this quantity 6326 cwt. was consigned to Belgium, 930 cwt. to the United States, and 923 cwt. to the United Kingdom. These supplies were derived largely from the Dutch East Indies, 3940 cwt. being imported to Singapore from the East Coast of Sumatra and 571 cwt. from Dutch Borneo. The following samples of kernels were examined. 1. "Large Pontianac nuts." Moisture 4.1; fat 60.9%. The fat was hard, and of a greenish-white colour. 2. "Large Pontianac or Sarawak nuts without guarantee of colour." Moisture 4.4; fat 53.2%; similar in character to fat from No. 1. 3. *Isoplera borneensis*. Moisture 6.6; fat 43.5%; the fat was greenish, hard and tasteless. 4. *Palatium oblongifolium*. Moisture 4.8; fat 53%; the fat was hard and of a greenish-cream colour. The extracted fats gave the following results:—

	1.	2.	3.	4.
Sp.gr. at 100°/15° C.	0.8523	0.8535	0.8563	0.8553
Melting point, °C.	31°—32°	32°—33°	29°	38°
Acid value	35.0	32.0	8.5	7.0
Saponification value	194.5	194.3	190.7	190.1
Iodine value%	31.0	31.4	31.8	35.9
Insoluble fatty acids% ..	95.0	93.8	93.9	94.3
Unsaturation matter% ..	0.6	0.8	1.0	1.0
Volatile acids—				
Soluble *	nil	nil	0.5	0.2
Insoluble *	0.4	0.5	—	—
Solidifying point of fatty acids (titer test)° C. ..	53.0°	53.5°	52.4°	58°

* c.c.N/10 alkali to neutralise acids from 5 grms. of fat.

Borneo tallow is used as an edible fat by natives; it is used in Europe for candle-making, but probably chiefly as a substitute for cacao butter which it resembles closely. (See also this J., 1904, 1152; 1909, 1146.)—R. G. P.

Madia saliva seeds; Oil of——. Bull. Imp. Inst., 1915, 13, 314—346.

Madia saliva (N.O. *Compositae*) is a native of Chile and California, closely allied to the sun-

flowers. It has been cultivated in Algeria, Asia Minor, and elsewhere; the plant withstands frost and yields 6 cwt. of seed per acre. Seeds from South Africa contained moisture 5.1; oil 36.5%. The oil was yellowish-brown and of the semi-drying type; sp. gr. at 15°/15° C., 0.925; saponification value, 194.5; iodine value, 128.9%; insoluble fatty acids, 95.8%, including 0.8% of unsaponifiable matter. The oil would be suitable for burning or for soap making, and possibly for edible use. The residual meal contained moisture, 8.11; crude proteins, 30.19 (true proteins, 24.29%); fat, 0.55; carbohydrates, 28.81; fibre, 26.14; ash, 6.20%. Nutrient ratio 1:1.5; food units 114. The meal was free from alkaloids and cyanogenetic glucosides and closely resembled sunflower seed and undeoiled cottonseed cake in composition; the seed husk was very tough and the suitability of the meal for feeding purposes can only be determined by practical feeding trials.

—R. G. P.

Chinese wood oil; Determination of the adulteration in —. J. C. Brier. J. Ind. Eng. Chem., 1915, 7, 953–957.

THE method proposed is based on the fact that Chinese wood oil shows anomalous optical dispersion, i.e., when examined with the Pulfrich refractometer, the green is on the upper and the red on the lower side of the spectrum, whereas in the case of all other oils examined, the red is on the upper and the green on the lower side. On adding increasing quantities of linseed oil to pure Chinese wood oil at 25° C., there is little effect on the spectrum until more than 8% has been added. From this point, with increasing additions, the yellow and green become more pronounced and the line of demarcation between them sharper, and the red diminishes in intensity, and ultimately disappears when 12% of linseed oil has been added. The green then gradually diminishes in intensity and with 15% of linseed oil only a yellow band remains. When the amount of linseed oil reaches 15.5%, red begins to appear on the upper side of the spectrum (this is termed the "turning point"), at 16–16.5% green begins to appear, and with still larger additions the normal spectrum is ultimately obtained. Similar results are obtained with other oils in place of linseed oil, the "turning point" being observed with from 14.5 to 17% of the foreign oil. The effect varies with the temperature. A sample of the oil to be tested is examined with the Pulfrich refractometer at 25° C. If the amount of adulterant be less than 8% the inverted spectrum characteristic of Chinese wood oil will be obtained, whilst if more than 15.5% of adulterant be present, the normal spectrum will be observed. Varying quantities of linseed oil are now added to portions of the sample, and the amount of adulterant present is taken as the difference between 15.5 and the amount of linseed oil required to be added to attain the "turning point." If the oil used as adulterant can be identified by a colour reaction or other test, the accuracy of the method can be increased, as it is then possible to replace the arbitrary number 15.5 by the number giving the actual percentage of the oil in question which must be added to Chinese wood oil to attain the "turning point." (See also this J., 1912, 731, 782, 997, 1189; 1913, 32, 149, 243, 496, 542; 1914, 1017, 1018.) —A. S.

Chaulmoogra oil. F. B. Power. Amer. J. Pharm., 1915, 37, 493–500.

THE results of the examination of chaulmoogra oil obtained by Chattopadhyay (see this J., 1915, 1102) are entirely at variance with the results of a long series of investigations of a genuine chaulmoogra oil from well-authenticated seeds of *Turukto-*

genos Kurzii, King, recorded by Power and his co-workers (this J., 1904, 669; 1905, 741; 1907, 420; Chem. Soc. Trans., 1910, 97, 1285–1289), who found that the genuine oil is a soft fat, m.p. 22° C., sp.gr. 0.951 at 25° C. and 0.940 at 45° C.; $[\alpha]_D^{25} = +52.0^\circ$; acid value 23.9; saponif. value 213.0; iodine value 103.2 (these values being also substantially adopted in the B.P. 1914). The fat consists to a large extent of the glyceryl esters of optically active acids of an entirely new type, the "chaulmoogric acid series," having the general formula $C_nH_{2n-4}O_2$ and possessing a cyclic structure, together with a small amount of palmitic acid. Considerable doubt exists not only as to the nature of the material used by Chattopadhyay, but also on the accuracy of the conclusions drawn from the chemical evidence as to the character of the substances present and on the existence as chemical entities of the supposed salts of "gyno-cardic acid." —T. C.

Fats; Biochemical test for rancidity of —. J. Vintilescu and A. Popesco. J. Pharm. Chim., 1915, 12, 318–323.

FATS in becoming rancid absorb oxygen from the air and can then take the place of hydrogen peroxide or oxidised oil of turpentine in the peroxidase test for blood. About 10 grms. of the oil or fat (melted at about 35° C.) is mixed with 4 to 5 drops of an aqueous solution of blood or of 3% hæmoglobin solution, 10 drops of freshly-prepared guaiacum tincture, and about 10 c.c. of water, and the tube closed and vigorously shaken for a minute. In the case of sound fats no coloration is obtained, but with rancid fats the emulsion is coloured blue in proportion to the degree of oxidation. The reaction is not due to the presence of acids, since acid oils after neutralisation and washing with water and alcohol give the coloration with the same intensity as before. In the case of slightly rancid fats the coloration is rendered more apparent by shaking the mixture with an equal volume of 95% alcohol, which dissolves the oxidation product. Fats exposed to light and air gave a distinct reaction after 24 to 48 hours, whilst any odour of rancidity was not apparent until after 4 to 5 days' exposure, and the acidity did not alter until after 8 to 9 days. Rancid fats heated for some minutes at 120° C. still give the reaction with the same intensity, but do not react after heating at 200° C. —C. A. M.

Sulphonated oils; Analysis of —. G. Bumeke. J. Amer. Leather Chem. Assoc., 1915, 10, 559–569.

TOTAL fatty matter must be determined directly and cannot be taken as the difference between 100%, and the sum of moisture, ash, and unsaponifiable matter. It is best estimated by hydrolysing with dilute hydrochloric acid and subsequently extracting with ether. If petroleum spirit be used oxidised fatty acids are not dissolved, and may be determined separately. 150–200 c.c. of petroleum spirit should be used for 4 grms. of oil, as a strong solution of unoxidised fatty acids is a solvent for oxidised acids. The petroleum spirit solution is filtered, and the oxidised fatty acids washed and dissolved in hot alcohol. Total sulphuric acid is estimated in the acid water and wash water from the previous determination. This is heated before adding barium chloride. Sulphuric acid in inorganic sulphates is determined by dissolving 10 c.c. of oil in 20 c.c. of concentrated brine, to which 100 c.c. of ether is added; after shaking, the aqueous layer is drawn off and the ether shaken with further smaller quantities of brine. Sulphuric acid as sulpho-fatty acids is the difference between these two determinations, and the content of sulpho-fatty acids can be calculated by a factor. Distillation with xylol

is recommended for the determination of water. Unsaponifiable matter is determined by the method of Spitz and Hönig (this J., 1891, 1039), using at least 200 c.c. of petroleum spirit for 10 grms. of oil. It is often preferable to use the total fatty matter rather than the original oil. Neutral oil is estimated by adding ammonia and glycerin to an aqueous solution of the oil and extracting three times with ether, using altogether 300—400 c.c. of ether for 10—30 grms. of oil. The ether extract is washed first with water, then with dilute hydrochloric acid, and again with water. The value of a sulphonated oil is best indicated by the total fatty and unsaponifiable matter and the content of water and sulphofatty acids.—F. C. T.

Oils (fixed and volatile) of Monodora myristica ("Oicere" seeds). See XX.

New direct-reading viscosimeter. MacMichael. See XXIII.

PATENTS.

Oil from seed; Presses employed in the extraction of— J. W. Payne, Millwall, Eng. Pats. 21,780, Oct. 30, 1914, and 6137, April 28, 1915.

The main ram of the press is annular in shape and a supplemental ram works in the central open space. The supplemental ram supports a pile of press-plates ready to be charged, and when in its lowest position its head rests on the main ram. The crushed seed is fed in regulated quantity into a pot which can be moved laterally into the press, and which has a sliding bottom. As the pot passes into the press the sliding bottom is withdrawn automatically, and the meal falls through into a moulding box resting on the top plate of the pile. As each charge leaves the pot the latter is withdrawn, and the moulding box, which is pivoted and counterpoised, automatically swings out of the way leaving a charge on the plate. The charged plate is then raised by the supplemental ram into the upper part of the press, where it is retained by catches, in position for pressing, the main ram is moved upwards a distance equal to the thickness of a press-plate, the supplemental ram is lowered, and the next plate is charged. These operations are repeated until the whole pile of plates is charged, whereupon the meal is pressed as usual. The press-plates have slots at the ends, through which pass vertical perforated plates depending from the head of the press.—C. A. M.

Catalyser [for hydrogenating oils] and process of making same. C. Ellis, Montclair, N.J. U.S. Pat. 1,156,068, Oct. 12, 1915. Date of appl., Apr. 3, 1915.

To obtain a finely-divided catalytic material capable of hardening resistant oils, finely divided nickel hydrate, $\text{Ni}(\text{OH})_2 \cdot \text{H}_2\text{O}$, with or without a similar compound of another suitable element, such as copper hydrate, is incorporated with an oily vehicle, and the mass is heated and exposed to the action of a reducing gas, such as hydrogen, the moisture formed by reduction being removed.

—E. W. L.

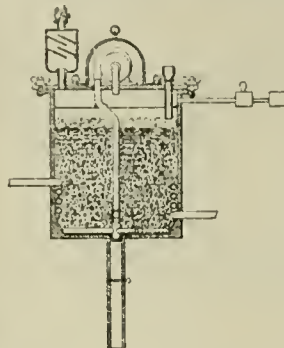
Fats and oils; Apparatus for treating— P. G. Kaiser and B. E. Reuter, Chicago, Ill. U.S. Pat. 1,156,905, Oct. 19, 1915. Date of appl., Nov. 20, 1913.

A HEATING and agitating device for the treatment of fats and oils comprises a vertical pipe within a tank, which is provided at the lower end with a number of radiating intake pipes and at the upper end with radiating discharge pipes. Steam under pressure is admitted to a nozzle within the lower end of the pipe and is discharged, together with the heated material, through the upper discharge

pipes. Simultaneous heating and agitation of the contents of the tank are thus effected. The nozzle may consist of a number of hollow inverted truncated cones which are superposed and connected together by means of perforated webs.

—C. A. M.

Hydrogenating process and apparatus [for oils]. K. P. McElroy, Washington, U.S. Pat. 1,157,993, Oct. 26, 1915. Date of appl., Mar. 28, 1912.



FRESHLY-REDUCED nickel is used as catalyst, and the hydrogen is circulated rapidly in minute bubbles ascending in a non-vertical path, in the apparatus shown, so as to produce with the mixture of oil and catalyst a gas-liquid emulsion. The circulation of the hydrogen is effected independently of the supply.—F. W. A.

Oil; Process of dehydrating— F. W. McNear, Menlo Park, and P. E. Bowles, jun., Reward, Cal. U.S. Pat. 1,158,253, Oct. 26, 1915. Date of appl., June 26, 1915.

AN emulsion of oil and water is treated with an alternating electric current of high potential and for a sufficient length of time to form a chain of water globules which will make a short circuit between the electrodes. The heat thus produced will generate steam, whereby the current will be prevented from passing through the emulsion in the path of the chain of water globules, but will act with increased force at other points, forming and breaking new chains in succession.—C. A. M.

Apparatus for purifying and filtering oils and other liquids. Eng. Pat. 192. See I.

Process of treating hydrocarbon oils [to produce fatty acids and esters]. U.S. Pat. 1,158,205. See IIA.

Moulded composition for electrical insulation [from Chinese wood oil]. Eng. Pat. 24,419. See XI.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Wood turpentine; Composition of— M. Adams. J. Ind. Eng. Chem., 1915, 7, 957—960.

SPECIMENS of wood turpentine were prepared from the wood of the single leaf nut pine (*Pinus monophylla*), the Jeffrey pine (*P. jeffreyi*), and the Western yellow pine (*P. ponderosa*) by distilling under diminished pressure, and the portion distilling below 160° C. was examined. In all three cases the constituents present in the oils from the corresponding oleoresins (Schorger, this J., 1912, 938; 1914, 33) were detected in the wood turpentines, and it is concluded that although they may differ somewhat in physical constants and percentage composition, turpentine oils from the wood and from the oleoresin are similar in character. The wood turpentine from the single leaf nut pine, after re-distillation with steam, had sp.gr. 0.9702 at 15° C., $n_D^{20} = 1.4771$; $[\alpha]_D^{20} = +21.15$, and is almost identical, physically and chemically, with the oil from the oleoresin. Re-distilled Jeffrey pine wood turpentine yielded about 90% of a fraction distilling at 99°—100.5° C., sp.gr.

0.6877 at 15° C., $n_D^{20}=1.3890$, and consisting of *n*-heptane. Re-distilled yellow pine wood turpentine had sp.gr. 0.8626 at 15° C., $n_D=1.4727$, $[\alpha]_D=-13.15$; it contained a greater proportion of low-boiling constituents than the oil from the oleoresin.—A. S.

Rosin from wood; Use of ammonium hydroxide for the extraction of—. H. K. Benson and H. N. Crites. J. Ind. Eng. Chem., 1915, 7, 918–920.

LABORATORY experiments have shown that the rosin can be almost completely extracted from resinous wood by heating it, in the form of chips, for five hours at 70° C. with eight times its weight of a 5% solution of "ammonium hydroxide" in a pressure vessel. The ammoniacal liquor when evaporated leaves a black tarry residue from which the rosin can be extracted by gasoline.—A. S.

Resins; Some little known—. Bull. Imp. Inst., 1915, 13, 357–375.

Resinous latices. A number of resinous latices and coagulated products from them yielded the following results (calculated on dry material):—

Name.	Origin.	Caoutchouc.	Resin.	Proteins.	Insoluble.	Ash.
		%	%	%	%	%
1. <i>Euphorbia Tirucalli</i>	Natal	14.3	73.8	1.3	8.6	3.7
2. " "	"	15.7	82.1	1.3	0.9	1.5
3. " "	Mauritius	11.8	79.1	1.9	7.2	4.9
4. <i>Euphorbia</i> sp., "Tshizimboti" ..	Rhodesia	8.1	67.5	2.5	21.9	4.8
5. <i>Euphorbia canariensis</i>	Canary Islands ..	12.6	77.3	2.7	7.4	4.0
6. <i>Conopharyngia elegans</i>	Transvaal	14.8	72.8	10.7	—	1.7
7. <i>Diptorhynchus mossambicensis</i> ..	Beira	24.4	74.6	1.0	—	—
8. "percha" from "gutta" ..	"	—	87.7	2.2	7.8	—
9. "Rubber" from fig tree	S. Rhodesia ..	28.0	68.2	1.0	—	2.8
10. <i>Anthostema senegalensis</i>	Sierra Leone ..	5.8	89.7	—	4.5	6.9
11. <i>Mimusops cuneifolia</i>	Uganda	9.5	84.7	—	5.8	—

All the *Euphorbia* resins were readily soluble in organic solvents, but would be of no value for varnish making as the solutions deposit crystals on standing. The resin of *E. Tirucalli* behaved similarly to colophony on dry distillation, but further investigation is necessary to ascertain if the distillates can be utilised as substitutes for rosin oils. The coagulated latex of *E. Tirucalli* is said to be worth 8d. per lb. for use in rubber manufacture (Agric. J. Union of S. Africa, 1913, 5, 706). The *Euphorbia* resins were transparent, brittle, and brownish yellow; they had a somewhat unpleasant smell and gave the following results:—

Resin of ;	Moisture.	Ash.	M.pt.	Acid value.	Saponification value.
	%	%	° C.		
<i>Euphorbia</i> , species 1	0.40	0.04	61°	7.9	—
" " 2	0.54	0.18	58°	7.9	—
" <i>Tirucalli</i>	0.77	0.11	55°	4.0	47.0
" "Tshizimboti"	—	—	57°	—	48.2

The use of *E. canariensis* for the same purpose is doubtful. The coagulated latex of *Conopharyngia elegans* is of the Almeidina gum type and worth about 3d. per lb. The coagulated latex of *Diptorhynchus mossambicensis* yielded some rubber-like substance of poor quality; the "gutta percha" had none of the properties of true gutta. Sample No. 9 was possibly derived from *Ficus utilis* but also resembled latex of *Euphorbia Tirucalli*.

The resins from *Mimusops cuneifolia* were hard, white, and crystalline and almost insoluble in cold alcohol; the coagulated latex was friable and unlikely to be of technical use.

Elemi resins. *Canarium colophania* oleoresin from Mauritius resembled commercial elemi from Manila (derived from *C. luzonicum*); it yielded 16.6% of volatile oil and about 75% of pale-brown transparent brittle resin. The volatile oil had a lemon-like odour, spec. gravity at 15°/15° C., 0.859; $[\alpha]_D=+3.13$; refractive index, 1.4725. The resin contained moisture, 1.8; ash, 1.7%, and had an acid value, 23.4; saponification value, 31.5; it would be of little or no value as a varnish as its solutions readily deposit crystals resembling the amyrrin of Manila elemi. The oleo-resin is similar to but not identical with Manila elemi, and would only be saleable as a substitute for Manila elemi, for which the demand is very small.—R. G. P.

Boswellia serrata; Turpentine oil and resin from—. Bull. Imp. Inst., 1915, 13, 351–356.

THE gum-resin of *Boswellia serrata*, a tree growing in the dry zones of India, is obtained by making incisions in the stem and is used locally in medicine; 778 cwt., valued at £1339, was exported in 1913—

1914, mostly to Germany and Austria-Hungary. On steam distillation the gum-resin yields resin and volatile oil. The volatile oil contains dextropinene and limonene (Rep. Bd. Scientific Advice India 1913—14, p. 17). A sample of the volatile oil gave sp. gr. at 15°/15° C., 0.8446; $n_D=1.3124$; ester value, 2.6; acetyl ester value, 36.4; 89% distilled between 153° and 160° and 11% between 160° and 180° C.; the oil is very similar to commercial turpentine oil and would be suitable for use as a substitute, for which purpose it should find a ready market at a price somewhat lower than that of American turpentine oil.

A sample of the resin gave moisture, 0.7%; ash, 0.5%; m.pt. 72° C.; acid value, 51.5; saponification value, 92; iodine value, 70%; sp. gr. at 20°/20° C., 1.082; the resin was soluble in all ordinary organic solvents. When dissolved in turpentine the resin gave a fairly brilliant coat, drying slowly and chipping easily. It would not compete with colophony as a varnish resin or for resin soap manufacture; and as it does not dissolve in sodium carbonate solution it would be useless as a paper size; it might be used in sealing wax. On dry distillation the resin yielded distillates different from those yielded by colophony.—R. G. P.

PATENTS.

Lampblack; Substitute for —. G. G. Blandone, C. W. Nichols, and F. Bruguere, New Orleans. La. U.S. Pat. 1,156,712, Oct. 12, 1915. Date of appl., Apr. 1, 1915.

The hulls or chaff of rice or other grain are carbonised and the charred product is reduced to a fine powder.—W. H. C.

Ink and process of making same. R. Hochstetter, Cincinnati, Ohio. U.S. Pat. 1,158,131, Oct. 26, 1915. Date of appl., Sept. 28, 1912.

An ink for oscillating mimeographs is obtained by grinding with oil or varnish a pigment made on a base which will only retain a small amount of varnish, and then adding a mixture of a vegetable oil and a mineral oil which will cause the ink to penetrate the paper without undue spreading. A small quantity of magnesium carbonate or other flocculent substance and of Turkey red oil or other sulphonated oil may also be added.

—C. A. M.

Elastic products and substitutes for natural lacs; Preparation of —. G. Nuth, Marseilles, France. U.S. Pat. 1,159,258, Nov. 2, 1915. Date of appl., Dec. 27, 1911.

SEE Fr. Pat. 435,650 of 1910; this J., 1911, 399.

Manufacture of colour lakes. U.S. Pat. 1,157,525. See IV.

Black finish [on iron]. U.S. Pat. 1,157,283. See X.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

Rubber; Velocity of solution of liquids in —. P. Bary. Comptes rend., 1915, 161, 589–591.

From data relating to the velocity of absorption of various liquids by rubber, published by Flusin (Thesis for Doctorate, Grenoble, 1907), the author concludes that for any given liquid the weight, p , of the liquid contained in unit weight of the rubber (i.e., rubber + absorbed liquid) after absorption has proceeded for t mins., is given by the formula $p = p_s / (A + t)$, in which p_s is the value of p corresponding to saturation of the rubber with the liquid, and A is a constant depending upon the nature of the liquid and the conditions of experiment, particularly the thickness of the rubber sheet. The values of p_s for some of the liquids used by Flusin were: carbon bisulphide, 0.916; chloroform, 0.940; toluene, 0.870; ether, 0.718; benzene, 0.840; xylene, 0.840; light petroleum spirit, 0.763; oil of turpentine, 0.818; benzyl chloride, 0.841; nitrobenzene, 0.639. It follows from the formula that the velocity of absorption in any one experiment is proportional to $(p_s - p)^2$.—J. H. L.

Some little-known resins. See XIII.

Isoprene from B-pinene. Schorger and Sayre. See XX.

PATENTS.

Hydrocarbons of the diolefin group, caoutchouc, and caoutchouc-like substances; Manufacture of —. H. Stern, Munich, Germany. Eng. Pat. 297, Jan. 7, 1915.

CAOUTCHOUC-LIKE substances or hydrocarbons suitable for preparing them are obtained by the action of fuming sulphuric acid on an aliphatic ketone or ketones, with or without an aliphatic alcohol or ether, or ethylene or its homologues. Examples: (1) 500 grms. of acetone (or its homologues, or mixtures of these) is heated with 350 grms. of fuming sulphuric acid containing 18–20% SO_3 ; the volatile liquid products are

distilled off and the residue neutralised with alkali. Approximately 350 grms. of solid, caoutchouc-like substance is obtained. (2) 3.5 litres of the fuming acid is added to a mixture of acetone (2 litres) and ethyl alcohol (1.5 litres) or ethyl ether (1.25 litres), and the temperature is kept below 80°–90° C. The volatile liquid by-products formed are distilled off, and can be used for obtaining caoutchouc. The acid liquor can be poured off from the solid product, which, after boiling with alkali, represents about 2 kilos. of raw caoutchouc. (3) 9 kilos. of the fuming acid is added in the course of 1½ hour to 6 kilos. of acetone, and the temperature is kept below 80°–90° C. The hot mixture is transferred to another vessel and 3 kilos. of ethylene gas is passed through it, whilst it is kept heated to 100°–110° C. The reaction is complete in 2–3 hours. The volatile liquids are distilled off, and the residue neutralised with alkali. About 5 kilos. of raw rubber and 1.5 kilos. of isoprene are obtained. The isoprene boils at 40° C. or under, and can be polymerised by the action of sulphuric acid, forming a caoutchouc-like substance, insoluble in alcohol. (4) 4 kilos. of ethylene gas (or its homologues) or 5 kilos. of alcohol vapour (or that of its homologues) and 6 kilos. of acetone vapour (or that of homologous ketones) are passed through red-hot tubes, and the products collected in fuming sulphuric acid: 4 kilos. of solids and 2 kilos. of liquid products are obtained.—E. W. L.

India-rubber; Materials and articles containing — and the manufacture thereof. G. W. Beldam, Ealing, and A. U. B. Ryall, Brentford. Eng. Pat. 3402 of 1915, date of appl., Oct. 23, 1914.

CLIPPINGS from wheel tyres or other similar waste produced prior to vulcanisation are reduced to a homogeneous mass, and then compressed and vulcanised under pressure. The material is suitable for floor coverings, or for the soles and heels of boots.—C. A. M.

Resilient and waterproof compositions [rubber substitutes]; Manufacture of —. C. L. E. Nelsom-Brixton. Eng. Pat. 24,106, Dec. 15, 1914.

A COMPOSITION of a resilient and waterproof nature is obtained by steeping gelatin or glue or both in skim milk or separated milk, then mixing with glycerin, applying heat to produce liquefaction, and finally adding potassium bichromate, ground leather, and other ingredients such as dextrin, paraffin wax, Venice turpentine, linseed oil varnish, glucose, and a preservative, with or without colouring matter, the mixture being heated and stirred.—T. C.

Elastic product and method of producing the same. G. Nuth, Assignor to L. Turcat, Neuilly, France. U.S. Pat. 1,159,257, Nov. 2, 1915. Date of appl., Oct. 15, 1909.

SEE Fr. Pat. 401,357 of 1908; this J., 1910, 225.

XV.—LEATHER; BONE; HORN; GLUE.

Anthrax spores in hides and skins; Destruction of — by solutions of hydrochloric acid and common salt. E. Hailer. Arb. Kaiserl. Ges.-Amt, 1911, 47, 69. Chem.-Zeit., 1915, 39, Rep., 273.

ANTHRAX-INFECTED ox hides are no more difficult to disinfect than sheep or goat skins. The spores in the corium are as readily destroyed as those in the epidermis and in the tissues adhering to the flesh side, so that deep-seated spores, difficult to destroy, have not to be considered. Treatment with 1% or 2% hydrochloric acid containing 10% of common salt at 40° C., or with the 2% acid at 20° C., is feasible, but after one hour's immersion of the hides or skins, the amount of free acid

remaining in the liquor should be determined and the amount of acid absorbed by the hide substance replaced by the addition of concentrated acid. No definite period of immersion applicable in all cases can be stated.—T. C.

Gambier; Oriental manufacture of [cube]—. A. T. Hough. *Leather Trades' Review*, Sept. 8, 1915, 512—514. *J. Amer. Leather Chem. Assoc.*, 1915, 10, 573—579.

THE gambier plant lives about 15 years but cannot be worked until three years old. Side branches only are cut off and are chopped into pieces about 5 in. long and boiled with water in a circular iron pan about 5 ft. diam. and 2 ft. deep, with a vertical wooden extension cemented on the edge. The furnace is excavated in the earth underneath the pan and built up with clay and stone. The gambier is extracted twice, fresh water being used for the second extraction only. An arrangement of concentric rattan rings is suspended just beneath the surface of the liquid to prevent frothing. When the liquid is sufficiently concentrated the material is forked out and the liquor strained into tubs of about 3 galls. capacity. To each tub $1\frac{1}{2}$ lb. of rice is added, which causes the liquor to set to a stiff paste by the swelling of the starch granules. When cool and pasty the gambier is poured into a box with a perforated bottom covered with sacking, where the material drains and sets firm, after which it is cut into cubes, which are dried for two days in the sun, and for a longer period on the beams in the roof of the factory.—F. C. T.

Tannin content of Pacific Coast conifers. II. K. Benson and T. G. Thompson. *J. Ind. Eng. Chem.*, 1915, 7, 915—916.

SAMPLES of sawmill waste from Douglas fir and Western spruce were extracted and the extracts analysed by the official methods of the American Leather Chemists' Association. In the case of Douglas fir the bark contained 6.31%, slabs 5.92%, and sawdust 1.06% of tannin. Western spruce bark contained 5.88% and slabs 3.69% of tannin. The spruce extract was of a clear brown colour, and the fir extract was reddish brown and produced leather having a colour similar to oak-tanned leather. Fir waste appears to be a suitable raw material for the manufacture of tanning extract in the United States. At present over 200,000,000 lb. of extract, containing 25% of tannin, is made per annum, mainly from chestnut wood, and the bark of the Eastern hemlock and chestnut oak. Western hemlock bark, of which a large supply is available, and which contains 15—17% tannin, has also been used to some extent. Three cords of fir slabs will yield as much tannin as one cord of Western hemlock bark (11.5 dolls. per cord) at less than one-half the cost for raw material.—A. S.

Leather; Changes in skins during their conversion into —. A. A. Schlichte. *J. Amer. Leather Chem. Assoc.*, 1915, 10, 526—558.

EXPERIMENTS were first carried out to study by the microscope the effect of liming and tanning on the skins. Good sections were obtained after imbedding in celloidin or after freezing; other methods, such as grinding or imbedding in paraffin wax, proved unsatisfactory. The fibre bundles of hide are partially separated into fibrils by liming, and in vegetable tanning the interstices are filled with solid material. In chrome-tanned leather these interstices are larger than in soaked hide and the fibre bundles and fibrils are sharply defined. Microscopic observation cannot be used as a method of tanning control, the differences in sections from various parts of the hide being very pronounced, and the changes from day to day during liming and tanning very small. Experiments were also made on the changes in volume

and weight of skins during liming, etc. For the measurement of volumes a cylinder closed by a screw cover and connected with a burette by a tube near the bottom was used. Liquid displaced by a solid in the cylinder flows into the burette and is measured. The pelt was always wiped with a moist cotton cloth wrung as dry as possible, and was measured in the liquor in which it had been lying. Calfskin increased in weight rapidly during the first three days of liming, then more slowly; unhairing and fleshing caused a sudden decrease which was recovered during bating; pickling and chrome tanning caused a decrease. Changes in volume correspond very closely to the changes in weight, so that density varies only slightly, first decreasing and then increasing a little during liming, decreasing slightly during bating, and increasing during pickling and chrome tanning. Pieces from the flank take up much more water during soaking and liming than do pieces from the butt, and after tanning have a considerably greater volume relative to the original volume of the dry, salted pieces. Flanks were painted with aluminium soap to prevent excessive swelling, but without success.—F. C. T.

Leather formation; Theory of —. W. Fahrion. *Collegium*, 1915, 332—335. *J. Amer. Leather Chem. Assoc.*, 1915, 10, 579—580.

TWO new theories of tannage, the dehydration hypothesis of Sommerhoff (compare this *J.*, 1913, 1023; 1914, 152, 493) and the peptisation theory of Moeller (this *J.*, 1915, 807), are criticised. Sommerhoff states that tannin reacts with the oxygen in the hydration water of hide albumin, and phlobaphenes with the hydrogen. He adduces no evidence, and the theory is untenable for chamoisage. In this case glycerin plays no part and the tannage is due to the oxidation of the unsaturated fatty acids of the fish oil, and not to their reduction, as Sommerhoff states. A glyceride never tans and can be extracted from the hide by solvents. Moeller assigns to the intercellular substance of hide the same composition as collagen and an important role in tannage. This substance is, however, a mucin and is totally removed in liming. Moeller's statement that pure formaldehyde will not tan is contradicted, and his theory of quinone tannage is rejected as too involved and as necessitating the presence of water, whereas an alcoholic quinone solution will tan.—F. C. T.

Analysis of sulphonated oils. Bumcke. *See XII.*

New direct-reading viscosimeter. MacMichael.

See XXIII.

PATENTS.

Tanning; Preparation of skins for —. S. W. Cook, London. Eng. Pat. 24,418, Dec. 21, 1914.

THE skins are treated with an enzyme such as maltase, diastase, or lactase, together with tryptic or lipolytic enzymes, separately or admixed. For example, the skins are washed in water and then put in a liquor made by dissolving 10 parts of malt diastase and 1 part of a tryptic enzyme in water containing dissolved ammonium borate and warmed to 95° F. (35° C.). Diastatic enzymes accelerate the action of trypsin, the gases evolved during fermentation effect a separation of the fibres and thus assist the action upon the intercellular albuminoids, and lipolytic enzymes, if present, emulsify the fats; the ammonium borate facilitates the removal of adhering lime.—E. H. T.

Leather; Tanning and waterproofing —. J. Moszynski, Philadelphia, Pa. U.S. Pat. 1,157,952, Oct. 26, 1915. Date of appl., July 28, 1913.

AFTER depilating the hide is immersed successively

in (1) a bath (25° barkometer, sp. gr. 1.025) consisting of water and 10 lb. each of cutch extract and chestnut extract, (2) a bath of sulphuric acid of 30° barkometer (sp. gr. 1.03), (3) a bath similar to the first bath which is increased 10° barkometer (sp. gr. 0.01) in strength by the addition of the tanning extracts at determined times, (4) a soda ash bath testing 25° at 126° F. (52° C.), (5) a bath of sulphuric acid of 30° barkometer, from which bath it is transferred to cold water, and dried, when it is ready to be made waterproof.—T. C.

Manufacture of coated fabrics [imitation leather].
Eng. Pat. 8202. See V.

XVI.—SOILS; FERTILISERS.

Soil gases. J. W. Leather. Mem. Dept. Agric. India, Chem. Ser., 1914, 4, 85—134.

THE soil to be analysed was extracted with a boring cylinder hermetically sealed at the top directly after the sample had been taken. The lower end was closed with a tightly-fitting cap immediately after its withdrawal from the soil, and a capillary tube passing through the cap enabled the gaseous contents to be extracted with a Töpler pump. After removing carbon dioxide and oxygen from the extracted gases, any hydrogen or hydrocarbon present was determined by passing over heated copper oxide, and argon was determined by passing the gas repeatedly over a mixture of lime, magnesium, and sodium. Determinations of the oxygen-argon and nitrogen-argon ratios indicated that the changes in the oxygen content of the soil gases are of most importance, and that variations in the nitrogen content are so small that they are practically negligible. The volume of adsorbed gas in the Pusa soil is very small and cannot exceed 4% of the total gases. Experiments on Bihar alluvium showed that the combined volumes of the gases and the soil water were normally about 50% of the total volume, and that during the heaviest rains the volume of gases is not reduced by more than one-half of the volume in the dry season. As the method of extracting the gases involved the inclusion of carbon dioxide dissolved in the soil water, it was necessary to calculate the proportions of that gas originally present in the free and dissolved states. Taking this into consideration the average composition of the air in five soil samples was: Nitrogen plus argon 83.24—92.15, oxygen 2.56—14.77, and carbon dioxide 1.05—5.00%. The highest percentages of (total) carbon dioxide found were 15.79 in a green-manured soil, and 21.14 near the roots of an indigo crop. If the amount of carbon dioxide is well below 10%, and if the soil is not particularly dry, nearly all of it is in solution as bicarbonate; a good soil contains sufficient normal calcium carbonate to fix all the carbon dioxide present. The amount of oxygen in the gases of fallow land is much less during the monsoon than in the dry season. The quantity of carbon dioxide is greater in cropped land than in fallow; it increases notably after the first heavy rains (when nitrification is at a maximum), and there is just as much at a depth of 5—6 ft. as in the surface soil, a relation which also obtains for land dressed with farmyard manure. Analyses made to ascertain if any of the nitrogen originally present in a green-manure (san hemp) re-appeared as gaseous nitrogen in the soil, gave a negative result, as the very slight increases observed came within the limit of the experimental error; soil samples from swamp rice land, however, contained such a very large amount of free nitrogen that some of it must have been derived from the

manure applied and from the soil itself. The soil gases in the vicinity of the roots of san hemp, maize, and indigo, were found to contain free hydrogen, in small but fairly constant amount, also a high CO₂-content and relatively little oxygen. Fallow Pusa soil is normally rich in nitrate especially after the first monsoon rain, but the amount of nitrate is diminished by a wheat crop. The soil gases in fallow land were examined before and after the period of active nitrification; down to 15.2 cm. the oxygen content very slightly diminished, but the carbon dioxide greatly increased during the time. Examination of the gases in contact with soils to which ammonium sulphate was added and which were contained in closed vessels, showed that when there was but very little air above the soil nearly all the oxygen disappeared, and that much carbon dioxide and very little nitrate were formed. Similar observations were recorded when much air was present above the soil, except that much nitrate was produced; the volume of carbon dioxide was very much less than that of the oxygen consumed, and much more oxygen disappeared than was necessary to produce the total of carbon dioxide and nitrate. A study of the diffusion of gases in the soil, and between it and the external air, leaves no doubt that large quantities of oxygen disappear. The diffusion of gases through soils down to 12—15 inches is so thorough that the value of surface cultivation cannot be ascribed to any increased aeration it promotes in the soil.—E. H. T.

Potassium and phosphate ions; Adsorption of — by soils. R. H. Bogue. J. Phys. Chem., 1915, 19, 665—695.

FOUR typical soils of the Connecticut Valley, a sandy soil, a fine sandy loam, a silt loam, and a clay soil, were subjected to the leaching action of water. Pure distilled water was made to percolate through 100 grms. of each soil at the rate of 50 c.c. per 24 hours, and the different fractions were analysed for potassium and phosphate (PO₄). In each case a high concentration of potassium was found in the first few fractions, but after about 1½ litres of water had passed through the concentration became nearly constant, though different for each kind of soil. The results for phosphate were similar, except that the concentration first rose before it began to fall (the sandy soil excepted), whereas the potassium ion concentration diminished regularly from the first. The leaching was continued until 4 litres of water had passed through, the soils were drained, and then extracted in two series with solutions of potassium chloride and monocalcium phosphate, each containing 200 parts of solid per million of water. The concentration of potassium in the percolates increased very rapidly at the outset but to a different extent for each soil, the clay soil showing the greatest adsorptive capacity and the sandy soil the least. After about 1 litre of solution had passed through, the concentration became practically constant. The phosphate ion was adsorbed at a much slower rate than the potassium, and the amounts adsorbed were also very different; thus the clay soil rapidly adsorbed phosphate after 5 litres of solution had percolated, but the constant concentration of potassium was reached after the passage of only 1 litre; and the amount of phosphate adsorbed was much greater than that of potassium. In both series the soils continued to adsorb very small quantities long after the ionic concentration in the extract had become practically constant, and this is held to be due to interaction between the dissolved salt and insoluble soil constituents. After thorough drainage, the same soil samples were again leached with water, and it was observed that the phosphate was removed far more slowly than the

potassium, that the rates of removal were high at first but gradually diminished till constant values were reached, and these constants were nearly equal for both kinds of ions. Hence it is probable that the concentrations of potassium and phosphate ions in the soil solutions would be practically the same, and independent of the amount of adsorbed ions originally contained in the soils. Continued extraction still removed small amounts of the ions at an extremely slow rate, but in all cases the quantities removed were far less than the soil had adsorbed during the percolation of the salt solution. This indicates that the elements adsorbed during percolation had been rendered insoluble and that their reversion to a soluble state was extremely slow. The results generally support the view that the concentration of salts in the soil solution is primarily determined by the physical condition (specific adsorptive capacity) of the soil, and not by its chemical composition.—E. H. T.

XVII.—SUGARS; STARCHES; GUMS.

Invert sugar; Determination of—in presence of *sucrose. Action of [alkaline] copper solutions on sucrose.* E. Saillard. Comptes rend., 1915, 161, 591—593.

THE author investigated the influence of sucrose on the apparent reducing power of invert sugar under two sets of experimental conditions (cp. Miller, this J., 1889, 1014; Pellet, this J., 1914, 35; and for the volumetric method, Ling and Rendle, this J., 1908, 582). In the first series of experiments Bertrand's solutions were used and his procedure was followed (see this J., 1907, 60) except that the liquid was heated in a conical 150 c.c. flask for 10 mins. in a bath of boiling water instead of being boiled for 3 mins. The weights of copper reduced by solutions containing different amounts of sucrose and invert sugar are given in Table I. In the second series 10 c.c. of copper sulphate solution containing 69.26 grms. per litre was mixed with 10 c.c. of a solution containing 346 grms. of Rochelle salt and 130 grms. of sodium hydroxide per litre, and 50 c.c. of sugar solution, and heated for 22 mins. in a water-bath at 62°–64° C.; the precipitate was collected and estimated by Bertrand's method. The results are given in Table II. The tables show that the influence of sucrose varies considerably according to the solutions used and the method of procedure. In the first series the absolute effect of the sucrose diminishes as the quantity of invert-sugar present is increased, whilst in the second series the reverse is the case. The author suggests the second method for the determination of reducing sugars in beet products after defecation with normal lead acetate and removal of lead with sodium carbonate.

TABLE I.

Weights of copper reduced, in mgrms.

Invert sugar in 20 c.c. of sugar solution, mgrms.	Sucrose in 20 c.c. of sugar solution, in grms.:						
	0	0.325	0.650	0.975	1.30	1.95	3.25
10	20.5	29.5	38.5	45.0	51.0	58.5	70.5
30	59.1	66.0	73.0	79.0	84.5	91.5	103.0
50	94.5	100.5	106.5	112.0	116.5	122.0	132.5
70	128.2	133.8	139.0	143.5	147.3	152.7	161.2
90	169.5	163.2	166.2	170.0	173.6	178.5	185.5

TABLE II.

Weights of copper reduced, in mgrms.

Invert sugar in 50 c.c. of sugar solution, mgrms.	Sucrose in 50 c.c. of sugar solution, in grms.:						
	0	0.815	1.63	2.44	4.07	6.52	8.15
8	14	15.2	16.1	16.8	18.1	19.4	20.1
16	28	29.6	30.4	31.2	32.5	34.2	35.2
24	42	44.0	44.8	45.6	46.9	49.0	50.4
40	70	72.8	73.6	74.4	75.9	78.8	80.8
56	98	101.6	102.4	103.2	105	108.7	111.2
64	112	115.9	116.8	117.6	119.7	123.7	126.5
72	126	130.3	131.1	132.0	134.4	138.8	141.8

—J. H. L.

Biochemistry of marine algae. Kylin. See VII.

Comparative experiments on the rapidity of fermentation and the yield of alcohol, using worts prepared from refined sugar and raw (beet) sugar. Foth. See XVIII.

New direct-reading viscosimeter. MacMichael. See XXIII.

PATENT.

Starch: Method of treating—. C. A. Tyler, Auburn, N.Y.. Assignor to National Chemical Co., Syracuse, N.Y. U.S. Pat. 1,157,738, Oct. 26, 1915. Date of appl., Aug. 22, 1914.

LAUNDRY starch is prepared by "cooking" a confined body of raw starch with steam under sufficient pressure to break up the mass of cooked starch into fine particles, and the mass is then cooled by introducing a current of cold air under such a pressure as to continue the agitation of the mass of starch.—J. F. B.

XVIII.—FERMENTATION INDUSTRIES.

Fermentation; Comparative experiments on the rapidity of—and the yield of alcohol, using worts prepared from refined sugar and raw (beet) sugar. Foth. Z. Spiritus-Ind., 1915, 33, 133—139. Z. angew. Chem., 1915, 28, Ref., 428.

WORTS prepared from refined sugar, even with the addition of a relatively large amount of nutrient substances, fermented more slowly than those prepared from raw beet sugar; but raw beet sugar worts (16%), without the addition of nutrient substances, were not completely fermented at the end of 72 hours, notwithstanding the presence of a large amount of yeast. A sufficiently active fermentation could be induced by addition of ammonium chloride or sulphate only when a large quantity of yeast was used at pitching, but when the quantity was small it was necessary to add also potassium and magnesium salts and soluble phosphates.—J. P. O.

Bacteria: Fermentative power of marine—. H. Coupin. Comptes rend., 1915, 161, 597—600.

PURE cultures of 43 marine bacteria, most of which were isolated from water from oyster beds, were seeded into twelve tubes of agar containing dextrose, levulose, galactose, sucrose, maltose, lactose, starch, glycogen, inulin, glycerol, or mannitol. The culture medium was first tinted with blue litmus and a reddening of this within 22 days was regarded as evidence of fermentation. The results are tabulated and the method is suggested as a means of distinguishing between bacteria. All except three of the organisms tested produced reddening in one or more of the tubes.

—J. H. L.

Ethyl alcohol from wood waste; Manufacture of —. II. *Hydrolysis of white spruce.* III. *Western larch as a raw material.* F. W. Kressmann. J. Ind. Eng. Chem., 1915, 7, 920—923.

FURTHER experiments on the lines described previously (this J., 1914, 880) have shown that for commercial working the most satisfactory conditions for the digestion of the wood are: pressure, 7½ atmospheres; duration of digestion, 20 mins. from time when working pressure is attained; ratio of water to dry wood, 125:100; ratio of acid to dry wood, 2½:100. Under these conditions white spruce yielded 23.61% of total sugar (reckoned on the dry wood); 71.4% of the total sugar was fermentable, the yield of alcohol being 8.54% of the weight of dry wood. Fermentation was carried on for 96 hours at 30° C. with a pure culture strain of *Sacch. cerevisiae* isolated from a yeast used in a Hungarian distillery for producing alcohol from beet molasses; a mixture of ammonium sulphate and malt combs was used as nitrogenous nutriment for the yeast, which was propagated in molasses solution; the yeast culture was used in the proportion of about 1% by volume of the total mash, and the alcohol yield includes that (about 2.5% of the total) derived from the molasses solution added with the yeast. The fermentation efficiency ranged from 91.8 to 100%.

Western larch (*Larix occidentalis*) sawdust when digested with 125% of water and 1.8% of sulphuric acid at 7.5 atmospheres for 10 mins., yielded 29.7% of sugars, of which 37.9% was fermentable, the yield of alcohol being 4.95% of the weight of the dry wood; under similar conditions white spruce yields 22% of sugars, of which 60—65% is fermentable. The larch wood contains a galactan which yields about 10—12% (on the dry wood) of galactose, and this accounts for the high yield of total sugar and low yield of alcohol, the yield of fermentable sugar being proportional to the cellulose content of the wood. Larch waste would be a suitable raw material for the production of alcohol if a yeast could be found which would ferment galactose as well as dextrose under practical conditions.—A. S.

PATENTS.

Beer and the like; Process of and apparatus for use in pasteurising —. E. M. Lundgren, Burton-on-Trent. Eng. Pat. 2745, Feb. 20, 1915.

THE apparatus is for attachment to metal casks or drums in which beer is pasteurised. It comprises an expansion chamber with two outlets provided with cocks, one of which can be attached to a supply of carbon dioxide; the other is screwed to the side-tube of a T-piece. When the expansion chamber has been filled with carbon dioxide the cocks are closed, the lower end of the cross-piece of the T is attached to the bung-hole of the cask, and the latter is filled with beer to the top of the cross-piece of the T, any air in the side tube of the latter being liberated by tilting the cask. A cork is pushed just inside the open end of the cross-piece of the T, which is then closed by a screw plug. The cock communicating with the expansion chamber is opened, and the cask turned on its side and pasteurised (and afterwards cooled) in this position, so that the carbon dioxide evolved remains in the cask and does not mix with that in the expansion chamber. When the cask has cooled, the screw plug of the T-piece is removed, and the cork pushed down into the bung-hole of the cask, after which the T-piece is disconnected from the cask.—J. H. L.

Yeast; Method of and apparatus for separating —from beer. J. P. Rock, Hove, Sussex. L. Venner, Brighton, and L. Lumley and Co., Ltd., London. Eng. Pat. 3067, Feb. 25, 1915.

IN a filter operated by suction or pressure, the

mixture of yeast and beer is allowed to flow on to a filter-cloth stretched horizontally over a filter-pan, and the yeast is removed by the continuous passage over the cloth of horizontal curved arms which scrape off the compact yeast layer and push it towards and eventually over the flanged edge of the filter, although the filter is still flooded with more liquid material. The arms are mounted to rotate on a central vertical shaft, and are so curved as to push the yeast towards the periphery of the filter, or in an alternative form of apparatus, towards a central hole. A second closed receptacle, below the filter-pan, communicates alternately with the latter and with the air, for the periodical reception of the filtered beer from the pan and its discharge from the apparatus. The second receptacle is evacuated by the pump before communication is opened with the pan, and the vacuum is released before the beer is discharged. The filtered beer is thus removed without passing through the pump, and without any fluctuation of the pressure on the filter.—J. H. L.

Malt mills. R. Boby, Ltd., and C. H. Griffiths, Bury St. Edmunds. Eng. Pat. 5185, Apr. 6, 1915.

IN carrying out the grinding and husking process of Eng. Pat. 23,787 of 1907 (this J., 1908, 825), the crushed grain from the first rollers is discharged, with or without preliminary sifting, on to a jiggling conveyor which separates the husks and delivers the remainder to the second rollers. A rotary sieve may be placed between the first rollers and the conveyor, or the conveyor itself may be constructed as a sieve with various sizes of mesh.

—J. F. B.

Alcohol; Manufacture of —from amylaceous materials saccharified by malt. A. J. Pottier. Fr. Pat. 474,501, Dec. 2, 1913.

THE following methods of operating are claimed:—Whole grains, *i.e.*, uncrushed maize, rice, etc., are digested, in the converter (which may be of iron), with water at 100° C. under a top-pressure of 3—4 kilos. (42—57 lb. per sq. in.) of air or carbon dioxide. The water is first made neutral to methyl orange and treated with 0.5—1 part of primary alkaline phosphate per 1000 parts of grain to prevent corrosion of the iron. After 1—1½ hours the pressure is released and the charge heated until all the gas is driven out, when the vessel is closed and superheated to a pressure of 2½—2¾ kilos. (32—39 lb. per sq. in.) for 1—1½ hours to liquefy the starch. As the charge flows from the converter it is cooled by mixing with a jet of water or by means of air, so that no destruction of the saccharifying agent is caused by local overheating. An infusion of ground malt (corresponding to 3—5 parts of barley per 100 parts of raw grain) is made below 30° C. without antiseptics, or below 50° C. with antiseptics, and the extracted grains are used for the saccharification of the main mash, the clear extract being added later, during fermentation. Open vessels are sterilised by filling them for a suitable time with an antiseptic solution, and closed vessels and pipes by means of steam. The surface of the malt used for saccharification is sterilised by an antiseptic which does not injure the diastase. The development of acidity in the mash being minimised by these means, the vinasses in a concentrated or dried form, with or without the spent grains, may be added to the following mash during fermentation, whereby all traces of dextrin and maltose are fermented and the valuable constituents of the vinasses accumulate.—J. H. L.

XIXA.—FOODS.

Influence of the prolonged infiltration of brine on building materials. Camilla. See IX.

Presence of histidine-like substances in the posterior lobe of the pituitary gland. [Colour reaction of histidine.] Aldrich. See XX.

Detection of histidine by colour reactions. Pauly. See XX.

PATENTS.

Foodstuffs and extracts of animal organs; Processes for isolating active substances from —. C. F. Boehringer und Soehne, Mannheim-Waldhof, Germany. Eng. Pat. 3074, Feb. 25, 1915. Under Int. Conv., Mar. 24, 1914.

IN the isolation of vitamins, and of active substances from animal extracts such as thyroid extract, the phosphotungstic acid precipitate is treated with acetone, which dissolves the greater part of the inactive substances. The residue may then be worked up by known methods, such as treatment with normal lead acetate.—J. H. L.

Milk and milk products; Method of preserving —. A. J. Davis, New York. U.S. Pat. 1,157,976, Oct. 26, 1915. Date of appl., Dec. 18, 1911.

MILK is pasteurised and, while hot, introduced into heated receptacles which are then closed, maintained at a pasteurising temperature for some length of time, and cooled.—W. P. S.

Sausages; Casing for —. W. P. Cohoe, Assignor to The William Davies Co., Ltd., and E. C. Fox, Toronto. U.S. Pat. 1,158,400, Oct. 26, 1915. Date of appl., Dec. 31, 1913.

SAUSAGE skins are formed of cellulose hydrate containing an edible ingredient which increases the elasticity and waterproof character of the material (see this J., 1914, 947).—W. P. S.

Fruit juices; Process of clarifying and concentrating —. E. Monti, Turin, Italy. U.S. Pat. 1,158,261, Oct. 26, 1915. Date of appl., Sept. 15, 1911.

SEE Fr. Pat. 431,619 of 1910; this J., 1912, 30.

XIXB.—WATER PURIFICATION; SANITATION.

Calcite; Solubility of — in water in contact with the atmosphere, and its variation with the temperature. R. C. Wells. J. Wash. Acad. Sci., 1915, 5, 617—622.

DISTILLED water or solutions of calcium bicarbonate were maintained at constant temperature in presence of calcite and agitated for long periods daily by a current of fresh air (containing 0.0302—0.0327% CO₂) previously filtered through cotton wool and washed with water. Equilibrium was attained in 30—50 days. The amounts of calcium carbonate dissolved at different temperatures are shown in a diagram, together with values obtained by Kendall (this J., 1912, 638) and Johnston (this J., 1915, 1051). The solubilities found were 82 parts CaCO₃ per million at 1° C., 59—61 at 21° C., and 57 parts per million at 23° C. The decrease of solubility with rise of temperature accounts for the observed diminution of the lime-content of the water of the Mississippi as it flows southward. The relatively rapid formation of marble from submerged coral is probably due to alternate solution and re-deposition of calcium carbonate with fluctuations of temperature of the water. In analysing natural waters a knowledge of the temperatures at which the samples were taken is necessary to decide satisfactorily whether the samples were saturated with calcium carbonate when collected.—J. H. L.

Potable waters; Determination of the specific electric conductivity of —. M. Fornaini. Annali Chim. Appl., 1915, 4, 150—182.

IN cases where it is required to ascertain rapidly

the content of total solids in water, measurement of the electric conductivity appears preferable to the gravimetric determination, but in general the one determination should be regarded as supplementary to the other. From the results of tests with a large number of different waters, it was found that the best factor for calculating the content of total solids in mgrms. per litre from the specific conductivity ($x_{18} \times 10^6$) is 0.71. If Kohlrausch's factor (0.75) be used, the results are too high, unless corrected by subtracting the number of degrees (French) of hardness of the water, determined by Clark's method. The results for total solids calculated from the conductivity are trustworthy only when the specific conductivity ($x_{18} \times 10^6$) is between 200 and 700; samples which give values higher than 700 should be diluted before testing.—A. S.

Gases dissolved in waters and effluents; Determination of —. A. A. Swanson and G. A. Hulett. J. Amer. Chem. Soc., 1915, 37, 2490—2500.

A METHOD is described for the determination of dissolved gases, depending on the law of distribution of a gas between the liquid and vapour phase. The vapour phase obtained by bringing the water into a vacuum or a neutral atmosphere and shaking a few minutes to establish equilibrium, is analysed, and the volume of the dissolved gas, calculated with the aid of the equation,

$$x = a \left(\frac{e(T+t)}{T} + 1 \right), \text{ where } x \text{ is the volume of}$$

dissolved gas, a the volume of the particular gas actually removed, e the solubility coefficient at the temperature, t , at which the phases were in equilibrium, and T the absolute temperature. (The volumes of the liquid and gas phases are assumed to be equal.) The apparatus consists essentially of two cylindrical glass bulbs of one-half and one litre capacity respectively, fitted with taps above and below, so that communication may be established between them. The larger bulb is filled with the water under examination and the smaller with mercury. On opening the lower connecting taps mercury flows into the larger bulb and displaces half the water. The upper tap is then closed and by raising the bulb the mercury flows out by the lower tap, leaving the water in a vacuum. After equilibrium is established the gas and vapour above the water are transferred by the upper connections to the smaller bulb, without change of pressure, by opening the lower taps, and then analysed in a gas burette in the usual way. The method has been employed with good results for oxygen, carbon dioxide, and nitrogen, and a modified method for oxygen, using a pure nitrogen atmosphere instead of a vacuum as above, has also been devised. In principle it is the same as that already described, but the determination of the oxygen in the vapour phase is carried out by sweeping the oxygen-nitrogen mixture directly into a quartz tube containing red hot copper. The volume of hydrogen required to reduce the copper oxide which is thus formed is then determined by passing a known volume from a gas burette over the heated oxide until no further decrease in volume is observed. The volume of oxygen in the gaseous phase is half that of the absorbed hydrogen, and substitution in the above equation gives the volume of oxygen dissolved initially in the water.—G. F. M.

Sewage disposal; New electrolytic method of —. J. C. Olsen. Amer. Inst. Chem. Eng. and Amer. Chem. Soc., Joint Meeting, Aug., 1915. Met. and Chem. Engineering, 1915, 13, 735—739, 793—797.

THE method, in which chemical treatment is combined with electrolytic treatment, is in use at

Elmhurst, New York, treating 750,000 gallons of sewage daily. The electrolyser consists of a horizontal wooden box, 23 ft. long, with a series of valves in the bottom for removing sludge. In the box is a series of elements made up of sets of vertical iron plates, 16 by 10 in. and $\frac{1}{8}$ — $\frac{3}{16}$ in. thick, bolted together with spaces of $\frac{3}{16}$ — $\frac{1}{4}$ in. between each; there are two rows of plates along the tank, arranged in an upper and a lower series, each row being composed of eleven sets, with fifty plates in each set. The method of connecting the sets electrically may be varied. The electricity required is obtained from a direct current generator of 5 k.w. capacity, giving a current of 40 amps. and 125 volts. In the spaces between the plates, paddles are mounted on shafts passing through holes in the plates and supported on bearings in the sides of the tank. The sewage is screened, treated with milk of lime, and pumped through the tank. The time of passage through the tank is about 1 min., and the quantity of electricity applied is 116 coulombs per gallon. After leaving the electrolyser, the sewage is given 4 hours' sedimentation in two settling tanks, and then passes to the discharge pipe. The sludge produced in the tanks is filter-pressed. The total cost of the treatment in the electrolyser is about 10 dollars per million gallons. In normal work, using about 8 grains of lime per gallon, the effect of passing sewage through the electrolyser was to reduce the turbidity from 41 parts per million gallons to 27 parts and after sedimentation to 7 parts, and the organic nitrogen from 13 to 9 parts in the electrolyser and to 5 parts after sedimentation; whilst the nitrates increased from a trace to 2.2 parts after electrolysis and to 3.8 parts after sedimentation, and the dissolved oxygen increased from 1.6 to 2.9 parts after electrolysis and to 3.9 parts after sedimentation. Without lime, very little purification resulted as shown by bacterial numbers, clarification, and flocculation. With a large excess of lime, the average purification was greatly exceeded. With lime alone without electrolysis, flocculation and precipitation were low and there was little decrease in the organic nitrogen. The stability of the effluent from the electrolytic process was shown by the decrease in the number of bacteria on keeping for a day or so, whereas after treatment with lime alone the number rapidly increased. No chlorine or hypochlorite was produced during electrolysis, and treatment of the sewage with lime and bleaching powder showed that chlorine did not act on the organic matter to such an extent as the oxygen produced during electrolysis. The sludge produced during the process remained stable for more than 4 days when pressed. The chief advantages of the method are that an effluent of a high degree of purity is produced, and may be discharged into a river without causing a nuisance; that no odour is produced; that the amount of space required for the plant is small; and that the initial cost is low.—J. H. J.

PATENTS.

Water; Process for softening and treating — so as to prevent the formation of boiler scale. H. Heller, Cologne, Germany. Eng. Pat. 22,361. Nov. 11, 1914.

THE feed water is treated with disodium phosphate, the precipitate formed is allowed to settle, and the clear water is treated with a quantity of vegetable extract, e.g., tannin. About 30 grms. of the sodium phosphate and 0.3 gm. of vegetable extract are required for each degree (German) of hardness per cubic metre of water.—W. P. S.

Water and other liquids; Apparatus for sterilising —. E. L. Joseph, London. Eng. Pat. 8812, June 15, 1915.

THE water or other liquid is led into a small

chamber the top of which is closed by an expandible diaphragm which is raised by the pressure of the water, and when raised operates a switch and closes an electric circuit to which a coil and an ozoniser are connected. The water leaves the bottom of the pressure chamber by a long discharge tube. The air admitted to the ozoniser is first dried by passing over calcium chloride, and after passing through the ozoniser is drawn by an injector into the discharge tube, where it is intimately mixed with the water flowing from the pressure chamber. A valve is provided between the tap on the water-inlet pipe and the pressure chamber for regulating the pressure of the water entering the chamber. The apparatus is suited for discontinuous domestic use.—J. H. J.

Water purifying device. L. C. Lashmet, Jacksonville, Ill. U.S. Pat. 1,157,233, Oct. 19, 1915. Date of appl., Nov. 14, 1914.

THE device consists of a tank of non-conducting material, within which is a horizontal shaft carrying vertical plates passing between other plates, alternately fixed to the bottom of the tank and suspended slightly above it; bars along the top and bottom connect the latter set of plates together. The two sets of plates are connected to a source of electric current. The inlet pipe carries a nozzle, by passing through which the water to be treated is forced against a water wheel fixed on the shaft, causing it to rotate.—J. H. J.

Water filtration; Art of —. W. M. Jewell, Assignor to Jewell Engineering Co., Chicago. U.S. Pat. 1,158,225, Oct. 26, 1915. Date of appl., Nov. 6, 1912.

WATER is treated with chemicals in order to precipitate the soluble salts capable of forming boiler scale, the precipitate is allowed to settle, and the water is filtered. Before the water is passed on to the filter a coagulant is added to prevent any precipitate remaining suspended in the water from adhering to the particles forming the filter bed.—W. P. S.

Filter [for water]. W. M. Jewell, Assignor to Jewell Engineering Co., Chicago. U.S. Pat. 1,158,226, Oct. 26, 1915. Date of appl., May 15, 1913.

IN a chamber containing a filter bed and a reservoir for the filtered water, the pipe conducting the water from the filter to the reservoir is provided with means by which a current of wash water may be passed through the filter bed in the opposite direction to the normal flow of the water. The wash water leaves the chamber by an overflow, and a device is provided for cutting off the supply of water to be filtered when the level of the water in the chamber rises to a predetermined point below the overflow.—W. P. S.

Sterilisation of fluids by ultra-violet rays; Apparatus for —. M. von Recklinghausen, Assignor to The R.U.V. Co., Inc., New York. U.S. Pat. 1,156,947, Oct. 19, 1915. Date of appl., Mar. 14, 1914.

STERILISATION is effected in a receptacle which has narrow inlet and outlet compartments adjoining each other and situated along a portion of the centre of the receptacle. A baffle-plate divides the remainder of the receptacle into two compartments. An ultra-violet lamp is placed over the inlet and outlet compartments. The water flows in a thin film over the edge of the inlet compartment, under the baffle-plate in the main receptacle, and in a thin film over the edge of the outlet compartment.—J. H. J.

Sterilising apparatus. M. von Recklinghausen, New York. U.S. Pat. 1,156,948, Oct. 19, 1915. Date of appl., Jan. 18, 1915.

A CHANNEL is formed of plate sections bolted

together, the bottom being of ridge and furrow shape and the top being closed with a flat plate. Small chambers containing ultra-violet lamps are placed in the contracted portions of the channel. The walls of the chambers being transparent to ultra-violet rays.—J. H. J.

Insecticide. R. E. Watson. Alva, Fla. U.S. Pat. 1,156,954, Oct. 19, 1915. Date of appl., July 3, 1913.

The insecticide consists of a mixture of copper aceto-arsenate, lead arsenate, and slaked lime in powdered form. The powder dissolves in water, with the formation of calcium acetate, copper arsenate, and copper-lead arsenate.—J. H. J.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Veratrine and some of its derivatives. G. B. Frankforter and W. Kritchevsky. J. Amer. Chem. Soc., 1915, 37, 2567—2569.

VERATRINE (cevadine) and cevine form molecular compounds with chloral and bromal, the composition of which depends to some extent on the relative amount of the alkaloid used. The chloro-compounds are precipitated from a solution of the alkaloid in carbon bisulphide on addition of the halogen-aldehyde as white amorphous substances which are resolved entirely into their components on heating to 130°—140° C. in an air-oven. They are insoluble in ether. The bromo-compounds are yellow. Similar compounds, insoluble in ether, are produced in many other cases when chloral is added to a solution of an alkaloid in carbon bisulphide, and their formation is suggested as a general alkaloidal reaction.—G. F. M.

Eucalyptus oil industry of California. P. W. Tompkins. J. Ind. Eng. Chem., 1915, 7, 995—997.

NEITHER Australian nor Californian *Eucalyptus globulus* oil, in the raw state, or re-distilled with steam, as in Australian practice, is soluble in 3 vols. of 70% alcohol, as required by the U.S. Pharmacopœia, but they can be made so by fractional distillation, with a loss of about 15% of the original volume in the case of the Californian oil; the quality is further improved by the use of caustic soda. According to R. T. Baker, very little *E. globulus* oil is now distilled in Australia, this species having been displaced by others yielding more oil with a much higher content of cineol. The oil of *E. polybractea*, in particular, is largely exported and probably is frequently sold as *E. globulus* oil. It is pointed out that the limit of 70% of cineol proposed for the coming edition of the U.S.P. will entail a refining loss in the case of Californian oils of at least 30% of the original oil if the phosphoric acid method of determination be adopted, and 15% if the resorcinol method be used. Californian oils can only be placed on an equal basis with Australian oils by fixing the minimum cineol content at 50% by the phosphoric acid method or 60% by the resorcinol method, and the solubility in 70% alcohol at 1 in 18 vols. By-product oils from refining could be used in the concentration of sulphide ores by flotation, as is extensively done in Australia.—A. S.

Distilled bergamot oil. Perf. and Ess. Oil Rec., 1915, 6, 333.

A SAMPLE of distilled bergamot oil from Reggio had the following characters:—Sp.gr., 0.870; $n_D^{20} = +5^\circ$; esters, 4.6%; total alcohols, 37.4%; non-volatile residue, 0.2%. The low percentage of esters and the odour indicate that the greater part of the linalyl esters has been decomposed. The odour of the oil resembles more nearly linaloe

oil than bergamot oil, and the oil should prove useful as a basis of lily-of-the-valley odours, especially in soap manufacture.

Monodora myristica ("Owere" seed): Oils (fixed and volatile) of —. Bull. Imp. Inst., 1915, 13, 346—350.

Two samples of seeds of *Monodora myristica* from West Africa yielded 2.2 and 5.9% of volatile oil with a pleasant lemon-like odour, sp.gr. at 15°/15° C., 0.849—0.859; optical rotation in 100 mm. tube at 20° C., —44.7° to —57.8°; acid value, 1.2—1.4; ester value, 1.9—6.4, acetyl ester value, 33.5—52.9; the two samples of oil were soluble in 4.5 and 6 or more volumes of 90% alcohol respectively. The volatile oil consisted largely of terpenes, but as the odour was neither distinctive nor very permanent, it would not be worth more than 1s. to 1s. 6d. per lb. The seeds also contained about 35% of dark brown fixed oil, sp.gr. at 15°/15° C. 0.918; saponification value, 180.6—186.7; iodine value, 110.6—118.4%; insoluble fatty acids, 92.8%; unsaponifiable matter, 1.6%. The residual meal contained a large amount of fibre and would probably be unsuitable for feeding purposes. Although the seeds could probably be obtained in quantity it seems unlikely that they could be utilised commercially.—R. G. P.

Natural and synthetic camphor; Distinction between —. P. Bohrisch. Pharm. Zentralh., 1914, 55, 1003. Chem.-Zeit., 1915, 39, Rep., 259.

WHEN 0.1-gram. of powdered natural camphor is treated with 10 drops of a cold mixture of equal parts of vanillin-hydrochloric acid and concentrated sulphuric acid on a watch glass, which is covered to prevent loss of hydrochloric acid, the mixture becomes rose-coloured after half an hour, pure green after two hours, and deep indigo-blue after five hours; the blue colour remains unaltered even after 24 hours. Synthetic camphor treated similarly gives a yellow coloration at first, then becomes colourless and turbid.—T. C.

Isoprene from β -pinene. A. W. Schorger and R. Sayre. J. Ind. Eng. Chem., 1915, 7, 924—926.

EXPERIMENTS with a modified form of Harries' isoprene lamp (this J., 1911, 1074) and also with a heated tube containing pumice impregnated with platinum black, showed that turpentine and β -pinene yield about the same amount of isoprene, viz., approximately 10% (compare Fr. Pat. 438,789; this J., 1912, 604). It is suggested that the pinene is partially converted into dipentene, which has been shown to give high yields of isoprene (Harries, loc. cit.; Staudinger and Klever, 1911, 1023).—A. S.

Civet; Study of —. E. Sack. Chem.-Zeit., 1915, 39, 538.

SCHIMMEL und Co. have inferred that the musk-aroma of civet is due to the ketone, muskone, isolated by Walbaum from musk, but the author has prepared and characterised a specific civet-ketone, zibethone (Ger. Pat. 279,313; this J., 1915, 636), which is not identical with muskone. The process for the isolation of muskone from musk, viz., distillation with steam and fractionation of the volatile oil, does not yield satisfactory results with civet, the distillate consisting merely of scatole and other malodorous products. The following process may be used:—The civet is boiled for several hours with strong alcoholic potash; the alcohol is distilled off, the residue treated with water and exhausted with ether. The residue from the ethereal extract is distilled with steam until all the scatole is driven off; it is again shaken with ether and the oil remaining

after distilling off the ether is treated with a little alcohol. The alcohol is distilled from the filtered solution *in vacuo*, leaving a yellow to brownish-black syrup amounting to 10–15% of the civet and possessing a pleasant musk-like odour, together with the animal aroma characteristic of civet. The pure ketone may be prepared by decomposition of the crystallised semicarbazone. The author gives a comparative summary of the properties of muskone, $C_{15}H_{28}O$, and zibethone, $C_{17}H_{30}O$, and their characteristic derivatives (semicarbazones and oximes). Zibethonoxime crystallises in white needles, m.pt. $92^{\circ}C$.—J. F. B.

Histidine-like substances in the posterior lobe of the pituitary gland; Presence of—. [Colour reaction of histidine.] T. B. Aldrich. J. Amer. Chem. Soc., 1915, 37, 203–208.

HISTIDINE and tyrosine in sodium carbonate solution give a marked red coloration with a solution of diazobenzenesulphonic acid in dilutions of 1:100,000, the reaction being also given by these compounds even when combined in the protein molecule (Pauly, Z. physiol. Chem., 1896, 22, 182). The author finds that the reaction is not specific for histidine and tyrosine, but is given by other substances such as *p*-hydroxyphenylethylamine and β -iminazolyethylamine. Histidine can be detected in presence of tyrosine by benzoylating with benzoyl chloride and sodium hydroxide solution, when only the histidine benzoyl derivative gives the reaction; if the histidine is combined in the protein molecule hydrolysis must precede the test (Inouye, Z. physiol. Chem., 1912, 83, 79). Preparations of the posterior lobe of the pituitary gland gave after benzoylation a strong Pauly diazo reaction but did not give the Weidel pyrimidine reaction (Fränkel, Monatsh. Chem., 1903, 24, 229) or the Knoop bromine reaction for histidine (Beitr. Chem. Physiol. Pathol., 1908, 11, 356), from which it is concluded that histidine-like compounds, but not histidine itself, are present which are not attached to the protein molecule.—T. C.

Histidine; Detection of—by colour reactions. H. Pauly. Z. physiol. Chem., 1915, 49, 426–427.

THE production of a red colour on the addition of diazobenzenesulphonic acid to an alkaline solution of histidine has never been claimed as a specific test for histidine, as all substances so constituted as to be capable of combining with diazo compounds may give similar colorations. The value of the reaction lies in the fact that of the amino-acids produced by the hydrolysis of proteins, histidine and tyrosine alone give such a coloration. The diazo reaction with histidine is very much more sensitive than either Weidel's or Knoop's bromine test, so that Aldrich (see preceding abstract) is no more justified in assuming the absence of histidine than in assuming the presence of histidine-like substances.—T. C.

Aliphatic ethers; Action of aluminium chloride on the—. [Detection of water in ether.] G. B. Frankforter and E. A. Daniels. J. Amer. Chem. Soc., 1915, 37, 2560–2567.

DEFINITE condensation products of chloral with aliphatic ethers in presence of aluminium chloride could not be isolated, and the reaction was of a more complex nature than was observed with aromatic ethers. Definite compounds of aluminium chloride with ethyl and propyl ethers were prepared. The former had the constitution, $Al_2Cl_6 \cdot 2C_2H_5O$; it formed colourless crystals, m.pt. 33° – $35^{\circ}C$., which decomposed rapidly in moist air, and slowly even over sulphuric acid in a desiccator. Unless perfectly dry ether is used in these preparations a cloudiness or precipitate, probably of a basic aluminium chloride, is formed,

and aluminium chloride is therefore recommended as a delicate reagent for the detection of water in ether. One drop of water in 500 c.c. of ether which had been dried over sodium gave a positive test with this reagent. The presence of more than 5% of alcohol in the ether obscures the reaction.—G. F. M.

Anæsthetic ether; Detection of hydrogen peroxide in—. F. Dietze. Apoth.-Zeit., 1915, 30, 165. Chem.-Zeit., 1915, 39, Rep., 259.

HYDROGEN peroxide can be detected in ether by the immediate red coloration produced in the ethereal layer when 5 c.c. is treated with 1 c.c. of *N*/10 potassium thiocyanate solution and 2 drops of a 5% acidified solution of ferrous ammonium sulphate, the latter being freshly prepared with precautions to prevent oxidation.—T. C.

PATENTS.

4,4'-Di[hydr]oxy-3,3'-diamino-arsenobenzene; Process for the preparation of—. H. E. Potts, London. From Soc. Anon. les Etablissements Poulenc Frères, Paris. Eng. Pat. 21,421. Oct. 23, 1914.

3-NITRO-4-HYDROXYPHENYL-1-ARSINIC acid is reduced by zinc in acetic acid solution at 25° – $35^{\circ}C$., and then in hydrochloric acid solution at 50° – $60^{\circ}C$., in presence of a small quantity of sulphurous acid, which appears to prevent the reduction being carried past the formation of the arseno-derivative.—B. V. S.

Hydrogenising unsaturated substances; Process for—. C. F. Boehringer und Soehne, Mannheim-Waldhof, Germany. Eng. Pats. (A) 21,883 and (B) 21,948, Nov. 2 and 3, 1914. Under Int. Conv., Nov. 10 and Dec. 24, 1913.

THE unsaturated substance in (A) aqueous or (B) alcoholic solution or suspension is treated with hydrogen in the presence of a suboxide of nickel, copper, iron, or cobalt, as catalyst. Details of the hydrogenation of quinine hydrochloride, of morphine, of cinnamyleocaine, of cinamic acid, and of amino-acetonitrile are given.—B. V. S.

Chlorinated hydrocarbons [tetrachloroethane, from coal gas]; Manufacture of—. H. K. Tompkins, Glasgow. Eng. Pat. 780, Jan. 18, 1915.

COAL-GAS, rich in ethane, is produced by distilling coal at a low temperature, e.g., 500° – $600^{\circ}C$. The ethane, together with a little ethylene, is separated by liquefaction, then again converted into gas, mixed with a suitable quantity of chlorine, and chlorinated by exposure to actinic light from a quartz lamp. The hydrogen chloride produced in the reaction is absorbed in water and used to prepare a solution of a chloride, e.g., zinc chloride, from oxide or carbonate, the solution being afterwards electrolysed to produce chlorine for use in a subsequent chlorination process. The coal-gas may also be chlorinated direct, in which case the actinic power of the light must be kept below that which would cause appreciable chlorination of the methane present.—E. W. L.

Organic solvents; Manufacture of—. H. Hibbert, Assignor to Gulf Refining Co., Pittsburgh, Pa. U.S. Pat. 1,158,217, Oct. 26, 1915. Date of appl., Dec. 5, 1914.

By the action of hydrogen in the presence of a catalyst, such as nickel oxide, the ketones in acetone oil are reduced to alcohols, which are then acetylated. The resulting solvent is mainly a mixture of acetic esters of secondary alcohols, about 50 to 60% of which distils between 90° and $160^{\circ}C$.—B. V. S.

Dihalogen-paraffins; Manufacture of —. F. E. Matthews, Blackheath, and H. J. W. Bliss, London. U.S. Pat. 1,158,524. Nov. 2, 1915. Date of appl., June 6, 1914.

SEE Eng. Pat. 15,048 of 1913; this J., 1914, 80 6

Process for isolating active substances from food-stuffs and extracts of animal organs. Eng. Pat. 3074. See XIXA.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Artificial light sources in photography. Lux. Deuts. Beleucht. Ges., Mar. 20, 1915. Chem.-Zeit., 1915, 39, 539—540.

A COMPARISON is given of the actinic values of the most important light sources used in photographic work. The unit is the activity of a Hefner lamp at a distance of 1 metre for 1 second, as measured by a non-colour-sensitive plate, and is called a *phot*, a name previously suggested by the Photographic Congress in Brussels. A table is given showing the voltage, ampère, energy consumption, illuminating power in Hefner candles (HK.), actinic value in *photos*, and efficiency (*i.e.*, *photos* per watt) for the Hefner lamp, a 10 HK. tungsten lamp (1 watt per HK.), a nitrogen tungsten lamp, an arc lamp with inclined carbons, a 220-volt enclosed arc lamp, and a $1\frac{1}{2}$ ampère quartz mercury-vapour lamp. The highest actinic efficiency is shown by the enclosed arc. In the case of the quartz mercury-vapour lamp the voltage gradually rises after starting the lamp, while the ampère steadily drops, stationary values being reached in about half-an-hour. The actinic value, however, reaches a maximum about 8 times the initial value, and then falls to about 3 times the initial value. A very steady arc was obtained by using tungsten electrodes, and such an arc lamp is suggested as likely to prove very useful in photographic work. For colour photography the nitrogen-filled tungsten lamp with parabolic reflector is recommended.—B. V. S.

Photometry of different coloured light sources. Pirani. See IIb.

PATENTS.

Photographie developer. C. J. Thatcher, New York. U.S. Pat. 1,158,011, Oct. 26, 1915. Date of appl., Mar. 22, 1915.

THE developer contains *p*-aminophenol sulphate, an alkali sulphite, an alkali carbonate, and an alkali hydroxide, the proportion of hydroxide to carbonate being from 1:10 to 1:30; the greater portion of the *p*-aminophenol sulphate may be replaced by quinol.—B. V. S.

Manufacture of moulded celluloid or the like. Eng. Pat. 21,002. See V.

XXII.—EXPLOSIVES; MATCHES.

PATENT.

Explosive projectiles; Preparation of the charges for —. Soc. Ital. Prod. Esplosidenti, and F. Quartieri, Milan, Italy. Eng. Pat. 19,565, Sept. 9, 1914.

To avoid the formation of spaces in the solidified explosive, the mould is filled with molten explosive from a superposed vessel connected with it by a pipe. When solidification commences after agitating the mould, it is again placed under the pressure of the head of molten explosive until complete solidification has taken place.—W. F. F.

XXIII.—ANALYTICAL PROCESSES.

Viscosimeter; A new direct-reading —. R. F. MacMichael. J. Ind. Eng. Chem., 1915, 7, 961—963.

IN the apparatus described, a disc is suspended in the fluid under examination by means of a torsion wire, about 10 ins. long, which passes through the stem of a plunger, and is fastened near the bottom, the triangular head of the wire being held between grooved pins on a standard. The plunger is provided with a dash-pot to check vibration and damp the action, and carries at the top a graduated dial. The fluid is contained in a double-walled cup of heavy spun brass, the space between the walls serving as a heating jacket and being provided with an electric heating coil. The cup is rotated by an electric motor and the deflection of the disc noted by means of a pointer on the standard. The instrument is calibrated by means of sugar syrup, and the viscosity is then read directly from the indication of the dial. It can be used for determining the viscosity of clay slips, and of solutions of glue, gum, starch, gelatin, etc.; straining is not necessary, as small particles of solid matter do not affect the accuracy of the determination.—A. S.

Indicators for the colorimetric determination of hydrogen-ion concentration; New —. H. A. Lubs and W. M. Clark. J. Wash. Acad. Sci., 1915, 5, 609—617.

A PRELIMINARY account is given of an investigation of indicators suitable for the determination of hydrogen ions in culture media and other liquids of similar colour. Homologues of methyl red (see Palitzsch, this J., 1911, 1470) show colour changes over substantially the same range as methyl red itself. The dialkyl derivatives are more intensely coloured than the mono-alkyl compounds; diethyl and di-propyl red ($R_2N.C_6H_4.N_2C_6H_4.COOH$) are more coloured than methyl red itself, and both change from red to yellow between $p_H=4.50$ and 6.50. Dimethyl- α -naphthylamine red (see Howard and Pope, Chem. Soc. Trans., 1911, 99, 1333) has the same range, changing from very brilliant purple to yellow. Several new indicators of the sulphone-phthalein type are described. Phenolsulphone-phthalein was prepared by a new method as follows:—Pure saccharin was converted into the ammonium salt of *o*-sulphobenzoic acid (see Remsen and Holmes, Amer. Chem. J., 1901, 25, 205) and then into the acid chloride (see Remsen and Dohme, *ibid.*, 1889, 11, 332). Ten grms. of the chloride, 15 grms. of phenol, and 10 grms. of freshly fused and powdered zinc chloride were mixed in a porcelain jar, and the mixture was heated at 140° C. for six hours and stirred frequently, then disintegrated and boiled with water for a few mins. and filtered. The washed residue, a bright red powder, was dissolved in strong alkali, and the solution filtered, slowly poured into dilute hydrochloric acid with constant stirring, boiled for a few mins., left for several hours and filtered. The residue was washed and dried in the air. Modifications of this method were used for the preparation of the sulphone-phthaleins of *o*-cresol, thymol, and α -naphthol. The characters of these indicators are as follows:—*Phenolsulphone-phthalein*, reddish violet to yellow between $p_H=6.50$ and 8.50; satisfactory differentiation over the whole range, but extremely sharp between $p_H=7.0$ and 7.5, with 4—6 drops of a 0.01% solution of the sodium salt. *o*-Cresolsulphone-phthalein (2—4 drops of a 0.05% alcoholic solution,) similar to the phenol compound, but on the whole less satisfactory. *Thymolsulphone-phthalein* (3—6 drops of a solution of 0.1 gm. in 200 c.c. of alcohol and 50 c.c. of water), blue to yellow between $p_H=8.0$ and 9.75; very sharp

differentiation between $p_H=8.0$ and 9.5 (same range as phenolphthalein). *α -Naphtholsulphone-phthalein* (1—2 drops of a solution of 0.1 grm. in 50 c.c. of alcohol and 150 c.c. of water), blue to yellow between $p_H=7.5$ and 9.0 , very sharp differentiation over the whole range. *Tetrabromophenolsulphone-phthalein* (by brominating phenolsulphone-phthalein in cold acetic acid), purple to yellow between $p_H=3.5$ and 4.5 ; from 3 to 5 drops of a 0.04% alcoholic solution is used. *Bromothymolsulphone-phthalein* (0.04% alcoholic solution), blue to yellow between $p_H=6.0$ and 7.25 .

—J. H. L.

Fluorine: Observations on the quantitative determination of —. W. H. Adolph. J. Amer. Chem. Soc., 1915, 37, 2500—2515.

THE methods hitherto in use for the determination of fluorine are critically reviewed, and the following conclusions are drawn: A re-fusion of the insoluble residues with carbonate serves to convert all the fluorine in silicate minerals into a soluble form, and it can then all be accounted for by the Berzelius-Rose method (precipitation with calcium chloride in presence of a soluble carbonate). The direct determination of fluorine in fluorspar is preferably carried out by the Offermann method (Z. angew. Chem., 1890, 3, 615) by volatilisation as silicon tetrafluoride, and an apparatus for decomposing fluorspar with quartz and sulphuric acid, and absorbing the tetrafluoride in water, is described and figured in detail. The decomposition is carried out at 220°C , and a slow stream of dry air is aspirated through the apparatus during the operation. The hydrofluosilicic acid is preferably determined by titration with potassium hydroxide, using phenolphthalein as indicator. Soluble fluorides can be most accurately determined by precipitation as lead chlorofluoride by addition of a saturated solution of lead chloride, in which the precipitate is quite insoluble. The precipitate should be collected and weighed in a Gooch crucible. For the detection and determination of small quantities of fluorine in minerals the only reliable method is the titanium-hydrogen peroxide colorimetric method of Steiger and Merwin (Amer. J. Sci., 1909, 28, 119).—G. F. M.

Copper: Electrolytic determination of — without platinum electrodes. J. Guzman and L. Ulzurum. Ann. Soc. Esp. Ph. Ch., 1915, 13, 289—293. Bull. Soc. Chim., 1915, 18, 684.

COPPER may be determined electrolytically in an ammoniacal electrolyte with a steel anode, cleaned with nitric acid and carefully dried, and a nickel-plated copper cathode, using an E.M.F. of 3 volts. The deposited copper must be washed with alcohol without breaking the circuit, and then dried at 90° — 100°C . for ten minutes. With commercial copper salts containing zinc the E.M.F. must not exceed 2 volts. Iron and magnesium do not interfere with the operation. Results are recorded showing complete agreement with those obtained with platinum electrodes.

—G. F. M.

Tin, antimony, and arsenic: Action of metallic magnesium on the sulphides of —. C. Pertusi. Ann. Chim. Analyt., 1915, 20, 229—233. (See also this J., 1915, 851.)

THE following procedure is recommended for detecting tin, arsenic, and antimony in the presence of each other. The precipitate of mixed sulphides, obtained in the ordinary course of analysis, is divided into three portions. The first is suspended in water and agitated or heated with magnesium powder until the yellow colour of the precipitate changes to brown, when the mixture is filtered and the residue treated with hydrochloric acid; the presence of tin in the

filtered solution is detected by means of mercuric chloride. The second portion is agitated for several minutes with magnesium powder and 4 or 5 c.c. of methyl alcohol, the mixture gently heated, filtered through a dry paper, and the filtrate received in a few c.c. of strong hydrochloric acid; the presence of arsenic is indicated by the formation of a yellow precipitate (As_2S_3). 1 mgrm. of arsenic may thus be detected in the presence of considerable quantities of tin and antimony; the separation of the precipitated arsenic sulphide from the opalescent liquid (containing suspended sulphur) may require several hours. The third portion is treated with concentrated hydrochloric acid, the solution filtered, and the filtrate treated with 1 drop of a 1% solution of mercuric chloride, followed by an excess of potassium hydroxide; a black turbidity is produced if antimony is present.—W. E. F. P.

Aluminium and glucinum [beryllium]: Separation of — by the use of acetyl chloride in acetone. H. D. Minnig. Amer. J. Sci., 1915, 40, 482—485.

THE procedure is the same as that adopted for the separation of iron from aluminium (see this J., 1915, 301), but, owing to the comparative insolubility of glucinum chloride in the acetone-acetyl chloride mixture, the process is limited to the separation of quantities of the two metals not exceeding the equivalent of 0.15 grm. of the oxides, and of this amount the glucinum oxide should not exceed one-third. A solution containing the chlorides of the two metals is evaporated to the smallest possible volume (if the evaporation proceeds to dryness, a drop of hydrochloric acid should be added in dissolving the salts, in order to prevent the formation of basic glucinum chloride), the residual solution is cooled, and acetone-acetyl chloride mixture (4:1) is added, drop by drop, until the hydrous aluminium chloride is precipitated completely; from 15 to 20 c.c. of the mixture is usually required. The liquid is then decanted through a filter, the precipitate washed by decantation with the precipitating mixture, then dissolved in a small quantity of water, and the precipitation repeated. The precipitate is finally collected, ignited, and weighed as aluminium oxide. The two filtrates are united, evaporated to remove acetone, the glucinum is precipitated as hydroxide with ammonia, collected, ignited, and weighed.—W. P. S.

Determination of benzol in gas. Neubeck. See IIA.

Photometry of different coloured light sources. Pirani. See IIB.

Application of the Davis spot test in the preliminary examination of cecidotes. Cloukey. See III.

Quantitative estimation of alizarin and certain other dyestuffs. Knecht and Hibbert. See IV.

Determination of carbon dioxide in carbonates decomposed by ammonium chloride solution. Cavazzi. See VII.

Determination of the oxy-acids of sulphur in admixture. Billeter and others. See VII.

New reaction for isothiocyanates. Denigès. See VII.

Determination of adulteration in Chinese wood oil. Brier. See XII.

Biochemical test for rancidity of fats. Vintilescu and Popesco. See XII.

Analysis of sulphonated oils. Buncke. See XII.

Determination of invert sugar in presence of sucrose. Action of [alkaline] copper solutions on sucrose. Saillard. See XVII.

Determination of the specific electric conductivity of potable waters. Fornaini. See XIXB.

Determination of gases dissolved in waters and effluents. Swanson and Hulett. See XIXB.

Veratrine and some of its derivatives. Frankforter and Kritehevsky. See XX.

Distinction between natural and synthetic camphor. Bohrisch. See XX.

Presence of histidine-like substances in the posterior lobe of the pituitary gland. [Colour reaction of histidine.] Aldrich. See XX.

chief exports are oil palm products, maize, and rubber. The rubber is obtained from wild plants, namely "Adele balls" from *Landolphia ovariensis*, and "Sayi rubber" from *Ficus Vogelii* and various vines. Plantations of coconut palms have extended steadily in recent years, and cotton has been grown with some success. Except for some native iron smelting the mineral resources are entirely undeveloped, but occurrences of iron ore, gold, chromite, bauxite, limestone, and galena have been noted.

The amounts and value of the chief exports of chemical interest from the Cameroons and Togoland are shown in the following table:—

	Cameroons.				Togoland.			
	1911.		1912.		1912.		1913.	
	tons.	£	tons.	£	tons.	£	tons.	£
Rubber	2664	551,513	2766	573,611	163	48,787	89	18,029
Palm kernels	14,937	208,393	15,742	220,308	11,452	168,978	7025	127,905
Palm oil	3333	71,215	3537	81,119	3284	70,643	1115	25,900
Copra	—	—	—	—	161	3064	129	3015
Cotton seed	—	—	—	—	574	1323	563	1372
Kapok	—	—	—	—	7	357	9	472
Kola nuts	87	953	235	8348	12	767	—	—
Gum arabic	259	2135	221	2218	—	—	—	—
Djave nuts	45	254	189	1258	—	—	—	—
Shea nuts and shea butter	65	232	105	645	39	1263	—	—

—A. S.

Detection of histidine by colour reactions. Pauly. See XX.

Action of aluminium chloride on aliphatic ethers. [Detection of water in ether.] Frankforter and Daniels. See XX.

Detection of hydrogen peroxide in anæsthetic ether. Dietze. See XX.

Books Received.

THE GASES OF THE ATMOSPHERE. By SIR WILLIAM RAMSAY, K.C.B., F.R.S. Fourth Edition. Macmillan and Co., Ltd., London. 306 pages, 8½×5½ in. Price 6s.

THE popularity of this highly interesting book is evident from the fact that it has reached the fourth edition. The first edition appeared in 1896, shortly after the discovery of argon, and the second four years later, following the recognition of helium, neon, krypton, and xenon. The third edition, published in 1905, contained an account of the radioactive gases of the atmosphere. While no sensational discoveries have been recorded in this field during the last ten years, considerable progress has been made in our knowledge of niton, or "radium emanation," and some light has been thrown on the possible sources of the rare gases of the atmosphere; an account of these serves to make the last chapter of this edition more complete.

The book contains portraits of Hales, Boyle, Mayow, Black, Daniel Rutherford, Priestley, Scheele, Lavoisier, and Cavendish.

ANALYST AND CLIENT. By C. H. and N. D. RIDSDALE. Ridsdale and Co., Middlesbrough. 198 pages, 8½×3½ in. Price 6s., 8s., or 10s. 6d., according to binding.

THE object of this booklet, as stated in the preface, is to help analysts and their clients (actual or prospective) to understand each other better. It is divided into three sections, of which the first contains general notes on sampling and analysis, with tables of chemical data and notes on constituents usually determined in the principal types of materials met with in metallurgical work. Section II. contains notes on the work of the technical specialist and pages ruled for recording results of analyses, with a few typical entries. Section III. consists of a very useful series of conversion factors, tables, and data for testing steel conductor rails.

Trade Report.

Prohibited exports.

By virtue of an Order in Council dated Nov. 24, 1915, the exportation of cotton wadding, cotton wool, and iron ore of all descriptions is prohibited to all destinations. The exportation of soft soap is prohibited to all destinations abroad other than British Possessions and Protectorates. The heading "China clay (including china stone and potters' clay)" now includes "ball clay," and the exportation of "Egg, yolk and liquid, and albumen" is prohibited to all foreign countries in Europe and on the Mediterranean and Black Seas, other than France, Russia (except through Baltic ports), Italy, Spain, and Portugal.

Economic resources of the German Colonies. Bull. Imp. Inst., 1915, 13, 392—422.

Cameroons.—The chief exports are rubber, palm kernels, cocoa, and palm oil, in the order given. Of the total exports of 5,957,516 lb. of rubber in 1911, only 23,912 lb. was plantation rubber; the corresponding figures for 1912 were 6,181,222 lb. and 53,040 lb. respectively. Most of the wild rubber is obtained from *Funtumia elastica*, but some from *Landolphia Davei*. In the plantations *Funtumia* is being displaced by *Hevea*; the first tapping of *Hevea* trees took place in 1912—1913. Machinery for the preparation of palm products has been introduced with success. The mineral resources have not been developed, but the occurrence of mica, galena, iron ores, clays and loams suitable for brick making, and brine springs has been reported. **Togoland.**—The

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Royal Society.

PRESIDENT'S ADDRESS.

(Chemical News, 1915, 112, 291—292.)

At the Anniversary Meeting of the Royal Society, held on November 30th, Sir William Crookes said:—

We meet to-day in circumstances of unparalleled gravity. I am sure we are all deeply conscious of the imperative necessity of modifying the methods of our activities, correcting mistakes, and planning reforms without which we cannot hope to maintain our position among the Nations. England, our England, is passing through a fiery furnace of stress and discipline, and we must face without flinching the bitter lessons to be learned.

The Nation's attitude towards science is, I think, largely due to the popular idea that science is a kind of hobby followed by a certain class of people, instead of the materialisation of the desire experienced in various degrees by every thinking person to learn something about innumerable natural phenomena still unsolved; and having learned, to control and apply them intelligently for the benefit of the human race. Many attempts have been made to explain exactly what is meant by science, and to differentiate true science from its counterfeit; and it is by no means easy to define it so that the vague general idea of the average man can be replaced by clear and precise conception. Even the most patient investigator, the most acute observer, must constantly feel "Oh, what a dusty answer gets the soul when hot for certainties in this our life." If we refer to our Charter, we shall find that the aim of the Royal Society is promoting natural knowledge by experiments, and if we regard science as synonymous with natural philosophy we may describe it as knowledge relating to natural objects and phenomena connected therewith based upon experiments. Life has been defined as the act of correspondence with our environment, and science may equally tersely be defined as the use of intelligence in effecting that correspondence.

I believe that the "hobby" attitude is due to our national character, and can only be rectified slowly step by step. We cannot suddenly become a truly scientific nation, either now during the war, or immediately on its conclusion. We shall have to make many fundamental alterations in our ideas and almost to change our natures before such a change can be effected. First among our defects must surely be placed mental inertia, our reluctance to do our thinking for ourselves and the slowness of our intellectual apprehension. This condition is fundamentally different from docility of mind, and its results are more disastrous because it tends to inhibit action on the part of those who should be leaders. Associated with it of course is our inherent stolid conservatism, which makes us too readily satisfied to continue in the ways of our forefathers, ways which, though good enough once upon a time, are now obsolete and undesirable. We are sometimes prone to underestimate our opponents' abilities and powers, and usually we have a hearty contempt for outside criticisms of our methods. Our mental inertia makes us slow to put our latent organising power into action.

The problem before us is twofold. We have, firstly, to find out how best to organise all our

present forces and employ the material at our disposal to win victory. Many suggestions have recently been made as to the best way to mobilise science and invention, so that, for example, schemes that show some likelihood of having military or naval value can be put at once to the test. At the beginning of the war the Royal Society appointed Committees for this purpose. Their scope could be extended usefully. They include men of naval and military experience, whose practical skill and knowledge supplement the theories of men of science. The second part of the problem is closely interwoven with the first, and its importance to the Nation is hardly inferior. If we neglect to alter our ways, if we continue to disregard the value of scientific work and are content with ignorance of scientific methods on the part of the authorities, we shall assuredly suffer total defeat in the industrial war which must of necessity follow upon the conflict of arms now raging. This is a matter in which men of science have a great responsibility to the Nation. We must not cease to bring to the notice of the public the facts of which we are too fully aware. The attitude of the Government and the public towards science has been mistaken. For this formidable error we suffer and, I fear, must long continue to suffer. The remedy involves many sacrifices and heavy expenditure, probably at first without apparent return. It is to the new generation now being educated that we must look for betterment of our position; and it is for youth we must now make plans. We must make all education more scientific. It is admitted we have much to learn from our adversaries; we must bring scientific methods to the front. As a well known writer has said of our young generation, "We must not let their schooling interfere with their education." I am, however, glad to note that already there are signs on the part of some of our larger companies and more intelligent manufacturers of a disposition to remedy shortcomings. The numerous "Polytechnics" that spring up in every manufacturing town (some wonderfully well equipped and organised) are turning out men with at least an insight into the scientific principles that underlie their particular spheres of work, and such men find their services readily accepted. There are also within my knowledge many instances where manufacturers encourage their lads to attend these institutions, giving them the necessary time and opportunity. But so far this is the isolated action of a few individuals, and needs both encouragement and organisation.

Should not science be represented on the Privy Council? It is astonishing that in so august a body science is almost ignored. Ought we not to have in the Cabinet a Minister of Science with a Board of Advisors similar to that of Agriculture, with the proviso that the Minister of Science should hold his office primarily by virtue of his scientific capacity? Power of organisation and general business ability should be regarded as essential secondary qualifications. The newly appointed Science Councils and Committees might be incorporated under the Ministry of Science—then and then only pure research would begin to take its place as an invaluable profession, with a status of its own at least on a level with that of other learned professions. The leaders of its rank and file would be doing work of fully as much value to the Nation as the work of the officers of our naval and military forces. Then, I feel convinced, the next generation would see the

disappearance of listless co-operation between manufacturer and scientific workmen, and we should hear less of the inferiority of British science as compared with that of our opponents. Given equal opportunities, our men would speedily give proof of fertility of ideas, of organising powers, and of resource and initiative. Research could be so thoroughly well organised that suitable workers would be jointly engaged with those problems for the speedy elucidation of which there is the greatest need, and the results of their investigations would be at the disposal of all British manufacturers. It rests with us to keep these ideas before the mind of the public now that at last it is ripe to consider them. "Be wise to-day; 'tis madness to defer."

Obituary.

B. W. GERLAND.

Death has claimed another of the rapidly diminishing number of original members of this Society, in the person of Dr. B. W. Gerland. In the early days of the Society he was a familiar figure at the meetings of the Manchester Section and contributed a number of useful papers to the Journal.

Early in his career he was a demonstrator under Frankland at Owens College, Manchester. Abandoning academic work, he became connected with the Alderley Edge Copper Works, where he conducted some important research work. Whilst here, he commenced his investigations on vanadium, which was at that time made from the mottramite found in the copper-bearing Keuper beds at Alderley Edge and Mottram St. Andrews. His work on vanadium included the discovery of metavanadic acid, HVO_3 , in 1873, and an investigation of the vanadyl sulphates; he also devised a process for the analysis of vanadium sulphates, which is described in Crookes' "Select Methods of Chemical Analysis," 4th Edn., p. 185.

After leaving the copper works, he held for some years an important position at the

Turkey-red dye works of Messrs. F. Steiner and Co., of Church, near Accrington. Subsequently he remained in the Accrington district engaged in private practice until a year or two ago.

He died on December 2nd, at the age of 85 years.

THOMAS PARKER.

The death occurred on December 5th of Mr. Thomas Parker, at Ironbridge, Shropshire.

Born at Ironbridge on Dec. 22nd, 1843, in humble circumstances, he entered the foundry of the Coalbrookdale Company when under 10 years of age, and here his natural talent for engineering found scope for development. He left this company in 1863 and worked for some years in Birmingham and Manchester, but returned to Coalbrookdale, and in 1876 was appointed to the company's chemical and electro-depositing department. At this time he built a dynamo which was used in deposition work, and later invented a steam-pump and the "Kyrle" slow-combustion grate, and also demonstrated the use of nitric acid in the manufacture of storage battery plates. In 1882 Parker joined P. B. Elwell in partnership and made a speciality of accumulators. In 1884 the firm was formed into a limited company, and manufactured a number of inventions due to Parker, and in 1890 additional works were put down for the manufacture of heavy electrical machinery. Among his electro-chemical inventions were processes for the deposition and refining of copper, the extraction of gold and silver, and the manufacture of phosphorus. In 1890 he took out a patent (Eng. Pat. 67 of 1890; see this J., 1891, 129) for the distillation of coal shale, and the like at a temperature of 550° – 650° C., with the production of increased yields of by-products and the formation of a coke (now known as "coalite") which will burn freely in an open grate.

He was a recognised authority on electric lighting and traction, and acted as one of the arbitrators in the case for the electrification of the London Metropolitan and District Railways.

Journal and Patent Literature.

PATENT SPECIFICATIONS may be obtained by post by remitting as follows:—

English.—6d. each, to the Comptroller of the Patent Office, Southampton Buildings, Chancery Lane, London, W.C.

United States.—1s. each, to the Secretary of the Society, who has to furnish the U.S. Patent Office with the following data:—Patent number, date, name of patentee, and title of invention.

French.—1 fr. 05 c. each, as follows: Patents dated 1902 to 1907 inclusive, Belin et Cie., Rue Ferou 8, Paris (6e.); Patents from 1908 to date, L'Imprimerie Nationale, 87, Rue Vieille du Temple, Paris.

I.—GENERAL; PLANT; MACHINERY.

Factories and Workshops; Annual report of the Chief Inspector of — for the year 1914.
Pp. v. +133. [Cd. 8051.] Price 1s. 2d.

THE work of the Factory Department was considerably disturbed as a result of the war, but the standard of inspection was fairly maintained during 1914. The total number of factories and workshops registered at the end of the year was 276,855, as compared with 274,569 in 1913. There were 1287 fatal and 51,276 non-fatal accidents

reported to certifying surgeons in 1914, as compared with 1309 and 56,870 respectively in 1913, whilst the number of accidents reported only to inspectors was 107,309 in 1914 and 119,982 in 1913. The number of effective visits by the inspectors was 426,434 in 1914 and 406,436 in 1913; prosecutions: 1914, 2852; 1913, 3872; contravention notices to occupiers: 1914, 192,001; 1913, 195,712. Attention is again directed to the formation in factories of small safety committees, composed of workmen, to investigate accidents and prevent their occurrence. At one large works, where this system has been followed for seven years, comparatively

few accidents now occur (compare Gray, this J., 1915, 1125). Accidents due to "scaffolds" and "slips" in blast-furnaces appear to be more common in Scotland than in England, probably owing to the greater use of coal and increase in the quantity of small ore. The tendency to form "scaffolds" may be diminished by briquetting or nodulising fine ores, but serious results to workmen as a result of explosions following "slips" can be prevented only by installation of automatic charging apparatus.

Explosions of dust, gas, etc. Tests by R. V. Wheeler at Eskmeals showed that samples of dust from paper-tube works yielded 24 to 54%, and dust from rag chopping and sorting rooms of paper mills yielded 27 to 77% of ash; those yielding less than 32% of ash were classed as dangerous. Tapioca dust, though yielding only 2% of ash, was not dangerous, the gases evolved on heating containing about 30% CO_2 . Dusts from the mixing and spice rooms of a cattle-food factory and from the grinding room of a provender mill proved to be dangerous dusts. Pitch dust is more highly inflammable than coal dust and almost as dangerous as sugar dust (compare this J., 1913, 447). Two explosions have been recorded recently in different works where "diazo-dye substances with aniline and naphthalene bases" were being dry ground in drum grinders. Some of these substances appear to undergo molecular change when heated, and it is suggested that frictional heat generated during grinding might be sufficient to start chemical action which, in a closed space, might become so violent as to burst the machine. A serious coal dust explosion occurred at a cement works in S. Wales; difficulty was experienced in closing a large valve at the bottom of a coal dust storage hopper, and the cover of the valve-box was removed before the valve was closed, whereupon a large quantity of coal dust escaped, and fell over the edge of the working platform on to the rotary kiln below, where it immediately ignited. In addition to the provision of padlocks for the valve covers and efficient means of escape from each floor of the kiln house, it is recommended that screens be installed below the coal dust shoots to remove foreign material liable to cause obstruction in conveyors, valves, etc., and that the coal grinding and feeding plant be completely separated, by concrete partitions, from the rotary kiln. An explosion of picric acid dust in the Huddersfield district caused eight deaths and injuries to many persons. Dry picric acid was being ground in a small hand-grinding mill in a room which was impregnated with fine dust, and it is presumed that a spark was generated in the grinding process (compare this J., 1915, 152). To prevent explosions arising from the use of compressed gases in cylinders, it has been suggested that different gases should be stored in differently coloured cylinders, but a case is cited to show that this precaution is not adequate. It is recommended that: (1) Residual gas or air in cylinders returned to the works should be removed before the cylinders are re-charged. (2) The cylinders should be numbered and registered. (3) Cylinders of different shapes should be used for different gases. (4) Cylinders for different gases should have screwed connections differing in diameter as well as in direction of thread. Two explosions of air receivers connected with air compressors were due to the ignition of a mixture of air and finely divided lubricating oil or oil vapour (compare this J., 1913, 739). Attention is directed to the need of great care in dealing with old drums and tanks which may have contained acids, chemicals, or inflammable spirits. In a works in the Swansea district, an old drum, which had contained sulphuric acid, was being pierced by a pick prior to charging into a steel furnace. The drum contained hydrogen, which was ignited by a

spark or otherwise, and the workman was killed by the resulting explosion.

Factories working under regulations. Out of 111 coarse-ware potteries, raw lead is now used only in 18; and out of 465 other potteries, including general fine household earthenware and chinaware manufactories, leadless glazes or glazes containing not more than 5% of "soluble lead" (see Thorpe, this J., 1901, 475) are used in 106. The average efficiency of the local exhaust apparatus used in potteries for removing dust showed a decided increase during 1914. In brass-casting establishments the use of mechanical ventilation for removing fumes is extending, but this is not always satisfactory when the roof is low and flat. Bronzing is becoming more concentrated in larger factories equipped with modern machines and benches provided with exhaust ventilation. The quantity of bronzed ware has diminished since the outbreak of war, as all the powder used was imported from Germany, and, up to the present, plans for manufacturing metallic powders in this country have not matured. The use of leadless glaze in vitreous enamelling is extending; for enamelling baths, leadless glazes are stated to give a finish comparing favourably with that produced by lead glazes.

Lead poisoning. The total number of cases of lead poisoning in 1914 was 445 (28 fatal), as compared with 535 (27 fatal) in 1913. Comparison of the figures for groups of industries over a number of years shows that lead poisoning has markedly diminished in industries where periodical medical examination is required and where exhaust ventilation can be applied locally, e.g., in the smelting of metals, tinning, white lead, pottery, and paints and colours, whereas little alteration in the figures is shown in industries where these precautions can be applied only to a slight extent, e.g., printing, plumbing, painting, etc. The principal cause of lead poisoning is the inhalation of fumes or dust of the metal or its compounds. K. W. Goadby and W. H. F. Oxley (Lancet, Oct. 3, 1914) found that the treatment in a bi-polar electric bath, recommended by T. Oliver (this J., 1913, 881), was of no value for removing lead from the animal system, and this conclusion has been confirmed in works where the treatment has been systematically tried.

Phosphorus poisoning. A method has recently been introduced from France for the manufacture of hydrogen by the action of caustic soda on ferro-silicon. This method is associated with grave danger owing to the liberation of hydrogen phosphide from the ferro-silicon (see Pellew, this J., 1914, 774), and the following precautions should be observed:—(1) The caustic soda and ferro-silicon should be stored in separate places. (2) The ferro-silicon in store should be kept dry. (3) It should not be manipulated by workmen whose hands or clothes are soiled with caustic soda. (4) Waste material from the hydrogen-generating tank should be conveyed into the open air through a closed pipe. (5) Free ventilation should be provided whenever gas is being generated. (6) Workmen should be warned of the danger of inhaling the gas.

Arsenic poisoning. One case occurred during the cleaning of an ammonium sulphate saturator in a shale oil works. The acid liquor contained arsenic equivalent to 179.5 grains As_2O_3 per gallon, and poisoning was probably due to hydrogen arsenide produced by the action of this liquid on a galvanised iron pail used by the workman. It is now required that wooden pails be substituted for metal pails in the sulphate house and in tanks which have contained sulphuric or hydrochloric acid.

Mercurial poisoning. Of the ten cases reported, four occurred in the manufacture of thermometers,

two from mercury fulminate dust in the filling of detonators, two in the manufacture of felt hats, and one each in the manufacture of mercuric cyanide and mercuric oxide paint. In thermometer works, cases of poisoning are probably due to the liberation of mercury vapour by the accidental breaking of thermometer bulbs when the mercury is being boiled to expel air.

Anthrax. The number of cases reported was 54, including 7 deaths, as compared with 70 (7 deaths) in 1913.

Fumes and gases. The cases of poisoning from gases and fumes reported in 1914 were as follows, the number of deaths being given in brackets:—Carbon monoxide: blast-furnace gas, 20 (6); power gas (suction, producer, Mond, Dowson), 21; coal gas, 7 (1); other cases, 14 (2); carbon dioxide, 3 (1); hydrogen sulphide, 22 (3); sulphur dioxide, 1; chlorine and hydrochloric acid fumes, 2; nitrous fumes, 9 (2); ammonia, 4 (1); benzene, naphtha, and petrol, 4 (2); nitro- and amino-derivatives of benzene, 38 (2); trichloroethylene, 1 (1); tetrachloroethane, 25 (4); other cases, 3. Administration of oxygen from cylinders fitted with pressure-reducing devices has frequently proved effective not only in cases of carbon monoxide poisoning, but also in poisoning from hydrogen sulphide and nitrous fumes. Of the 38 cases of poisoning by nitro- and amino-derivatives of benzene, 28 were due to the use of dinitro-compounds in the manufacture of a particular explosive in one factory. To render the explosive safer for use in mines, a certain percentage of a deliquescent substance was added and this rendered the product more easily absorbed by the skin. Moreover, as a great demand for the explosive arose, much overtime had been worked. The danger has been materially reduced by improving the local exhaust ventilation and reducing the spells of work in the mixing room to four hours per day.

Industrial eczema. The following precautionary measures are recommended for use where workers come in contact with chromic acid or its salts:—(1) Daily inspection of the hands and arms of the workers. (2) Even the smallest abrasion should be washed in running water and immediately covered by collodion or by a dressing of boracic lint or cyanide gauze under an impervious waterproof dressing; the dressing should be changed daily. (3) Long rubber gloves should be worn. (4) The arms of the workmen should be smeared with a suitable ointment, e.g., a mixture of 3 parts of *paraffinum molle*, B.P., and 1 part of lanoline, with the addition of 5 drops of 90% phenol to every 4 oz.; or a mixture of "mineral lard," 3 lb., paraffin wax, 7 oz., and "cyllin," 1½ oz. For protecting the skin against oil of turpentine a mixture of lanoline and castor oil (equal parts, or 50 : 100), to which 1—2% of phenol is added, is recommended.

Results of five years' notification of lead poisoning. It appears from the tabulated figures that the continued diminution in the number of cases has not been accompanied by a corresponding fall in the number of deaths reported, and this is attributed to the fact that, following on the operation of the Workmen's Compensation Act of 1906, deaths of lead workers suffering not only from chronic nephritis, but also from phthisis and pneumonia have been certified more frequently than formerly as due to lead poisoning. In most industries where lead or its compounds are dealt with, the provision of local exhaust ventilation and periodical medical examination has resulted in a marked diminution of cases of lead poisoning.

Tetrachloroethane poisoning (see Willcox, this J., 1915, 508). The following precautionary measures have been adopted:—(1) Operations in which varnish containing tetrachloroethane is used are carried out in a separate shop or a screened-off

portion of a larger shop. (2) Exhaust fans are provided at the floor level. (3) No workpeople are allowed to remain in the shop during meal-times. According to experiments made by K. B. Lehmann in Germany, the vapour of tetrachloroethane is about 9 times as poisonous as that of carbon tetrachloride and about 4 times as poisonous as that of chloroform.—A. S.

Washing and distilling liquids; New methods used in —. C. H. Borrmann. Z. angew. Chem., 1915, 28, 377—380, 381—388.

THE author gives an account of the favourable results which have attended the introduction of the washing and distilling columns, devised by Kubierschky, into different branches of chemical industry. The washing column, suitably modified to meet special requirements, is used for washing one liquid with another, for washing and cooling gases, and for condensing vapours. In operations of this kind, the lighter liquid or the gas usually becomes specifically heavier during the treatment, and this leads to the production of local currents, eddies, etc., which interfere with the efficient working of ordinary counter-current apparatus. In the Kubierschky apparatus, the column is divided into compartments, and by means of connecting pipes or passages, the lighter liquid or gas is made to enter each compartment at the top and to flow downwards, and then to rise through the connecting pipe or passage to the top of the next higher compartment. The heavier liquid flows downwards through the column in fine streams through perforations in the partitions dividing the compartments. By the use of a washing column of this type it has been found possible to work successfully, on a commercial scale, the pro-

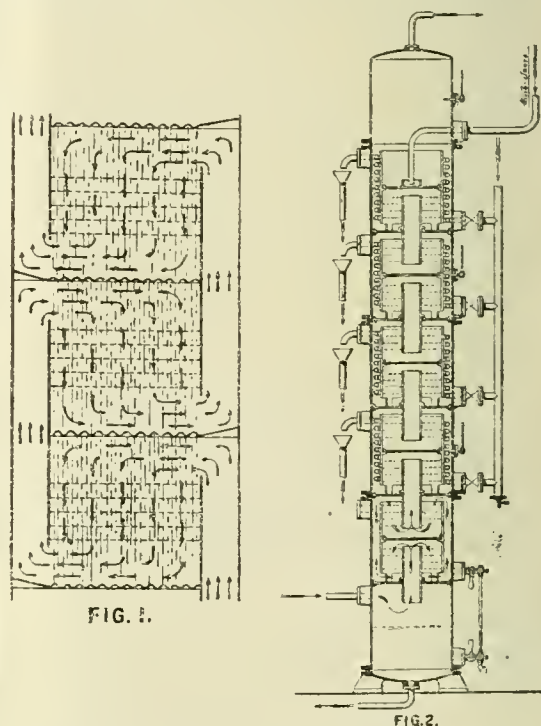


FIG. 1.

FIG. 2.

cess for refining lignite tar oil by washing with alcohol (see Ger. Pat. 232,675; this J., 1911, 610). The tar oil flows downwards through the column, a portion of which is shown in Fig. 1, whilst the alcohol enters near the bottom and leaves at the top, but flows downwards in each separate

compartment, as indicated by the arrows. The alcohol dissolves phenolic and resinous constituents from tar oil, and refined paraffin oil containing a small percentage of alcohol leaves the bottom of the column. This and the alcoholic solution of phenols, etc., are led through heat interchangers to separate distilling columns to recover the alcohol, which is used again. About 0.7 kilo. of alcohol is used per kilo. of oil, and the loss of alcohol is less than 1% of the quantity of oil treated. The cost of the process, including interest on capital, depreciation, etc., is only 110.7 per 100 kilos. of oil (about 4d. per cwt.). A similar method is used to recover the aniline remaining dissolved in the aqueous liquor obtained during its manufacture; benzene is used as solvent for the aniline. A plant capable of treating 8 cb. m. (about 280 cb. ft.) of the liquor per hour requires only one attendant. A similar form of apparatus may be used for the continuous nitration of benzene. The nitrating acid flows downwards through the column (see Fig. 2) and the benzene is introduced near the bottom and takes the path indicated by the arrows; the compartments of the column are provided with separate cooling coils as shown. The crude nitrobenzene leaving the upper part of the column passes to a washing column, where it is washed with water, and then to a distilling column to recover the excess of benzene. Toluene can be nitrated in the same way, and by controlling the rate of flow of the toluene and the mixed acid, nitration to mono-, di-, and tri-nitrotoluene can be effected in a single column. Moreover, as the fresh toluene comes in contact only with nearly exhausted nitrating acid, the undesired formation of *m*-nitrotoluene is avoided. In the Kubiarsky gas washer it is stated that the passage of the gas downwards through each compartment, in the same direction as the washing liquor, results in an increase of draught equivalent to 10–20 mm. of water. The essential feature of the new form of distilling and rectifying column is that the condensed liquid flows downwards continuously in the form of fine streams, offering a large surface to the vapour, instead of flowing from compartment to compartment through special overflow tubes; also, as in the washing column, vapours which become heavier during rectification flow downwards through each compartment of the column. In alcohol stills of this type, results are obtained equal to those furnished by stills of ordinary type of twice the height, and it is possible to prepare absolute alcohol continuously almost as cheaply as 94–95% alcohol in the usual type of apparatus. Distilling plants for the manufacture of bromine (this J., 1914, 135), each with a daily output of 300 kilos. of liquid bromine, have been installed in 20 works in Germany. Apparatus has also been devised in which, by use of superheated steam, it is possible to distil even high-boiling products (petroleum, oils, fatty acids, tar, etc.) at atmospheric pressure; the chief part of the steam is not condensed with the distillation products, but is passed through a superheater and used again. In distilling petroleum, for example, petroleum spirit is first driven off by means of live steam, and the residual oil is then pumped into a high-level reservoir and flows, at about 90° C., through a condenser, into a second column, where the lamp oil fractions, etc., are expelled by means of superheated steam. The vapours leaving the column are cooled to a little over 100° C.; the oil is thus almost completely condensed, and the greater part of the steam is passed through a steam jet blower or rotary compressor and then to the superheater, the remainder being led into the first column to distil off the petroleum spirit; by condensing the vapours from the second column in stages, any desired fractions can be obtained. In a plant of this type for tar distillation, the steam consumption

is only 5–10% of the quantity of tar, whilst for the superheater a quantity of tar or fuel oil equal to 2–3% of the quantity of tar distilled is required.
—A. S.

PATENTS.

Drying by the circulation of air; Apparatus for —. W. Yates, H. W. S. Martin, and Matthews and Yates, Ltd., Swinton. Eng. Pat. 22,158, Nov. 7, 1914.

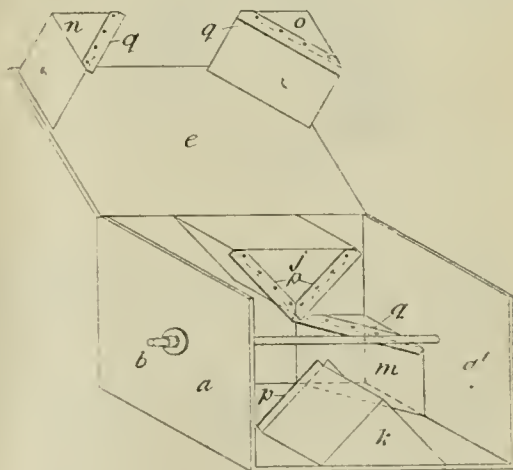
THE apparatus consists of a single drying chamber along the side of which are a number of heating chambers which open into the drying chamber. Fans are fixed in the upper parts of the heating chambers and heat radiators in the lower parts. Fresh air is admitted to the apparatus by an inlet at one end and approximately the same quantity of air is expelled at the other end so as to induce a steady and controlled flow through the apparatus. The heated air thus follows a spiral path along the drying chamber, passing through each radiator and fan in succession.—W. C. H.

Oils [e.g., lubricating oils] and other liquids; Apparatus for purifying and filtering —. W. F. Warden, Cuyahoga Falls, Ohio, U.S.A. Eng. Pat. 192, Jan. 5, 1915. Under Int. Conv., Jan. 5, 1914.

THE oil passes through an externally heated settling tank containing water, and then through a tank provided with removable filtering screens, into a second water chamber, from which it overflows into a collecting tank.—W. F. F.

Mixing dry materials; Machines for —. A. B. Lennox, A. Tate, and T. Clifton, Newcastle-on-Tyne. Eng. Pat. 2945, Feb. 23, 1915.

THE apparatus consists of a rectangular box, *a*, which can be revolved about its horizontal axis, *b*, and is provided inside with solid or hollow



triangular prisms or beaters, *j*, *k*, *m*, *n*, *o*, as shown in the figure, to agitate and mix the materials. Lips, *p*, *q*, may be attached to the inner edges of the prisms, those on the middle prisms, *j*, *k*, being parallel to the sides of the box, and those on the corner prisms, *m*, *n*, *o*, parallel to the bottom.—W. C. H.

Air-filters. G. A. Mower, and Sturtevant Engineering Co., Ltd., London. Eng. Pat. 9390, June 26, 1915.

AIR is filtered through bags which are periodically caused to collapse from both ends and are then released to allow them to extend again and come to a sudden stop, whereby a shaking "flick"

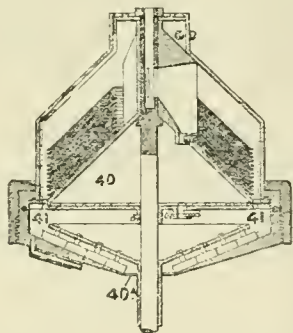
is imparted to them. The ends of the bags are attached to an upper and a lower frame, and flexible connections pass from the upper frame over pulleys to the lower frame, so that the weight of the lower frame serves to keep the upper frame at its highest position with the bags taut. Automatic mechanism periodically depresses the upper and raises the lower frame and then suddenly releases both. The filter comprises a number of filter sections, with control mechanism which successively cuts off each section from the vacuum and opens it to the atmosphere during the time occupied by the shaking in that section.—W. C. H.

Hydro-extractors and like machines. H. A. Haley, Colwyn Bay, N. Wales. Eng. Pat. 10,223, July 14, 1915.

THE hinged safety cover of a hydro-extractor is closed and opened by means of a shaft having a screw groove which engages with a sleeve, so that when the latter rises on the shaft it acts on a counterweighted arm attached to the cover and closes the latter, whilst when it descends the cover is opened. Various alternative devices are described for preventing the sleeve from descending, and thus locking the closed cover, until the machine comes to rest.—W. C. H.

Centrifugal separator. E. W. Beach, Winnetka, Ill. U.S. Pat. 1,158,959, Nov. 2, 1915. Date of appl., July 16, 1912.

A ROTATING casing is divided by a disc, 40, provided with peripheral openings, 41. Liquid is admitted to the lower part of the casing and forms



a layer on the side, which partly obstructs the openings, 41. The lighter constituent of a mixture passes upwards into the main separating compartment and the heavier constituent passes downwards to the discharge, 40a.—W. F. F.

Separating liquids [water] from gas [steam] or the like. F. Nies, T. Vogel, and F. Berg, Mannheim, Germany. U.S. Pat. 1,159,073, Nov. 2, 1915. Date of appl., Dec. 1, 1911.

A NUMBER of bars of Y-section, with the upper limbs perforated and the lower limb imperforate, are arranged in vertical and horizontal rows to form a cellular structure. Each bar is supported by adjacent bars at its longitudinal edges and at the section line of the three limbs. The bars are mounted in a frame and pressed into contact by side strips held in place by screws. The whole is contained in a casing through which the mixed fluid to be separated is passed horizontally.—W. F. F.

Separating water [vapour] from gas. H. Blan, Augsburg, Germany. U.S. Pat. 1,160,826, Nov. 16, 1915. Date of appl., Feb. 1, 1913.

A COMPRESSED mixture of water vapour and gas

is cooled in successive stages while moving upwards, the liquefied portions flowing downwards. The cooling is effected by expansion of the gases and evaporation under low pressure of part of the liquefied gases.—W. F. F.

Pump for corrosive liquids. A. Ferraris, Turin, Italy. U.S. Pat. 1,159,201, Nov. 2, 1915. Date of appl., Aug. 12, 1915.

IN a siphon pump in which a chamber containing oil is interposed between the pump cylinder and piston and a chamber communicating with it, containing corrosive liquid (see Eng. Pat. 4482 of 1914; this J., 1915, 263), the pump cylinder communicates with the oil chamber below the top of the latter, and means are provided for discharging acid gas, produced in the chamber, to the atmosphere. The discharge pipe extends over a tank which surrounds the upper part of the pump cylinder and receives oil which escapes from the piston; any oil carried by the acid gas is thus discharged into the tank and thence returned to the chamber.—W. C. H.

[Fuller's] earth-treating process and product. M. J. Welsh, Assignor to The Atlantic Refining Co., Philadelphia, Pa. U.S. Pat. 1,159,450, Nov. 9, 1915. Date of appl., Jan. 26, 1915.

FULLER'S earth or similar earthy material for filtering, decolorising, or purifying liquid, is treated with acid, washed, and calcined. The calcination may precede the acid treatment.—W. F. F.

Cements, ores, and other materials in a rotary kiln; Process of treating —. G. Polysius. Fr. Pat. 475,313, July 18, 1914. Under Int. Conv., July 18, 1913.

SEE Eng. Pat. 17,145 of 1914; this J., 1915, 963.

Vacua; Apparatus for producing —. J. H. Storm and S. G. van Welderen. Fr. Pat. 475,237, May 22, 1914.

SEE Eng. Pat. 21,508 of 1914; this J., 1915, 999.

Liquid; Apparatus for introducing — into another liquid under pressure. R. C. Parsons. Fr. Pat. 475,408, July 18, 1914.

SEE Eng. Pats. 16,751 and 29,329 of 1913; this J., 1914, 949.

Evaporation and distillation of liquids. C. T. Thorssell. Fr. Pat. 476,135, Sept. 2, 1914.

SEE Eng. Pat. 9295 of 1914; this J., 1915, 538.

Centrifugal separation of solids from liquids; Method and apparatus for the —. J. Hughes, W. O. Travis, and R. A. Sturgeon. Fr. Pat. 476,341, Oct. 19, 1914.

SEE Eng. Pat. 24,038 of 1913; this J., 1915, 263.

Impregnating liquids with carbon dioxide and other gases; Apparatus for —. A. A. Pindstoffe. Fr. Pat. 476,587, Sept. 16, 1914.

SEE Eng. Pat. 19,769 of 1914; this J., 1915, 344.

Method and apparatus for treating fluid material. U.S. Pat. 1,160,169. See X.

Process of rendering corrosive fluids non-corrosive. U.S. Pat. 1,151,255. See XX.

II.A.—FUEL; GAS; MINERAL OILS AND WAXES.

Petroleum;] Action of Florida earth on unsaturated compounds [in —]. L. G. Gurvitsch. J. Russ. Phys. Chem. Soc., 1915, 47, 827—830. J. Chem. Soc., 1915, 108, i., 933—934.

WHEN the ethereal extract of the resinous colouring

matters removed from petroleum by "floridin" is freed from ether by distillation and the residue added to the original decolorised petroleum, the resulting product is darker than the untreated petroleum. Since "floridin" contains no substances which can be extracted by organic solvents, its action on petroleum must be accompanied by chemical change of some constituent of the petroleum. That such change consists in polymerisation of unsaturated compounds is shown by the behaviour of "floridin" towards amylene and the terpenes. When freshly rectified amylene, b.pt. 39° — 10.5° C., is mixed with an equal weight of dehydrated "floridin," a considerable rise of temperature occurs; after two hours, about 15%, and after two days, about 85% of polymerised products, b.pt. above 100° C., are formed, these consisting largely of the di-amylene obtainable by the action of sulphuric acid on amylene. In the case of pinene, the addition of 5% of "floridin," causes vigorous boiling, and with a larger proportion the whole of the liquid may be projected from the containing flask. After careful treatment of a specially purified sample of pinene, b.pt. (98%) 151.8° — 157.9° C., sp.gr. at $18^{\circ}/18^{\circ}$ C. 0.8627, $[\alpha]_D = -39.6^{\circ}$, with 25% of "floridin," a liquid, sp.gr. at $18^{\circ}/18^{\circ}$ C. 0.8928, $[\alpha]_D = -5.0^{\circ}$, was obtained. Fractionation of the latter gave 6—7% of camphene, calculated on the weight of the original pinene; this yield is capable of being increased considerably. No dipentene was found, but 37% of the treated liquid, b.pt. above 200° C., apparently consisted of sesqui- and poly-terpenes. Polymerisation of amylene is effected also by carbon and by alumina, the development of heat in the latter case being more marked than with "floridin." In the case of pinene, addition of blood charcoal or alumina is accompanied by generation of comparatively little heat, and the pinene remains unchanged.

Steam turbine oils; Examination of —. F. Schwarz and J. Marcusson. Mitt. k. Materialprüf., 1914, 32, 496—502.

For determining the tar-forming value of mineral oils, the authors prefer to heat at 120° instead of 150° C. as recommended by Kissling (this J., 1906, 977; 1907, 463; 1908, 1053; 1909, 84, 591). The subsequent treatment is then facilitated, as practically no coke is formed; and the tar-forming values thus determined are just as valuable as the sum of the tar-forming and coke-forming values (Kissling) for characterising turbine oils. 50 grms. of the oil is heated in a 200 c.c. Erlenmeyer flask (diam. of bulb 7.5 cm., height 12.5 cm.) for 50 hours continuously in an air-oven at 120° C. The flask stands inside a shallow, thick-walled porcelain vessel which rests on a thick sheet of asbestos a few cm. above the bottom of the oven, and the inner wall of the oven is preferably lined with asbestos. The oil is treated with 50 c.c. of an aqueous solution containing 50% of alcohol by weight and 4% of sodium hydroxide, heated for 15 mins. at 80° C. under a reflux condenser, shaken vigorously for 5 mins., and transferred to a separating funnel. After standing over-night, the alkaline solution is filtered, extracted with 30 c.c. of light petroleum spirit, acidified with dilute hydrochloric acid, and the tarry substances removed by extracting several times with benzene. The benzene solution is washed with water, evaporated, and the residue dried at 105° C. for 10 mins. The requirements for turbine oils of good quality have been given previously (this J., 1914, 128). The portion of mineral lubricating oils soluble in acetone (Schwarz, this J., 1911, 527) has a higher tar-forming value than the original oil, and if the acetone-soluble portion be dissolved in petroleum spirit and shaken with castor oil,

the latter extracts a portion with a still higher tar-forming value. It is obtained in the form of a soft resinous mass, which can be separated by treatment with fullers' earth and extraction with petroleum spirit into about 15% of a solid resin and 85% of a viscous oil.—A. S.

Asphalts; Differentiation of natural and artificial —. J. Marcusson. Mitt. k. Materialprüf., 1914, 32, 419—431. (See also this J., 1914, 739.)

Determination of natural asphalt in admixture with artificial asphalt.—The constituents of coal-tar and coal-tar pitch which dissolve in organic solvents are almost completely converted by strong sulphuric acid into water-soluble sulphonic-acids, whereas in the case of natural asphalt, insoluble compounds richer in sulphur than the original material are obtained. The latter form a black, coal-like powder which is soluble in pyridine. A sample prepared from crude Trinidad asphalt contained 8.1% sulphur and one from the purified asphalt, 7.7%. Ten grms. of the asphalt is shaken with 75 c.c. of ether-hydrochloric acid (prepared by shaking ether with strong chilled hydrochloric acid), which is added in 3 to 4 portions, with constant shaking. After about 10 minutes' shaking 75 c.c. of water is added, and the liquid heated on the water-bath until the odour of ether has disappeared. The acid solution is filtered, and the insoluble residue washed, dried if necessary, and extracted with boiling chloroform. The extract is evaporated, the bituminous residue dried at 105° C. and weighed, and 3 grms. thereof treated with constant shaking with 6 c.c. of strong sulphuric acid, and then heated for 45 mins. on the water-bath. After cooling, it is mixed with about 200 c.c. of water, and left for an hour. The black deposit is then filtered off, washed with cold water until free from acid, dried at 105° C., and weighed. In test experiments with crude and purified Trinidad asphalt containing respectively 45 and 48% of bitumen, the quantities of insoluble matter found were 2 to 6% lower than the quantity of bitumen in the sample. It is therefore advisable to add a correction of 4% to the weight of the deposit obtained. *Saponifiable constituents.*—Natural asphalts yield, on heating, distillates with high acid and saponification values. For example, four samples gave acid values of 6.9 to 15.4 and saponification values of 28.5 to 36.5, whilst petroleum residues had acid values ranging from 0.1 to 0.4 and saponification values of 7.9 to 13.5. Five grms. of benzene-soluble bitumen is dissolved in 25 c.c. of benzene (free from thiophene), and boiled for 1 hour beneath a reflux condenser with 25 c.c. of N/1 alcoholic potassium hydroxide. After cooling, the liquid is treated with 200 c.c. of neutral 96% alcohol, which precipitates the bulk of the pitch-like substances, and is titrated without filtration with standard hydrochloric acid, using phenolphthalein as indicator. *Asphaltites.*—Syrian asphalt, gilsonite, grahamite, etc., differ from ordinary asphalt in chemical properties. They only contain a trace of free acids (e.g., 0.1 to 0.5%), with the exception of manjak (Barbados) with e.g., 2.4%. Oily constituents unattacked by sulphuric acid varied from 1.4 to 6.7%, but manjak showed 17%, and thus differed from all other asphaltites examined.—C. A. M.

New methods used in washing and distilling liquids. Borrmann. See 1.

Storage of ammoniacal liquor. Curphey. See VII.

Direct production of liquor ammoniac from gas liquor. Hilgenstock. See VII.

Absolute viscometer. Stone. See XXIII.

PATENTS.

Peat or turf; Process for the preparation of pure — and the article produced. W. von Ruckteschell, Terijöki, Finland. Eng. Pat. 5218, Feb. 28, 1914.

PEAT is dried, reduced to a fine powder by milling, passed through a sieve, and exposed to a current of air which separates it from the heavier impurities. (Reference is directed, in pursuance of Sect. 7, Sub-sect. 4, of the Patents and Designs Act, 1907, to Eng. Pats. 2831 of 1870, 17,096 of 1903, and 700 of 1904; this J., 1904, 897; 1905, 322.)—W. F. F.

Sawdust; Process for briquetting—. M. Perlewitz, Berlin. Ger. Pat. 286,846, Aug. 15, 1911.

SAWDUST is mixed cold with from one-fifth to one-quarter of its weight of crude naphthalene, and the mixture is pressed in hot moulds.—A. S.

Coke; Removal and loading of a mass of — located on a quenching bench. C. Still, Recklinghausen, Germany. Eng. Pats. (A) 8609, June 10, and (B) 8705, June 12, 1915. Under Int. Conv., June 26 and Nov. 16, 1914. Additions to Eng. Pat. 7364, May 17, 1915 (this J., 1915, 1045).

(A) COKE which has been discharged from a coke-oven on to a stationary quenching bench, is moved forward over a grating formed of T-irons extending longitudinally, the flanges of which are gradually tapered so that the width of the gaps increases in the direction of movement of the coke. (B) The coke on the quenching bench moves forward over a grating which is at first substantially horizontal and then slopes downwards.

—W. F. F.

[Gas] retorts; Machines for charging and discharging—. J. G. W. Aldridge, London. Eng. Pat. 22,066, Nov. 5, 1914.

A CHARGING scoop, open at the bottom, and composed of a side frame and pivoted front push-plate, is operated by a chain which is wound on a polygonal drum. The chain is made in stepped widths so that it may all be wound upon a relatively small drum, the wider sections being formed of series of pairs of parallel links spaced apart to accommodate narrower sections. A plate is provided to form a bottom for the charging scoop when outside the retort.—W. F. F.

[Gas] retort houses. A. McD. Duckham, Ashted, Surrey. Eng. Pat. 24,289, Dec. 18, 1914.

IN a vertical-retort house, the hot air from the bottom of the settings is deflected by covers through gratings in the side walls of the house, so as to prevent overheating of the working platforms above. Cooler air may be supplied to the space above the covers through openings in the walls, or through a ventilating shaft extending downwards to a suitable level.—W. F. F.

Water-gas; Using exhaust steam in the manufacture of—. H. E. Smith, London. Eng. Pat. 23,052, Nov. 25, 1914.

IN water-gas producers of the intermittent type, the exhaust steam from the turbine which operates the blower is passed into the producer through a liquid seal, which may be adjusted in depth to give the required pressure.—W. F. F.

Water-gas generator. Dellwik-Fleischer Wassergas-Ges., Frankfurt, Germany. Ger. Pat. 286,600, June 27, 1913.

THE cylindrical generator is divided into two compartments by a vertical partition which does not extend to the top. During the "blow" period, separate blasts of air are forced through the two compartments, but in the gas-making stage the

steam passes through the two compartments in succession. In this way the formation of carbon monoxide is minimised during the "blow" and increased during the gas-making period.—A. S.

Gas producer. W. J. Lindsay, Philadelphia, Pa., Assignor to Camden Iron Works, Camden, N.J. U.S. Pat. 1,160,516, Nov. 16, 1915. Date of appl., Nov. 12, 1913.

THE rotating cylindrical body of the producer is provided with a fixed cover having two eccentric holes, and a fixed beam above. Bent stirring bars supported by the beam, and adjustable vertically, project through the holes, and are rotated by gearing.—W. F. F.

Fuel for internal combustion engines; Liquid — [from tar oil]. G. E. Heyl and T. T. Baker, London. Eng. Pat. 23,014, Nov. 24, 1914.

A LIQUID fuel for use in internal combustion engines with a suitable (paraffin) carburetter, is obtained from the middle oil distilled from coal tar between 170° and 230° C., by mixing with 10–30% of caustic soda in aqueous solution, separating, treating with 2–5% of sulphuric acid, washing, and cooling to 4° C.; the oil is pressed or decanted from the naphthalene which separates, then distilled and the fraction up to 230° C. collected, thereby retaining in the still substances which would give a deposit on admixture of the tar oil with a mineral oil; the redistilled oil is cooled to 4° C., and the naphthalene-like solid which separates removed by pressing or decanting; finally the oil obtained is mixed with petrol, paraffin oil, or other hydrocarbon liquid fuel.—F.W.A.

Distilling oil; Method of and apparatus for—. J. T. Davis, Alameda, Cal., Assignor to F. W. Clayton, San Francisco, Cal. U.S. Pat. 1,159,186, Nov. 2, 1915. Date of appl., July 22, 1913.

OIL is sprayed against an abutment in the first of a series of evaporating chambers with sloping bottoms, connected to individual condensers, and heated by sand baths. The oil is withdrawn from each chamber, passed through a steam-heated coil, and discharged against the abutment of the next chamber.—W. F. F.

Gas from bituminous fuels; Process for the production of — in intermittent operation. P. Koster, Assignor to Dellwik-Fleischer Wassergas-Ges. m.b.H., Frankfurt, Germany. U.S. Pat. 1,160,908, Nov. 16, 1915. Date of appl., Jan. 24, 1914. SEE Fr. Pat. 466,422 of 1913; this J., 1914, 585.

Illuminating gas; Process of purifying and enriching—. Comp. Franç. du Centre et du Midi pour l'Eclairage au Gaz. Fr. Pat. 475,486, Feb. 26, 1914.

SEE Eng. Pat. 5764 of 1914; this J., 1915, 268.

Gases; Purification of [combustible]—. E. I. Hall. Fr. Pat. 476,475, Nov. 5, 1914.

SEE U.S. Pat. 1,120,475 of 1914; this J., 1915, 91.

Petroleum; Process of distilling crude—. S. W. Whitmore. Fr. Pat. 476,190, Sept. 17, 1914.

SEE U.S. Pat. 1,125,422 of 1915; this J., 1915, 218.

Petroleum and other oils; Process and apparatus for treating—. Lucas's Low Pressure Oil Cracking Process, Ltd. Fr. Pat. 476,603, Nov. 24, 1914.

SEE Eng. Pats. 12,653 and 18,923 of 1914; this J., 1915, 707.

Fuel for internal-combustion motors and like purposes. H. Goldstein. Fr. Pat. 476,494, Nov. 10, 1914.

SEE Eng. Pat. 21,316 of 1914; this J., 1915, 947.

Apparatus for purifying and filtering oils and other liquids. Eng. Pat. 192. Sec I.

Heating device for corrosive gases, vapours, and liquids, especially for heating the liquor in the direct recovery of ammonia. Ger. Pat. 286,606. Sec IIb.

Eliminating sulphur from oils. Eng. Pat. 22,117. Sec III.

Ammonium compounds. [Absorption of ammonia by peat.] Eng. Pat. 18,558. Sec VII.

Petrol-proof paint. Eng. Pat. 997. Sec XIII.

IIb.—DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

Hefner lamp; Dependence of the light of the — on atmospheric conditions, more especially atmospheric pressure. E. Ott (translated by W. J. A. Butterfield). J. Gas Lighting, 1915, 132, 378—381.

THE formulæ proposed by E. Liebenthal, Charlottenburg, and W. J. A. Butterfield, J. S. Haldane, and A. P. Trotter (this J., 1911, 1005), for calculating the variation of illuminating power of the Hefner lamp due to differences of atmospheric pressure and percentage of aqueous vapour and of carbon dioxide in the air, show some divergence, and further investigations have therefore been made by the author at the suggestion of the International Photometric Commission. Experiments were first made at various elevated stations in Switzerland and in a mine in Alsace, but the results were unsatisfactory. A series of experiments was then made in a closed iron vessel through which a constant stream of air was passed; the pressure inside the vessel could be varied from about 800 to 600 mm. of mercury. From the results obtained the author concludes that while for variations of pressure from 816 to 717 mm. Liebenthal's formula is correct, when the pressure varies from 717 to 614.5 mm. it gives too low a result; and while the formula of Butterfield, Haldane, and Trotter gives a correct average over the whole range, their points lie on a straight line, while the author's lie on a curve. With regard to the influence of aqueous vapour the results did not differ seriously from those obtained by the previous observers, but were rather nearer those of Butterfield, Haldane, and Trotter. The influence of carbon dioxide was found to vary considerably and to depend upon whether the carbon dioxide was introduced as such or was the result of combustion and breathing in the atmosphere in which the experiments were carried out. The author concludes that it is desirable to carry out the determination of illuminating power in a well-ventilated room, and proposes the following formula, which omits any reference to the variations in the percentage of carbon dioxide: $y = 1.019 - 0.0055x + 0.00011(b - 760)$, where y = illuminating power, x = volume, expressed in litres, which the aqueous vapour associated with 1 cb. in. of dry air, free from carbon dioxide, would have at the same temperature and pressure, and b = atmospheric pressure between 717 and 816 mm.—W. H. C.

Electric arc; The consumption of carbon in the —. I. Variation with current and arc length. II. Influence upon the luminous radiation from the arc. W. G. Duffield. Proc. Roy. Soc., 1915, A 92, 122—143.

THE loss of an atom of carbon from the cathode of a very short carbon arc is accompanied by the transfer, between the poles, of a quantity of electricity equivalent to four electronic charges. This has been determined from observations of the consumption of carbon with varying conditions of current density and length of arc, and from the theoretical value of the electrochemical equivalent of carbon. In long arcs, in addition to this loss due to actual transmission of the electric current, carbon is consumed by combustion or evaporation. The author discusses the bearing of the research upon the various theories of the electric arc, and also shows that increase in brightness of the arc in air is intimately connected with the increase in consumption of carbon.—B. N.

PATENTS.

Heating device for corrosive gases, vapours, and liquids, especially for heating the liquor in the direct recovery of ammonia. Bergwerkses. Trier, Hamm, Germany. Ger. Pat. 286,606, Sept. 30, 1914.

A METAL tube, to which the heating agent is supplied, is enclosed in an outer vessel of quartz or similar material not attacked by the gas or liquid to be heated, and the intermediate space is filled with a liquid to serve as heat-transmitting medium.—A. S.

Tungsten filaments for electric incandescence lamps; Manufacture of —. E. R. Grote, Merton Park, and J. W. H. Reynolds, Streatham Common, Surrey. Eng. Pat. 22,057, Nov. 5, 1914.

A MIXTURE of tungstic acid or sodium tungstate with gelatinous aluminium hydroxide is used as a binder for metallic tungsten or its compounds.—B. N.

Incandescence lamp. F. Skaupy, Berlin, Assignor to General Electric Co., New York. U.S. Pat. 1,159,111, Nov. 2, 1915. Date of appl., Nov. 3, 1910.

A TUNGSTEN-FILAMENT lamp is provided with an inorganic halogen compound, e.g., of thallium, having a vapour pressure adapted to generate, at the temperature attained during the normal working of the lamp, a halogen-containing atmosphere having a pressure not exceeding that of "a first-class vacuum." The atmosphere is chemically active towards tungsten, and renders the deposit on the bulb less light-obscuring than a tungsten deposit.—B. N.

Electrode; Arc-lamp —. C. Field, Assignor to National Carbon Co., Cleveland, Ohio. U.S. Pat. 1,158,997, Nov. 2, 1915. Date of appl., Aug. 8, 1913.

A CARBON conducting body is combined with the double fluoride of potassium and zirconium.—B. N.

Electrode; Arc-lamp —. G. M. Little, Pittsburgh, Pa., Assignor to Westinghouse Electric and Manufacturing Co. U.S. Pat. 1,159,511, Nov. 9, 1915. Date of appl., Mar. 3, 1914.

THE electrode contains a metallic oxide mixed with titanium and tungstic oxides.—B. N.

Peat; Treatment of —. Apparatus for the heat treatment of peat. N. Testrup, London, and T. Rigby, Dumfries. Assignors to Wetcarbonizing, Ltd., London. U.S. Pats. 1,160,463 and 1,160,464, Nov. 16, 1915. Dates of appl., Feb. 25, 1913, and Sept. 24, 1914.

SEE Fr. Pat. 455,896 of 1913; this J., 1913, 937.

Gases of dry distillation: Purifying—and recovering by-products. K. Burkheiser, Assignor to Burkheiser und Co., Hamburg, Germany. U.S. Pat. 1,160,836, Nov. 16, 1915. Date of appl., Aug. 7, 1912.

SEE Fr. Pat. 448,728 of 1912; this J., 1913, 413.

Volatile products from solid carbonaceous material; Separation of—. Oil and Carbon Products, Ltd. Fr. Pat. 475,238, July 16, 1914.

SEE Eng. Pat. 15,368 of 1914; this J., 1915, 1081.

Incandescence bodies for electric lamps. C. O. Bastian. Fr. Pat. 476,589, Sept. 25, 1914.

SEE Eng. Pat. 22,331 of 1913; this J., 1914, 1197.

III.—TAR AND TAR PRODUCTS.

Tar; Partial distillation of— in a Wilton's continuous still. F. Livesey. Southern Gas Assoc., Nov. 11, 1915. J. Gas Lighting, 1915, 132, 373—375.

THE plant, of a capacity of 4000 galls. of crude tar per 24 hours, consisted of a feed tank of 550 galls. capacity, a heat interchanger, a cast iron coil still having 12 circular coils, 3 feet diam. and 2 inch bore, and an expansion box from which the tar flowed through the heat interchanger to the finished tar tank. The vapours passed through a condenser and purifier. Owing to the high water content of the tar under treatment it was found that working at 130° C. in the tar it could not be completely dehydrated. Further the crude tar leaving the heat interchanger only had a temperature of 60° C. By interposing a steam heater between the interchanger and the still, the temperatures were easily raised to 150° and 100° C. respectively, and 3000 galls. of tar per 24 hours was dehydrated. The condenser being too small, a small cast-iron washer was added, and in order to obtain tar containing less naphthalene, and more suitable for roads, the plant was worked at 170° C. and an additional condenser was placed between the expansion box and the final condenser. By keeping the first condenser at 93° C., oil of the following quality was obtained:—Sp.gr. 1.028; water, 3%; phenols, 9%; and naphthalene, 26.3%; liquid at 30° C. The naphtha after two washings and three distillations yielded 45.5% of benzol giving 90% at 120° C.

Tar treatment for toluol extraction. The toluol content of tar treated at various temperatures in the still is shown below:—at 190° C., 0.2%; at 200°, 0.153; at 210°, 0.025; at 220°, 0.007 to nil; at 230°, nil. To reach a temperature of 200° C. it was necessary to add 4 more coils to the still, making 16 in all. The following table gives the capacity of the plant at various temperatures:—

	230° C.	220° C.	210° C.	200° C.	190° C.
Crude tar, galls. per hour ..	222.8	198.8	192.8	225.6	179.7
Dehydrated tar, galls. per hr.	107.0	138.0	129.5	156.9	132.8
Dehydrated tar, %.....	48.0	69.4	62.6	69.5	73.0

The comparison of the results obtained by working at 220° and 200° C. is shown below.

At 220° C. the financial results are as follows:—

	£	s.	d.
By 556 gallons of refined tar at 2½d. per gallon	6	7	5
206 gallons of creosote at 5½d. per gallon	6	8	7
62½ gallons of naphtha			
67½ gallons of 5° Tw. (sp.gr. 1.025) liquor at ½d. ..	4	1	
	£13	0	1

Less working costs:

	£	s.	d.
884 gallons of crude tar at 2½d. per gallon	8	5	9
Labour, 6½ hours	3	0	
Coke, 3 cwt. at 1s. 6d. per cwt.	4	6	
Interest and depreciation at 7% on £400, adjusted to gallonage	1	7	
	£8	14	10

The net profit is thus £4 5s. 3d. or nearly 1.15d. per gallon of crude tar treated. At 200° C. the financial results were:—

	£	s.	d.
By 580 gallons of refined tar at 2½d. per gallon	6	12	11
185 gallons of creosote at 5½d. per gallon	5	18	10
63 gallons of naphtha			
78 gallons of liquor at ½d. per gallon	4	9	
	£12	16	6

Less working costs:—

	£	s.	d.
907 gallons of crude tar at 2½d. per gallon	8	10	1
Labour, 6 hours	2	9	
Coke, 2½ cwt. at 1s. 6d.	3	9	
Interest and depreciation at 7% on £400, adjusted to gallonage	1	8	
	£8	18	3

Net profit, £3 18s. 3d., or 1.03d. per gallon of crude tar treated.

When shutting down the plant the following precautions should be observed:—The fire is drawn and dehydration continued until the temperature has fallen to 130° C.; the tar is then diverted from the expansion box and circulated back to the feed tank until the temperature has fallen low enough for it to be safe to pump water through the coil still to displace the tar. The heat interchanger is then drained out and the plant is ready for starting at any time. The plant has treated 1,200,000 gallons of crude tar, and the repairs have been practically nil. The cost was £265 for the plant and £130 for the building. The pressure in the still varied: with tar containing 7—15% water it was from 15 to 25 lb. per sq. in., but with tar containing 30% of water it was higher. The heat efficiency of the plant was from 38 to 40%.
—W. H. C.

Tar dehydration; Notes on—. R. Wardell. J. Gas Lighting, 1915, 132, 375—376.

A "HIRD" continuous plant to deal with 20 tons of tar per day consisted of a mild steel rectangular still, 11 ft. by 5 ft. by 3 ft. 6 ins. deep, fitted with one horizontal row of five 6-inch longitudinal steel tubes, through which the gases from a coke breeze furnace pass. Vertical 21-inch baffle-plates cause the tar to travel four times backwards and forwards through the still, giving a total path of about 40 ft. The tar flows from the store tank to the still through the inner tube, 11 ft. long by 1 ft. diam., of a heat interchanger, the outer tube being 11 ft. long by 2 ft. diameter. The dehydrated tar flows through the annular space to the store tank. The condenser is 4 ft. diam. by 7 ft. deep, and is fitted with a 3-inch coil. The tar enters the still at 71° C. and travels through it in a layer of about 15 inches deep. The table below shows the result of a test with carburetted water-gas tar working at a still temperature of 147° C.

	Crude tar.	Dehydrated tar.	Distillate.
Water	31%	less than 1%	91%
Light oils (up to 170° C.) .	15%	7½%	2½%
Specific gravity.....	1.054	1.067	0.905

	15 hours.	24 hours.	Cost per 24 hours.
Tar (galls.).....	1110	2256	£ s. d.
Fuel (cwt.).....	14.3	23	11 6
Steam, oil, etc.			2 6
Wages			8 3
Interest and depreciation			3 10
			£1 6 1

This cost is equivalent to 0.11d. per gallon, or 2s. 5½d. per ton of tar treated.

With coal tar, working with a still temperature of 204° C., all the light oils and most of the phenols are driven off, but it is necessary to work at 260° C. to prepare tar to comply with No. 2 Specification of the Road Board. Details of the two tests are given below. At 204° C. the distillation tests gave the following results:—sp.gr. 0.950; 100 c.c. on fractionation gave 5% at 100° C. and 17% at 120° C.; tar acids (phenols) 11%.

The treated tar was entirely free from water. At 260° C. the distillation test of the prepared tar was as follows:—Up to 140° C., no water; 140° to 220° C., 2.6%; 140° to 300° C., 22%. The prepared tar had sp.gr., 1.21; distillate: sp.gr., 0.995; 100 c.c. fractionated gave 23% at 200° C.; tar acids (phenols) 18%; pyridine bases, 3%.

Working at the higher temperature it was found necessary to introduce steam into the condenser to prevent naphthalene from crystallising.—W. H. C.

Carbolic oil; Process for the preparation of—F. Raschig. Z. angew. Chem., 1915, 28, 409—412.

THE German "middle oil" from tar distillation is relatively poor in phenol and the preparation of a carbolic oil rich in phenol is an essential preliminary to the caustic soda extraction. This is achieved most successfully by fractional distillation of the middle oil *in vacuo*. A still of 5–20 cb.m. capacity, heated with steam under 6–8 atmospheres pressure, is connected by a wide, slightly inclined still-head to the base of a column, 14 m. high and 60 cm. diameter, filled with Raschig's rings (see Eng. Pat. 6288 of 1914; this J., 1915, 907), and provided with a reflux tube at the bottom leading back into the still. The column is surmounted by a dephlegmator leading to a worm condenser, from which a vertical exit pipe at least 12 m. long to overcome, when full, the atmospheric pressure, discharges the distillate into the open air under normal pressure, and it can thus be sampled from time to time as desired. The condensing water is run first through the condenser and then through the dephlegmator, and the distillation is so arranged that about four times as much vapour is condensed in the latter as in the former. Under these conditions, with a column of the height specified, a fraction (solvent naphtha II.) free from phenol is first obtained, and then, by a fairly sudden transition, carbolic oil passes over containing 30–40% of phenol. Eventually the phenol content sinks to 20–25% and the oil on cooling to 15° C. deposits naphthalene, at which point the distillation is stopped, and the residue in the still is run into a cooling bath to crystallise. With the same plant a considerable carbolic oil fraction can be obtained from "light oil," and at the same time commercial benzol and toluol are obtained of better quality than by the usual methods, and quite free from phenol.—G. F. M.

Sodium phenoxides; Hydrolysis of—in aqueous solution. D. R. Boyd. Chem. Soc. Trans., 1915, 107, 1538—1546.

DETERMINATIONS of the hydrolysis constants of the sodium compounds of phenol and a series of

alkyl-substituted phenols were made by the method of Shields (this J., 1893, 632), and either by calculation or direct measurement the results were referred to *N*/32 solutions at 25° C. It was thereby shown that the acidity of phenol is diminished by the introduction of alkyl groups, contrary to the statements of Bader (Z. physik. Chem., 1890, 6, 290). The alkyl group is most effective in the *ortho*-position, slightly less in the *para*-, and much less effective in the *meta*-position. An isopropyl group in the *ortho*-position acts much more strongly than a methyl group, but in the *meta*-position this difference is not noticeable; thus thymol is much less acidic than carvacrol. A methoxy group in the *ortho*-position to the hydroxyl group scarcely alters the dissociation constant of the phenol. The percentage degrees of hydrolysis of the sodium compounds of the following phenols in *N*/32 solution illustrate the above conclusions: Guaiacol 5.58, phenol 5.60, *m*-cresol 6.08, *p*-cresol 7.27, *o*-cresol 7.51, *o*-4-xylenol 8.28, *p*-xylenol 8.57, carvacrol 8.83, *m*-6-xylenol 10.07, thymol 10.31, ψ -cumenol 10.96, and mesitol 13.83.—G. F. M.

Thiophen in benzene; Determination of—V. Paolini and B. Silbermann. Atti R. Accad. Lincei. 1915, [v], 24, ii, 206—210. J. Chem. Soc., 1915, 108, ii, 806.

THE following method for the estimation of thiophen in benzene gives good results. A little more than the calculated quantity of mercuric oxide is dissolved in glacial acetic acid, and the liquid cooled, mercuric acetate being deposited. The benzene to be tested is then added, and the mixture heated on a boiling water-bath for about fifteen minutes. The precipitate formed, consisting solely of thiophen tetramercuriacetate, is separated from the cold liquid, washed several times with ether, dried at 100° C., and weighed.

Piperidine analogues, in which the nitrogen is replaced by phosphorus, arsenic, antimony, or bismuth. G. Grüttner and M. Wiernik. Ber., 1915, 48, 1473—1486.

A NEW series of heterocyclic compounds has been prepared containing five carbon atoms and one atom of phosphorus, arsenic, antimony, or bismuth. Cyclopentamethylenephosphine, $C_5H_{10}P.C_6H_5$, was obtained by the action of the magnesium compound of 1.5-dibromopentane on phosphenyl chloride, and is a stable colourless oil of b.pt. 154°—155° C. (22—24 mm.), slightly soluble in water, readily soluble in alcohol, ether, benzene, and petroleum spirit. Cyclopentamethylenephosphine, $C_5H_{10}As.C_6H_5$, and cyclopentamethylenephosphine, $C_5H_{10}Sb.C_6H_5$, are produced in a similar manner, and are colourless viscous oils of b.pt. 153°—154° C. and 169°—171° C. (18—20 mm.). Ethyl-cyclopentamethylenephosphine, $C_5H_{10}Bi.C_2H_5$, is obtained by the interaction of ethyl-bismuth-dibromide and the magnesium compound of 1.5-dibromopentane, and forms a pale yellow viscous oil of b.pt. 108°—112° C. (18—20 mm.).—F. W. A.

Hydrogenated aromatic hydrocarbons; Thermal decomposition of—D. T. Jones. Chem. Soc. Trans., 1915, 107, 1582—1588.

THE thermal decomposition of cyclohexane, methylcyclohexane, and di- and tetrahydronaphthalene in contact with porous porcelain was studied. Contrary to expectation, scission between carbon and hydrogen was very pronounced, the gaseous products containing 40% of hydrogen with the first two substances, and 80% with the latter two, in marked contrast to the behaviour of hexane and the cyclopentanes and cycloheptanes, from which scarcely any hydrogen is eliminated. The hydrogenated aromatic com-

pounds approach therefore the aromatic hydrocarbons in this respect, but it should not be inferred that they have retained their aromatic structure intact with six extra hydrogen atoms loosely attached, since the scission of the carbon-carbon bonds takes place apparently with the same facility as the scission of the carbon-hydrogen bonds, as evidenced by the presence of methane, ethylene, etc., in the products of decomposition. The decomposition of the cyclohexanes and of tetrahydronaphthalene commenced at 490°—510° C., and benzene and naphthalene respectively were formed in considerable quantities in addition to the gaseous products, which in the first case contained hydrogen, methane, ethane, and ethylene, with but traces of acetylene, and in the latter case, hydrogen and methane only. Dihydronaphthalene decomposed in a similar way at about 390° C.—G. F. M.

Sulphonic acids; Conversion of aliphatic and aromatic—into aldehydes and phenols. J. A. Mandel and C. Neuberg. *Biochem. Zeits.*, 1915, 71, 180—185. *J. Chem. Soc.*, 1915, 108, i., 934.

THE sulphonic group in aliphatic and aromatic sulphonic acids is readily removed as sulphuric acid by the action of hydrogen peroxide in the presence of a minute quantity of a ferric salt, but the yields are not sufficiently good for the general use of the method for the preparation of aldehydes and phenols. Ethanesulphonic acid, when treated in this way, yields acetaldehyde, aminoethanesulphonic acid (taurine) yields aminoacetaldehyde, benzenesulphonic acid yields phenol, resorcinol, and catechol, and toluene-*o*-sulphonic acid yields benzaldehyde.

2-Aminopyridine; Nitration of—. II. A. E. Tschitschibabin and B. A. Razorenov. *J. Russ. Phys.-Chem. Soc.*, 1915, 47, 1286—1296. *J. Chem. Soc.*, 1915, 108, i., 992.

FURTHER experiments have shown that in the nitration of 2-aminopyridine (this *J.*, 1915, 863), the hydrogen of the amino-group is first replaced, the initial product being pyridyl-2-nitroamine, which subsequently undergoes isomerisation into 3- and 5-nitro-2-aminopyridines. In comparison with the analogous benzenediazoic acid, pyridyl-2-nitroamine exhibits marked stability towards acids, its solution in concentrated sulphuric acid undergoing decomposition slowly at the ordinary temperature and very slowly indeed below 0° C.; on heating, however, isomerisation occurs readily and yields principally 3-nitro-2-aminopyridine, the proportion of the 5-nitro-compound increasing with the temperature. By the further action of nitric acid, 5-nitro-2-aminopyridine yields 5-nitropyridyl-2-nitroamine, and this undergoes isomerisation, forming 3,5-dinitro-2-aminopyridine, long straw-yellow needles, m.pt. 191°—192° C. A characteristic property of the nitroamines of pyridine is the almost complete loss of the basic properties of the nitrogen atom of the pyridine nucleus, whereas the acidic properties are strongly marked.

New methods used in washing and distilling liquids. Borrmann. See I.

Differentiation of natural and artificial asphallums. Marcusson. See II.A.

Catalytic reduction of aldehydes and ketones. Skita. See XX.

Action of alkalis on trinitrotoluene. Copisarow. See XXII.

PATENTS.

Oils [e.g. tar oils]; Eliminating sulphur from—. E. V. Evans, and South Metropolitan Gas Co., London. Eng. Pat. 22,147, Nov. 6, 1914.

THE oil is vaporised, mixed with 5—10% of hydrogen, or with a gas containing hydrogen, and passed over a heated catalytic or contact substance such as nickel deposited on fireclay. Hydrogen sulphide is formed, and is removed by any known means. If the oil cannot be distilled, it may be heated in contact with the catalyst while hydrogen is passed through or over it.—W. F. F.

Liquid fuel for internal combustion engines [from tar oil]. Eng. Pat. 23,014. See II.A.

IV.—COLOURING MATTERS AND DYES.

Manufacture of organic dyestuffs [in France]. A. Wahl. *Bull. Soc. d'Encouragement pour l'Ind. Nationale*, 1915, 122, 492—509.

THE French coal-tar dyestuff industry may be said to date from the technical production of aniline by Béchamp by the reduction of nitrobenzene with iron and acetic acid, introduced by Dalsace into his works at Saint-Denis in 1862; this was followed by the manufacture of dimethylaniline in 1866 by Poirrier and Bardy by heating aniline salt and methyl alcohol in autoclaves at a pressure of 30 atm., which led to the production by Lauth of Paris Violet; the technical separation of benzene and toluene by Coupiér at Creil; Rosenstiehl's discovery of *o*-toluidine; the work of Grimaux and de Laire on Diphenylamine Blues, and the discovery of the first azo dyestuff by Roussin in 1872. Among the reasons to which must be attributed the failure of the French to establish a colour industry, is the patent legislation, according to which a new substance may be made the subject of a patent, so that the inventor of a much preferable method of production is unable to work the new process until the patent for the substance itself has expired. For example, the Magenta patented by Verguin was obtained only in poor yield, but Gerber-Keller was unable to work in France his process using mercury nitrate, which gave a much better yield, and had to take the process to the firm of Geigy at Basle. Again, in 1867 Coupiér suggested the nitrobenzene process, a considerable advance on the arsenic process, but he was able to patent the process when Rosenstiehl succeeded in showing that the toluidine used by Coupiér gave a Magenta which was the homologue of Verguin's product, and hence differed from the patented product. The Indanthrenes, discovered and patented in France, were eventually marketed by German firms on account of the original process being less economical. To render ineffective the laws regarding the working of a patent within two years, failing which licences to work must be granted, the German firms have established branches in France as well as England, where dyestuffs are not really manufactured, but merely finished. The imposition of a duty of 1 fr. per kilo. on dyestuffs, and 0.15 fr. per kilo. on intermediate products, whereas raw materials are free from duty, has led to fine distinctions. Thus the colourless leuco-bases of the triphenylmethane dyestuffs are admitted as intermediate products. The author urges the elimination of these anomalies, but points out that prohibitive fiscal measures are not to be considered the remedy. The educational and commercial systems are responsible in part for the non-success of the industry. The German patents in the colour industry number over 300 per annum. New products are

placed on the market in a continuous stream with a progressive decrease in the selling price.

The German exports (in tonnes) of coal-tar colours other than Alizarin and Indigo in 1912 to the following countries were: Belgium, 2145; France, 1229; Great Britain, 11,054; Italy, 3879; Holland, 1358; Austria-Hungary, 5781; Russia, 1265; India, 3558; China, 3727; Japan, 3715; United States, 11,592.

The German exports of dyestuffs and certain products used in their manufacture in 1913 were as follows:—

	Kilos.	Value in francs.
Aniline and its salts	7,264,000	7,398,750
Naphthols and naphthylamines	3,106,400	3,797,500
Sodium nitrite	198,300	131,250
Aniline colours	64,287,900	177,598,750
Alizarin	6,132,600	11,657,500
Anthracene colours	4,907,000	15,308,750
Indigo	33,352,800	66,653,750
Indigo carmine.....	256,500	1,181,250
		233,727,500

or a total value of over 11½ millions sterling.

Regarding the future of the French colour industry, the author points out that the manufacture of dyestuffs is now established at Paris, Nancy, and Lyons, and it will be possible to get together a nucleus of specialists, but it will not be so easy to find men trained in the various branches of manufacture; these, however, could doubtless be induced to come from Switzerland if necessary. The question of capital should offer no difficulty (the Saint-Denis Société has decided to increase its capital), and may be used for the extension of existing resources, as in the case of British Dyes, Ltd., in England. The present production of crude tar products is not equal to the demand, the principal source of the coal-tar being from the manufacture of metallurgical coke, not from gas-works. For example benzene has been imported from Belgium, Great Britain, and Germany.

It is not regarded as probable that sentiment will play much part eventually in the purchase of dyestuffs, and hence it will be essential to offer colours practically at the same prices as German firms.

For the present it will be most desirable to concentrate on the manufacture of colours of which the patents have expired; but such products are in many cases sold at a very low price, as the original patentees have had the opportunity to develop the plant and process. The manufacture of the necessary intermediate products further increases the difficulty of the problem, but every problem can be solved, given time and money, and definite objects.—F. W. A.

Coupling of diazonium salts with amines, phenols, and phenolic ethers: Mechanism of the —. P. Karrer. Ber., 1915, 48, 1398—1406.

WHEN dibutyl- or di-isoamyl-aniline is coupled with a diazo compound, such as diazotised sulph-anilic acid, one of the alkyl groups is eliminated, giving mono-alkylated compounds of the formula, $\text{RHN.C}_6\text{H}_4.\text{N}:\text{N.C}_6\text{H}_4.\text{SO}_3\text{Na}$. K. H. Meyer (this J., 1914, 687) has stated that, at least in the case of coupling with phenolic ethers, diazonium salts first attach themselves to the conjugated double linkage of the benzene ring, whereas Auwers and Michaelis (Ber., 1914, 47, 1286) consider that the diazonium salts attach themselves to the alkoxy-groups. Auwers and Michaelis found that on coupling with diazonium salts the alkyl residue of the alkoxy-group is eliminated, giving

hydroxyazo dyestuffs, whereas according to Meyer mixtures of alkoxyazo- and hydroxyazo-dyestuffs are produced. The difference in the behaviour of the alkylated anilines on coupling is considered by the author to be due to the heavier butyl or isoamyl groups absorbing much more of the nitrogen affinity than the methyl groups, hence giving a conjugated double linking of a much greater degree of unsaturation. According to Meyer's theory this should lead to a greater affinity for diazonium salts, which is apparently not the case. The mechanism of the reaction is quite clear if the diazo-compound is considered to attach itself first to the nitrogen atom, for the larger the alkyl groups the larger the amount of the nitrogen affinity they absorb, and the less does coupling tend to take place. In the case of large groups, e.g., in di-isoamylaniline, the addition of the diazonium salt can only occur when one amyl residue has been eliminated and replaced by the diazo-residue, which then migrates to the *para*-position. The fact that dimethyl-*o*-toluidine does not as a rule couple with diazonium salts, whereas the *para*-isomer couples readily, is also opposed to Meyer's views. The most probable hypothesis to explain the mechanism of the coupling process is considered to be as follows: In coupling a diazonium salt with a primary, secondary, or tertiary amine, a phenol, or a phenolic ether, the diazo compound first attaches itself to the nitrogen or oxygen atom to form ammonium or oxonium compounds, and then the azo dyestuff is produced by intramolecular rearrangement. In case the nitrogen or oxygen atom is too heavily loaded, having no longer sufficient residual affinity, an alkyl group must first be eliminated.—F. W. A.

Indigotin from indican; Photochemical formation of —. C. Neuberg and E. Schwenk. Biochem. Zeits., 1915, 71, 219—225. J. Chem. Soc., 1915, 108, i., 1004.

IN the presence of various catalysts (ferrous sulphate, uranyl sulphate, manganous sulphate, cerous sulphate, sodium anthraquinone-2.7-disulphonate, etc.), indican is converted into indigotin by the action of ultra-violet rays.

Triphenylmethane derivatives; Colour reactions of —. E. Noelting and A. Kempf. Bull. Soc. Chim., 1915, 17, 385—389.

THE halochromy shown by triarylcannabinols in the formation of salts has been investigated. The coloration increases in intensity and the basic properties are increased by the introduction of OH or OCH_3 groups. Dale and Schorlemmer showed that rosolic acid gives with hydrochloric and sulphuric acids well defined compounds which are not hydrolysed by water, and it has now been found to give a crystalline picrate. As Baeyer and Villiger showed that the red sulphate and nitrate of trianisylcannabinol are hydrolysed by water, the OCH_3 group does not increase the basicity as much as the OH group. Rosolic acid has been known for many years as a substantive orange dyestuff for silk and wool, and it has now been found that it dyes cotton mordanted with tannin and tartar emetic, behaving as a basic dyestuff. Its hexamethoxy-derivative, eupittonic acid, and the colourless trianisylcannabinol exhibit a similar behaviour. In a neutral bath trianisylcannabinol is taken up by silk and wool without the production of colour, but an orange colour is developed on after-treatment with acid. The same behaviour is noted if dyeing is effected in presence of a large excess of a mineral acid. In the case of the phenylbis[methoxytolyl]-methanes the compound with the methyl and methoxy groups in the *ortho*-position dissolves in sulphuric acid to an orange solution, whereas the *para*-isomer gives a violet solution; neither of

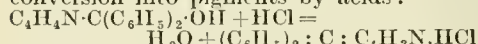
these leuco-compounds can be dyed on tannin-mordanted cotton. The corresponding carbinols have been prepared by oxidation with lead dioxide in acetic acid solution; the *o*-isomer dissolves in sulphuric acid to a red solution, the *p*-isomer to a solution of a claret colour; the former dyes tannin-mordanted cotton an intense red, whereas the latter does not dye such material. Dianisylphenylcarbinol exhibits practically the same behaviour as trianisylcarbinol, but gives a redder shade on tannin-mordanted cotton. The suggestion of Baeyer and Villiger that the colorations produced by the methane derivatives with sulphuric acid may be due to oxidation to the carbinol by the sulphuric acid, is untenable, as on pouring the coloured solution into water, no change is noted in the melting-point of the product separated, and on almost neutralising the aqueous solution it does not dye tannin-mordanted cotton, proving the absence of carbinol. By introducing amino-groups into triphenylcarbinol in *para*-position to the methane carbon atom, basic carbinols are obtained, such as Malachite Green, Magenta, and Crystal Violet. With one molecule of acid these carbinols give highly coloured green, red, violet, etc., salts which dye silk, wool, and tannin-mordanted cotton the corresponding shades. These mono-acid salts when dissolved in concentrated sulphuric acid give orange solutions similar to the solution of the non-substituted triphenylcarbinol; the auxochrome character of the NH_2 or NR_2 group is apparently destroyed by their combination with the sulphuric acid. Rosolic acid, Benzaurin, etc., and the hydroxy-derivatives of Malachite Green dissolve in sulphuric acid to an orange solution, whereas the leuco-compounds do not give any coloration with sulphuric acid. The introduction of several hydroxy-groups into the benzene nucleus leads to the formation of a coloured solution, *e.g.*, the leuco-bases from protocatechuic and *o*-protocatechuic acid give a yellow coloration, more pronounced in the latter case, and a similar colour is given by the leuco-base from pyrogallaldehyde.—F. W. A.

Diphenyldipyrromethane, diphenylpyrrolylcarbinol, and a new colouring matter of the pyrrole series; Preparation of —, V. V. Tschelincev, B. V. Tronov, and A. P. Terentiev. J. Russ. Phys. Chem. Soc., 1915, 47, 1211—1223. J. Chem. Soc., 1915, 108, i., 990—991.

THE condensation of benzophenone with pyrrole in alcoholic solution, and in presence of a small proportion of hydrochloric acid as catalyst, yields diphenyldi-2-pyrromethane, $(\text{C}_6\text{H}_5\text{N})_2\text{C}(\text{C}_6\text{H}_5)_2$, m.pt. 264°C ., and diphenyl-2-pyrrolylcarbinol, $\text{C}_6\text{H}_5\text{N}.\text{C}(\text{C}_6\text{H}_5)_2\text{OH}$, which appears to be the first product of the reaction, and gives rise to diphenyldi-2-pyrromethane by interaction with a second molecule of pyrrole.

Diphenyl-2-pyrrolylcarbinol forms a dark red, amorphous powder, decomposing at about 170°C . It acts as an indicator, being coloured a bright red, resembling magenta, by inorganic or organic acids, and yellow by alkali hydroxide or carbonate or ammonia. In the air it undergoes gradual change, probably owing to anhydride-formation, and possibly to condensation; the red colour of its solution slowly alters to bluish-violet.

Diphenyl-2-pyrrolylcarbinol is a coloured base, capable, like triphenylmethane compounds, of conversion into pigments by acids:



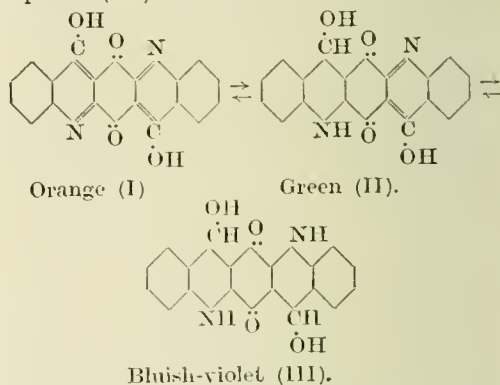
The colouring matter produced is allied, on the one hand, to the triphenylmethane dyes, and, on the other, to difluorene, fulvene, indigotin, and, possibly, chlorophyll and hæmin; as with Malachite Green, the tertiary nitrogen atom of

this colouring matter may play the part of an auxochromic group.

Treatment with zinc dust and hydrochloric acid yields the leuco-compound, $\text{C}_6\text{H}_4\text{N}.\text{CH}(\text{C}_6\text{H}_5)_2$. By means of this colouring matter, tissues are dyed raspberry-red, the colour being stable towards the action of boiling water or treatment with soap or bisulphite.

Quinonediacridone. V. V. Scharvin. J. Russ. Phys. Chem. Soc., 1915, 47, 1260—1268. J. Chem. Soc., 1915, 108, i., 1004—1005.

QUINONEDIACRIDONE, the anhydride of quinone-dianthranilic acid (quinone-bis-*o*-aminobenzoic acid), is prepared by heating the latter with concentrated sulphuric acid at 200°C .; it forms slender, orange needles, and is characterised by sparing solubility in all the ordinary solvents and by very slight reactivity. Sulphonation with fuming sulphuric acid containing 50% of the anhydride yields a product which is readily soluble in water but forms a sparingly soluble sodium salt. Quinonediacridone forms with potassium hydroxide an insoluble red salt, which is readily hydrolysed by water. This behaviour indicates that its structure is probably represented by formula I. (*vide infra*). The latter also explains the behaviour of quinonediacridone on reduction by means of hydrosulphite, this yielding first a green compound (II) and then a bluish-violet compound (III):



Compound (III), $\text{C}_{20}\text{H}_{14}\text{O}_4\text{N}_2$, forms microscopic, rectangular plates, and is somewhat more readily soluble than quinonediacridone. In concentrated sulphuric acid it dissolves, giving a pure blue solution, which soon becomes green and then yellow, dilution of the final liquid resulting in the precipitation of quinonediacridone; gentle heating accelerates these changes. Quinonediacridone dyes wool and silk yellow in an acid bath. Cotton can be dyed only with the help of reduced quinonediacridone; the tissue, coated with a liquid paste of quinonediacridone and gum and then dried, assumes a green colour when immersed in alkaline hydrosulphite solution, and a stable red colour after subsequent oxidation in the air. If the reduction proceeds as far as the development of the violet colour, oxidation is considerably retarded. Albuminous fibres are, however, best dyed by means of the sulpho-derivative of quinonediacridone in a faintly acid bath, silk then assuming a splendid, golden colour; if, in addition, hydrosulphite is present, albuminous fibres are dyed blue. In view of the insolubility of quinonediacridone and particularly of its stability towards different reagents, these dyes are characterised by great fastness, which is also exhibited towards the action of light. When exposed in an atmosphere of hydrogen to the light, the colouring matters readily undergo reduction, this action being especially marked with the sulpho-acid.

Colour of dyes; Nature of the vibrations causing the—. E. R. Watson and D. B. Meek. Chem. Soc. Trans., 1915, 107, 1567—1578.

THE authors advance the theory that the vibrations causing the colour of dyes are due to pulses passing backwards and forwards along a conjugate chain of alternate double and single bonds as the substance changes from one quinonoid form to another. In the ionised condition, when the most intense colour of the dye is developed, there is no vibration of the atoms of the molecule but only a rhythmic rearrangement of strains, the period of which would be proportional to the length of the conjugate chain. The theory was tested on these lines by comparing the ratio of the wave-lengths of the maxima of the principal absorption bands of pairs of very similarly constituted substances which had, however, conjugate chains of different lengths. Thus, for example, tetramethyldiaminodiphenyl carbinol (Michler's carbinol) has a conjugate chain of five double bonds, and the corresponding Michler's ketone three double bonds, whilst the wave-lengths of the absorption maxima are 6100 and 3680, respectively, or almost exactly 5:3. The same agreement was observed amongst pairs of flavone colouring matters, and is adduced in support of the theory.—G. F. M.

Colour of dyes; Effect of additional auxochromes on the—. Part I. *Phthalein and Benzein dyes*. V. R. Medhi and E. R. Watson. Chem. Soc. Trans., 1915, 107, 1579—1582.

ALCOHOLIC solutions of fluorescein, gallein, and dihydroxyfluorescein, and resorcinolbenzein, pyrogallolbenzein, and hydroxyquinolbenzein were examined spectroscopically, both with and without addition of potassium hydroxide. In both groups increase in the number of auxochromes widened the absorption band in the visible spectrum and shifted the maximum slightly towards the red. Addition of alkali enhanced this effect, and the band became shallower.—G. F. M.

PATENTS.

Sulphurised chrome-dyestuffs of the gallocyanine series; Manufacture of—. O. Imray, London. From Soc. Chem. Ind. in Basle, Switzerland. Eng. Pat. 2837, Feb. 22, 1915.

DYESTUFFS suitable for printing as chrome dyestuffs or for dyeing chromed wool in an acid bath, are made by sulphurising with alcoholic polysulphide the gallocyanines derived from gallamic acid, such as Gallamine Blue, Coelestine Blue, or their leuco-products, such as Modern Violet. Pure blue to greenish blue prints and dyeings are obtained of greater fastness to washing and light than those produced by the parent dyestuffs. By addition of benzidine, *m*-toluylenediamine, etc., during the sulphurising process, products giving greener and hence fuller shades are obtained.

—F. W. A.

Antraquinone dyestuffs soluble in water; Manufacture of greenish-blue—. Akt.-Ges. f. Anilinfabr., Berlin. Eng. Pat. 7877, May 27, 1915. Under Int. Conv., June 22, 1914.

IN place of the 1-amino-4-halogen-antraquinone-2-sulphonic acids mentioned in Ger. Pat. 280,646 and Eng. Pat. 7861 of 1915 (this J., 1915, 545, 829), 1-amino-halogen-antraquinone-6- or 7-sulphonic acids may be used. Valuable dyestuffs are obtained which dye wool greenish-blue shades.

—F. W. A.

Tetrachlorobenzaldehyde and new [triphenylmethane] colouring matters therefrom; Manufacture of—. R. B. Ransford, London. From L. Cassella und Co., Frankfurt, Germany. Eng. Pat. 13,970 of 1915; date of appl., July 8, 1914.

TETRACHLOROBENZAL chloride (Eng. Pat. 16,317 of

1914; this J., 1915, 1203) is dissolved in about 6 parts of concentrated sulphuric acid at 90° C.; on pouring the solution into ice water, tetrachlorobenzaldehyde is obtained as a white powder, which may be purified by converting into the bisulphite compound, and crystallises from ether as colourless needles of m.p.t. 97°—98° C. On condensing with *o*-hydroxycarboxylic acids, e.g., *o*-cresotinic acid, and oxidation of the leuco-compounds produced, e.g., with sodium nitrite dissolved in concentrated sulphuric acid, nitric acid, nitro-compounds, or fuming sulphuric acid, valuable new dyestuffs of the triphenylmethane series are produced. These dyestuffs surpass in intensity and fastness other known dyestuffs of a similar character, and are distinguished by their bright greenish blue shade. Tetrachlorobenzal chloride may be used direct, by heating to 90° C. with concentrated sulphuric acid, cooling, and then condensing with *o*-cresotinic acid.—F. W. A.

Azo dye. O. Günther, Opladen, Germany, Assignor to Synthetic Patents Co., New York. U.S. Pat. 1,159,375, Nov. 9, 1915. Date of appl., Oct. 6, 1914.

SEE Eng. Pat. 29,567 of 1913; this J., 1915, 899.

Azo dye; Yellow—. J. Huismann, Cologne, Germany, Assignor to Synthetic Patents Co., New York. U.S. Pat. 1,159,386, Nov. 9, 1915. Date of appl., Nov. 5, 1914.

SEE Eng. Pat. 6444 of 1914; this J., 1915, 866.

[Disazo] dyestuffs; Yellow—and process of making same. H. Wagner and J. Erber, Assignors to Farb- u. vorm. Meister, Lucius, und Brüning, Höchst, Germany. U.S. Pat. 1,160,471, Nov. 16, 1915. Date of appl., June 25, 1913.

SEE Fr. Pat. 459,468 of 1913; this J., 1913, 1101.

Alizarin; Production of—. Chem. Fabr. Griesheim-Elektron. Fr. Pat. 475,141, July 15, 1914. Under Int. Conv., Nov. 22, 1913.

SEE U.S. Pat. 1,150,152 of 1915; this J., 1915, 955.

Sulphurised chrome dyestuffs of the gallocyanine series; Preparation of—. Soc. pour l'Ind. Chim. à Bâle. Fr. Pat. 475,947, Mar. 27, 1914.

SEE Eng. Pat. 2837 of 1915; preceding.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Parchment papers, imitation parchment papers, and pergamin papers; Durability tests on—. C. Bartsch. Mitt. k. Materialprüf., 1914, 32, 510—518.

THE tests were made on samples taken from packets, enclosed in wrapping paper, which had been stored since 1907. The breaking length of the imitation parchment papers and pergamin papers was practically unaffected by storage, and that of the parchment papers was only slightly diminished, but the elongation (at breaking point) and, especially, the resistance to creasing were markedly reduced. The effects on parchment papers were greater the higher the acid content, but in the case of imitation parchment papers and pergamin papers no notable difference could be detected between samples having an acid reaction and those having a neutral reaction. Similar effects were produced by heating for a short period, but with a series of different samples the effects were not always parallel to those produced by storage. Storage in a cellar, in which the temperature and humidity of the air suffers but slight variations, is less detrimental

than storage under other conditions; it is advantageous to keep the atmosphere relatively moist.
—A. S.

Parchment paper; Strength of air-dry and wet — W. Herzberg. Mitt. k. Materialprüf., 1914, 32, 539—540.

It has been stated (Papier-Zeit., 1913, 779) that the strength of genuine parchment paper is practically unaffected by treating the paper with hot water. Tests on four different samples which had been immersed in water showed, however, that the strength is diminished by more than one-half, whilst the elongation (at breaking point) increases by about one-half. Similar effects were produced by hot and by cold water.—A. S.

"Sulphite acid" [calcium bisulphite solution]; Tower systems of making — G. B. Steffanson. Chem. Eng., 21, No. 6. Chem. News, 1915, 112, 255—257, 265—266.

ACID bisulphite solution, for use in the manufacture of sulphite pulp, is made either from limestone in systems of high towers, low towers, or horizontal chambers, or (as is usual in America) from milk of lime in closed tanks. The high tower system is said to be displacing all others in Europe and to be gaining ground in America, in spite of the lower cost of installing other systems. The burner gas employed should contain not less than 12—14% SO_2 , in order to avoid formation of calcium sulphate, and the ratio of free to combined sulphurous acid in the liquor produced should be kept constant, in such proportion that, after "blowing" with cooled gases from the digesters, without previously separating condensed steam, the liquor is of proper strength for the digestion process. The liquor is analysed with sufficient accuracy by diluting 1 c.c., adding starch, and titrating with $\text{N}/10$ iodine, then destroying the blue colour with a few drops of thiosulphate solution, and titrating with $\text{N}/10$ sodium hydroxide, in presence of phenolphthalein. The number of c.c. of iodine solution used indicates the total amount of SO_2 present, and the difference between double the volume of iodine solution and the volume of sodium hydroxide solution indicates the amount of combined SO_2 , the percentages of free and combined SO_2 in the liquor being obtained by multiplying by the factor 0.32. The percentage of CaO in the liquor is to the combined SO_2 as 28 to 32. The storage tanks and digesters are lined with acid-proof bricks, which may be set in mortar composed of Portland cement (1 part) and crushed and sifted acid-proof brick (1—2 parts), in combination with litharge and asbestos, the mortar being gauged with sodium silicate solution (4° B., sp.gr. 1.029). Fittings on the digesters should be of phosphor-bronze.
—F. SODN.

Norwegian turpentine oil [from sulphite-cellulose manufacture]. Fosse. See XIII.

PATENTS.

Cotton waste and other fibrous materials; Apparatus for degreasing — and recovering benzene used in the process. W. B. Howard, Rawtenstall, Lancs. Eng. Pat. 6529, May 1, 1915.

THE kiers in which the material is extracted are placed in a separate building at some distance from that containing the stills, condensers, and benzene storage tanks. The benzene is circulated through the rotary kiers by means of a pump situated in a wire-screened open structure near the still-house, and is conveyed to and from the kier-house by pipes connected with one trunnion of each kier. The residual benzene, after extraction, is discharged as vapour through the opposite trunnion, and led through pipes, lying in a trough of cold water, to the condensers in the still-house. Valves are

provided for closing the connecting pipes, not only in the vicinity of the kiers but also outside the building.—J. F. B.

Greasy materials; Apparatus for scouring — and recovering the solvent. C. H. L. Wiese, Neumünster, Germany. U.S. Pat. 1,160,481, Nov. 16, 1915. Date of appl., Mar. 24, 1915.

THE extraction vessel consists of a rotary drum mounted on hollow trunnions, provided with a helical heating coil and a perforated coil parallel to the heating coil; both coils revolve with the drum and have inwardly projecting looped portions adapted to stir the contents of the drum. The ends of the two coils pass concentrically through the hollow trunnions and are surrounded by supply and discharge pipes communicating with the drum.
—J. F. B.

[Flexible] composition of mallet [from oxidised oils and cellulose esters]. B. B. Goldsmith, New York. U.S. Pat. 1,152,625, Sept. 7, 1915. Date of appl., Aug. 3, 1912.

THE product of the oxidation of vegetable oils, e.g., soya bean, cottonseed, olive, linseed, corn (maize), or castor oil, with dilute nitric acid, may be mixed with (solutions of) cellulose esters to form flexible compositions. *Example*.—200 c.c. of the oil, 100 c.c. of water, and 60—100 c.c. of nitric acid (sp.gr. 1.4) are heated on the water bath until the reaction is finished. The product is freed from acid and may be added to nitrocellulose dissolved in amyl acetate and diluted with benzene or petroleum spirit.—F. SP.

Calcium bisulphite liquor; Method of production of — [in the manufacture of sulphite cellulose]. H. O. V. Bergström, Stockholm. U.S. Pat. 1,159,352, Nov. 9, 1915. Date of appl., Sept. 25, 1914.

VAPOUR from the sulphite boilers or the acid liquor of sulphite cellulose manufacture is condensed, and uncondensed sulphur dioxide is collected and used in the sulphite process, whilst the condensed liquid is introduced into an apparatus in which sulphur dioxide and organic substances are driven off. The evolved gases either pass into a second condenser, from which the sulphur dioxide is returned to the sulphite system, or enter an absorption apparatus in which sulphur dioxide is absorbed for use again, unabsorbed gases being condensed and collected. The second condensed liquid is heated to expel sulphur dioxide, and the issuing gases are passed through a reflux condenser to the sulphite system.—F. SODN.

Fibrous caps for bottles and other containers; Manufacture of — A. Westlake and P. Poetschke, New York. U.S. Pat. 1,160,478, Nov. 16, 1915. Date of appl., Dec. 12, 1913.

FIBROUS caps for bottles, etc., are made by treating fibrous material when in a soft and pliable condition with an emulsion prepared by the action of an alkali hydroxide on aliphatic resins, and subsequently treating with a precipitating agent such as alum.—F. SP.

Plastic [insulating] body [from paper pulp]; Method of making a — L. H. Bakeland, Yonkers, N.Y., Assignor to General Bakelite Co., New York. U.S. Pat. 1,160,362, Nov. 16, 1915. Date of appl., Oct. 2, 1909.

AN insulating material is made by adding to paper pulp a phenolic condensation product which is transformable by heat into an infusible body, heating the mixture until the condensation product is uniformly distributed over the fibres, separating the liquid, and subjecting the material to heat and pressure.—J. F. B.

Paper-like product and method of making the same. L. H. Baekeland, Yonkers, N.Y., Assignor to General Bakelite Co., New York. U.S. Pat. 1,160,365, Nov. 16, 1915. Date of appl., Apr. 17, 1915.

AN alkaline solution of a phenolic condensation product, which can be converted into an infusible substance by heating, is incorporated with wet paper pulp, and the condensation product is precipitated on the fibre by treatment with a metallic salt which reacts with the alkali to form an insoluble hydroxide.—A. S.

Paper pulp and the like; Process of bleaching——. K. Mørch, Greaaaker, Norway. U.S. Pat. 1,160,942, Nov. 16, 1915. Date of appl., Nov. 30, 1914.

PAPER pulp, containing about 20–22% of dry fibre, is treated with the necessary quantity of bleaching agent and subjected to a kneading operation until the bleaching agent has been thoroughly worked into the fibres; the pulp is then agitated until the desired degree of bleaching has been reached.—J. F. B.

Resin size for paper manufacture; Method for preparing——. B. Knüttler, Winchester, Mass., and W. A. Oppen, Stoneham, Mass. U.S. Pat. 1,160,906, Nov. 16, 1915. Date of appl., Feb. 5, 1914.

RESIN size is heated in a closed vessel with steam under pressure until it attains substantially the temperature and pressure of the steam; it is then discharged in a thin stream into a body of heated water at a lower temperature.—J. F. B.

Textile industries; Application of bacterial diastases to the—— [for removing starchy dressings]. A. Boidin and J. Effront. Fr. Pat. 475,431, Feb. 21, 1911.

SEE Eng. Pat. 1411 of 1913; this J., 1915, 1201.

Cotton and other combustible substances; Treatment of—— to render them permanently less inflammable. Whipp Bros. and Tod, Ltd. Fr. Pat. 475,899, Aug. 3, 1914. Under Int. Conv., Aug. 5 and Sept. 17, 1913.

SEE Eng. Pats. 17,815 and 20,972 of 1913; this J., 1914, 1045.

Cotton and other combustible substances; Treatment of—— to render them permanently less inflammable. Whipp Bros. and Tod, Ltd. Fr. Pat. 475,898, Aug. 3, 1914. Under Int. Conv., Aug. 5, Sept. 17, and Oct. 24, 1913.

SEE Eng. Pats. 17,814, 20,971, and 24,088 of 1913; this J., 1914, 1045.

Wool-scouring and analogous liquors; Process for recovering useful products from——. W. G. Abbott, jun. Fr. Pat. 475,987, Aug. 12, 1914.

SEE U.S. Pat. 1,110,277 of 1914; this J., 1914, 1006.

Paper pulp or cellulose from bamboo or similar materials; Production of——. J. L. Jardine and T. A. Nelson. Fr. Pat. 475,981, Aug. 11, 1914.

SEE Eng. Pat. 18,371 of 1913; this J., 1914, 1006.

Pulp for use in making paper and the like; Apparatus for refining——. T. H. Nash. Fr. Pat. 475,450, July 20, 1914.

SEE Eng. Pat. 6876 of 1914; this J., 1914, 640.

Cellulose; Digestion process for the manufacture of——. E. Morterud. Fr. Pat. 475,988, Aug. 12, 1914. Under Int. Conv., Aug. 12, 1913.

SEE Ger. Pat. 273,860 of 1913; this J., 1914, 746.

Toxic product [for wood preserving] and method of making same. U.S. Pat. 1,155,708. See IX.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

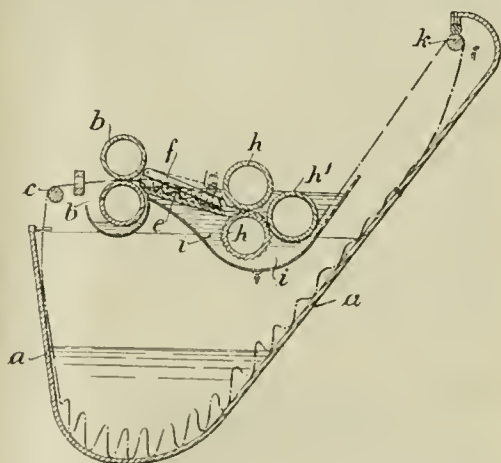
PATENTS.

Indigo fermentation vat; Manufacture of stable concentrated preparations suitable for the——. O. Imray, London. From Farbw. vorm. Meister, Lucius, und Brüning, Höchst, Germany. Eng. Pat. 22,148, Nov. 6, 1914.

ALBUMINOUS products are mixed, in presence or absence of bacteria, with water-soluble concentrated carbohydrates in such concentration as is necessary to produce the preservative effect of these bodies, and indigo or indigo white is added. *Example:* 10 kilos. of rye-bran is extracted with 50 litres of cold or warm water, the liquid extract, which may be subjected to hydrolysis, is evaporated *in vacuo* to a syrup and mixed with about 3 kilos. of molasses. The paste obtained is stable indefinitely and is suitable for transport; it does not putrefy or dry up. Vegetable casein, albumose, peptone, etc., may be used in place of the gluten of the bran extract, as albuminous substance, and invert sugar, glucose, maltose, glycerin, etc., may be used as water-soluble carbohydrates. (Reference is directed, in pursuance of Sec. 7, Sub-sect. 4, of the Patents and Designs Act, 1907, to Eng. Pats. 3706 of 1879; 15,471 of 1896; 1221 and 3492 of 1901; 25,400 of 1910; and 2191 of 1912; this J., 1902, 261; 1911, 817; 1912, 516.)—F. W. A.

Textile piece goods, warp yarns and the like; Machines for treating with liquids——. J. S. Ainley, Huddersfield. Eng. Pat. 1237, Jan. 26, 1915.

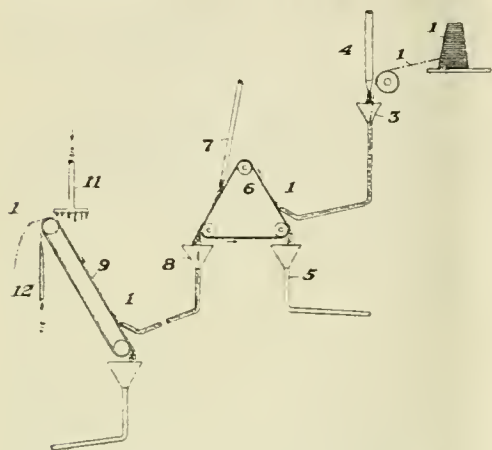
THE fabric passes from a guide roller, *c*, between squeezing rollers, *b*, into a series of inclined troughs, *c*, one for each draft of the fabric, to which liquid



is supplied. Hinged lids, *f*, of suitable weight, press on the folds of the fabric formed in travelling through the troughs, and may be weighted by additional weights, *g*. One or more pairs of crushing rollers, *h*, plain or fluted, receive the fabric on emerging from the troughs, and a roller, *h1*, engages with the lower one of the pair, a tank, *i*, being arranged to contain the troughs and rollers. A taking-off roller, *k*, keeps the material tight as it emerges from the roller, *h1*, and delivers it to the tank, *a*, the process being repeated until the material is thoroughly scoured. The liquor in the tank, *i*, may be delivered into a sump, or into the machine, *a*, from which it may be pumped up for further use.—B. N.

Treating [washing, dyeing, etc.] thread; Process of —. C. S. Althouse, Reading, Pa. U.S. Pat. 1,153,004, Sept. 7, 1915. Date of appl., Mar. 21, 1912.

THE thread, 1, is conveyed through a tube, 3, filled with liquid from 4, to a separator, 6, consisting



of a moving belt; the separated liquid runs into 5, and the thread is treated with a second liquid from 7, before leaving the belt. It then passes through a tube, 8, on to a drying apron, 9, and is subjected to air-blasts from 11, and from 12.

—F. W. A.

Proofing; Process and apparatus for —. L. Geer, New York. U.S. Pat. 1,160,980, Nov. 16, 1915. Date of appl., Apr. 26, 1910.

IN proofing with a substance which is solid at the ordinary temperature, several sprays of the heated, atomised proofing substance are projected in directly opposite directions over the material to be proofed, within a closed heated chamber, the material being moved in a plane parallel to the plane of projection of the sprays.—F. W. A.

Dyeing; Process of —. J. Schmitz, Philadelphia, Pa., Assignor to Uniform Dyeing Machine Co., Groveville, N.J. U.S. Pat. 1,160,001, Nov. 9, 1915. Date of appl., June 13, 1914.

SEE Eng. Pat. 84 of 1915; this J., 1915, 832.

Dyeing piece goods, yarn, or raw stock; Process of —. Uniform Dyeing Machine Co. Fr. Pat. 475,920, Aug. 4, 1914.

SEE Eng. Pat. 17,296 of 1914; this J., 1915, 902.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Ammonia-soda process (Striebeck system); Development of the —. K. W. Jurisch. Chem. Ind., 1915, 38, 9, 61. Chem.-Zeit., 1915, 39, Rep., 373. (Compare this J., 1911, 281.)

IN the Striebeck system, carbon dioxide under an excess pressure of 1.6 atmospheres enters pear-shaped carbonators, 6.2 m. high, and 5 m. maximum diameter, through six distributing arms in the conical base of the vessel. These arms are constructed in the form of an inverted U, open on the under side, and provided also with side slits. The stirring vessel for emptying the carbonators is 2.5 m. high and 5 m. in diameter, and requires 2–3 horse power. The bicarbonate is separated in vacuum filters, and for calcination only the Thelen apparatus is employed. The decomposition vessels for the ammonium chloride

liquor are of the Honigmann form. The main column is Striebeck's own invention, and consists essentially of a tower, 9 m. high, which can be made in the form of a single iron casting, and is divided into 36 compartments by horizontal steps 25 cm. apart on the narrow sides and 50 cm. on the long sides. The advantage of this system in reduced steam consumption is discounted by the difficulty in cleaning and the short life of the column. The ammonia absorption apparatus and that for the preparation of the ammoniacal brine are likewise peculiar to Striebeck's system, but the author considers the Mond absorption plant to be much superior.—G. F. M.

Potash from felspar. Chem. Eng., 21, No. 5. Chem. News, 1915, 112, 266–268.

POTASH recovered from felspar by processes involving the incidental production of Portland cement, is not regarded as a likely competitor with commercial "muriate" from Germany, which is said to be produced at less than 15 cents. (7½d.) per unit of potash (20 lb. K₂O); but the utilisation of felspar, with common salt and phosphate rock, to furnish phosphoric oxide, soda-ash, potassium chloride, and alumina, is shown, from estimated working expenses, to offer a satisfactory margin of profit. In this process, phosphate rock is heated with common salt at 1100° C. in a current of carbon dioxide, so as to yield phosphorus and carbon as oxychlorides, and a residue of lime and soda, from which the soda is recovered by leaching; the oxychlorides are passed over felspar at 600° C., to give aluminium chloride, phosphoric oxide, and a residue containing silica and potassium chloride which is extracted with water; the aluminium chloride, after separating from iron chlorides, is converted into pure alumina by heating in the presence of carbon dioxide at 800° C.—F. SODN.

Potash problem; The —. U.S. Comm. Rept., No. 253, and Eng. and Min. J., Nov. 27, 1915.

ACCORDING to a patent taken out recently by a Canadian, felspar is heated with limestone and iron oxide to about 1200° C., whereupon a semi-fused mass is produced, from which the potassium salts are said to be readily extracted by treatment with dilute acid.

THE U.S. Geological Survey suggests that a possible source of potash may exist in the tailings which are piled up at the concentrating mills of the large copper mines in the Western States. The "porphyry" ores, which are being mined in vast quantities, contain more potash than copper, and this accumulates in the tailings in the form of silicate. The quantity of potash which could be obtained from this source is estimated to exceed the present American consumption.

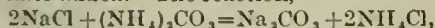
Perchloric acid and potassium sulphate as an example of reversible change; The interaction of —. W. A. Davis. Chem. Soc. Trans., 1915, 107, 1678–1681.

THE reaction between potassium sulphate and perchloric acid is shown to be a reversible one, but the potassium may be separated quantitatively as perchlorate on the addition of alcohol if an excess of perchloric acid is present (see this J., 1912, 1045). In general practice it is found to be preferable to remove the sulphate by evaporation with baryta solution prior to evaporating with perchloric acid.—B. N.

Carbonates of the alkali metals; Formation of —. P. Melikov and M. Rozenblat. J. Russ. Phys. Chem. Soc., 1915, 47, 1093–1094. J. Chem. Soc., 1915, 108, ii., 768.

IN the determination of alkali metals in the form of

chlorides, these are often heated with excess of ammonium carbonate. The authors find that, when ammonium carbonate is added gradually to fused sodium or potassium chloride in a platinum crucible, sodium or potassium carbonate is formed in amount depending on the quantity of ammonium carbonate added. The reaction,



is reversible, and if ammonium carbonate and chloride are added together to the fused chloride, no formation of sodium carbonate takes place. Fused sodium or potassium sulphate gives no corresponding carbonate when treated with ammonium carbonate.

Sodamide and hydrogen; Reaction between —.

F. D. Miles. *Proc. Roy. Soc. Edin.*, 1915, 35, 134—137. *J. Chem. Soc.*, 1915, 108, ii., 768.

WHEN sodamide is heated in a stream of hydrogen at temperatures between 200° and 300° C., a reaction occurs in which a portion of the sodamide is converted into sodium hydride with liberation of ammonia according to the equation, $\text{NaNH}_2 + \text{H}_2 = \text{NaH} + \text{NH}_3$. This reaction does not appear to take place when sodamide is heated with hydrogen in an enclosed space up to 300° C. (compare Titherley, *Chem. Soc. Trans.*, 1804, 65, 509).

Ammoniacal liquor; Storage of —. W. S. Curphey. *J. Gas Lighting*, 1915, 132, 424.

THE loss of ammonia caused by the storage of liquor under conditions which allow air to circulate above the surface, can be prevented by covering the surface of the liquid with a layer of suitable oil. A layer of 0.1 inch of oil affords complete protection against loss of volatile ammonia, and also retards the formation of ammonium salts by oxidation, thus effecting a saving of lime or alkali. In a 100 gallon rectangular tank the loss per hundred parts of free ammonia was reduced from 43.2% in 8 days without oil, to 0.5% when a layer of oil $1\frac{1}{4}$ ins. thick was employed. With a cylindrical boiler placed horizontally, a layer of 0.2 inch of crude paraffin oil effected a saving of 20.4%, while a layer of mineral oil 0.08 inch in thickness reduced the loss of free ammonia in 92 days from 38.7% to 0.5% in a 90-gallon iron drum without a lid but stored under cover.

—W. G. C.

Liquor ammoniæ from gas liquor; Direct production of —. R. W. Hilgenstock. *Amer. Gaslight J.*, Oct. 18, 1915. *J. Gas Lighting*, 1915, 132, 436—437.

THE crude liquor is pumped into three carbonic acid extractors where it is heated to 212° F. (100° C.) to decompose the ammonium carbonate, the ammonia passing into absorption chambers while carbonic acid, hydrogen sulphide, and pyridine escape. The hot decarbonated liquor flows into a still, in the upper part of which it is freed from volatile ammonia and any remaining carbonic acid and hydrogen sulphide, while in the lower section, the liquor is mixed with milk of lime to decompose ammonium salts. The gaseous ammonia passes into a washer where it meets a stream of water, the flow of which is so regulated that only sufficient ammonia is absorbed as will suffice to retain the carbonic acid and hydrogen sulphide, the effluent being returned to the carbonic acid extractor. The excess of ammonia is passed through caustic soda solution (1.114 sp.gr.) to absorb any remaining traces of carbonic acid, etc., then washed with heavy tar oil to remove tarry matters and pyridine, and absorbed in distilled water either directly to yield the commercial product, or after passing through charcoal and bone-black filters if it is

desired to produce pure ammonia solution. By this process a plant treating 30,000 tons of gas liquor containing 2% ammonia is stated to give £5220 net profit per annum.—W. G. C.

Water of crystallisation. II. Compounds with 2H₂O. III. Compounds with 5H₂O. Copper sulphate. I. Guareschi. *Atti R. Accad. Sci. Torino*, 1915, 50, 881—902. 1125—1145. *J. Chem. Soc.*, 1915, 108, ii., 770, 774—775.

THE temperature of dehydration of dihydrated calcium sulphate is not 130° C., as stated by Rosenstiehl (*Bull. Soc. Chim.*, 1911, 9, 281—295), but 93°—94° C., or, in a current of dry air, 81°—82° C., these temperatures being valid for both the natural and the precipitated salts; the former, however, loses immediately a large proportion of its water when heated in a current of dry air, whereas the latter exhibits only a slight loss after some hours. The semi-hydrated sulphate is probably to be regarded as of the formula $\text{Ca}_2\text{S}_2\text{O}_7 \cdot \text{H}_2\text{O}$. Dehydrated sodium nitroprusside rapidly absorbs 2H₂O from the air, and the hydrate thus obtained undergoes complete dehydration much more easily than the original hydrate, the temperature of dehydration being 98°—99° C. The final $\frac{1}{2}\text{H}_2\text{O}$ is removed only slowly and with difficulty, the probable formula of the salt being $[\text{Na}_2\text{Fe}(\text{NO})(\text{CN})_5]_2 \cdot 4\text{H}_2\text{O}$. Cupric chloride is completely dehydrated at 55° C. in a current of dry air, or at 15° C. over sulphuric acid at a pressure of 10 mm. Sodium bromide loses both mols. of water in an oven at 30° C., the first rapidly and the second more slowly. Sodium iodide undergoes complete dehydration in seven to eight days over sulphuric acid at 15°—17° C. Cadmium acetate loses $1\frac{1}{2}\text{H}_2\text{O}$ rapidly in a steam oven, and the remainder slowly, its formula being probably a multiple of the simple one; its dehydration temperature is 50° C. Potassium ethane-aa-disulphonate loses 1H₂O rapidly, and the remaining 1H₂O very slowly in an oven at 30° C. Sodium dithionate is dehydrated at 50° C. in an oven or at 42° C. in a current of dry air, the final 1H₂O being removed only very slowly. The dehydration point of barium dithionate is 50° C. in an oven or 30° C. in a current of dry air. Over calcium chloride at 21°—23° C., pentahydrated copper sulphate loses only 2H₂O, yielding the pale sky-blue trihydrate, which loses 2H₂O, forming the monohydrate in a thermostat at 60° C. or, if left in the air, is re-converted into the pentahydrate. The latter undergoes no change at 40° C., but loses 2H₂O at 45°—50° C., a further 2H₂O at 60° C., and the final 1H₂O at 206° C. In a current of dry air at 41°—42° C., $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ loses $1\frac{1}{2}\text{H}_2\text{O}$ in five hours, and another $\frac{1}{2}\text{H}_2\text{O}$ in a second period of five hours; no further loss then occurs at 50°—60° C., but at 72° C. 2H₂O is removed, the monohydrated salt remaining. At 206°—207° C., $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ loses 4H₂O in less than half an hour, a further $\frac{1}{2}\text{H}_2\text{O}$ being removed very slowly, and the last $\frac{1}{2}\text{H}_2\text{O}$ more slowly still.

Water in salt solutions; Dissociation of —. W. Palmaer and K. Melander. *Z. Elektrochem.*, 1915, 21, 418—425.

IN very concentrated aqueous solutions of salts the water is to be regarded as the dissolved substance. For determining the electrical conductivity of hydrogen ions in such solutions, lithium and calcium chloride solutions were used. Purified hydrogen was passed through an apparatus having two communicating vessels, with platinised platinum electrodes, one containing a concentrated and the other a weaker solution of the salt, the two solutions having the same electrolytic conductivity. The whole apparatus was placed

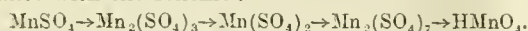
in a thermostat maintained at a definite temperature (22°, 25.5°, or 50° C.) for 20 hours and the potential difference between the two electrodes measured. The conclusion was drawn that the difference in potential between two solutions of like ions but of different total concentration was nil when the ionic pressure in the two solutions was equal. Taking 0.14 volt. as the observed difference in potential between 11.8N and 1.5N solutions of lithium chloride at 22° C., it was calculated that the stronger solution contained about 240 times as many H-ions. In the case of calcium chloride solutions of 10N and 1.7N strength respectively, the difference in potential between the electrodes (0.14 volt.) at 25.5° C. showed that the concentrated solution contained about 235 times as many H-ions as the weaker solution.—C. A. M.

Lower compounds of certain elements. [*Calcium subhydride.*] L. Marino. Atti R. Accad. Lincei, 1915, [v], 24, ii. 143—149. J. Chem. Soc., 1915, 108, ii., 770—771.

MOLDENHAUER and Roll-Hansen (this J., 1913, 789) found that, when one-half the quantity of hydrogen required to give the normal hydride has been absorbed by calcium, the pressure curve undergoes change in direction. Repetition of this work by the author and Quinto gave results which were in moderately good agreement with those of the above-named authors, but when an attempt was made to construct the curve representing the dissociation of calcium subhydride, it was found that part of the hydrogen had escaped measurement. This phenomenon has been traced to the volatility of the calcium. As the temperature is raised, dissociation proceeds in accordance with the equilibrium, $\text{CaH}_2 \rightleftharpoons \text{Ca} + \text{H}_2$, but at temperatures below 800° C. a little of the calcium is condensed in the part of the tube which is less strongly heated, and the liberated hydrogen is fixed by the calcium in correspondence with the dissociation pressure of the hydride at the lower temperature. A method has been devised for determining the distribution of the hydrogen in the various parts of the apparatus, and the new pressure curve thus obtained fails to indicate the presence of a new compound. These results show that it is inaccurate to speak of the heats of combination of the first and second atoms of hydrogen with calcium, and afford an explanation of the divergence of the value of the heat of combination determined calorimetrically from that calculated by means of Nernst's formula.

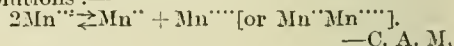
Manganous salts; Electrolytic oxidation of — and compounds obtained thereby. M. Sem. Z. Elektrochem., 1915, 21, 426—437.

THE electrolytic oxidation of manganous salts in sulphuric acid solution follows a course in accordance with the scheme:—



With the exception of $\text{Mn}_2(\text{SO}_4)_7$ the occurrence of each stage in the process has been directly proved. By the use of manganese electrodes it was possible to obtain solutions containing up to 92 grms. $\text{Mn}(\text{SO}_4)_2$ per 100 c.c. Electrolytic oxidation of manganous acetate in acetic acid affords a simple method of preparing manganic acetate. For example a solution of 100 grms. of manganous acetate in 100 c.c. of 50% acetic acid (to which a little sodium acetate was added) was electrolysed between platinum electrodes with an anodic current density of 0.5 to 1.0 amp. per sq. cm., whilst the cathodic current density was kept as strong as possible. After every 2 to 3 ampère-hours the deposited manganic acetate was filtered off, and the filtrate saturated with fresh manganous acetate. Yields of 22.50 grms. and 19.70 grms. were obtained as against the theoretical

22.95 grms. and 20.00 grms. The voltage required was 17.9 without sodium acetate, or 12 to 15 after the addition of that salt. Manganous chloride is oxidised to manganic chloride when electrolysed in hydrochloric acid solution at 10° C., whilst manganous nitrate in strong nitric acid solution is oxidised to manganic nitrate. This latter salt is also formed in Volhard's test for manganese by oxidation with lead dioxide and nitric acid. The curious behaviour of manganic salts when hydrolysed, and the behaviour of manganese oxides on treatment with dilute acids may be explained by the assumption that in solutions of manganic salts there are not only trivalent manganese compounds but also double compounds of divalent and quadrivalent manganese, as concluded by Franke (J. prakt. Chem., 1887, 11, 454). The following state of equilibrium would thus occur in the solutions:—



—C. A. M.

Iodine in plant and animal tissues; Distribution of —. A.T. Cameron. J. Biol. Chem., 1915, 23, 1—39.

IN continuation of previous work (this J., 1914, 912), the author has investigated further the distribution of iodine in algae, the presence of iodine in animal tissues and other materials, and the degree of variation of iodine content in fish and other thyroids. The detailed results are tabulated; the material was dried at 100° C. before analysis. The iodine content of marine algae varies between 0.001 and 0.7%. Of the brown algae only the *Laminariaceae* and one or two *Fucaceae*, and of the red algae only the *Rhodomelaceae* and *Delesseraceae* contain more than 0.1% of iodine; in the green algae the iodine content is invariably very low. Nearly all the species with relatively high contents of iodine grow below the tidal zone and are never exposed. Young plants contain more iodine than full grown plants. In *Nereocystis* the float usually contains less iodine than either the fronds or the stipe. All species of marine animals contain iodine; in many cases where a relatively high content of iodine was observed, the material examined was in the nature of an external secretion, viz., worm tubes (0.009—0.741%), the opercula of the whelk (0.03%), and the byssus of the mussel (0.042%). The iodine content of vertebrate thyroid (dry) tissue ranges from 0.01 to 1.16%.—A. S.

Rare earths. I. [Neodymium]. C. Garnier. Arch. Sci. phys. nat., 1915, [vi], 40, 93—105 and 199—213. J. Chem. Soc., 1915, 108, ii., 775—776.

A QUANTITY of commercial neodymium salt containing traces of praseodymium and samarium was purified by means of fractional crystallisation of the nitrobenzenesulphonates (Holmberg, this J., 1907, 342), since this method was found to be the most efficient and speedy. In this way fifteen final fractions were obtained, and examination of the absorption spectrum and determinations of atomic weight indicated that fractions 5 and 6 were free from praseodymium. The colour of neodymium oxide has been variously described as blue, ash-grey, green, blue with a violet tinge, pale violet, lavender, nearly white with a tinge of bluish-grey, and finally Waegner states (Z. anorg. Chem., 1904, 42, 118) that the colour depends, not only on the purity of the substance, but also on the method of preparation. He obtained the oxide rose-brown, blue, and rose coloured. The author concludes that the difference in colour of Waegner's oxides is not due to difference in the amount of oxygen contained, as is claimed, but rather to a difference in the degree of hydration. Neodymium hydroxide, $\text{Nd}(\text{OH})_3$, was heated at various temperatures in an electric furnace in a current of nitrogen, and the loss of water controlled.

It was thus shown that two hydrates in addition to the normal hydroxide exist. The first of these, $2\text{Nd}_2\text{O}_3 \cdot 3\text{H}_2\text{O}$, is formed at 320°C ., and is stable up to 520°C . It has a light brown colour tinged with rose, and apparently corresponds by its reflexion spectrum with the similarly coloured oxide of Wagnier (*loc. cit.*). The second hydrate, $\text{Nd}_2\text{O}_3 \cdot \text{H}_2\text{O}$, has a less pronounced colour than the first-mentioned product, and is stable between 520°C and 580°C ., and is shown to be identical with the substance regarded by Wagnier as Nd_2O_3 . This hydrate on further heating passes directly into the blue sesquioxide, and the colour changes slowly as the temperature increases, passing through the shades mentioned at the commencement, and only taking on the blue colour at 1000°C . The reflexion spectrum of the mixed product shows the presence of both $\text{Nd}_2\text{O}_3 \cdot \text{H}_2\text{O}$ and Nd_2O_3 until it has been heated at 1000°C .

Graphitic acid. L. Balbiano. *Annali Chim. Appl.*, 1915, 4, 231—245.

GRAPHITIC acid and graphitic oxide, prepared by different methods from samples of natural and Acheson graphite, varied in composition between limits corresponding to the formulæ $\text{C}_{13}\text{H}_4\text{O}_7$ and $\text{C}_{11}\text{H}_4\text{O}_7$. On heating *in vacuo* carbon monoxide, carbon dioxide, and water are produced, and at high temperatures (1000°C .) also some hydrogen and a small quantity of methane, due to a secondary action of water vapour on the residual carbon. When graphitic acid or oxide is boiled with barium hydroxide solution, barium carbonate is formed; whilst after treatment with hydroxylamine in aqueous alcoholic solution, a residue of graphite containing adsorbed water is left. It is concluded that the so-called graphitic acid and oxide are adsorption compounds of graphite, water, carbon monoxide, and carbon dioxide.—A. S.

Tower systems of making "sulphite acid." Steffanson. See V.

Prevention of hydrolysis in cyanide solutions. Leslie. See X.

PATENTS.

Sulphuric acid chambers. J. Harris, Sheffield, and D. H. Thomas, Morriston, Glamorgan. Eng. Pat. 6026, Apr. 22, 1915.

The chamber is surrounded and supported by vertical pillars and horizontal girders, the curtain being attached to the latter by means of hooks. Each hook is pivoted on a leaden strip fixed to the curtain, and its other end, shaped like a U, fits into a similarly shaped piece on the girder. A block is wedged in between the curtain and framework at the point of attachment of the hook. A rent or tear in the curtain is readily accessible, as only one hook has to be detached. The roof is arched and suspended by similar hooks from bars arranged radially between a central ring and the outer framework. A pipe or flue may pass through the aperture within the ring to allow gases to pass from or into the chamber.—E. H. T.

Ammonia compounds. [Absorption of ammonia by peat.] T. Rigby, Dumfries, Scotland, and Wetcarbonizing, Ltd., Westminster. Eng. Pat. 18,558, Aug. 11, 1914.

PEAT which has been treated by heat, or wet-carbonised, is used as an absorbent for ammonia gas, especially for that obtained from ammonia-recovery gas producers. The ammonia fixed in this manner is not again liberated below 100°C ., and the product possesses valuable fertilising power. Old peat is better than young, but even

with the latter the nitrogen content can be raised from 1.2 to about 3%.—E. H. T.

Ammonia; Production of—. F. W. de Jahn, Assignor to General Chemical Co., New York. U.S. Pat. 1,151,537, Aug. 24, 1915. Date of appl., Feb. 21, 1914.

NITROGEN and hydrogen, in the volumetric ratio of 1:3, are brought under a pressure of 34—95 atmos., into contact with a catalyst, consisting essentially of an alkali metal and nitrogen (see following abstract), and heated to 550° — 600°C . The gases must be purified from contact poisons. The yield of ammonia, which depends upon the gaseous pressure, is about 5% by volume.—E. H. T.

Ammonia; Catalyst for the production of—, and process of making. F. W. de Jahn, Assignor to General Chemical Co., New York. U.S. Pats. (A) 1,159,364 and (B) 1,159,365, Nov. 9, 1915. Dates of appl., June 30, 1914, and May 5, 1915.

(A) PURIFIED, ignited granules of pumice stone are heated with metallic sodium in a neutral atmosphere; the sodium is melted and by vigorous stirring is caused to distribute itself uniformly in the pores of the pumice stone. The material is then heated in ammonia gas at about 300°C . until a constant weight is attained. (B) The sodium, prior to being heated in ammonia, is treated with a cobalt compound, and water-soluble matter is removed from the product.—E. H. T.

Ammonia from the elements; Manufacture of—. Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 286,719, Jan. 15, 1914. Addition to Ger. Pat. 285,698 (this J., 1915, 1143).

CONTACT substances are prepared from alkali or alkaline-earth ferro- or ferri-cyanides by heating at a temperature below 500°C . and under pressure, in a current of nitrogen and hydrogen, or in one of these gases.—A. S.

Ammonium bicarbonate solution; Continuous production of a warm-saturated—. Chem. Fabr. Brugg A.-G., Brugg, Switzerland. Ger. Pat. 286,241, July 4, 1914.

THE solution is prepared in a truncated pyramidal column composed of superposed sections. The column is packed with filling material and there is a cooling coil in each section. Ammonia solution is introduced at the top of the column and carbon dioxide at the bottom. The temperature of the solution in each section is higher than in the section above, and the saturated solution leaves the column at 50° — 60°C . The parts of the apparatus which come in contact with the solution are made of aluminium or magnalium.—A. S.

Ammonium bicarbonate; Process for chemically drying centrifuged—. Chem. Fabr. Brugg Akt.-Ges., Brugg, Switzerland. Eng. Pat. 9051, June 19, 1915. Under Int. Conv., June 19, 1914.

CENTRIFUGED ammonium bicarbonate is treated with ammonia and carbon dioxide gases, whereby the adherent moisture is utilised to produce more bicarbonate. The apparatus is constructed of aluminium or of magnalium, and consists of an externally cooled, closed chamber containing mechanism for agitating, a single inlet pipe for the ammonia and carbon dioxide, which are forced in under 1½ atmos. pressure, openings for charging and discharging, a narrow outlet for gas, and an external gutter for collecting the water used to spray the vessel as the gases are admitted.—E. H. T.

Ammonium bromide from mother liquors from the potash industry and similar liquors and from coals containing bromine; Process for obtaining—. M. Isleib, Magdeburg, Germany. Ger. Pat., 286,183, Apr. 10, 1914.

COAL is moistened with the liquor containing brom-

ine and then carbonised. The sublimate produced is mixed with the condensed aqueous liquor, the whole concentrated at 60° C., the ammonium chloride which crystallises out is separated, and the residual liquor, containing ammonium bromide, is evaporated at 40° C. until a saline crust forms, then treated with 15 times its quantity of 95% alcohol in a closed vessel, and the alcoholic solution separated after 24 hours. The solution contains chiefly ammonium bromide. By treatment with caustic soda the dissolved salts may be converted into a mixture of sodium salts, from which pure sodium bromide is dissolved by treatment with 12 times its quantity of 90% alcohol.—A. S.

Potash; Recovery of— from potassium-iron silicates. H. P. Bassett, Catonsville, Md., Assignor to The Spar Chemical Co., Baltimore, Md. U.S. Pat. 1,159,464, Nov. 9, 1915. Date of appl., Feb. 19, 1914.

GREEN sand marl, consisting chiefly of glauconite, or other potassium-iron silicate, is washed and dressed to eliminate the larger particles of admixed quartz, dried, mixed with sodium bisulphate and salt, and then heated to a dull red heat in presence of sufficient reducing agent to reduce some of the sulphate to sulphide; the product is then lixiviated and the dissolved potassium compounds recovered.—E. H. T.

Alkali hydroxides and cement-making material; Process for the simultaneous production of soluble—. Process for the simultaneous production of soluble alkali compounds and cement-making materials. A. W. Heyman, Northampton, Pa. U.S. Pats. (A) 1,160,171 and (B) 1,160,172, Nov. 16, 1915. Dates of appl., Apr. 17, 1909, and Mar. 21, 1912.

(A) ARGILLACEOUS rock or other mineral containing insoluble alkali is heated, preferably above a red heat, with calcareous material, and the product is lixiviated with water. The calcareous material should be added in such proportion that the ratio of calcium oxide to argillaceous material in the insoluble residue is between 1.7 and 2.2. (B) A mineral containing insoluble alkali and calcareous material (or to which calcareous material is added), but free from chloride, is heated as above, and the heated product is lixiviated with water. Carbon dioxide may be passed into the water during lixiviation.—F. SOBX.

Vanadium and selenium; Compounds of—. F. von Oefele, New York. U.S. Pat. 1,154,949, Sept. 28, 1915. Date of appl., May 20, 1913.

VANADIUM selenides (V_2Se , white; V_2Se_2 , yellow; V_2Se_3 , red; V_2Se_4 , dark blue; V_2Se_5 , green; V_2Se_6 , perselenide) and derivatives of vanadates and vanadites in which one atom of oxygen is replaced by selenium, are obtained by treating an oxide of vanadium with selenium dioxide, or selenium and nitric acid, and heating the compound formed, with or without reducing agents, until reduction is complete. The compounds are stated to be either directly soluble in the body liquids or to form soluble compounds when introduced into the body.—W. R. S.

Hydrogen; Apparatus for effecting reactions of— under pressure. M. Pier, Zehlendorf, Germany. U.S. Pat. 1,159,865, Nov. 9, 1915. Date of appl., May 7, 1914.

AN inner and an outer tubular vessel are separated by a space containing a material which is inert and impervious with respect to hydrogen (e.g., a metal with low fusion point) and which closely embraces the inner vessel. The tubes may be open, but in contact at each end, and with means for closing the ends. Hydrogen is supplied to the inner tube.—F. SOBX.

Tungsten or molybdenum carbide; Production of pieces of— of any desired size. Voigtländer und Lohmann Metall-Fabr.-Ges., Essen, Germany. Ger. Pat. 236,184, Apr. 17, 1914.

A MIXTURE of tungstic or molybdic anhydride or oxide with the necessary quantity of powdered carbon is placed in a carbon crucible and heated in a carbon tube resistance furnace, provided with carbon current-leading connections, until a fluid melt is obtained.—A. S.

Acetic acid from acetylene; Process for producing— by electrolysis. C. Hansen and A. Weindel, Leverkusen, Germany, Assignors to Synthetic Patents Co., New York. U.S. Pat. 1,159,376, Nov. 9, 1915. Date of appl., Jan. 28, 1914.

SEE Fr. Pat. 467,778 of 1914; this J., 1914, 830.

Hydrochloric acid; Manufacture of— from its elements. Soc. Ital. di Elettrochimica. Fr. Pat. 476,631, Dec. 1, 1914.

SEE Eng. Pat. 22,024 of 1914; this J., 1915, 1142.

Sodium carbonate; Process and apparatus for the production of—. M. Spazier. Fr. Pat. 476,081, Aug. 22, 1914.

SEE Eng. Pat. 29,837 of 1913 and U.S. Pat. 1,127,691 of 1915; this J., 1914, 749; 1915, 282.

Nitrogen compounds of aluminium and alkali or alkaline-earth metals; Process of producing—. D. A. Peniakoff, Brussels. U.S. Pat. 1,159,989, Nov. 9, 1915. Date of appl., Feb. 10, 1914.

SEE Fr. Pat. 465,679 of 1913; this J., 1914, 644.

Nitrogen compounds [cyanides]; Method for producing—. C. E. Acker, Ossining, N.Y., Assignor to The Nitrogen Co. U.S. Pat. 1,160,811, Nov. 16, 1915. Date of appl., Sept. 2, 1910.

SEE Fr. Pat. 425,699 of 1910; this J., 1911, 956.

Cyanogen compounds; Process and furnace for making—. A. R. Lindblad. Fr. Pat. 476,615, Nov. 26, 1914.

SEE Eng. Pat. 22,852 of 1914; this J., 1915, 905.

Nitrogen; Fixation of— by means of ferro-aluminium. Soc. Générale des Nitrures. Fr. Pat. 476,121, Apr. 4, 1914.

SEE Eng. Pat. 4287 of 1915; this J., 1915, 961.

Hydrogen sulphide from gases; Process of removing—. K. Burkheiser, Hamburg, Germany. U.S. Pat. 1,160,375, Nov. 16, 1915. Date of appl., Mar. 2, 1914.

SEE Fr. Pat. 469,122 of 1914; this J., 1914, 953

Ammonia and hydrogen sulphide from gases or solutions; Recovery of—. F. Duviolsard. Fr. Pat. 475,463, July 20, 1914.

SEE Eng. Pat. 17,475 of 1914; this J., 1915, 897.

Electrolysis of alkali chlorides or alkaline-earth chlorides. A. Clemm, Mannheim, Germany. U.S. Pat. 1,160,847, Nov. 16, 1915. Date of appl., Oct. 16, 1913.

SEE Eng. Pat. 21,462 of 1913; this J., 1914, 312.

Salt; Production of cooking— from rock salt. L. W. Damman. Fr. Pat. 475,235, May 1, 1914.

SEE Ger. Pat. 276,344 of 1913; this J., 1915, 138.

Base-exchanging substances; Manufacture of—. W. E. Evans and E. L. Leblanc. Fr. Pat. 475,743, July 28, 1914.

SEE Eng. Pat. 17,663 of 1914; this J., 1915, 904.

Zinc solutions; Extraction of zinc from— as oxide. P. Ferrere. Fr. Pat. 476,271, Apr. 11, 1914.
SEE Eng. Pat. 13,333 of 1914; this J., 1915, 228.

Heating device for corrosive gases, vapours, and liquids, especially for heating the liquor in the direct recovery of ammonia. Ger. Pat. 286,606. See 11B.

Method of production of calcium bisulphite liquor. U.S. Pat. 1,159,352. See V.

VIII.—GLASS; CERAMICS.

Annual Report of the Chief Inspector of Factories and Workshops. Sec 1.

Mixture	1:3	1:4	1:5	1:6	1:7	1:8	1:9	1:10	1:15	1:20
After 7 days	100	80	60	40	35	30	25	20	10	7
After 28 days	100	80	65	50	40	35	30	25	15	10

PATENTS.

Glass. E. C. Sullivan and W. C. Taylor, Assignors to Corning Glass Works, Corning, N.Y. U.S. Pat. 1,151,911, Aug. 31, 1915. Date of appl., Oct. 27, 1913.

THIS glass is adapted to give air-tight joints with metal wires and has a linear expansion of more than 0.000012, and the requisite degree of fluidity when heated to a temperature of 610° C. It is composed of about 42% of silica, 19 of soda, 5 of potash, 19 of barium oxide, and 15% of alumina.—W. C. H.

Glaze, enamel, or glass composition. S. H. Hull, Cincinnati, Ohio. U.S. Pat. 1,158,922, Nov. 2, 1915. Date of appl., Mar. 20, 1914.

THE composition contains metallic lead in the form of a powder substantially as impalpable as white lead, for which it is substituted.—W. C. H.

Ovens and drying apparatus for use in making tiles, bricks, pottery, and analogous ware, and for annealing, etc. C. Dressler. Fr. Pat. 475,887, Aug. 1, 1914.

SEE Eng. Pat. 18,821 of 1913; this J., 1915, 81.

IX.—BUILDING MATERIALS.

Plastic [cement] mortars; Testing of—. M. Gary. Mitt. k. Materialprüf., 1914, 32, 434—448.

COMPARATIVE mechanical tests were made with prisms prepared from cement and sand gauged to a plastic mortar, in accordance with a suggestion of a committee of the International Society for Testing Materials (compare Schüle, this J., 1913, 1069), and with test-pieces made from the same materials gauged to an "earth-moist" mortar as prescribed in the German standard tests (compare this J., 1910, 1107). With the cement-sand mixtures tested, from 10 to 11.8% of water was used in preparing the plastic mortar, and from 8.25 to 9.3% for preparing the "earth-moist" mortar. Considerably more concordant results were obtained with the test-pieces made from "earth-moist" mortar rammed into the moulds than with the prisms moulded with plastic mortar.—A. S.

Concretes prepared from cement and gravel; Results of tests of—. H. Burchartz. Mitt. k. Materialprüf., 1914, 32, 474—496.

USING five different Portland cements and three consignments of river gravel, a large number of

samples of concrete were prepared, the ratios of cement to gravel being 1:3, 1:4, 1:5, 1:6, 1:7, 1:8, 1:9, 1:10, 1:15, and 1:20 respectively. Sufficient water was used to obtain the concrete in an "earth-moist" condition, and it was then rammed into moulds, and allowed to harden 1 day in the mould and then up to 28 days in the air, being moistened every day from the second to the twenty-eighth. Tensile and bending tests were found to give less concordant results than crushing tests, and, moreover, gave lower values for the 28-day tests than for the 7-day tests. The detailed results of the tests are tabulated. The comparative values for the crushing strength of the different mixtures, taking the value for the 1:3 mixture as 100, were approximately:—

If the crushing strength after 7 days be taken as 100, the following figures would represent approximately the crushing strength of the various mixtures after 28 days: 1:3 mixture, 120; 1:4, 125; 1:5, 130; 1:6, 135; 1:7, 140; 1:8, 145; 1:9, 150; 1:10, 155; 1:15, 165; and 1:20 mixture, 170. It is stated that for practical purposes these figures may be used for calculating the strength of different concrete mixtures from results obtained with one mixture of the same materials, and for calculating the strength after 28 days from the strength after 7 days.—A. S.

Mortars and concretes; Compressive strength of Portland cement—. R. J. Wig, G. M. Williams, and E. R. Gates. Technol. Paper No. 58, U.S. Bureau of Standards. J. Franklin Inst., 1915, 180, 608—613.

ABOUT 20,000 tests were made of mortars and concretes of various compositions in which about 150 different aggregates, consisting of limestones, granites, gravels, trap rocks, and cinders (slags), were used. *Mortars:* The highest compressive strengths were generally obtained with aggregates having a gradation of particles approaching a straight line, but certain other aggregates also gave high strengths. As material for fine aggregates, sand was not superior to limestone screenings; the value of such material can only be determined satisfactorily by a practical test made under the same conditions as in the proposed structure. *Concrete:* No standard of compressive strength can be assumed or guaranteed for concrete of any particular composition unless all the factors entering into its preparation are controlled, a desired strength not being necessarily guaranteed by a specification requiring only the use of certain types of materials in stated proportions. The relative value of fine aggregates for concrete mixtures cannot be determined by testing them in mortar mixtures, and the relative value of coarse aggregates can only be ascertained by testing them in such combination with the fine aggregates as to produce maximum density in the concrete, assuming the ratio of cement to total combined aggregate to be the same in all cases. Density is a good measure of the relative compressive strength of different mixtures of the same aggregates with the same proportion of cement to total aggregate: the mixture having the greatest density will have a relatively high strength, but not necessarily the maximum; the compressive strengths of concretes having the same density, but composed of different aggregates, may vary widely. No definite relation exists between the gradation of the aggregate and the

compressive strength of the concrete; the gradation curve for maximum compressive strength is usually the same as that for maximum density, but differs for each aggregate. When the relative volumes of fine and coarse aggregate are fixed, the compressive strength of a concrete increases directly with the cement content, but not in the same proportion; otherwise, an increase in the proportion of cement to total fine and coarse aggregates may result in a higher or lower strength. The compressive strength of concrete made to a definite specification and exposed under given conditions can only be determined by testing the concrete actually prepared and treated in the prescribed manner.—W. E. F. P.

Concrete; Influence of temperature on the strength of —. A. B. M'Daniel. Bull. No. 81, Univ. of Illinois, U.S.A. J. Gas Lighting, 1915, 122, 439.

DETERMINATIONS were made of the crushing strength of cylindrical test-pieces of concrete hardened for periods of from 3 to 28 days at temperatures varying between 20° and 90° F. (—7° and 32° C.). The specimens were 6 in. high and 6 in. in diameter and all composed of "Universal" Portland cement, clean and well graded sand (density 1.79, sp.gr. 2.65, and containing 32% of voids) and crushed limestone ("good quality") in the proportions of 1:2:4 by weight or 1:2.2:3.6 by volume. Under uniform temperature conditions the strength of the concrete increased with age, the rate of increase being lower at the lower temperatures and declining as the age advanced. Under normal hardening conditions (60°—70° F., 16°—21° C.) the compressive strength of the concrete subjected to a uniform temperature at the ages of 7, 14, and 21 days was approximately 50, 75, and 90% of the strength at 28 days, the percentage values being less at the lower and greater at the higher temperatures. Specimens maintained at 60°—70° F. for one week had practically double the strength of those kept at 32°—40° F. (0°—4° C.) for the same time. Curves are given for use in determining the representative strengths of similar concretes prepared and aged under the conditions of the tests.

—W. E. F. P.

PATENTS.

Fire-brick and like refractory material, paving and building slabs, artificial stone and the like; Process for the manufacture of —. F. L. Schauernmann, Twickenham, Middlesex. Eng. Pat. 4142, Mar. 16, 1915.

GROUND or broken silica or flint is incorporated with a mixture consisting of blue lias lime, sodium silicate, and a solution of "cuttle-fish powder" in water. The mass is moulded into shapes, dried, and fired. For building or paving slabs sand may be substituted for broken flint, and cement for blue lias lime.—W. C. H.

Cementitious product. C. Ellis, Montclair, N.J., Assignor to Ellis-Foster Co. U.S. Pat. 1,151,515, Aug. 24, 1915. Date of appl., Nov. 9, 1911.

THE product is a partially fritted mass of associated cement materials in substantially the proportions occurring in Portland cement; the components are virtually in true combination and similar to well clinkered Portland cement. The mass, produced in a slow calcining or decarbonating zone of a special rotary kiln, is free from carbon dioxide and consists of relatively soft, porous granules possessing cementitious properties and capable on further heating of coalescing into cement clinker of ordinary vitrified character without any substantial change in composition.—W. C. H.

Toxic product [for wood preserving] and method of making same. J. A. de Cew, Montreal, Canada. U.S. Pat. 1,155,708, Oct. 5, 1915. Date of appl., Feb. 25, 1914.

AN alkaline arsenical compound, e.g., sodium arsenite, is added to waste sulphite liquor from pulp mills, and the product made slightly acid. The arsenic compound combines with the organic colloidal materials of the sulphite liquor.—W. C. H.

Brick-kiln. F. W. Miles, Assignor to Hydraulic Press Brick Co., St. Louis, Mo. U.S. Pat. 1,159,062, Nov. 2, 1915. Date of appl., Nov. 25, 1914.

THE upper part of the bottom of the kiln is perforated throughout and provided underneath with connecting flues. On each side of the kiln chamber double walls form combustion pockets to which gas is supplied and also air which passes to the pockets through flues in the kiln bottom. The products of combustion are drawn evenly over the material to be burnt from both sides of the chamber, then through the perforations in the bottom to a main flue beneath. The main and air conducting flues are situated close to each other in order to preheat the air before it enters the combustion pockets.—W. C. H.

Brick-kiln. C. Smith, Assignor to Claude Smith Co., Chicago, Ill. U.S. Pat. 1,159,539, Nov. 9, 1915. Date of appl., Feb. 18, 1915.

THE wall of a circular kiln is composed of a thin layer of refractory material completely encased in a metallic shell which extends below the ground line. A number of fire-boxes are arranged in openings in the wall and extend outwards from the metallic shell. The parts of the shell beneath the fire-boxes are tied together by connecting elements.—W. C. H.

Highly-refractory material and process for making it. A. Pfaff, Freiberg, Germany. U.S. Pat. 1,159,264, Nov. 2, 1915. Date of appl., Mar. 24, 1915.

A MIXTURE of about equal parts of zirconia and carborundum, in which the grains of the latter are coarser than those of the former, is moulded into shapes, which are then burnt.—W. C. H.

Furnace-lining. A. P. Meyer, Aspinwall, Pa., Assignor to Allen S. Davison Co., Pittsburgh, Pa. U.S. Pat. 1,160,085, Nov. 9, 1915. Date of appl., Apr. 22, 1915.

THE material consists of a mixture of granulated hard burnt dolomitic lime and sufficient granulated basic open-hearth slag to serve as a binder and to fill the voids between the granules of lime.—W. C. H.

Simultaneous production of alkali hydroxides or soluble alkali compounds and cement-making materials. U.S. Pats. 1,160,171 and 1,160,172. See VII.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Steel forgings; The cause and effect of "ghost lines" in large —. J. O. Arnold, Inst. Mech. Eng., Nov. 19, 1915. Engineering, 1915, 100, 542—544.

THE author considers that "ghosts" are formed in large ingots by segregation in the following manner:—Just before the ingot solidifies, a definite alloy of iron with manganese sulphide freezes out from solution, and segregates to a series of centres. These frozen masses seem to form nuclei, around which gather the migratory elements of steel, namely, carbon, sulphur, phosphorus, and, if present, nickel. A more or less globular compound segregate, somewhat variable in composition, is thus

produced. On forging, the "ghost globules" relatively high in carbon, sulphur, and phosphorus, are drawn out into strings, which, on turning, exhibit themselves as the well-known "ghost lines." In an annealed forging the "ghost line" is converted into a streak of iron free from carbon, but containing in solid solution, and hence invisible, the iron phosphide, which has expelled the carbon to the edge of the "ghost." The sulphur is scattered through the iron of the "ghost" in the form of dove-grey streaks of manganese sulphide. Sulphur and phosphorus both amount to about 0.1% in the "ghost lines" in structural steel. Mechanical tests made on test-bars cut from a propeller shaft so as to contain well-marked "ghost lines" did not reveal any signs of weakness due to the presence of the latter, and the author is of opinion that no risk is incurred by using shafts similar to that examined. Some large "ghosts" examined by the author were produced in the following circumstances. In casting a 57-ton mild-steel nickel-chrome ingot a burst-out occurred at the bottom 5 minutes after the casting was completed, and the ingot was hollow for 21 in. down, owing to the "bleeding" of about 17 tons of steel. The "ghosts" were found on the inner surface of the hollow portion. Some were about 9 in. long and $\frac{1}{8}$ in. in diameter. Their appearance is considered to prove conclusively that "ghosts" freeze first at many degrees above the freezing point of the main mass. Determinations made on the steel free from "ghosts" and on some chipped-out "ghost" material gave respectively the following results:—C 0.19, 0.27; Mn 0.53, 0.57; Si 0.168, 0.215; S 0.037, 0.12 (mean); P 0.028, 0.082 (mean); Cr 0.75, 0.74; Ni 3.74, 4.24%.—T. ST.

Iron, molybdenum, and carbon; Chemical and mechanical relations of.—J. O. Arnold and A. A. Read. *Inst. Mech. Eng.*, Nov. 19, 1915. *Engineering*, 1915, 100, 555—557.

FIVE steels were prepared containing respectively Mo 2.43, 4.95, 10.15, 15.46, and 20.70%, with carbon ranging between 0.71 and 0.82%, and the forged annealed bars were tested mechanically. All the bars hammered soundly. Portions of the steels were dissolved electrolytically and the carbide residues investigated. No definite molybde of iron corresponding to tungstide of iron was obtained. The iron and molybdenum in the residues were determined by dissolving in nitro-hydrochloric acid, sulphating, and then estimating first the iron by titration with permanganate after reduction with sulphurous acid, and secondly the iron and molybdenum together, by titration with permanganate after reduction with amalgamated zinc in a Jones reductor (compare Randall, this J., 1907, 1164). The results indicated mixtures of Fe_3C and $\text{Fe}_3\text{Mo}_3\text{C}$, free iron carbide disappearing at about 18.25% Mo. The pure double carbide was obtained as a fine grey powder insoluble in strong boiling hydrochloric acid, and was not attracted by a magnet. The double carbide was also obtained from the steel with Mo 20.70% after drastic quenching, and this result is considered to demonstrate that the carbon in hardened steels exists in the form of carbide in solid solution. Quenching and file hardness experiments made with the steel containing Mo 15.46% showed that the transformation of the ferro-molybdenum pearlite to its hardenite began at about 925°C. and was completed at about 1100°C. After quenching from above 1100°C. the steel was "dead hard" to the file and was very brittle. The use of high percentages of molybdenum in steels is therefore to be avoided. Low percentages exert a beneficial influence on certain classes of steel when used either alone or to replace about $2\frac{1}{2}$ times the percentage of tungsten. In their

mechanical properties annealed molybdenum steels are distinctly inferior in ductility to corresponding tungsten steels, when statically tested in tension, and their inferiority under alternating stresses is very marked.—T. ST.

Iron; Corrosion of.—K. P. Grigorowitch. *Rev. Soc. russe de Métal.*, 1914, 1, 70—88, 115—147. *Rev. Mét.*, 1915, 12, Extraits, 242—247.

THE electrolytic corrosion of iron in contact with different metals and other substances was studied. Contact with iron sulphide was found to promote corrosion; the sulphide was not dissolved during the process, its electrolytic potential being lower than that of metallic iron: the greater ease of oxidation of iron containing sulphur (as MnS) may thus be due to local currents produced between the ferrite and manganese sulphide. The divergence of opinion as to the relative corrodibilities of cast and wrought iron and steel is regarded as proceeding from inherent differences in the methods of investigation employed. The influence of thermal treatment on the solubility (corrosion) and electrolytic potential of various steels was determined; the solubility of ordinary cast steel was greatest after quenching, or reheating to 400°C., and generally least after annealing, but varied only slightly with the carbon content; the electrolytic potential of the steels varied with the temperature and time of reheating, but more with regard to the intermediate than to the initial and final values.

—W. E. F. P.

Molybdenum steel; The corrosion of.—L. Aitchison. *Chem. Soc. Trans.*, 1915, 107, 1531—1538.

EXPERIMENTS made with a standard pure carbon steel and with a series of steels containing varying quantities of molybdenum up to 20%, employing solutions containing (a) 3% salt, (b) 1% sulphuric acid, (c) 10% sulphuric acid, and (d) tap water, have shown that there is a definite increase of corrosion by addition of molybdenum to the steel until very high percentages are reached. With the acid solutions, the corrosion is less than with carbon steel when the specimen contains 15% or more of molybdenum.—B. N.

Ferric iron solutions; Reduction of—prior to titrating with permanganate. A. Hoenig. *Z. anal. Chem.*, 1915, 54, 441—457. *J. Chem. Soc.*, 1915, 108, ii., 800—801.

THE methods usually employed (use of zinc, aluminium, magnesium, silver, stannous chloride, etc.) are criticised, and the following modification of the stannous chloride method is recommended. About 0.11 gm. of hæmatite, 0.25 gm. of other iron ore, 0.5 gm. of bauxite, or 5 grms. of limestone is operated on. The final filtrate should occupy about 50 c.c., and contain about 10 c.c. of free hydrochloric acid. After heating the solution in a measuring flask, stannous chloride solution is slowly added until the liquid is quite decolorised; a large excess of the reagent should be avoided. 2 grms. of flowers of sulphur is now introduced, and the whole is boiled for one to two hours in a current of carbon dioxide; the water evaporating should be frequently replenished. When cold, the whole is made up to the mark, and an aliquot part of the clear liquid is transferred to a flask already containing 100 c.c. of water and 25 c.c. of manganese solution, and slightly tinged with permanganate, and the whole is now titrated with standardised permanganate (1 c.c.=0.0027843 gm. of ferric oxide). The manganese solution is prepared by dissolving 170 grms. of crystallised manganese sulphate in water, adding 400 c.c. of phosphoric acid (sp.gr. 1.7) and 340 c.c. of sulphuric

acid (sp.gr. 1.8). The whole is then diluted with water to 2.5 litres.

Cyanide consumption on the Witwatersrand. H. A. White. J. Chem., Met., and Min. Soc., S. Africa, 1915, 16, 24—36.

THE average consumption of cyanide is stated to be 0.40 lb. per ton of ore treated. To determine whether any material saving could be effected, the following analysis of cyanide loss was made (in lb. NaCN per ton of ore; "other losses" include thiocyanate, ferrocyanide, ammonia compounds, and zinc box losses):—

Mine.	Loss as cyanides in pulp.	Loss as HCN-gas.	Other losses.	Total.
Simmer Deep ..	0.1184	0.1367	0.0499	0.305
Rose Deep	0.1008	0.1326	0.0346	0.268
Geduld	0.1274	0.1233	0.0693	0.320

Increased proportion of slime in the pulp treated increases the loss owing to the greater amount of liquid in the slime tailing. The loss by evaporation of hydrocyanic acid was not diminished by loose or incomplete covering of the vessels containing the solutions. Weak liquors kept their strength for 7 days in presence of protective alkali, while with strong ones the loss became serious if the free alkalinity was below 0.01% NaOH. The evaporation loss was considerably greater with pure solutions than with mill solutions containing zinc. The working loss at the stage of transferring from the collectors to the first slime settling vat, was found to be 0.0122 lb., and from the first to the second settling vat, 0.0188 lb. NaCN per ton of slime.—W. R. S.

Cyanide solutions; Prevention of hydrolysis in —. H. M. Leslie. J. Chem., Met., and Min. Soc., S. Africa, 1915, 16, 36—49. (See also preceding abstract.)

THE decomposition of cyanide solutions by exposure to the air was investigated, and is attributed to hydrolysis into hydrocyanic acid and free alkali; the rate of hydrolysis increases with the temperature and dilution. The liberated alkali has little or no protective action, while addition of free alkali only affords incomplete and temporary protection. In two parallel experiments on a 0.25% solution, the loss in a closed vessel was only 6.8%, while in an open vessel all the cyanide was destroyed in 24 days. In tests on a large scale at the Village Deep mine, the results obtained indicated an annual loss by evaporation of over 20 tons of potassium cyanide. Tests made in a small experimental cyanide plant built on the "closed system" principle indicated a possible saving of 50—60% of cyanide. In the discussion H. A. White pointed out that the covering of solution sumps, which was the rule in the early days of the process, had been abandoned, it being now recognised that aeration was essential for correct working. He described some experiments showing that practically no loss of hydrocyanic acid occurred if the air in contact with the cyanide liquor was free from carbon dioxide.

—W. R. S.

[Gold and silver.] *Zinc-dust precipitation tests; The results of* —. N. Herz. Trans. Amer. Inst. Min. Eng., Sept., 1915. Min. and Eng. World, 1915, 43, 769—771.

SHARWOOD'S method for determining the precipitating efficiency of zinc dust (this J., 1912, 437) yields results much lower than those ordinarily obtained if the standard silver cyanide solution is replaced by a similar solution containing an equivalent proportion of gold alone or gold and

silver together; this is in agreement with the fact that, in practice, gold is more difficult to precipitate than silver. Results more in harmony with those of actual practice are obtained by employing a solution twice as strong in silver as that originally recommended. The new solution contains exactly 30 grms. of potassium silver cyanide and about 1.5 of potassium cyanide (or equivalent quantities of the corresponding sodium compounds) per litre. Before final dilution, the free cyanide content of the solution is adjusted to about 0.2% NaCN, a slight excess of lime water added, and the liquid filtered; the solution is then diluted to the mark and tested for protective alkalinity, which should be equivalent to between 0.01 and 0.015% NaOH. The impurities in zinc dust are also considered and their probable influence on the precipitation test discussed. In 13 samples of commercial zinc dust from different sources, the percentages of lead, cadmium, and zinc oxide varied between 0.15 and 5.20, 0.00 and 3.90, and 6.30 and 17.85, respectively.—W. E. F. P.

Gold and copper; Transformations in alloys of —. N. Kurnakov, S. Shemtschushni, and M. Zasedatelev. J. Russ. Phys. Chem. Soc., 1915, 47, 871—897. J. Chem. Soc., 1915, 108, ii., 783—784.

MEASUREMENTS of the hardness of gold-copper alloys by Brinell's method confirmed the existence of a very distinct maximum of hardness (200 kilos. per sq. mm.) at about 50 at. % of gold, but yielded a diagram, the form of which was not in agreement with that required by theory for a series of solid solutions. The authors have, therefore, carried out a new series of systematic investigations of the cooling curves, microstructures, hardness, and electrical conductivities of the cooled and tempered alloys. The results of these measurements show that the continuous isomorphous mixtures of copper and gold, or the α -solutions, are stable only at temperatures of 367.3° C. (50 at. % Au) and 370.8° C. (25 at. % Au). Below these transformation points, decomposition of the isomorphous mixtures occurs, with separation of the definite compounds, CuAu and Cu₃Au, which form solid solutions with excess of their components. The very simple forms of electrical conductivity and hardness diagrams previously observed correspond with a continuous series of α -solid solutions of gold and copper, the decomposition of these not being noticed during the cooling of the fused alloy. The transformation of such a solution with separation of the new phases requires a moderately long time, and the necessary tempering may be considerably delayed. Closer examination of the influence of tempering and cooling on the alloy containing 50 at. % Au reveals an interesting difference in properties between the α -solid solution and the auride, CuAu, which is the product of the transformation at temperatures below 370.8° C. The α -solution is a comparatively soft, plastic substance, which can be rolled or drawn into wire, whilst the compound, CuAu, exhibits marked hardness and brittleness, in consequence of which rolling or drawing is impossible. Thus, with this alloy (50 at. % Au), the influence of tempering and cooling on the properties of the solid is the reverse of that with many other metals.

Zinc coating on galvanised iron articles; Determination of the nature and thickness of the —. O. & Bauer. Mitt. k. Materialprüf., 1914, 32, 448—474.

A PIECE of the galvanised iron is immersed in 2% sulphuric acid containing 2 grms. As₂O₃ per litre until the evolution of gas ceases, whereupon it is immediately withdrawn, wiped with cotton wool, rinsed with alcohol, dried, and weighed. The loss of weight represents the amount of the coating.

The solution is tested for iron, the presence of which indicates that the article was coated by the hot galvanising process. Experiments showed that in the case of electrolytically galvanised iron, the zinc coating is removed quantitatively, and the solution is free from iron, whereas with articles coated by the hot galvanising process, both the outer coating of pure zinc and the intermediate layer of zinc-iron alloy are dissolved. These results show that there can be no formation of an intermediate layer of zinc-iron alloy in electrolytically galvanised iron (compare Guertler, this J., 1911, 1003). As a confirmatory test, a piece of the galvanised iron is immersed for 24 hours in a solution of ammonium citrate (200 grms. of $\text{NH}_4\text{C}_6\text{H}_5\text{O}_7$ per litre) and the loss in weight determined. If the zinc coating was applied by the hot galvanising process, the solution will contain dark flocks of metallic lead and a deposit of spongy lead will be left on the iron, whereas in the case of electrolytically galvanised iron, no such deposit will be observed and the solution will be clear. Similar dark flocks separate in the treatment with the sulphuric acid-arsenious acid reagent, but may sometimes consist of reduced arsenic. A sample of sherardised iron behaved like iron galvanised by the hot process when submitted to the above tests.—A.S.

Bronze (Cu 88, Sn 10, Zn 2); The microstructural changes accompanying the annealing of— H. S. Rawdon. U.S. Bureau of Standards. J. Franklin Inst., 1915, 180, 607–608. (See also this J., 1915, 1057.)

THE crystal or grain size of the cast alloy not deformed by mechanical means or induced internal strains was not changed by annealing, and the characteristic polyhedral twinned crystals were produced only when the structure had been distorted previous to heating. The size of the crystals produced by annealing (for 1, 2, 4, and 8 hours at 400°, 600°, and 800° C.) samples whose surfaces had been previously distorted by machining, increased with the time of heating, and the depth of recrystallisation was practically constant for a given temperature, thus substantiating Tammann's theory of recrystallisation of "cold-worked" metals on heating.—W. E. F. P.

Metallic colloids; Spontaneous formation of—in contact with a dispersive medium. H. Nordensen. Koll. Chem. Beihefte, 1915, 7, 91–109. J. Chem. Soc., 1915, 108, ii., 752–753.

ACCORDING to Traube-Mengarini and Scala (this J., 1911, 210; 1912, 310), colloidal solutions of many metals are obtained when these are brought into contact with dispersive media, such as water and ethyl alcohol. Experiments by the author have failed to confirm the above observation, and his results lead to the conclusion that in no case are metallic colloids formed by the spontaneous dissolution of the metals. When oxidisable metals are submitted to the action of water, colloidal solutions of the oxide or hydroxide are sometimes obtained, but the effect in such cases is primarily due to chemical action between the metal and traces of oxygen. Colloidal solutions of this nature are formed by lead in contact with water and many organic solvents. Silver is also very readily attacked by oxygen both in water and in ethyl alcohol, and the resulting colloidal oxide is subsequently transformed into metal, so that in this case colloidal metal solutions are obtained. The formation of the colloidal silver is, however, a secondary effect, and cannot be interpreted as evidence of the spontaneous disintegration of the solid metal.

Colloidal metals; Formation of—by the action of light, Röntgen, and radium rays on metals in contact with a dispersive medium. H. Nordensen. Koll. Chem. Beihefte, 1915, 7, 110–136. J. Chem. Soc., 1915, 108, ii., 753. (Compare preceding abstract.)

PREVIOUS experiments on the action of ultra-violet light and Röntgen rays on metals in contact with water and other dispersive media (Svedberg, this J., 1909, 1316) have been interpreted as affording evidence that colloidal solutions of the metals are formed in these circumstances. The further investigation of this question has shown that light, Röntgen, and radium rays have no effect beyond that of accelerating the changes which take place in the absence of these rays. Gold and platinum are entirely unaffected. The oxidisable metals yield colloidal solutions of the oxides or hydroxides. In the case of silver, the initially formed colloidal oxide is rapidly reduced under the influence of ultra-violet rays, and colloidal silver is thereby obtained.

The polish problem. See VII.

PATENTS.

Iron ores; Process of treating—to obtain a new product for use in smelting. D. V. Hollingworth and R. C. Magowan, Stoke-on-Trent. Eng. Pat. 18,103, July 31, 1914.

IRON ores containing carbonaceous material, such as black band ores, are heated to redness out of contact with air, and the distillation products recovered. The residue (named "carbousiron") consists of ferrous and ferric oxides with some retained carbon and hydrocarbons, the particles of which are in intimate contact with the particles of the iron oxides. This product is thus in a suitable condition for economical smelting in a blast furnace, and yields a very uniform iron.—T. St.

Steel; Process of heat treatment of— E. C. R. Marks, London. From Soc. Anon. Ital. Gio. Ansaldo & Co., Genoa, Italy. Eng. Pat. 18,387, Aug. 7, 1914.

THE steel (gun parts, armour plates, etc.) is gradually heated to a uniform temperature approximating that of the first arrest on the cooling curve; after a predetermined period it is slowly cooled to a uniform temperature slightly above that of the last arrest on the curve; this temperature is maintained for a definite period, and the steel is then quenched.—W. E. F. P.

Iron and steel; Method of preventing the rusting of— D. F. Comstock, Brookline, Assignor to Comstock and Wescott, Boston, Mass. U.S. Pat. 1,159,748, Nov. 9, 1915. Date of appl., June 2, 1911.

THE metal is treated with an alcoholic solution of an alkali hydroxide, exposed to the air to evaporate the solvent and convert the hydroxide into carbonate, and then coated with shellac.—W. E. F. P.

Zinc ores or products; Extraction of zinc compounds from— H. T. Durant, and The Metals Extraction Corporation, Ltd., London. Eng. Pat. 21,737, Oct. 29, 1914.

ZINC sulphide ore is roasted to produce as much zinc sulphate as is practicable, and the coarse and fine parts of the crushed roasted ore are separately leached with water to dissolve the zinc sulphate, the fine part being treated in a filter-press. The solution is separated and the residues treated first with a quantity of dilute sulphuric acid insufficient to dissolve the whole of the zinc oxide remaining,

and finally with a quantity more than sufficient to dissolve the last remains. The liquor obtained from the last extraction is used in conjunction with a fresh supply of dilute acid to dissolve the zinc from a fresh batch of roasted ore.—T. St.

Sulphides [e.g., of lead and zinc]; Separation of mixed metallic—. L. Bradford, Broken Hill, N.S.W. Eng. Pat. 21,880, Nov. 2, 1914. Under Int. Conv., Nov. 13, 1913.

FLOTATION is effected in an acid medium to which a frothing agent and a small quantity of a reducing agent (e.g., thiosulphate, sulphite, sulphur dioxide, or hydrogen sulphide) are added; in presence of the reducing agent the zinc blende is wetted, and the galena is obtained as float concentrate. The non-floating portion is treated with an oxidising agent or with steam and air and again subjected to flotation separation to recover the zinc blende.

—W. R. S.

Lead alloys; Hard—. F. C. Frary, Minneapolis, and S. N. Temple, St. Paul, Minn. U.S. Pats. 1,158,671—1,158,675, Nov. 2, 1915. Dates of appl., (A) July 26, (B) July 31, (C) Aug. 2, (D) Aug. 13, and (E) Aug. 13, 1915.

THE alloys consist of lead, a small amount of hardening agent (e.g., copper), and (A) less than 2% of calcium; (B) a small quantity of mixed alkaline-earth metals; (C) a small quantity of strontium; (D) less than 10% of barium; or (E) less than 1% of magnesium.—W. R. S.

Annealing-furnace. J. E. White, Tarentum, Assignor to West Penn Steel Co., Brackenridge, Pa. U.S. Pat. 1,158,760, Nov. 2, 1915. Date of appl., Mar. 18, 1915.

THE furnace has a combustion chamber at one end and the roof slopes downwards from this end towards the opposite end. The combustion chamber is shut off from the interior of the furnace by a bridge wall, from which an inner horizontal roof extends nearly to the downward-sloping outer roof at the opposite end of the furnace, thus leaving a transverse gas port communicating with the interior. Circulation ports are also provided at the sides of the horizontal roof. The bottom of the furnace is provided, on each side of a central pier, with longitudinal channels having outlet openings communicating with outlet ports leading to a stack and provided with controlling dampers.—T. St.

Furnace; Metal-melting—. O. J. Warman, Assignor to The Buckeye Products Co., Cincinnati, Ohio. U.S. Pat. 1,158,875, Nov. 2, 1915. Date of appl., Mar. 16, 1912.

THE crucible stands on a pedestal within a cylindrical furnace made of fire-resisting material and provided with a single fuel inlet inclined downwards. The pedestal is cylindrical except that opposite to the fuel inlet a vertical deflector edge is formed, the sides of the edge being tangential to the surface of the cylinder. The flame is projected slantingly downwards against the bottoms of both sides of the angle, to the bottom of the annular channel formed between the furnace-wall and the pedestal, and thence is reflected upwards and around the pedestal and crucible.—T. St.

Sulphating materials [ore]; Method of—. H. B. Hovland, Duluth, and G. B. Frankforter, Minneapolis, Minn. U.S. Pats. (A) 1,159,032 and (B) 1,159,033, Nov. 2, 1915. Dates of appl., May 15 and May 28, 1915.

(A) THE ore is treated with sulphurous acid in presence of oxygen, the pressure being maintained above atmospheric. The reaction is augmented by the catalytic action of an electric arc. (B) THE

material to be sulphated is made into a pulp and subjected at the ordinary temperature, under sufficiently high pressure, to the action of a sulphur-yielding substance, e.g., sulphurous acid, and chemically available oxygen. The reaction is augmented by means of a catalytic agent.—T. St.

Metals [copper]; Method of sulphidising—. H. B. Hovland, Duluth, Minn. U.S. Pat. 1,159,042, Nov. 9, 1915. Date of appl., July 16, 1915.

THE solution obtained by treating copper-bearing or other ore with an appropriate solvent, is treated with calcium sulphide and ferric sulphate, with or without an acid, to precipitate the copper or other metal as sulphide.—W. E. F. P.

Ores and the like; Apparatus for leaching—. P. A. Robbins, Timmins, Ontario. U.S. Pat. 1,160,200, Nov. 16, 1915. Date of appl., Aug. 19, 1914.

THE apparatus consists of an open, cylindrical tank the lower part of which is in the form of an inverted, truncated cone, and an open cylinder of about the same height, which is arranged concentrically within the tank so as to divide it into two compartments communicating at their lower ends. A mixture of ore pulp and solvent is supplied to the outer compartment, the liquid from which is discharged by means of a peripheral overflow; the more solid portion accumulating at the bottom is fed into the lower end of the inner compartment by means of a rotary scraper, agitated therein with a second liquid, and the mixture discharged through vertical pipes extending through the bottom of the apparatus.

—W. E. F. P.

Delinting; Electrolytic process of—. *Electrolytic delinting system*. H. Goldschmidt, Essen, Germany, Assignor to Goldschmidt Delinting Co., New York. U.S. Pats. (A) 1,160,400 and (B) 1,160,401, Nov. 16, 1915. Date of appl., Feb. 5, 1908.

(A) SEVERAL lots of scrap tin are immersed in each of several alkaline baths in metal receptacles, the electrolyte being supplied at a high temperature and withdrawn from each receptacle separately. An electric current of high amperage is passed through each bath and the scrap tin, the current being distributed in parallel through the several lots of tin in each bath. (B) An electric current is passed through each of several vessels, which have individual electric switches for short-circuiting them. A high supply reservoir, for delivering electrolyte, is connected by a main supply and branch pipes with the vessels, the pipes ending in sections of insulating material at each vessel. The electrolyte is passed through one or more slime tanks to a low return reservoir, from which it may be returned to the supply reservoir, and individual controlling means are provided for governing the flow of electrolyte to the vessels.

—B. N.

Metallic coverings [e.g., tin]; Method of removing from other metals. H. Foersterling and H. Philipp, Perth Amboy, N.J., Assignors to The Roessler and Hasslacher Chemical Co., New York. U.S. Pat. 1,160,590, Nov. 16, 1915. Date of appl., Mar. 15, 1910. Renewed Apr. 6, 1915.

TIN-PLATE scrap is treated with metallic sodium which alloys with the tin; the alloy is removed from the iron and its constituents recovered.

—W. R. S.

Aluminium or aluminium alloys; Process of melting—. G. Mellen, Mount Vernon, N.Y. U.S. Pat. 1,160,430, Nov. 16, 1915. Date of appl., Feb. 10, 1911.

THE melting chamber is partly exhausted and the air replaced by a gas having no action on the

charge. The charge is then melted, and the chamber again partly exhausted. Alternatively an inert atmosphere may be produced by introducing a reagent capable of combining with atmospheric oxygen at the temperature employed.

—W. E. F. P.

Aluminium; Process for producing — from clay, kaolin, and other aluminium silicates. G. Mellen, East Orange, N.J., Assignor to United Aluminium Ingot Co. U.S. Pat. 1,160,431, Nov. 16, 1915. Date of appl., Aug. 27, 1912.

In a cyclic process, clay, etc., is fused with sodium sulphate and sulphuric acid, the product lixiviated with water, and the mixture filtered. The filtrate is treated with a solution of sodium fluoride, the precipitated aluminium fluoride filtered off, and the filtrate evaporated to recover sodium sulphate for further use. The aluminium fluoride is fused with a sodium salt, the melt electrolysed to recover aluminium, and the exhausted electrolyte used to precipitate fresh aluminium fluoride.

—W. E. F. P.

Ores; Process of smelting —. J. H. Klepinger, M. W. Krejci, and C. R. Kuzell, Great Falls, Mont. U.S. Pat. 1,160,621, Nov. 16, 1915. Date of appl., Jan. 21, 1915.

FINELY divided oxidised ore is blown into a treatment chamber, with or without finely divided flux and fuel, or gaseous fuel may be employed. The fused particles of reduced metal and slag are precipitated to the floor of the chamber and conveyed under agitation and in a reducing atmosphere to a settler, where metal and slag separate.—W. R. S.

Slag; Utilising the heat of molten —. R. Bagga-ley, Pittsburgh, Pa. U.S. Pat. 1,160,817, Nov. 16, 1915. Date of appl., Feb. 25, 1915.

A RECEPTACLE containing water is mounted upon trunnions, and has a flat top plate in which are fixed parallel, downwardly tapering, open-top slag tubes, which extend downwards within the receptacle. Water and steam supply and circulating connections extend through one of the trunnions. The slag tubes are discharged by inverting the container, and can be sprayed with water while inverted.—W. R. S.

Metals; Method of reducing —. J. W. Beckman, Berkeley, Cal. U.S. Pat. 1,160,822, Nov. 16, 1915. Date of appl., Dec. 9, 1914.

OXIDISED ores are heated to a temperature above their melting-point (e.g., to about 2000° C.) in an electric furnace, then transferred to a converter, and subjected to the action of a reducing gas, obtained from the cracking of natural oil and mixed with air to maintain the temperature of reaction.

—W. R. S.

Fluid material; Method of and apparatus for treating — [to control solidification]. C. Hering, Philadelphia, Pa. U.S. Pat. 1,160,169, Nov. 16, 1915. Date of appl., Dec. 7, 1912.

A RESTRICTED region near the top of the molten material is subjected to the action of an electric current which is of such strength as to effect heating and automatic stirring (by producing the "pinch effect") in the upper portion of the mass.

—F. SODN.

Steel; Process of treating —. C. H. A. F. L. Ross, Balnagowan Castle, Scotland. Eng. Pat. 5269, Apr. 7, 1915. Under Int. Conv., July 27, 1914.

SEE U.S. Pat. 1,151,049 of 1915; this J., 1915, 1017.

Armour plates; Method and apparatus for the cementation of — by mixed carburising agents. Soc. Anon. Ital. Gio. Ansaldo & Co. Fr. Pat. 475,744, July 28, 1914. Under Int. Conv., Oct. 16, 1913.

SEE Eng. Pat. 18,386 of 1911; this J., 1915, 88.

Steel; Process for the heat treatment of —. Soc. Anon. Ital. Gio. Ansaldo & Co. Fr. Pat. 475,745, July 28, 1914. Under Int. Conv., Nov. 10, 1913.

SEE Eng. Pat. 18,387 of 1914; preceding.

Steels containing chromium and copper; Manufacture of —. Soc. Anon. des Acières et Forges de Firminy. Fr. Pat. 475,973, Mar. 28, 1914.

SEE Eng. Pat. 3427 of 1915; this J., 1915, 1017.

Castings of iron oxide; Manufacture of —. Soc. Ital. di Elettrochimica. Fr. Pat. 475,817, July 30, 1914.

SEE Eng. Pat. 17,161 of 1914; this J., 1915, 910.

Tin from tin plate waste; Process for extracting —. Chem. Fabr. von der Linde, and G. von der Linde, St. Toenis, Germany. Eng. Pat. 11,071, May 5, 1911. Under Int. Conv., May 5, 1913.

SEE U.S. Pat. 1,116,176 of 1914; this J., 1914, 1214.

Tin or tin compounds; Process for obtaining —. J. Rueb. Fr. Pat. 475,752, July 28, 1914.

SEE Eng. Pat. 20,609 of 1914; this J., 1915, 1059.

Furnaces for reducing ores. New Metals Process Co. Fr. Pats. 476,216 and 476,217, Aug. 6, 1914.

SEE Eng. Pats. 17,322 and 17,323 of 1914; this J., 1915, 910.

Metals; Extraction of — from ores. New Metals Process Co. Fr. Pats. 476,218 and 476,219, Aug. 6, 1914.

SEE Eng. Pats. 17,324 and 17,325 of 1914; this J., 1915, 875, 1017.

XI.—ELECTRO-CHEMISTRY.

Silent discharge in gases at atmospheric pressure. St. Sachs. Ann. Physik. 1915, [iv.], 47, 886—926. J. Chem. Soc., 1915, 108, ii., 735.

ACCORDING to Warburg's theory (Verh. Deut. Physikal. Ges., 1903, 20, 382) of the action of the Siemens ozoniser, the apparatus behaves as an ordinary condenser until the applied potential difference exceeds a certain limiting value. Above this limit discharge occurs, and electricity must be supplied to maintain the potential difference constant. The ratio of this quantity of electricity to the difference of potential affords a measure of the "apparent capacity" of the ozoniser. The apparent capacity of an ozoniser has been investigated in a series of experiments with air, oxygen, nitrogen, hydrogen, carbon dioxide, and mixtures of helium and neon at atmospheric pressure. It is found that the apparent capacity of the ozoniser, through which hydrogen or nitrogen is passed, is independent of the rate at which the gas is passed through the apparatus. On the other hand, the experiments with air, oxygen, and carbon dioxide show that the apparent capacity increases with the rate at which the gas is passed through the ozoniser. Chemical changes are brought about by the action of the silent discharge on these three gases, whereas these changes are absent in the case of hydrogen and nitrogen. The observations lead to the conclusion that chemical reactions facilitate the passage of the discharge, but that the accumulation

of the products of the reactions is, in general, unfavourable to the discharge. The fact that the apparent capacity of the ozoniser when supplied with air, oxygen, or carbon dioxide varies with the speed of the current of gas, is in agreement with this statement.

Consumption of carbon in the electric arc. Duffield. See IIb.

Electrolytic oxidation of manganous salts, and compounds obtained thereby. Sem. See VII.

Electrolytic hydrogenation of unsaturated aliphatic acids. Pomilio. See XX.

PATENTS.

Arc between electrodes not in contact; Method of establishing a voltaic —. F. C. Ucar, Madrid. Eng. Pat. 2349, Feb. 13, 1915.

A HIGH-VOLTAGE auxiliary current is used to produce a discharge between the electrodes, thus striking the arc, which, when once established, is maintained in normal conditions without continuing the current. For this purpose, a transformer is employed with low tension and high tension coils, with condensers, a spark gap, and another coil divided at its middle point. The ends of this coil are connected to the electrodes, and the division points to the supply leads, these points corresponding to the nodes of the fundamental electric oscillation in such manner that self-inductances are unnecessary to prevent the high voltage current extending to the supply leads. In an alternative arrangement, two transformers are employed, one being provided with spark gap and condensers, and its high tension coil coupled with the low tension one of the second transformer. The divided coil forms the high tension coil of this transformer, the ends of which are connected to the electrodes, and the divided points to the supply leads and to an arrangement of electrolytic or electric valves capable of preventing the passage of the high voltage current.—B. N.

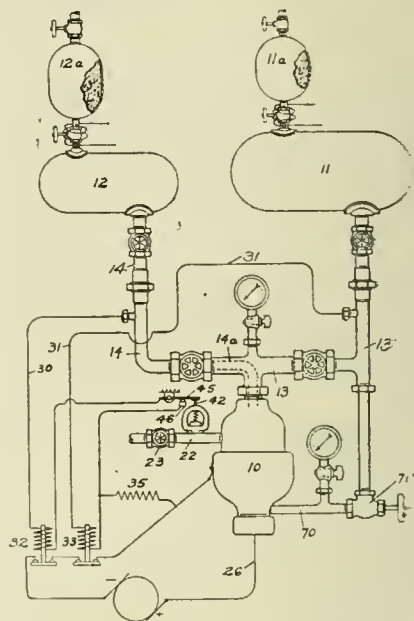
Furnace; Electric —. P. A. Boeck, Assignor to Norton Co., Worcester, Mass. U.S. Pats. (A) 1,158,971 and (B) 1,158,972, Nov. 2, 1915. Date of appl., Nov. 2, 1911.

(A) THE furnace chamber consists of a receptacle, open at the top, having a helical groove in its outer surface, which merges at the bottom edge into a spiral groove in the base, so as to form a continuous groove; a resistor is arranged within the groove, with its ends projecting respectively from opposite ends. Alumina, previously melted, forms a refractory envelope of high thermal conductivity covering the resistor, and a heat-retaining packing surrounds the envelope. (B) The furnace chamber is provided with refractory walls, surrounded by a resistance element, and around this is arranged an envelope of alumina, previously melted, which distributes and equalises the heat, and prevents general or local overheating. A heat-insulating packing surrounds the envelope of alumina.—B. N.

Gases; [Electrolytic] apparatus for producing —. R. H. Goddard, Worcester, Mass. U.S. Pat. 1,154,009, Sep. 21, 1915. Date of appl., Jan. 4, 1915.

LIQUID, e.g. a weak acid solution, is electrolysed in the chamber, 10, which is formed from two heavy cast portions screw-threaded together, the oxygen passing through the pipes, 14a and 14, to the gas chamber, 12, whilst the hydrogen passes through the pipe, 13, to the chamber, 11. At the start, electrolyte is supplied through the pipe, 22, until the chambers, 10, 11, and 12, are filled with liquid, and the gas is then accumulated

in the chambers, 11 and 12, until a very high pressure is reached. If necessary, the gases may be dried by means of suitable material in the



chambers, 11a and 12a, before being stored in suitable vessels. The conductors, 30 and 31, are arranged in a shunt circuit with a resistance, 35, so that only a feeble current is passed through this circuit, and, when either of the ends of the conductors, 30 and 31, are uncovered by the electrolyte, the main circuit is broken by a relay, 32 and 33. By means of a piston and spring attached to the rod, 42, the contacts, 45 and 46, may be separated when the pressure within the chamber, 10, has risen to a predetermined value. Metallic ring electrodes are separated by a porous ring, and supported in position by concentric non-conducting cylindrical shells. The conductor, 26, passes through two sets of packing, one in a recess and one in the base of the chamber, 10; and by means of a by-pass, 70, and valve, 71, the pressure is allowed to rise within the recess until it is half the maximum pressure in the chamber, 10, when the valve, 71, is closed.—B. N.

Galvanic cell [depolariser]. M. L. Kaplan, Brooklyn, N.Y. U.S. Pat. 1,160,999, Nov. 16, 1915. Date of appl., Dec. 24, 1914.

A DENSE form of manganese dioxide is deposited as a depolarising coating on finely-divided graphite, from a manganese nitrate solution mixed with the graphite, and the material is freed from matter soluble in water and compressed. The coating acts as a binding agent, agglomerating the carbonaceous material.—B. N.

Electrolytic cells. H. R. Nelson, Elizabeth, N.J., U.S.A. Eng. Pat. 10,604, July 21, 1915. Under Int. Conv., Aug. 17, 1914.

SEE U.S. Pat. 1,149,210 of 1915; this J., 1915, 969.

Electric flame arc furnaces; Process for preventing punctures in —. Norsk Hydro-Elektrisk Kvaelfstofaktieselskab. Fr. Pat. 475,989, Aug. 12, 1914.

SEE U.S. Pat. 1,148,343 of 1915; this J., 1915, 913.

Method and apparatus for treating fluid material [to control solidification]. U.S. Pat. 1,160,169. See X.

Method of making a plastic [insulating] body from paper pulp. U.S. Pat. 1,160,362. See V.

XII.—FATS; OILS; WAXES.

Fish oil stearine and oleine. M. Tsujimoto. J. Chem. Ind., Tokyo, Japan, 1915, 18, 1062—1071.

SAMPLES of fish oil stearine, oleine, and soap stock fatty acids, said to be obtained mainly by dis-

Soy oil, which is best refined by reduction with zinc dust and sulphuric acid, followed by treatment with Kambam earth (see this J., 1913, 12; 1915, 840), is a commercial product used in the manufacture of low-grade soaps. Saké oil is not yet a commercial article.—C. A. M.

Mustard oil and composition of black mustard seeds. C. A. Huber and P. Van der Wielen. Pharm. Weekblad, 1915, [39]. Perfumery and Essent. Oil Rec., 1915, 6, 341—342.

SAMPLES of black mustard seeds from various sources have been examined, and the amounts of volatile and fatty oil, with the constants of the latter, determined, with the following results:—

Origin of seed.	No. of seeds in 1 grm.	Volatile oil %	Fatty oil %	Sp. gr. 15° C.	Ref. index 22° C.	Iodine value.	Saponif. value.
Dutch	1125	1.23	25.7	0.923	1.4731	126	183
North-Holland	976	1.15	28.0	0.921	1.4724	124	187
English	630	1.07	31.4	0.920	1.4719	119	182
Russian	362	0.63	37.0	0.921	1.4725	120	189
Caucasian	1690	1.07	29.8	0.919	1.4712	113.5	190
Italian	910	0.87	32.5	0.919	1.4720	115	188.5
Sicilian	964	0.94	32.9	0.921	1.4721	114.5	187
Rumanian	490	0.66	35.7	0.921	1.4714	120	190
Bombay	292	1.07	33.5	0.920	1.4721	119	183

—T. C.

tillation from the fatty acids of Japanese herring oil, had the following characters:—

	Stearine.	Oleine.	Soap stock fatty acids.	
			1	2
M.pt.	53.5° C.	—	39.5–40° C.	37.5–38.5° C.
Solidif. pt. (liter test) ..	52° C.	—	—	—
Sp.gr. 15°/4° C.	—	0.9009	—	—
Neutralisation value ..	213.65	169.67	201.90	196.65
Saponific. value. .	214.56	191.05	210.30	202.98
Iodine value (Wijs) ..	17.38	63.38	38.41	42.70
Unsap. matter ...	—	4.78%	1.83%	2.87%
Mackey test* ...	—	93° C. after 1 hr., 97° C. after 2 hrs.	—	—

* See Hyland and Lloyd, this J., 1915, 62; Mackey, 1915, 595.

—C. A. M.

"Soy" and "saké" oils. M. Tsujimoto and T. Ueno. J. Chem. Ind., Tokyo, Japan, 1915, 18, 1072—1076.

"Soy" oil is a mixture of soya bean and wheat oils obtained as a by-product in the brewing of soy (yield 0.25 to 0.3% by volume). It is a dark red to brown liquid or semi-solid mass with an aromatic odour of soy. "Saké" oil consists chiefly of rice oil and is found floating on the surface after the fermentation of saké (yield 0.01 to 0.02% by vol.). It is an orange-yellow liquid with an odour of saké. Samples of these oils had the following characters:—

	Soy oil.		Saké oil.
	1	2	
Sp.gr. 15°/4° C.	0.9000	0.9835	0.9031
Solidif. pt.	—5° C.	—13° C.	Turbid at 6° C.
Acid value	59.24	55.03	22.59
Saponif. value	184.12	182.81	179.11
Iodine value (Wijs)	127.79	133.22	101.56
Refractive index (20° C.)	1.4650	1.4633	1.4660
Unsap. matter %	2.88	2.72	—

Fats: Hydrolysis of — by steam under pressure. J. Marcussön. Mitt. k. Materialprüf., 1914, 32, 502—506.

TRIBENZOLIN, tripalmitin, and tristearin were partially hydrolysed by heating with water under pressure in an autoclave, and from the residue the non-hydrolysed glyceride was separated by the method of Spitz and Hönig (this J., 1891, 1039), using benzene as solvent in the case of tribenzol. In all three cases the residue had a lower melting point than the original ester, and in the case of tripalmitin and tristearin, the residues also gave lower Hehner and saponification values and higher saponification values after acetylation. It was proved that under the conditions used for acetylating, no replacement of fatty acid residues by acetyl groups occurred (compare Willstätter and Madinaveitia, Ber., 1912, 45, 2827), and hence the high acetyl values found can be attributed only to the replacement of hydroxyl by acetoxy groups. The results show that in the hydrolysis of fats by steam under pressure, mono- and diglycerides are formed as intermediate products. Similar results were obtained with palm-kernel oil, and hydrolysis by acids and by enzymes appears to proceed in like manner.—A. S.

Fats, fixed and essential oils, and waxes; Determination of the acid and ester values of —. H. F. Slack. Chem. and Drug., 1915, 87, 673—674.

ABOUT 5 grms. of oil is heated to about 80° C. and the acid value determined by titration with N/10 alcoholic potassium hydroxide solution. 20 c.c. of approximately N/1 solution of potassium hydroxide in benzyl alcohol is then added, and the flask heated over a direct flame for 5 minutes beneath a reflux condenser. The solution is cooled to about 100° C., diluted with neutralised methyl alcohol, and the excess of alkali titrated with N/1 hydrochloric acid, with continual agitation. The benzyl alcohol method is particularly suitable for the saponification of beeswax. The solution is best prepared by heating the potassium hydroxide with a little benzyl alcohol and pouring the solution into the remainder of the cold solvent. It is advisable to determine the acid and ester values of the benzyl alcohol and to apply the correction to the final results. The ordinary

process of saponification may be accelerated by reducing the volume of neutralised alcohol in the determination of the acid value, and by using alcoholic alkali for the titration of the free acids, and *N/1* alcoholic alkali solution for the saponification, the flask being constantly shaken during the boiling.—C. A. M.

Fatty acids in soap; Determination of—H. F. Slack. *Pharm. J.*, 1915, 95, 696—697.

FIVE grms. of the shredded soap is dissolved in 10 c.c. of hot glycerol, and the fatty acids liberated from the solution by the addition of 4 c.c. of hydrochloric acid (1:3). They will form a clear, supernatant layer, which can be withdrawn into a graduated pipette, after the addition of hot water if necessary. The top of the pipette is closed with a rubber tube and clip, the pipette suspended in a cylinder of water at 50° to 55° C., and the volume of fatty acids read. To obtain accurate percentages the sp.gr. of the fatty acids should be known, but in practice it is sufficient to refer to a table giving the sp.gr. of the fatty acids from the following kinds of soap at 50° to 55° C.: (1) Milling; (2) household; (3) shaving; (4) coconut; and (5) soft soaps. For comparative purposes, however, the results may be stated in the number of c.c. of fatty acids yielded by a given weight of the soap.—C. A. M.

Beeswax and its adulterants; Viscosity of—U. Fabris. *Staz. Sperim. Agrar. Ital.*, 1915, 48, 595. *Annali Chim. Appl.*, 1915, 4, 285—286.

THE viscosity of beeswax and of a number of its adulterants was determined at 100° C. in an Ostwald viscosimeter, the values obtained being referred to that of nitrobenzene determined in the same apparatus and taken as unity. Except in the case of tallow, the values for the adulterants (carnauba wax, Japanese wax, spermaceti, paraffin, and ceresin) differed by at least 100 from that of beeswax.—A. S.

Fat recovery from sewage. Paulmann. See XIXB.

Electrolytic hydrogenation of unsaturated aliphatic acids. Pomilio. See XX.

Absolute viscometer. Stone. See XXIII.

PATENTS.

Oil-bearing material; Apparatus for and method of cooking—A. W. French, Piqua, Ohio. U.S. Pat. 1,158,476, Nov. 2, 1915. Date of appl., July 31, 1911.

THE oil-bearing material is heated in a number of chambers so connected that the material can be discharged automatically from one chamber to the next, and thus the quantity of material in the chambers and the time required for its passage through the apparatus definitely adjusted. Means are provided for admitting a regulated fine spray of water to the first chamber and for removing excess of water vapour and moisture from the other chambers.—W. P. S.

Oil-expressing apparatus. A. W. French, Piqua, Ohio. U.S. Pat. 1,158,797, Nov. 2, 1915. Date of appl., July 22, 1914.

A NUMBER of presses are arranged round a chamber in which the material is heated; the material is delivered from the chamber into a charging device so mounted that it may be moved from the discharge opening of the chamber to a position over a press, and from one press to another.—W. P. S.

Hydrogenation-catalyst; Semi-reduced—C. Ellis, Montclair, N.J. U.S. Pat. 1,159,480, Nov. 9, 1915. Date of appl., July 6, 1915.

A FINELY divided catalyst for hydrogenating fatty

material, etc., is obtained by partially reducing a basic compound of nickel with hydrogen. The product, which contains nickel and a lower oxide of nickel, is collected in a liquid which will keep it from contact with the air.—C. A. M.

Fatty and oleous materials; Process of separation of— from watery emulsions and finely-subdivided solid materials insoluble in water. G. Bottaro, Genoa, Italy. U.S. Pat. 1,159,355, Nov. 9, 1915. Date of appl., Nov. 12, 1914.

THE insoluble salt (e.g. a neutral salt of an alkaline earth metal) is converted into a soluble salt to separate it from the fatty substance. The latter is then separated from the water, and the soluble salt precipitated from the aqueous solution.—C. A. M.

Fatty acids; Process for bleaching—G. Petroff and G. von Tischenko, Petrograd, Russia. Eng. Pat. 9635, Apr. 18, 1914.

SEE Fr. Pat. 467,188 of 1914; this J., 1914, 875.

Edible oils; Process and apparatus for treating [hydrogenating] mixtures of—C. Ellis. Fr. Pat. 475,477, July 15, 1914.

SEE U.S. Pat. 1,095,144 of 1914; this J., 1914, 603.

Oil expressing apparatus. A. W. French, Piqua, Ohio, U.S.A. Eng. Pat. 11,814, Aug. 16, 1915.

SEE U.S. Pat. 1,158,797 of 1915; preceding.

Fatty aqueous emulsions containing insoluble sulphites of alkaline-earth metals; Process of de-emulsifying—G. Bottaro, Genoa, Italy. Eng. Pat. 22,351, Nov. 11, 1914.

SEE U.S. Pat. 1,159,355 of 1915; preceding.

Fatty substances; Process of separating— from aqueous emulsions containing finely divided, insoluble solid substances. G. Bottaro. Fr. Pat. 476,492, Nov. 10, 1914. Under Int. Conv., Nov. 14, 1913.

SEE U.S. Pat. 1,159,355 of 1915; preceding.

Sulphonated stearic products; Production and utilisation of—Levinstein, Ltd. Fr. Pat. 475,211, July 16, 1914.

SEE Eng. Pat. 16,577 of 1913; this J., 1914, 930.

Sulphonated palmitic products; Production and utilisation of—Levinstein, Ltd. Fr. Pat. 475,212, July 16, 1914.

SEE Eng. Pat. 16,578 of 1913; this J., 1914, 875.

Apparatus for purifying and filtering oils and other liquids. Eng. Pat. 192. See I.

[Flexible] composition of matter [from oxidised oils and cellulose esters]. U.S. Pat. 1,152,625. See V.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Iron-gall inks; Influence of the purity of the air of the testing room on the results of the durability test of—F. W. Hinrichsen and R. Kempf. Mitt. k. Materialprüf., 1914, 32, 536—538.

THE results of the durability test (no formation of a deposit or skin on allowing the ink to stand for 14 days exposed to the air) are markedly affected when considerable quantities of hydrogen chloride, sulphur dioxide, or ammonia are present in the air, but the traces of these gases, and of hydrogen sulphide, etc., ordinarily contained in the laboratory air have no appreciable influence.—A. S.

Turpentine oil; Norwegian—[from sulphite-cellulose manufacture]. H. W. Fosse, Ber. Deut. Pharm. Ges., 1915, 25, 303–313.

THE crude oil, obtained as a by-product in sulphite-cellulose manufacture, had sp.gr. at 15/15° C. 0.8918, $[a]_D^{20} = +7.8^\circ$, and contained no free acids; the greater part boiled between 157° and 160° C. The oil contained sulphur compounds and oxygenated substances, and had an unpleasant odour. The sulphur compounds and unpleasant odour were largely removed by treatment with calcium hypochlorite. The oil contains about 80% of d-pinene, with small amounts of sylvestrene and sesquiterpenes.—R. G. P.

PATENTS.

Paint; Petrol-proof—A. G. Hopkins, Kidderminster. Eng. Pat. 997, Jan. 21, 1915.

SODIUM silicate (12 parts) and light precipitated chalk (3 parts) are emulsified with oil (3 parts), a solution of egg-albumin (1 lb. in a pint of water to which oil of turpentine may be added), and lead carbonate. To this may be added a suitable calcium compound (calcium sulphate) mixed with oil, with or without liquid glue, shellac, rosin, or spirit varnish. The painted article is gently heated until the paint has set.—C. A. M.

Calcium sulphate-zinc sulphide pigment; Process for manufacturing—J. L. Carpenter, Brooksville, Miss., U.S.A. Eng. Pat. 3689, Mar. 8, 1915.

SEE U.S. Pat. 1,146,690 of 1915; this J., 1915, 914.

Condensation products from phenols, formaldehyde, and the like; Production of—K. Tarassoff, Moscow, Russia. Eng. Pat. 6716, Mar. 17, 1914. Addition to Eng. Pat. 528, Jan. 8, 1914.

SEE Fr. Pat. 470,810 of 1914; this J., 1915, 187.

Method of preparing resin size for paper manufacture. U.S. Pat. 1,160,906. See V.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

PATENTS.

Rubber; Coating fabrics with—F. A. Seiberling, Akron, Ohio, U.S.A. Eng. Pat. 1289, Jan. 26, 1915.

THE fabric passes from bolts or rolls, successively, through a frictional roller tensioning device, calenders where it receives a coating of rubber on one side, a second tensioning device, a second set of calenders where it is coated on the other side, a roller cooling device, a selvage trimmer, and a third set of calenders where it receives a skim-coating of rubber, to a reeling-machine.—E. W. L.

Rubber and rubber-like materials; Process of treating—R. B. Price, New York, Assignor to Rubber Regenerating Co. U.S. Pat. 1,158,843, Nov. 2, 1915. Date of appl., Nov. 15, 1913.

AFTER, or during, the incorporation of the vulcanising agent with a vulcanisable plastic, the latter is kneaded, e.g., between rolls, and simultaneously subjected to the action of an enveloping vacuum. The mass may then be enveloped in a yielding covering and subjected to pressure; or pressure may be applied direct to the exposed surfaces of the mass, either during or subsequent to the operations of kneading and subjecting to a vacuum.—E. W. L.

Rubber; Extraction of—*Triturating-machine.* D. Vecchini, New York, Assignor to Franco-American Rubber Co., Wilmington, Del. U.S. Pats. 1,159,137 and 1,159,138, Nov. 2, 1915. Dates of appl., Apr. 17 and May 21, 1914.

RUBBER is separated from shrubs or barks in which it is present in the form of filaments, by a process of trituration in a special machine, designed to break up the plant tissues and agglomerate the filaments without crushing or breaking them. The dried shrub or bark is fed into a conical hopper whence it is conveyed downwards, by means of blades on a vertical shaft driven from below, and subsequently by means of a feed screw on the shaft, through a vertical cylindrical casing having a helically-grooved internal surface. Thence the coarsely-crushed material passes downwards between the inner surface of a conical member suspended from the cylinder, and the outer surface of a smaller conical member attached to the vertical shaft. The inner surface of the outer member is provided with straight, alternately long and short ribs, whilst the outer surface of the inner cone has inclined ribs co-operating with the ribs of the outer cone.—E. W. L.

Rubber; Process of vulcanising—P. J. Murrill, New York, Assignor to Goodyear's Metallic Rubber Shoe Co. U.S. Pat. 1,159,327, Nov. 2, 1915. Date of appl., Dec. 10, 1914.

BEFORE vulcanising rubber with sulphur monochloride, the latter is purified by intimately associating it with an agent, such as metallic sodium or other alkali metal, which is inert towards the monochloride and its solvents.—E. W. L.

Rubber substitute and its manufacture. V. Ottorepetz. Fr. Pat. 476,396, Oct. 26, 1914.

SEE Eng. Pat. 21,524 of 1914; this J., 1915, 971.

Purification of hydrocarbons containing the conjugated double bond. Eng. Pats. 5073 and 5074. See XX.

XV.—LEATHER; BONE; HORN; GLUE.

PATENTS.

Tanning extracts; Apparatus for dissolving and treating vegetable—E. Schaub, Weehawken, N.J., Assignor to P. Voiges, New York. U.S. Pat. 1,158,304, Oct. 26, 1915. Date of appl., Mar. 2, 1914. Renewed Feb. 26, 1915.

THE material under treatment is supported on a perforated false bottom in a vertical, cylindrical or frusto-conical vessel provided with a central shaft; the portion of the shaft above the false bottom is surrounded by a sleeve, and the shaft and sleeve are rotated in opposite directions by means of bevel gears. The sleeve carries radial, perforated agitating arms, with perforated wings or blades at the ends, and perforated blades are also fixed to the inner wall of the vessel to assist the agitation. Below the false bottom is another agitator, fixed to the central shaft, and also a heating coil. A sampling tube controlled by a valve is fixed on one side of the vessel, and thermometers are supported in pipe stems passing through the wall of the vessel respectively above and below the false bottom.—A. S.

Condensation products [tanning materials] from dihydroxydiarylethanes; Preparation of—Ges. f. Chem. Ind. in Basel. Ger. Pat. 285,772, Sept. 2, 1913.

DIHYDROXYDIARYLETHANES. obtained by the

action of acetaldehyde on phenol or its homologues in presence of acid condensing agents, are converted into soluble substances, capable of tanning hide, by treatment with formaldehyde and normal sulphites.—A. S.

Leather: Preparation of waterproof sole—by impregnation. W. Rechberg. Hersfeld, Germany. Ger. Pat. 286,225, Nov. 2, 1913.

The leather is treated on the surface with a concentrated saline solution, then dried, impregnated as usual with fats, resins, hydrocarbons, or the like, and the salts then removed from the outer layer by brushing in warm water. Instead of a saline solution, a solution of glue, gelatin, albumin, or the like, to which a chromate or bichromate has been added, may be used. Leather free from impregnating material on the surface, but with the interior rendered waterproof, is obtained by this process.—A. S.

Hides; Treatment of—before tanning. C. C. Moore. Fr. Pat. 476,071, Aug. 20, 1914.

SEE Eng. Pat. 18,890 of 1913; this J., 1914, 326.

XVI.—SOILS; FERTILISERS.

Soil analysis; Method of mechanical—, S. Odén. Int. Mittell. Bodenkunde, 1915, 5, 257—311. Bull. Agric. Intell., 1915, 6, 1307.

The determination of the rate of sedimentation of soil particles in water affords a means of ascertaining the distribution of the soil components. By finding the weights of the particles sinking to the bottom of a uniform suspension of the soil sample in water in measured times, a sedimentation curve can be drawn which depends upon the size of the particles, and which is found to be characteristic of each soil sample. With the aid of this curve, it is possible to calculate the curve for the distribution of soil particles. The rate of sedimentation is measured in a cylinder, 11.75 inch high, filled with water, and containing, within 2 mm. of its base, a copper disc suspended by thin silver wires from one arm of a very delicate compensating balance: the other arm of the balance carries a compensating weight which can be increased or decreased automatically. When the soil sample is put in the cylinder, the copper plate sinks owing to the incidence of the soil particles upon it, but rises again as soon as the compensating weight on the other arm increases. This process is repeated until all the particles have settled, and then the total increase of the compensating weight gives the weight of the sample. The time of sedimentation is measured synchronously with the weights.—E. H. T.

Nitrite-forming organism [from the soil]: A new—, N. J. Joshi. Mem. Dept. Agric., India, Bacter. Ser., 1915, 1, 85—96. Bull. Agric. Intell., 1915, 6, 1305—1306.

By inoculating Pusa soil into Omélianski's medium, containing calcium carbonate instead of magnesium carbonate, a fluid culture of various bacteria was obtained, among which was a mass of ramifying thread-like organisms. When plated on silicate jelly and Beijerinck's agar, containing ammonium sulphate instead of sodium ammonium hydrogen phosphate, small white colonies developed after 10 days, and these also appeared as threads under the microscope. On inoculating Omélianski's solution with one of these colonies, nitrite, but no nitrate, was detected after 15 days at 30° C. The optimum temperature of activity of this organism is 25°—35° C., and the thermal death-point 70°—

80° C. It does not develop under anaerobic conditions; its action is retarded by asparagin and dextrose but stimulated by urea. Ammonium carbonate was the only nitrogen compound which was easily converted into nitrite by the organism when phosphates were excluded.—E. H. T.

Polish: Fixation of—by soil bacteria. S. Kyropoulos. Z. Gährungsphys., 1915, 5, 161—166. Bull. Agric. Intell., 1915, 6, 1306—1307.

SOIL samples of like humidity were treated with varying amounts of potash, sucrose being added to stimulate bacterial growth, and after incubating at 20°—25° C. for some weeks, the potash left in the soil was determined. It was found that none had been removed by the bacteria. Water-culture experiments gave a like result.—E. H. T.

Soil; Radioactivity of—and value of radium fertilisers. R. R. Ramsey. Science, 1915, 42, 219. Bull. Agric. Intell., 1915, 6, 1305.

THE amount of radium in an acre of soil to a depth of 5 inches is calculated to be about 1 mgrm., and the amount of emanation given off by the soil is from 50 to 100 times that emitted by the radium in the 5-inch layer. Hence to double the amount of emanation in the soil about 75 mgrms. of radium per acre would be required, and this would cost \$7500 (about £1500) per acre. A commercial radio-fertiliser examined would furnish to the soil only one-tenth as much radium as is normally present.—E. H. T.

Phosphoric acid of basic slag; Solubility of—in water saturated with carbonic acid. J. G. Mashaupt. Verslagen van Landbouwkundige Onderzoekingen d. Kijkslandbouwproefstations, 1915, No. 17, 97—135. Bull. Agric. Intell., 1915, 6, 1308—1310.

IN determining the solubility of the phosphoric acid of soils and fertilisers, insufficient attention is given to the fact that the smaller the ratio of material to water, the greater is the effect of the free lime and of the calcium silicates: the determination of the rate of solution by continued extraction would be preferable to the method of intermittent extraction. Wagner's method gives results proportional to those obtained with water saturated with carbonic acid, but has not been proved to estimate the relative fertilising powers of different types of basic slag, because the results have not been verified by cultural experiments, and there is no evidence that the total of phosphoric acid dissolved in a number of extractions is the only important factor. The varying solubility of the phosphoric acid of basic slag in 2% citric acid is not primarily due to the lime or calcium silicate content, but to the calcium phosphate itself, and very probably to the existence of calcium phospho-silicates. Slags with a high phosphoric acid content have always a relatively low solubility, especially in carbonic acid. Further experiments have shown that there is no direct relation between the lime and total silica content, and the solubility in 2% citric acid; nor any between the silicic acid soluble in acids and the solubility of the phosphoric acid. The phospho-silicates contain their silicic acid in a form incapable of determination. The solubility figures for citric acid and for water saturated with carbonic acid, after one extraction, show considerable differences; the latter solution is regarded as resembling the soil solution more nearly than the former.—E. H. T.

Sulphur compounds; Relation of—to plant nutrition. E. B. Hart and W. E. Tottigham. J. Agric. Res., 1915, 5, 233—250.

GREENHOUSE experiments were performed to trace the influence of sulphates and of sulphur upon some

common farm crops, which were grown in Miami silt loam soil contained in wooden boxes, the fertilising materials being thoroughly incorporated in the soil prior to sowing or transplanting. When mature, the plants were weighed, dried quickly at 50° C., then air-dried for 2–3 weeks, and weighed again. The yields given are based upon that of the control box (100). Each box contained 33 lb. of soil; the quantity of sulphate used was 12 grms. and of sulphur 5 grms. With sodium sulphate the yields were: beans (seeds only) 169, clover (roots) 152, radishes 126, rape (tops) 111, barley 147, and oats (straw) 68. With calcium sulphate the yields were: beans (seeds) 149, clover (hay) 110.4, (roots) 188, radishes 115, rape (roots) 115, barley (grain) 179, beans (straw and pods) 89, peas 87, oats (straw) 67. With a complete fertiliser containing calcium phosphate (12 grms.), potassium chloride (4.5 grms.), and sodium nitrate (10 grms.), in addition to sodium sulphate (12 grms.), the yields were: beans (seed) 185, (complete fertiliser alone 225), clover (hay) 153 (136), peas 93 (90), radishes 256 (236), rape (tops) 222 (188), (roots) 154 (157), barley 153 (111), oats 340 (200). Calcium sulphate and the same fertiliser gave: beans 226 (223), clover (hay) 160 (136), peas 103 (90), radishes 257 (236), rape (tops) 221 (188), (roots) 181 (151), barley 158 (111), oats 340 (200). In general, calcium sulphate was more beneficial than sodium sulphate, and the influence of both upon the root development of red clover and rape was particularly favourable. The effect of sulphur was generally harmful; the yield of beans was 51, clover 38, peas 17, radishes 60, barley 107, oats 82, and the crops were no better when calcium carbonate was added to the soil.—E. H. T.

Wood and plant ash; Composition of —. R. A. Berry. J. Board Agric., 1915, 22, 766–768.

The quantities of potash and of phosphoric acid present in various wood ashes, etc., are shown in the following table:—

Ash.	Potash (K ₂ O).		Phosphoric acid (P ₂ O ₅) Total.
	Total.	Soluble in water.	
Bracken	20.45	10.61	3.37
Spruce	11.94	8.23	7.01
Hardwood, largely oak trimmings	3.53	2.75	—
Mixed forest produce	3.13	1.50	1.54
Soft wood, forest fire	11.79	6.53	5.23
Hard wood, engine fire	10.44	6.77	5.02
Flue dust from blast furnaces	3.75–3.93	2.13–2.64	—

The phosphates are present chiefly in the form of calcium and magnesium phosphates. Whilst it is difficult to value the ashes for manurial purposes on the basis of the total potash, it is evident that four of the above ashes could be used in place of a low-grade potash fertiliser, such as kainit. The phosphates have much the same value as those in steamed bone flour. From the “lop and top,” undergrowth, weed growth, and litter in any average type of woodland, about 0.5 ton of ash is obtained per acre; 10 acres of fully-stocked bracken land produce 1 ton of ash. (See also this J., 1914, 1216).—W. P. S.

Carbon dioxide; Assimilation of — [by plants]. R. Willstätter and A. Stoll. Ber., 1915, 48, 1510–1564.

In an investigation of the relationship between the chlorophyll content of leaves and their power of assimilating carbon dioxide, the ratio of the weight of gas absorbed to the weight of chlorophyll—called the assimilation number—was determined, under

varying conditions of illumination and temperature, for a large variety of leaves in different states of maturity. For normal leaves, of good assimilating power and rich in chlorophyll, the assimilation number was approximately constant, i.e., the chlorophyll content was roughly proportional to the power of assimilation, but this did not hold for green leaves in autumn, which assimilate very poorly, for leaves of yellow varieties poor in chlorophyll, which assimilate very strongly, for etiolated green leaves, nor for early spring foliage, which possesses a high assimilating power. The assimilation of leaves rich in chlorophyll is not affected by very appreciable variations in the intensity of the incident light, but is accelerated by increase of temperature: on the other hand, yellow plant leaves, poor in chlorophyll, did not assimilate better when the temperature was raised from 15° to 30° C., but increase of the light intensity promoted assimilation and decrease hindered it. Leaves changing colour in autumn assimilated less well as the chlorophyll content diminished; autumnal green leaves maintain their assimilating power even after they have fallen. Faded leaves, collected from the ground 1–2 days after falling, showed a high assimilation number, in spite of a high chlorophyll content: in some cases, however, green leaves plucked in October and November showed very low assimilation, but younger leaves from the same stem gave a high assimilation number. These and other observations are all explicable on the hypothesis that, in addition to the chlorophyll, there is another important factor which regulates assimilation, viz., an enzyme which operates in close conjunction with the colouring matter. This enzyme is probably located at the point of contact between plasma and chloroplasts, and its function may be to decompose, with evolution of oxygen, an intermediate compound produced by the union of carbon dioxide and chlorophyll.—E. H. T.

Feeding and manurial values of sugar beet crowns and leaves. See XIXa.

PATENTS.

Fertiliser; Process of producing —. S. B. Newberry and H. N. Barrett, Baybridge, Ohio. U.S. Pat. 1,158,711, Nov. 2, 1915. Date of appl., Mar. 15, 1912.

The conversion of insoluble calcium phosphate into a citrate-soluble form is effected by calcining it in a powdered state at 2500°–3000° F. (1370°–1650° C.) with 5–15% of a volatile salt of an alkali metal, which accelerates the action.—E. H. T.

Superphosphate; Tilling reaction chamber for making —. H. W. Hall. Fr. Pat. 476,536, Nov. 17, 1914.

See Eng. Pat. 22,645 of 1914; this J., 1915, 439.

Ammonia compounds. [Absorption of ammonia by peat.] Eng. Pat. 18,558. See VII.

XVII.—SUGARS; STARCHES; GUMS.

Sucrose; Action of — on alkaline copper solutions. L. Maquenne. Comptes rend., 1915, 161, 617–623.

The reducing power of sucrose on boiling alkaline copper solutions, unlike that of invert-sugar, is affected to a greater extent by variations in the copper-content than by variations in the alkali-content of the reaction mixture; changes in the duration of boiling also have a greater effect on the reducing power of sucrose than on that of invert-sugar. The author investigated the reducing powers of sucrose and invert-sugar separately and

together, using 35—40 c.c. of reaction mixture containing 10 c.c. of copper solution (40 grms. $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ per litre) and 10 c.c. of tartrate solution (200 grms. of Rochelle salt and 150 grms. NaOH per litre); the mixture was heated to boiling in 90—100 secs., maintained in gentle ebullition for 3 mins. and cooled rapidly, and the reduced copper was estimated iodometrically without filtration. In experiments with different amounts of pure sucrose alone, the weight of copper reduced attained a maximum value (22 mgrms.) when the reaction mixture contained 4 grms. of sugar; 10 grms. of sucrose reduced slightly less copper than 2 grms. In experiments with invert sugar (0—50 mgrms.) together with quantities of sucrose less than 10 grms., the total reduction was less than the sum of those calculated for the invert-sugar and sucrose separately, and the effect of the sucrose diminished as the quantity of invert-sugar was increased (cp. Saillard, this J., 1915, 1220). With 10 grms. of sucrose both sugars appeared to exert their normal reducing powers, the reduction curve for the mixtures being parallel to that for invert-sugar alone. With 12 grms. of sucrose in the reaction mixtures more copper was reduced than by the same quantities of sucrose and invert-sugar heated separately.—J. H. L.

Reducing sugars; Determination of—. Volumetric method for determining cuprous oxide without removal from Fehling's solution. F. M. Scales. J. Biol. Chem., 1915, 23, 81—87.

THE method consists in converting the cuprous oxide into cuprous chloride, adding the latter to excess of iodine solution, and titrating the excess of iodine. Reduction with the sugar solution is effected as described by Munson and Walker (this J., 1906, 656), and the solution, after boiling for 2 mins., is agitated and poured through a funnel into a 200 c.c. volumetric flask containing 15 c.c. of concentrated hydrochloric acid to which 15 c.c. of water at 80°—95° C. has been added just before the copper solution; the tip of the funnel stem should be below the surface of the liquid. After rinsing the funnel, etc., the solution in the flask is made up to the mark, the flask stoppered, shaken, and two 50 c.c. portions of the solution transferred each to a 500 c.c. flask containing 250 c.c. of water and 25 c.c. of $N/20$ iodine solution, the acid solution being run in slowly, from a pipette, about 1 cm. below the surface of the iodine solution. The excess of iodine is then titrated with $N/20$ thiosulphate in presence of starch solution. The method has given good results with dextrose, maltose, lactose, and invert sugar, and may also be used for the quantitative determination of copper.—A. S.

Sugar; Analysis of denatured—. von Wissell. Chem.-Zeit., 1915, 39, 769—770.

WHEN sugar is denatured by mixing it with chopped straw, chaff, bran, sunflower-seed meal, etc., for the purpose of preparing a cattle food, the sucrose undergoes gradual inversion, particularly if the moisture-content of the mixture exceeds 3—4%. For instance, a mixture of chopped straw and sucrose contained, when prepared, 92.5% of sucrose, 0.5% of invert sugar, and 3.7% of water. After three weeks, the quantity of sucrose had diminished to 85.4% whilst the amount of invert sugar had increased to 6.5%. It is pointed out that, in such mixtures, the determination of the sucrose by direct polarisation yields untrustworthy results.—W. P. S.

Marine algae of the Pacific Coast; Complex carbohydrates and forms of sulphur in—. D. R. Hoagland and L. L. Lieb. J. Biol. Chem., 1915, 23, 287—297. (See also this J., 1915, 610.)

ALGINIC acid containing only traces of mineral

matter and nitrogen was prepared from *Macrocystis pyrifera* by treating a sodium carbonate extract with hydrochloric acid, re-dissolving in sodium carbonate and re-precipitating with acid several times, then dissolving again in sodium carbonate, purifying the sodium alginate by dialysis, decomposing it with hydrochloric acid, and purifying the alginic acid by dialysis. Alginic acid dried at 100° C. will absorb 200 to 300 times its weight of water. Its optical activity is $[\alpha]_D^{25} = -169.2^\circ$. The sugars produced by hydrolysis with 2% hydrochloric acid gave a yellow osazone, m.pt. 154°—155° C., closely resembling *l*-xylosazone, and also a red amorphous osazone. Complex carbohydrates were also isolated by precipitating an acid extract of the seaweed with alcohol. The carbohydrate from *Macrocystis pyrifera* yielded on hydrolysis a methylpentose having the properties of fucose, but that from *Iridaea laminarioides* yielded only galactose. Of the 4.44% of total sulphur present in *Ulva fasciata*, 2.85% was present as soluble sulphates, 0.36% as soluble organic compounds (not precipitated by barium chloride), 0.69% as insoluble compounds not volatilised during incineration, 0.47% as insoluble compounds volatilised during incineration, and 0.11% as compounds volatile with steam.—A. S.

Starch; Soluble—. M. Samec and S. Jeucic. Koll. Chem. Beihefte, 1915, 7, 137—171. J. Chem. Soc., 1915, 103, i., 941. (Compare this J., 1914, 760.)

AN account is given of the methods which have been used in the differentiation and characterisation of the various forms of soluble starch. New experiments have been made in which these physico-chemical methods were applied to the examination of soluble starches prepared in different ways. In general, the formation of soluble starch is accompanied by a reduction in the size of the molecules, but this is not always the case. The varieties obtained by the method given by Malfitano and Moschkoff (this J., 1910, 506, 1402), and by heating with glycerol, contain no phosphorus, but this element is present in the other forms examined. According to Fouard (this J., 1907, 832), the coagulation of starch which has been "purified" by treatment with hydrochloric acid represents the reversal of the process by which soluble starch has been formed, but the authors' observations are quite inconsistent with this view.

Feeding and manurial values of sugar beet crowns and leaves. See XIXA.

PATENTS.

[Sugar] cane juice; Apparatus for bleaching—. W. H. Waggoner, Jeanerette, La. U.S. Pat. 1,152,458, Sept. 7, 1915. Date of appl., Feb. 19, 1915.

A TANK is divided by a transverse vertical partition into an open chamber for the reception of the juice and a closed bleaching chamber into which it is forced together with sulphur dioxide. An outlet pipe from the bleaching chamber is provided with means for returning the juice to the open chamber if it requires a second treatment. The two chambers communicate by means of a pipe near the bottom of the tank, which passes through the partition; the end of the pipe within the receiving (open) chamber is closed, but there are ports in the walls, near the end, through which the juice can enter; the other end of the pipe (in the bleaching chamber) is open. Within the pipe, near its closed end, and co-axial with it, is a nozzle directed towards the open end and communicating with a supply of sulphur dioxide. Inside this nozzle is a smaller one opening in the same direction, through which a jet of steam or other fluid can be forced so as to draw into the pipe sugar juice (through the ports) and sulphur dioxide,

and force both together into the bleaching chamber, whereby also the contents of the latter are kept in circulation.—J. H. L.

Starches ; Apparatus and process for making modified — A. W. H. Lenders, Cedar Rapids, Iowa. U.S. Pats. (A) 1,159,591 and (n) 1,159,592. Nov. 9, 1915. Dates of appl., May 8, 1913, and June 25, 1914.

(A) THE apparatus comprises a jacketed dextrinising vessel in which the charge can be continuously agitated, steam and cold water connections for the jacket, and a feeding mechanism in which the starch is mixed with acid before it enters the vessel. The feeding mechanism may comprise a hopper with a valve at the bottom, a screw conveyor below the hopper with its flight notched to provide mixing blades, and an atomiser to spray the starch with acid as it falls from the hopper to the conveyor. (B) The process consists in spraying and mixing powdered starch with a definite proportion of acid as it is fed into a dextrinising vessel, heating and agitating the charge until the desired degree of conversion has been attained, and then cooling the vessel externally by means of water.—J. H. L.

Sugar, sugar products, or chemical substances ; Process and apparatus for producing dry — without waste liquid. J. C. Grière. Fr. Pat. 475,440, May 25, 1914.

SEE Eng. Pat. 13,364 of 1914 ; this J., 1915, 1066.

XVIII.—FERMENTATION INDUSTRIES.

Phosphatases of malt. L. Adler. Biochem. Zeits., 1915, 70, 1—36. J. Chem. Soc., 1915, 108, i., 1020—1021.

MALT contains at least two kinds of phosphatases, one of which brings about the solution of insoluble organic phosphate complexes, whereas the other influences the formation of inorganic phosphates. The temperature optimum for the phosphatases is about 58° C.; above this temperature their activity rapidly diminishes. In extract of malt which has been kept for five hours, the enzyme causing the solution of the organic phosphate complex has lost its activity, whereas that inducing the formation of inorganic phosphate retains its activity for fourteen hours. The activity depends largely on the concentration of the solutions, as a high viscosity and the presence of the reaction products (inorganic phosphates) have a deleterious influence. An extract of 1 part of malt in 20 parts of water gives the best results ; in more dilute solutions, the formation of inorganic phosphates diminishes. The hydron concentration is also of great importance ; when $p_H=5.4$, the total phosphoric acid of malt can be rendered soluble, 93% of which will be found in the form of inorganic phosphate. The phosphatases are still more sensitive to the hydroxyl ion concentration, but they are still active in a relatively acid solution ; when $p_H=2.0$, the phytin passes into solution. For the destruction of the phosphatases by alcohol, a somewhat drastic treatment is necessary ; it is best accomplished by heating with 85% alcohol. This treatment forms the foundation of a method for the determination of the pre-existing phosphates in malt. The phosphatases are secretion enzymes which exert their activity outside the cell. The phytase is a phosphatase which plays an important part in the reaction ; it also acts on commercial phytin preparations. (See also this J., 1915, 1158.)

Fermentation of living yeast ; Influence of the alternating current on — E. Hägglund. Biochem. Zeits., 1915, 70, 164—170. J. Chem. Soc., 1915, 108, i., 1043.

THERE is an increase in the zymase activity in

living yeast when the culture is submitted to the action of an alternating current. This is most marked at the commencement of the fermentation, and may reach as much as 100%. After a time, however, the increase of the fermentation produced by the current diminishes, and when 20% of the sugar has been fermented, the rate is not higher than in the control experiments. The current does not lead to an increase in the hydron concentration as compared with the increase in the control experiments. It is suggested that acids inhibit the acceleratory action of the alternating current.

Carboxylase and other enzymes of yeast. C. Neuberg. Biochem. Zeitsch., 1915, 71, 1—103. J. Chem. Soc., 1915, 108, i., 1043—1044.

EXPERIMENTS are quoted to illustrate the stability of the carboxylase in permanent preparations. The carboxylase is still active in preparations made from yeast-juice which have been heated for ten minutes at 54°—55° C., although such preparations are without fermentative action on sugar. The carboxylase also acts on pyruvic acid after the yeast-juice has been submitted to dialysis. Yeast in which the sugar-fermenting properties have been exhausted by fermentation retains the carboxylase, which still exists in juices which have been kept for prolonged periods, and in which putrefaction even has started. The carboxylase action can take place between 10° and 20° C., not only on pyruvic acid, but on other α -keto-acids, such as oxalacetic acid and methylthiopyruvic acid. The highest temperature of action is 70° C. for the carboxylase of fresh yeast ; for maceration juices or permanent preparations the critical temperature is 65°—68° C. The corresponding temperatures for the zymase action are 70° and 51° C. The carboxylase action on pyruvic acid takes place best in the presence of a "buffer." That generally employed was dipotassium hydrogen phosphate, but borates are equally effective. The carboxylase action is readily destroyed by previous treatment of the yeast with acids or alkalis and subsequent neutralisation. The carboxylase is very insensitive to the action of various organic substances, such as the alcohols, glycols, glycerol, acetone, pyridine, and the aldehydes.

Carboxylase exists in plasmolysed yeast. The presence of pyruvate (and the exertion of a carboxylase action) does not inhibit the invertase action of yeast ; rather it causes, generally, a slight stimulation of this action. The general conclusion is drawn that the invertase action is independent of that of the carboxylase. By treatment of a yeast with 2% of pyruvic acid at 37° C. for forty-eight hours, it loses both its carboxylase and zymase functions ; similar treatment with 2% of dextrose leaves the fermentative functions intact. This action of pyruvic acid does not take place in the presence of a "buffer." Potassium pyruvate stimulates the fermentative activity of yeast-juice on various sugars, including dextrose, levulose, mannose, sucrose, and maltose. A similar activating action was observed with the salts of other keto-acids, all of which are derivatives of various amino-acids derived from proteins, and it is suggested that there is some natural relationship between the processes of alcoholic fermentation, fermentation in the absence of sugars, and protein metabolism.

Attention is directed to the great stability of invertase solutions, one of which was kept by the author for 800 days without undergoing injury.

Carboxylase ; Relationship of — to zymase. C. Neuberg. Biochem. Zeits., 1915, 71, 133—134. J. Chem. Soc., 1915, 108, i., 1015.

THE three species of *Pseudosaccharomyces* (*germanicus*, *javanicus*, *indicus*), which were found by Klöcker to have no fermentative action on sugars,

were also found to be without action on pyruvic acid. This is not due to the action of some inhibitory substance, but to the absence of a carboxylase, as the addition of an ordinary yeast to the mixtures rapidly caused evolution of gas.

Phytochemical reductions. X. Reduction of glycolaldehyde to ethylene glycol. C. Neuberger and E. Schwenk. *Biochem. Zeits.*, 1915, 71, 114—117. *J. Chem. Soc.*, 1915, 108, i., 1045.

THE glycol was obtained in a yield of about 30% of the theoretical quantity by adding the aldehyde to sugar-yeast fermentation mixture. It was isolated and identified by oxidation to glycolaldehyde, which was obtained in the form of its *p*-nitrophenyllosazone.

Phytochemical reductions. XI. Conversion of ethyl disulphide into ethyl mercaptan. C. Neuberger and E. Schwenk. *Biochem. Zeits.*, 1915, 71, 118—121. *J. Chem. Soc.*, 1915, 108, i., 1046.

THIS reduction takes place according to the equation $C_2H_5.S.S.C_2H_5 + H_2 = 2C_2H_5SH$ when the disulphide is added to a sugar-yeast fermentation mixture. The mercaptan was isolated in the form of a pure lead salt.

Phytochemical reductions. XII. Conversion of citronellal into citronellol. P. Mayer and C. Neuberger. *Biochem. Zeits.*, 1915, 71, 174—179. *J. Chem. Soc.*, 1915, 108, i., 1046.

THE above reduction takes place when citronellal is added to a yeast-fermentation mixture. The citronellol was isolated, and identified by the preparation of the silver salt of the phthalic ester, m.pt. 123° C., after recrystallisation from methyl alcohol.

Yeast; Changes in the alcohol and aldehyde content of — on keeping and on autolysis. C. Neuberger and E. Schwenk. *Biochem. Zeits.*, 1915, 71, 126—132. *J. Chem. Soc.*, 1915, 108, i., 1045.

PERFECTLY fresh yeast does not contain acetaldehyde, but if kept, acetaldehyde is formed, and can be separated by washing the yeast with tap-water and centrifuging. If living yeast is kept in airtight boxes at 5°—10° C., a marked increase in both the acetaldehyde and ethyl alcohol content can be detected. By the autolysis of both fresh and dried yeast in water saturated with carbon dioxide, an increase of both acetaldehyde and alcohol could be detected. There was no quantitative relationship between the increased acetaldehyde or alcohol formed, the increase in the amount of the former being always considerably larger than that of the latter.

Co-enzyme action of the salts of α -keto-acids. C. Neuberger and E. Schwenk. *Biochem. Zeits.*, 1915, 71, 135—143. *J. Chem. Soc.*, 1915, 108, i., 1045—1046.

IT was found that a mixture of salts of α -keto-acids in presence of dipotassium hydrogen phosphate could activate yeasts or yeast preparations which had been freed from the co-enzyme. No single salt was found to bring about this result. A mixture of potassium or calcium salts of the following acids was employed: pyruvic, α -ketobutyric, α -ketoisovaleric, α -ketohexic, phenylglyoxalic, phenylpyruvic, *p*-hydroxyphenylpyruvic, hydroxypyruvic, oxalacetic, and α -ketoglutaric acids. These may be considered as derivatives of amino-acids, and attention is directed to the possible connection between the protein and carbohydrate metabolism of yeast. The amount of activation produced is less than that produced by a natural co-enzyme prepared (by dialysis, by heat, etc.) from yeast.

Succinic acid; Mechanism of the natural formation of —. C. Neuberger and M. Ringer. *Biochem. Zeits.*, 1915, 71, 226—244. *J. Chem. Soc.*, 1915, 108, i., 1046.

BY the action of fresh yeast or yeast-juice, α -ketoglutaric acid can be converted into succinic acid, and a nearly theoretical yield has been obtained. This formation is in marked contrast to the formation of succinic acid from glutaric acid, which only takes place in the presence of living and fermenting yeast. Succinic acid has also been obtained by the putrefaction of α -ketoglutaric acid in yields varying between 14 and 19%. In addition, formic, acetic, and propionic acids are formed.

Urease and oxidase; Retention of activity by — after exposure to the temperature of liquid air. J. S. Hepburn and C. B. Bazzoni. *J. Franklin Inst.*, 1915, 180, 603—605.

THE power of urease to hydrolyse urea is but slightly affected when the enzyme is subjected to the temperature of liquid air; after 100 hours' exposure to this temperature the activity is diminished by only 3.7%. The loss in activity is far greater (44.4%) when the enzyme is kept at ordinary temperature for 100 hours, although protected by the presence of a bactericide (0.2% of tricresol). Oxidase, exposed to the temperature of liquid air for 3½ hours, still retains its power of producing a cherry-red coloration with a mixture of 1% peptone solution and dilute *p*-cresol solution. (See also this J., 1915, 628).—W. P. S.

New methods used in washing and distilling liquids. Borrmann. See I.

"Soy" and "saké" oils. Tsujimoto and Ueno. See XII.

Detection and determination of small quantities of phosphoric acid, especially in drinking water. Medinger. See XIXb.

Method of determining proteolytic enzymes. Neppi. See XXIII.

PATENTS.

Beer [of low alcohol-content]; Process of brewing —. E. Hinterlach, Munich, Germany. U.S. Pat. 1,152,415, Sept. 7, 1915. Date of appl., Mar. 23, 1915.

FERMENTED beer is stored at a low temperature, then mixed with unfermented wort to reduce its content of alcohol to any desired degree, and afterwards stored at about 0° C., filtered, and pasteurised. The cold storage before pasteurisation diminishes the deleterious effects of the latter on the beer.—J. H. L.

Brewing process. B. Hehle, Kansas City, Mo. U.S. Pat. 1,154,989, Sept. 28, 1915. Date of appl., June 19, 1914.

THE malt is ground in such a manner that the grains are split longitudinally from end to end to expose the mealy contents completely, and the production of flour is avoided as far as possible. The mash is sparged with water at 156°—162.5° F. (69°—72.5° C.). It is stated that the process avoids the formation of "hard-ends," improves the filtration of the mash, and increases the yield of extract by 3—5%.—J. H. L.

Spirit; Process for rectifying — in apparatus working periodically. C. Schilling. First Addition, dated July 24, 1914, to Fr. Pat. 459,947, July 3, 1913.

SEE Eng. Pat. 16,474 of 1914; this J., 1915, 1160.

XIXA.—FOODS.

Butter ; Rapid separation of pure fat from the non-fatty constituents of—. S. Korpacz. Z. Unters. Nahr. Genussm., 1915, 30, 24. Bull. Agric. Intell., 1915, 6, 1390—1391.

By mixing an excess of burnt gypsum with butter, the water of the latter is absorbed, and if the mixture be heated, the butter-fat will melt and can be readily removed. 40 grms. of butter and 10 grms. of pure, finely powdered plaster of Paris are well mixed in a flat porcelain dish; after 10 minutes, the mass is heated, and when the fat has melted, it is passed through a dry filter.—E. H. T.

Yoghurt bacillus. F. Ducháček. Biochem. Zeits., 1915, 70, 269—293. J. Chem. Soc., 1915, 108, i., 1042.

ACCORDING to Effront, the milk-souring bacillus exerts a strong proteoclastic action on caseinogen, a reaction which was found by other investigators to be wanting. A comparison was therefore made of the action of strains of bacilli obtained from Effront (from a commercial medicinal source) and from Metschnikov, which was recognised as a true strain of *B. bulgaricus*. The investigations revealed many marked differences. The latter strain is much more sensitive, is readily killed by acids, and will only develop in certain culture media, which must contain sugars. The bacillus obtained from Effront was much less sensitive, and, in contrast to the true *B. bulgaricus*, readily digested proteins. Other marked differences were found, and reasons are given for supposing that Effront's bacillus was not a mere biological modification of the true Yoghurt bacillus. Attention is directed to the difficulty of completely sterilising milk, to the ease with which the true *B. bulgaricus* is destroyed, and to the great possibilities of this taking place in commercial preparations, and the predominance in these of other strains of bacteria which remain owing to incomplete sterilisation.

Proteins and other nitrogenous compounds ; Action of certain lactic acid bacteria on—. A. Stutzer. Biochem. Zeits., 1915, 70, 299—305. J. Chem. Soc., 1915, 108, i., 1041.

EXPERIMENTS were made with *B. Delbrückii* (warm lactic acid bacillus) and *B. cucumeris fermentali* (cold lactic acid bacillus), which are used in the preparation of ensilage, to ascertain their action on proteins and other nitrogenous substances. It was found that both kinds rapidly produced acid, but did not break down proteins into amino-acids. When allowed to grow on media containing other nitrogenous substances, the *B. cucumeris fermentali* converted only 1.8% of ammonium acetate, 17.4% of asparagine, and 6.5% of urea into proteins under the conditions of experiment employed. There is no evidence, therefore, that the proteins of fodder can be increased by the addition of simpler nitrogenous compounds to the materials employed for ensilage.

Butter and margarine ; Rapid method for the determination of fat and water in—. A. A. Besson. Chem.-Zeit., 1915, 39, 770—772.

Water. 5 grms. of the sample is weighed into a flat-bottomed aluminium basin, 6 cm. diam., and 1.5 cm. high; this basin is placed in another similar basin, 8 cm. diam., and 2.5 cm. high. The smaller basin carries a wire frame which supports an inverted aluminium funnel of such diameter that its edge is below the top edge of the larger basin. The whole apparatus is then weighed, placed in an oven at 160° C. for 20 minutes, and again weighed. If desired, the apparatus may be heated over a flame to evaporate the water more rapidly. The loss in weight gives the quantity of water present. *Fat* is determined by heating

5 grms. of the sample for 1 minute with 40 c.c. of hydrochloric acid (2:1), transferring the mixture to an apparatus called a sapometer, and dissolving the fatty portion in about 100 c.c. of ether, a portion of the latter being used to rinse out the vessel in which the mixture has been heated. Water is then added so as to bring the ethereal layer into the graduated portion of the apparatus, the mixture is shaken, allowed to separate, an aliquot portion of the ethereal layer is drawn off, evaporated in a weighed flask, and the residue of fat is dried and weighed.—W. P. S.

Proteins of wheat flour ; Nature of the — extracted by various solvents. C. H. Bailey and M. J. Blish. J. Biol. Chem., 1915, 23, 345—357.

THE four wheat proteins, albumin, globulin, gliadin, and glutenin, yield on hydrolysis products containing 6.8%, 7.7%, 25.5%, and 18.9%, respectively, of the total nitrogen in the form of ammonium compounds, and these values were utilised for calculating the relative proportions of the different proteins extracted by various solvents, the proportion of total nitrogen present as ammonium compounds in the extracts being determined after hydrolysis. The extract of a patent flour with 1% sodium chloride solution contained more than half of the total protein extracted as gliadin, whilst with 10% sodium chloride solution and with 5% potassium sulphate solution only 15% of the total protein extracted consisted of gliadin. 50% alcohol at room temperature extracts more protein in 20 hours than 30% or 70% alcohol, but extraction is not complete unless a temperature of 83°—84° C. is used, when 3 hours suffices. In each case gliadin forms 93% of the total protein extracted. The amount of non-gliadin proteins extracted by 50% alcohol is independent of the percentage of these constituents in the flour. Non-gliadin proteins cannot be separated quantitatively from gliadin by coagulation in boiling water, as much gliadin remains uncoagulated.—T. C.

Gossypol, the toxic substance in cottonseed meal. W. A. Withers and F. E. Carruth. J. Agric. Res., 1915, 5, 261—288.

THE phenolic substance, gossypol, first isolated from cotton seed "foots" by Marchlewski (this J., 1900, 912), may be extracted from cottonseed kernels by ether after removal of the bulk of the oil by means of petroleum spirit. The crude product may be purified by precipitation with petroleum spirit from an ethereal solution, and forms a crystalline acetate when precipitated with acetic acid (yield, 0.8 to 1% of the original kernels). It is very toxic to animals either when given in one large dose or in small daily doses; the smallest fatal dose for rabbits was 0.24 gm. of crystalline acetate per kilo. of body weight. It forms a non-toxic oxidation product, and to this fact is attributed the destruction of the toxicity of cottonseed meal by boiling with alcoholic caustic soda. Cottonseed kernels are rendered less toxic by partial extraction and non-toxic by complete extraction of gossypol, by means of ether or ether and alcohol. Treatment of cottonseed meal with iron salts reduces the toxicity, possibly by oxidation of the gossypol or by the formation of a sparingly soluble compound (lake). The main difficulty in treating the meal in bulk is that the seed tissue surrounding the cells interferes with the action of solvents or chemical agents.—C. A. M.

Feeding stuffs ; Influence of the war on supplies and use of—. E. T. Halnan. J. Board Agric., 1915, 22, 737—741.

ALTHOUGH the supplies of linseed cake and cottonseed cake are likely to remain inadequate, there will be a good supply of palm-kernel cake and

coconut cake, and to a less extent, of groundnut cake. Feeding experiments with palm-kernel cake have shown that this feeding stuff has approximately the same food value, for bullocks and milking cows, as linseed cake and cottonseed cake (see this J., 1915, 1108): at its present price, £7 10s. per ton, it is an economical feeding stuff. Compared with linseed cake at £9 to £10 10s. per ton, coconut cake is worth about £6 15s. to £7 per ton as a feeding stuff for dairy cows and bullocks; it keeps well if stored in a dry place, but rancidity rapidly sets in if the cake becomes moist. Groundnut cake has been reported upon favourably by various experimenters; its high protein content renders it liable to bacterial decomposition, with the subsequent development of toxic substances, and, consequently, the cake should be fed with caution, any samples exhibiting the slightest signs of rancidity or bitterness being rejected. Dried yeast is suitable for pig feeding, but cows dislike it owing to its bitterness.—W. P. S.

Sugar beet crowns and leaves; Feeding and manurial values of —. J. Board Agric., 1915, 22,750—760.

THE crowns and leaves contain 19.5% of dry solids, 2.37% of protein, 8.24% of sugar and other carbohydrates, 3.05% of crude fibre, and 5.41% of ash; 100 lb. of the crowns and leaves has approximately the same feeding value as 2 lb. of cottonseed meal. The material forms an excellent fodder for cows, but excessive feeding tends to produce diarrhoea, symptoms of poisoning, and bone weakness. The leaves must be kept dry and clean, and supplementary fodder provided. The crowns, as separate from the leaves, appear to be a good food for sheep, horses, and pigs. Silage may be prepared from the crowns and leaves, and a fodder having a value equal to that of good meadow hay is obtained by drying the crowns and leaves artificially. The crowns and leaves from 1 acre of land contain 92—119 lb. of nitrogen, 28—41 lb. of phosphoric acid, and 125—152 lb. of potash, and the ploughing under of the crowns and leaves is attended with good results for the following crops (oats and potatoes). —W. P. S.

Pepsins of different strengths; The total nitrogen and α -amino-nitrogen content of —. T. B. Aldrich. J. Biol. Chem., 1915, 23, 339—343.

DETERMINATION of the total nitrogen and also of the α -amino nitrogen by Van Slyke's method (this J., 1911, 771, 1135; 1915, 1110) of a number of samples of pepsin of varying proteolytic activity, showed that whilst the total nitrogen was almost constant (14.09% to 14.94%) and bore no relation to the activity, the α -amino-nitrogen decreased from 3.65% to 2.06% with increasing strength of the pepsin from 1:6000 to 1:15,000 (proteolytic activity), indicating that the purification employed gradually removed the simpler amino substances. —T. C.

Analysis of denatured sugar. Von Wissell. See XVII.

PATENTS.

Fish; Preserving fresh —. G. A. Smith, London. Eng. Pat. 23,194, Nov. 27, 1914.

THE fish are placed in a box, two opposite sides of which consist of louvres, which is then placed in a case with a water-tight lid. These cases can be used singly or in series. Cold brine is passed through the cases, and then led to a filter composed of a series of porous shelves under which are two chambers, filled with broken carbon and connected to a source of electric current. In passing through the filter, the brine is deprived of its slime and gases by the porous shelves and

is electrolysed in the lower chambers. It is then passed to a storage tank and used again.—J. H. J.

Coffee extract; Process and apparatus for the manufacture of —. L. Etaix and G. A. Gain, Paris. Eng. Pat. 2722, Feb. 19, 1915. Under Int. Conv., Feb. 27, 1914.

GROUND roasted coffee is heated to 200°—300° C. in a closed chamber, and a current of cold air or carbon dioxide, nitrogen, etc., is passed through the powder while the latter is agitated. The air, containing the volatile aromatic constituents of the coffee, is led into chambers connected in series and containing dry powdered coffee extract prepared from coffee from which the aromatic constituents have been removed as described. This dry extract absorbs the aromatic constituents.—W. P. S.

Coffee; Process of making soluble —. G. H. Benjamin, New York. U.S. Pat. 1,158,431, Nov. 2, 1915. Date of appl., Sept. 23, 1914.

COFFEE beans are subjected to the action of warm water for a length of time sufficient to effect partial germination and production of maltose, then heated to 150°—160° F. (66°—71° C.), dried in a current of air, roasted, ground, and the powder percolated with water; the extract obtained is concentrated, and dried in a current of air. —W. P. S.

Coffee; Cereal — in tablet form, and process of manufacturing the same. J. L. Kellogg, Battle Creek, Mich. U.S. Pat. 1,159,949, Nov. 9, 1915. Date of appl., May 4, 1912.

THE browned and prepared cereal coffee is boiled with water, the solid residue is drained and pressed, and the extract is evaporated to a syrup, mixed with so much sugar that it crystallises on cooling, cooled, powdered, dried by a current of cold air if necessary, again powdered, and then bolted and compressed into tablets.—J. H. L.

Bread; Manufacture of —. H. A. Kohman, C. Hoffman, and A. E. Blake, Pittsburgh, Pa., Assignors to Ward Baking Co., New York. U.S. Pats. (A) 1,158,933 and (B) 1,158,934, Nov. 2, 1915. Dates of appl., Mar. 26, 1913, and Dec. 10, 1914.

THE amount of yeast required may be diminished by incorporating with the dough (A) ammonium chloride and calcium sulphate or (B) calcium sulphate.—W. P. S.

Food products; Process and apparatus for drying —. W. D. Edwards and T. E. Koehler. Fr. Pat. 475,905, Aug. 3, 1914.

SEE Eng. Pat. 15,662 of 1914; this J., 1915, 813.

XIXB.—WATER PURIFICATION; SANITATION.

Nitrates [in water]; Modification of Pelouze's method for determining —. E. A. Letts and F. W. Rea. Proc. Roy. Soc. Edin., 1915, 35, 168—169. J. Chem. Soc., 1915, 108, ii., 793.

THE method described consists in heating a weighed quantity of the specimen containing the nitrate with a measured volume of standard ferrous sulphate containing a little free sulphuric acid, and estimating the amount of unchanged ferrous sulphate by means of standard potassium permanganate. 10 c.c. of N/1 ferrous sulphate and 5 c.c. of concentrated sulphuric acid are placed in a 200 c.c. flask, which is cooled, fitted with an inverted condenser, and the air expelled by a current of pure carbon dioxide; the condenser is

then removed for a moment, the sample added, the condenser replaced, and the flask heated for about fifteen to thirty minutes. The contents of the flask are then cooled and titrated with standard permanganate solution. The figures given in the paper show that the method is both trustworthy and accurate. It is specially recommended for the estimation of nitrates in water analysis.

Phosphoric acid; Detection and determination of small quantities of—, especially in drinking water. P. Medinger. Chem.-Zeit., 1915, 39, 781—782.

A SOLUTION of ammonium molybdate of 40% strength is treated with a solution of strychnine nitrate of 1% strength until the cloudiness at first formed no longer dissolves on shaking, and the mixture is then poured into an equal volume of concentrated nitric acid, allowed to stand over night, and made up to a half litre. To 20 drops of the reagent is added 10 c.c. of the water to be tested, and the mixture shaken once; an immediate pronounced cloudiness, aggregating to a precipitate in 20 seconds, indicates 10 mgrms. P_2O_5 per litre; a similar cloudiness but with precipitation in 2 min. indicates 5 mgrms.; an immediate slight cloudiness, quickly increasing, indicates 1 mgrm.; a slight cloudiness after 3—5 sec. indicates 0.5 mgrm. P_2O_5 , and so on for other amounts; 0.1 mgrm. per litre is about the limit of sensitiveness. For hard and impure waters, the time for formation of the precipitate should be restricted to 30 sec., corresponding to a limit of 0.25 mgrm. P_2O_5 per litre. The reagent is most delicate when fresh, but the delicacy can be restored by addition of a few more drops of the strychnine solution. The method is specially useful for detecting sewage in drinking water. It may be used also for detecting mineral phosphates in wine.—J. H. J.

Sterilisation of water by carbon dioxide under pressure. H. Colin. Comptes rend., 1915, 161, 652—655.

WATER inoculated with various kinds of bacteria was subjected to carbon dioxide under pressure in a vessel of silvered copper. The vessel was shaken to facilitate solution of the gas, and samples of the liquid were withdrawn from time to time and tested. The following organisms were destroyed within the times and under the pressures stated:—*B. typhosus*, 20 hours at 15 kilos. (per sq. cm.), 9 hours at 20 kilos., and 3 hours at 25 kilos. *B. dysenteriae*, 15 hours at 15 kilos., and 6 hours at 20 kilos. *B. cholerae*, 10 hours at 10 atm. *B. pyocyaneus*, 48 hours at 18 kilos. *B. diphtheriae*, almost instantaneously under 25 kilos., and within 3, 9, and 24 hours at 20, 15, and 10 kilos. respectively. *B. coli communis* and *B. subtilis* were not destroyed within 4—5 days under 25 kilos. pressure, but the former was seriously weakened. Stagnant water from the Seine still contained putrefactive organisms after fairly prolonged treatment under 20 kilos. pressure of carbon dioxide, but only *B. subtilis* survived several hours under 25 kilos. —J. H. L.

Sewage; Fat recovery from—. Paulmann. Preuss. Verb. beamt. Nahrungsmittelchem., Oct. 3, 1915. Chem.-Zeit., 1915, 39, 792.

THE methods employed for fat recovery fall into two groups. The first comprises simple mechanical methods, such as that of Kremer and Schilling (see Eng. Pats. 14,603 of 1901 and 14,461 of 1903; this J., 1902, 917; 1903, 1095), which recover a portion only of the fat present in the surface scum; the recovered fat is used for soap making. Sometimes the whole crude scum is pressed and used as an addition to cattle foods. The second group comprises mechanical methods

used in combination with chemical methods. Extraction of the wet sludge with benzene leads to heavy losses of benzene. Degener sought to avoid this by first separating some of the water mechanically, then by the application of heat reducing the water remaining to 40%, and then extracting with a solvent in the cold. But the sludge residue is wet and expensive to transport, the amount of heat required is excessive, and there is a large volume of solvent to evaporate by steam. (See also this J., 1915, 679.)—J. H. J.

Slaughter-house refuse; Destruction of pathogenic bacteria in— by sulphuric acid. H. Foth and B. Schubert. Deutsch. Tierärztl. Wochens., 1915, 23, 287—289. Bull. Agric. Intell., 1915, 6, 1292.

To test the sterilising action of crude sulphuric acid upon the effluent from slaughter-houses, guinea pigs and mice were inoculated with two species of anthrax which possess very resistant spores. When the animals were killed and their bodies treated with a mixture of 3 parts of acid and 1000 parts of water for 24 hours, bacteriological tests showed that the pathogenic organisms had been completely destroyed.—E. H. T.

Annual Report of the Chief Inspector of Factories and Workshops. See I.

PATENTS.

Water purification. F. R. and W. H. Webb, Randalstown, Ireland. Eng. Pat. 22,048, Nov. 5, 1914.

BLEACHING powder or other hypochlorite is added to the water, and afterwards an acid or an acid salt, e.g., aluminium sulphate, whereby bicarbonates present in the water are decomposed and the nascent carbon dioxide acts on the hypochlorite to liberate chlorine. The water is allowed to settle in a tank and is then run off through perforated trays to remove residual carbon dioxide. If necessary a bicarbonate may be added to the water.—J. H. J.

Water purifier. M. B. Cresswell, Des Moines, Iowa. U.S. Pat. 1,158,450, Nov. 2, 1915. Date of appl., Apr. 4, 1914.

A TANK is divided into a number of boiling compartments each containing steam coils at one end, and connected at the opposite end with a still chamber. Scum chambers with skimming apparatus are provided for each compartment. Each boiling compartment is connected with the still chamber and the scum chamber, and all the boiling compartments can be connected together. —J. H. J.

Sewage; Method of and means for treating—. W. M. Beckett, Manchester. Eng. Pat. 21,985, Nov. 4, 1914.

THE sewage enters an enclosed tank with a floor pervious to air. Compressed air rising through the floor agitates the sewage and sludge, and the gases given off are passed with the air to a destructor or other combustion furnace. The purified liquid is discharged from the tank by a floating arm, down to a certain level, below which the sludge is allowed to collect, a portion being run out from time to time.—J. H. J.

Sewage; Tank for the purification of—. G. W. and J. F. Naylor, Denby Dale, Yorks. Eng. Pat. 23,146, Nov. 27, 1914.

THE tank has a level floor and is divided into several compartments by baffle-plates reaching from the top nearly to the bottom, and which may be inclined in the direction of the flow of sewage. Porous tiles are fitted in the floor behind each baffle-plate and air is forced through the tiles. Air may

also be blown over the surface of the sewage by pipes attached to the top of the baffle-plates. The circulation of the sewage is assisted by the upward current of air, and the sludge is kept in suspension. The exit pipe of the tank is provided with a float discharge, arranged to empty three-fourths of the contents, leaving the remainder to "activate" the succeeding supply of sewage. The baffle-plates may also be arranged to reach the bottom of the tank, and pipes provided passing through each plate. The tank may be divided longitudinally into two sections to economise space—J. H. J.

Water; Process and apparatus for adding coagulants to —. A. P. Strohmenger. Fr. Pat. 476,590. Sept. 29, 1914.

SEE Eng. Pat. 22,050 of 1913; this J., 1914, 372.

Gas from sewage; Manufacture of —. Wet-carbonizing, Ltd. Fr. Pat. 475,287, July 17, 1914.

SEE Eng. Pat. 16,800 of 1913; this J., 1914, 938.

Sewage and other liquids; Process for purifying —. L. Linden, Brussels, Assignor to W. J. Stewart, Belfast. U.S. Pat. 1,160,918, Nov. 16, 1915. Date of appl., June 29, 1914. Renewed May 27, 1915.

SEE Eng. Pat. 1266 of 1914; this J., 1914, 938.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Arecolidine. H. Emde. Apoth.-Zeit., 1915, 30, 240—241. J. Chem. Soc., 1915, 108, i., 981—982.

THE mother liquors obtained in the technical preparation of arecoline hydrobromide contain minute quantities of an isomeric alkaloid which is precipitated by even weak bases. This is designated *arecolidine*, and is probably 3,4-dimethoxy-1-methyl-1,2-dihydropyridine, $C_8H_{13}O_2N$. It crystallises in transparent needles, m.pt. after sublimation $110^\circ C.$, has an odour of acacia, and is very hygroscopic. The aurichloride forms yellow leaflets, m.pt. 219° — $220^\circ C.$ (decomp.), the platinum-chloride, stout, dark orange needles, which decompose at 222° — $223^\circ C.$ The base remains unchanged under the conditions in which arecoline is hydrolysed to arecaidine, and therefore the oxygen atoms are not present as a carboxyl group.

Valerian; Proposed substitutes for preparations of —. Thomson. Pharmazev. J., 1915, 28, 273. J. Pharm. Chim., 1915, 12, 358—363.

THE following synthetic esters of borneol have been introduced as substitutes for the somewhat varying mixtures which constitute the active principles of valerian root: *Bornylal* or bornyl isovalerate is a colourless, almost tasteless liquid of aromatic odour, b.pt. 254° — $256^\circ C.$, sp.gr. 0.953, $[\alpha]_D = -30.78^\circ$. The saponification value of the commercial product is 211.41. It has a sedative and tonic action, but is rapidly hydrolysed in the acid medium of the stomach, and therefore *neobornylal*, bornyl isovaleryl glycolate, which is stable in acid solution, has been introduced. It is prepared by the action of sodium isovalerate on bornyl monochloracetate, and forms a colourless, tasteless liquid, b.pt. 284° — $286^\circ C.$ *Valissane* is bornyl α -bromoisovalerate, and is prepared by the action of α -bromoisovaleric anhydride on borneol. It is a tasteless liquid of aromatic odour, having $[\alpha]_D = -25.31^\circ$, and a saponification value of 315.5. Treatment with alcoholic potassium hydroxide eliminates all the bromine. *Adamone*, or bornyl dibromocinnamate, is prepared as a white, microcrystalline powder, m.pt. $72^\circ C.$, by brominat-

ing in the cold the product obtained by the action of an alcoholic solution of borneol on cinnamic acid in presence of sulphuric acid.—G. F. M.

Brazilian jalap. E. M. Hohmes. Pharm. J., 1915, 95, 671.

BRAZILIAN jalap, the root of *Piptostegia Pisonis*. Mart., has for some time past been imported into Germany as a cheap source of jalapin. It occurs as transverse circular sections, averaging $1\frac{1}{2}$ to 2 inches in diam. and about $\frac{1}{4}$ inch in thickness, marked with several concentric rings, and except for its pale greyish brown tint and numerous dots of translucent pale resin on the surface, much resembles white bryony root. The root, which yields 8.9% of ash, contains over 20% of resin answering to all B.P. and U.S.P. tests for the resin of true or Vera Cruz jalap, but only 0.85% of the resin is soluble in ether.—T. C.

Karasu-zansho [*Xanthoxylum ailanthoides*]; *Volatile oils from leaves of* —. Y. Shinosaki. J. Chem. Ind. Tokyo, Japan, 1915, 18, 1077—1081.

VOLATILE oils from the leaves of *Karasu-zansho*, which is indigenous to the southern parts of Japan, were of a light greenish-yellow to orange colour and had a characteristic odour. They had the following characters:—

	Mature leaf oil.	Semi-mature leaf oil.	Young leaf oil.
Sp.gr. at $15^\circ C.$	0.8437	0.8385	0.8390
Congeeing point	$+3^\circ C.$	$+2.5^\circ C.$	$0^\circ C.$
n_D^{20}	1.4474	1.4408	1.4440
α_D	-6.35°	-5.75°	-6.63°
Acid value	0.94	—	0.4
Saponif. value	2.81	4.21	1.83
Saponif. value after acetylation	20.53	14.96	1.68

The principal constituents were methyl-*n*-nonyl-ketone, terpenes, and phenols (about 1.5% in the mature leaf oil).—C. A. M.

Formosan Yamakosho; Volatile oil from leaves of —. Y. Shinosaki. J. Chem. Ind. Tokyo, Japan, 1915, 18, 1081—1083.

THE leaves of Formosan *Yamakosho* (botanical name unknown) yielded 1.2% of a light yellowish-brown oil with an odour of camphor. It had the following characters:—Sp.gr. at $15^\circ C.$, 0.9049; $n_D^{20} = 1.4635$, $\alpha_D = -18.8$; saponif. value after acetylation, 48.66; insol. in 70% alcohol. 90% of the oil distilled between 160° and $190^\circ C.$, and 6% between 190° and $205^\circ C.$ It consisted of about 33% of hydrocarbons and about 49% of cineol (as determined by the resorcinol method).

—C. A. M.

Chrysanthemum cinerariaefolium, Trev.; *Essential oil of* —. P. Siedler. Ber. Deut. Pharm. Ges., 1915, 25, 287—302.

INFORMATION is given relating to the culture, morphology, and microscopic characters of the flowers, which are used as insect-powder. The flowers yielded 0.067% of volatile oil of pasty consistency and strong aromatic odour. The oil contained acids, phenols, aldehydes, and possibly terpenes, but the quantities obtained were too small for identification.—R. G. P.

Tasmanol, a phenol occurring in some eucalyptus oils. R. Robinson and H. G. Smith. J. Royal Soc. N.S.W., 1915, 48, 518. Perfumery and Essent. Oil Rec., 1915, 6, 347.

THE oils of certain Tasmanian species of eucalyptus, including *E. linearis* and *E. Risdoni*, contain an optically inactive, liquid phenol, tasmanol, b.pt.

268°—273° C., sp.gr. 1.077 at 23° C., n_D^{20} = 1.5269, which is soluble in caustic alkalis and in ammonia, and partly soluble in sodium carbonate solution, and gives a characteristic deep red colour with ferric chloride in alcoholic solution. It contains one methoxy group and has apparently two phenolic groups *para* to each other. Tasmanol is associated more with cineol-phellandrene oils; certain species which do not contain phellandrene contain another phenol, allied to tasmanol, but giving a green colour with ferric chloride and readily soluble in sodium carbonate solution.—T. C.

Butyl butyrate; Presence of — in eucalyptus oils.

H. G. Smith. J. Royal Soc. N.S.W., 1915, 48, 464. *Perfumery and Essent. Oil Rec.*, 1915, 6, 347.

BUTYL butyrate is a constituent of a certain class of eucalyptus oils. It is possibly formed from butaldehyde which is present in most crude eucalyptus oils. Normal butyric acid is also present in some oils, probably derived from hydrolysis of the ester. The greater proportion of the total esters in the oil of *E. Perriniana* consists of butyl butyrate.—T. C.

Anethol; Solidifying and melting point of —.

R. Meldrum. *Chem. News*, 1915, 112, 259—260.

THE solidifying point of a sample of anethol, determined by various methods, ranged from 13.5° to 15.9° C. The lack of uniformity is considered due to varying degrees of supercooling induced by melting the substance at different temperatures. Melting above the melting point gave low solidifying points, but the temperature of the room had no appreciable influence on the results obtained. The melting point of the sample, observed with a "coated" thermometer bulb, was 15.8° C. After 5 months' exposure to light, the solidifying point was 5.5° C.—F. SOBX.

Salicylic acid compounds; Quantitative determination of — in urine and other body fluids.

T. W. Thoburn and P. J. Hanzlik. J. Biol. Chem., 1915, 23, 163—180.

SALICYLIC acid and its derivatives in urine can be quantitatively recovered in the form of the free acid, and thus determined, by steam distilling 100 c.c. of the urine (after evaporation in neutral or alkaline solution if very dilute) with 20 c.c. of 85% phosphoric acid. An aliquot portion of the distillate is then compared colorimetrically with a standard solution of sodium salicylate after adding ferric ammonium sulphate solution. In the case of blood and joint fluid the material is first extracted with small quantities of ether, avoiding violent shaking, to remove free salicylic acid, which is determined colorimetrically in the residue from the ether extract, and 15 c.c. of the extracted fluid is then diluted with 98% alcohol to 150 c.c., shaken vigorously, and filtered after standing one hour. 100 c.c. of the filtrate is evaporated, with the eventual addition of water, until all alcohol is removed, the mixture again filtered, the residue washed free from salicylic compounds with boiling water, and the solution distilled with phosphoric acid, the salicylic acid being estimated colorimetrically in the distillate. In the case of faeces 25—50 grms. of the dried material is extracted in a Soxhlet apparatus with a mixture of equal parts of ether and ethyl acetate until free from fatty matter, the ether extract discarded unless salicylic esters are likely to be present, and the material extracted with 98% alcohol. The alcohol is boiled off from the alcoholic extract after adding water, then excess of milk of lime is added, the mixture filtered, the residue well washed with boiling water, and the solution distilled with excess of phosphoric acid.—T. C.

Catalytic reduction of aldehydes and ketones. A. Skita. *Ber.*, 1915, 48, 1486—1498.

THE statement of Ipatiew (this J., 1913, 107) that methylethylacrolein requires a high pressure for its catalytic hydrogenation is incorrect, as it can be reduced to methylpropylacetaldehyde (b.pt. 116° C.) in presence of palladous chloride and gum arabic at the ordinary pressure; α -hydroxy- β -methyl- β -pentene (b.pt. 166°—169° C.) is obtained as a by-product, and by using colloidal platinum α -hydroxy- β -methylpentane (b.pt. 146.5° C.) is obtained. Benzaldehyde is reduced to benzyl alcohol in alcohol solution, using colloidal platinum, to toluene in acetic acid solution, using chloroplatinic acid and gum arabic at the ordinary pressure, and to hexahydrotoluene (b.pt. 102° C.) at 3 atm. pressure. Mesityl oxide may be reduced to 2-keto-4-methylpentane (b.pt. 115° C.) or to methylisobutylcarbinol, α - and β -ionone to hexahydro-ionone (b.pt. 142°—143° C. at 20 mm.); pulegone is converted into menthol; acetone, methylpropyl ketone, diethylketone, and cyclohexanone into the corresponding carbinols; acetylacetone into methylpropylcarbinol, and benzophenone into dodecahydrodiphenylmethane.—F. W. A.

Aliphatic acids; Electrolytic hydrogenation of unsaturated —. U. Pomilio. Z. Elektrochem., 1915, 21, 444—448.

MONO-, di-, or tri-carboxylic acids were dissolved or suspended in water or dissolved in 96% alcohol containing sulphuric acid (final strength 0.55N) and electrolysed in an earthenware cell by means of a current of 10 to 20 volts and 0.5 amp. The cell was closed by a rubber stopper through which were passed a thermometer, a rotating electrode terminating in a roll of nickel wire gauze, a funnel for replacing sulphuric acid, and a tube for the introduction of hydrogen. This cell was suspended in a beaker containing N/2 sulphuric acid and a platinum wire formed into a ring as the anode. The temperature was maintained throughout at 25° C. The degree of hydrogenation effected depended not only on the nature of the acid, but also on the medium in which it was dissolved or suspended. Citraconic acid and allied acids were only hydrogenated with difficulty, whilst maleic acid could be hydrogenated readily. Fatty acids insoluble in water (oleic, erucic, ricinoleic, and linolenic acids) offered the greatest resistance to hydrogenation. For example commercial oleic acid, with iodine value 75.5, was hydrogenated at 70° C. with 20% sulphuric acid as anolyte and with lead peroxide electrodes. The iodine value was reduced to 72 after 180 mins. and to 68.1 after 600 mins. No better results were obtained in alcoholic solution or by the use of other metals as electrodes.—C. A. M.

Toxicity; Measurement of —. W. J. V. Osterhout. J. Biol. Chem., 1915, 23, 67—70.

FOR determining the toxicity of various substances the author has used a method depending upon the effect produced by the substance on the electrical conductivity of living tissue (*Science*, 1912, 35, 112). The electrical resistance of the tissue in a solution of the toxic substance is compared with its resistance in a solution of the same conductivity, representing the normal environment of the tissue, e.g., sea water in the case of marine algae; the resistance of the normal environment is taken as 100%. The resistance in the toxic solution either first rises and then falls, or falls continuously, until the death point is reached, after which it remains constant. The curves showing the fall in electrical resistance approach the axis asymptotically, and hence in the usual method of determining toxicity by measuring the time necessary for the toxic solution to cause death, the

results must be uncertain owing to the impossibility of ascertaining the precise moment of death. It is suggested that the time necessary for the action to proceed halfway from the normal condition to the death point, as obtained from the electrical resistance curve, be taken as a standard for comparison. In a number of cases the action of toxic substances, as measured by the electrical method, follows the course of a monomolecular reaction, and the velocity constant of the reaction is then the best standard for comparison.—A. S.

Action of Florida earth on unsaturated compounds. Gurvitsch. See 11A.

Conversion of aliphatic and aromatic sulphonic acids into aldehydes and phenols. Mandel and Neuberg. See III.

Determination of the acid and ester values of fats, fixed and essential oils, and waxes. Slack. See XII.

Mustard oil and composition of black mustard seeds. Huber and Van der Wielen. See XII.

Conversion of citronellal into citronellol. Phytochemical reductions. XII. Mayer and Neuberg. See XVIII.

Method of determining proteolytic enzymes. Neppi. See XXIII.

PATENTS.

Unsaturated hydrocarbons containing the conjugated double bond; Purification of —. F. E. Matthews and E. H. Strange, London. Eng. Pats. 5073 of 1915, date of appl., Nov. 11, 1914, and 5074, Apr. 1, 1915. Additions to Eng. Pat. 6897, Mar. 18, 1914.

ANY chloride which yields hydrochloric acid when treated with water, *e.g.*, sulphur chloride, phosphorus chloride, or aluminium chloride, or a sulphonic chloride, such as benzenesulphonic chloride, may be added to the mixture of hydrocarbon and sulphur dioxide (see this J., 1915, 635) to increase the yield of the crystalline sulphoxide. *Example.*—174 grms. of crude isoprene (from turpentine), 12 grms. of disulphur dichloride, 10 grms. of powdered ice, and 198 grms. of liquid sulphur dioxide are heated in a sealed tube for 12 hours at 50° C. Uncombined hydrocarbon and the excess of sulphur dioxide are then removed, and the remainder is treated with hot water and filtered. 120 grms. of pure crystalline sulphoxide is obtained, giving a nearly quantitative yield of isoprene on heating.—F. Sp.

Surgical dressing [pine oil and iodine]. J. Liddle, Glasgow. From Apinol Chemical Co., Wilmington, N.C., U.S.A. Eng. Pat. 11,526, Aug. 10, 1915.

AN antiseptic dressing for wounds is made by dissolving not less than 5 grms. of iodine, or an equivalent amount of tincture of iodine (containing 70 grms. of iodine in one litre of alcohol), in one litre of pine oil, *i.e.*, a fraction of pine- or fir-wood turpentine distilling chiefly between 190° C. and 220° C., having a specific gravity of 0.89 to 0.95, and a refractive index of about 1.486 at 20° C.—F. Sp.

Corrosive fluids [halogen derivatives of hydrocarbons]; Method of rendering — non-corrosive. G. E. Ferguson, New York, Assignor to Pyrene Manufacturing Co. U.S. Pat. 1,151,255, Aug. 24, 1915. Date of appl., Nov. 18, 1913.

CORROSIVE fluids, particularly those which owe their corrosive properties to dissolved oxygen, are

rendered non-corrosive by the addition of a substance capable of absorbing the corroding agent. Thus the corrosion of metal containers, *e.g.*, fire extinguishers, by halogenated hydrocarbons may be prevented by the addition of aldehydes, *e.g.*, benzaldehyde (for iron vessels), or of toluene, benzyl chloride, benzal chloride, etc.—F. Sp.

Sera; Potentiated — [rich in protective ferments], and process of making them. E. Abderhalden, Halle, Germany. U.S. Pat. 1,151,536, Aug. 124, 1915. Date of appl., May 14, 1915.

SERUM rich in protective ferments is produced by injecting cancerous tissue into a test animal, withdrawing serum from it before the protective ferments have disappeared (usually from two to five days after injection), and injecting this serum into a second animal. The serum from the latter contains a greater proportion of protective ferments, and the process is repeated until a serum of the desired strength is obtained, as shown by the amount of dialysable substances produced when it reacts with cancerous tissue. Since any number of animals may be injected with serum from the first, an unlimited supply of rich serum may be obtained, and the method also avoids risk of infection of the final serum from the original diseased tissue.—F. Sp.

Isoprene; Production of —. A. Heinemann, London. U.S. Pat. 1,159,380, Nov. 9, 1915. Date of appl., Mar. 13, 1914.

SEE Eng. Pats. 14,040 and 24,236 of 1910; this J., 1911, 909.

Diacyldiaminophenol compounds. D. Maron, Geneva, Switzerland, Assignor to Synthetic Patents Co., New York. U.S. Pat. 1,159,403, Nov. 9, 1915. Date of appl., July 20, 1914.

SEE Ger. Pat. 286,460 of 1913; this J., 1915, 1168.

Esters of [hydr]oxy fatty acids; Manufacture of —. R. Gräter, Charlottenburg, and H. Pohl, Bieblich, Assignors to Chem. Werke vorm. H. Byk, Lehnitz-Nordbahn, Germany. U.S. Pat. 1,160,595, Nov. 16, 1915. Date of appl., May 29, 1913.

SEE Fr. Pat. 458,645 of 1913; this J., 1913, 1086.

Tar colloid having curative properties; Manufacture of a light-coloured — [from oil of cade]. I. Bugarszky, Assignor to L. Torok, Budapest, and Dr. Kereszty, Dr. Wolf és Tsa Vegyészeti Gyár, R.T., Ujpest, Austria-Hungary. U.S. Pat. 1,160,992, Nov. 16, 1915. Date of appl., Dec. 17, 1912.

SEE Ger. Pat. 277,061 of 1912; this J., 1913, 1172.

Acetaldehyde from acetylene; Preparation of —. Consortium f. Elektrochem. Ind. G. m. b. H. Fr. Pat. 475,183, July 16, 1914.

SEE Eng. Pat. 16,957 of 1914; this J., 1915, 888.

Gallie acid from gall-nuts; Preparation of —. Nitritfabrik A.-G. Fr. Pat. 475,372, Feb. 16, 1914. SEE U.S. Pat. 1,100,730 of 1914; this J., 1914, 844.

Pyridinecarboxylic acids and pyridine; Manufacture of —. A. Heinemann. Fr. Pat. 475,589, July 23, 1914.

SEE Eng. Pat. 17,003 of 1913; this J., 1914, 889.

Compounds of vanadium and selenium. U.S. Pat. 1,154,949. See VII.

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

Asphalts; Chemistry of the — with special reference to their photochemical properties. P. Gödrich. *Monatsh. Chem.*, 1915, 36, 535—548. *J. Chem. Soc.*, 1915, 108, i., 978—979.

ASPHALT can combine to a slight extent with sulphur chloride without becoming insoluble in carbon bisulphide. The product is darker and harder than the original natural product and also is more sensitive to light. The chemical action of the sulphur chloride is both substitutive and additive, mainly the former. With a larger proportion of sulphur chloride, the solution of asphalt deposits a black, spongy solid containing about 18% of sulphur, whilst there remains in solution a constituent of lower sulphur content than the original natural material. Of several samples of asphalt examined, a Cuban product was most sensitive to light. Light from any part of the spectrum is capable of rendering asphalt insoluble, but concurrent contact with oxygen is also necessary; the oxygen may be atmospheric, or may be introduced into the asphalt in the form of a little benzoyl peroxide. Solutions of asphalt exhibit absorption bands in the blue and yellow portions of the spectrum.

Light-filter for the ultra-violet portion of the spectrum; Quantitative —. N. P. Peskov. *J. Russ. Phys. Chem. Soc.*, 1915, 47, 918—942. *J. Chem. Soc.*, 1915, 108, ii., 716—717.

THE author has devised a light-filter, in which gaseous bromine and chlorine are used in conjunction, which absorbs the spectral region 500—300 μ . The coefficients of absorption in the invisible part of the spectrum were measured for gaseous chlorine and bromine for forty-three lines of the spectrum of the quartz lamp. It was found that when dry chlorine and bromine are mixed, the character of their absorption remains unchanged, Beer's law being consequently obeyed. The light-filter has been subjected to detailed quantitative investigation, concentrations of bromine and chlorine being found which permit of the filtering of any part of the spectrum chosen beforehand; this filtration may be restricted within such narrow limits as 250 and 240 μ .

Photochemical reactions; Variation of the temperature-coefficients of — with the wave-length. M. Padoa and T. Minganti. *Atti R. Accad. Lincei*, 1915, [v], 24, ii, 97—101. *J. Chem. Soc.*, 1915, 108, ii., 719—720.

THE authors have measured the temperature-coefficients of Eder's reaction,

$2\text{HgCl}_2 + (\text{NH}_4)_2\text{C}_2\text{O}_4 = 2\text{HgCl} + 2\text{NH}_4\text{Cl} + 2\text{CO}_2$, proceeding under the influence of lights of various wave-lengths. Besides white light, ultra-violet light with the luminous zone $\lambda=400-280$, and maximum intensity at $\lambda=366$, dark blue with the zone $\lambda=478-410$ and the maximum at $\lambda=448$, and green with the zone $\lambda=510-505$ and the maximum at $\lambda=533$, were used. In the case of the green light, the reaction proceeds so slowly that a little dilute aqueous tetrabromofluorescein was added as a sensitiser; the latter was also employed in some of the experiments with white light. For the temperature interval $20^\circ-40^\circ\text{C}$., the temperature-coefficients are as follows: white light, 1.29; ultra-violet, 1.05; dark blue, 1.21; green, with sensitiser, 1.75; white, with sensitiser, 1.50. In accordance with the results previously obtained with phototropic substances, the temperature-coefficients increase with the wave-length of the activating light. With white light, the sensitiser used raises the temperature-coefficient considerably, since it gives preponderance to the action of the yellow and green rays, which without

it are of slight activity. Red light has no action, even in presence of a sensitiser. Certain evidence indicates that, in the assimilatory process of plants under the influence of chlorophyll, the temperature coefficient is considerably greater than 1. In the light of the above results, the view usually accepted, that photochemical reactions are always characterised by temperature-coefficients approximating to 1 (compare Berthelot, this J., 1915, 515, 58t), requires modification.

XXII.—EXPLOSIVES; MATCHES.

Trinitrotoluene; Action of alkalis on —. M. Copisarow. *Chem. News*, 1915, 112, 283—284.

TRINITROTOLUENE when treated with a methyl alcoholic solution of caustic potash or ammonia forms addition compounds, $\text{C}_6\text{H}_2(\text{CH}_3)(\text{NO}_2)_3\text{NO}(\text{OCH}_3)\text{OK}$, H_2O , and $\text{C}_6\text{H}_2(\text{CH}_3)(\text{NO}_2)_3\text{N}(\text{NH}_2)(\text{ONH}_4)$; O, respectively, regarded by Hantzsch (Ber., 1899, 32, 628, 3137; 1910, 43, 2119) as derivatives of nitroic acid, $\text{R}\cdot\text{NO}(\text{OH})_2$, or nitroic acid esters, $\text{R}\cdot\text{NO}(\text{OR}')\text{OH}$. The formation of these addition products represents the first stage in the action of alkalis on trinitrotoluene, but they are rapidly decomposed, both substitution and condensation reactions taking place. The former, for example, lead to the formation of dinitrotoluidines when alcoholic ammonia is used, whilst by condensation nitro-nitrosodibenzyls and nitronitrosostilbenes are formed, which undergo further condensation in the form of nitro salts to yield azoxy and azo compounds. α -Trinitrotoluene dissolved in alcohol or acetone reacts readily with sodium carbonate, baryta, or lime water in the cold, giving a deep red coloration; with sodium bicarbonate a coloration changing from violet to purple and then red is produced. According to Will (this J., 1914, 376), β - and γ -trinitrotoluenes are still more sensitive, reacting with a 1% solution of sodium carbonate and lead oxide to form derivatives of tolyl oxide. Green (this J., 1908, 69) determined the temperature at which colour formation commenced under constant conditions of alkalinity and concentration, and found that, in the case of derivatives of p -nitrotoluene with a substituted group in *ortho*-position to the methyl group, the greatest effect was produced by the NO_2 group, 2,4-dinitrotoluene giving a coloration below -20°C . The author found that under similar conditions, 2,4,6-(α)trinitrotoluene gives a coloration (orange-red changing to deep red) below -65°C . From the information available in regard to the action of alkalis on trinitrobenzene and on p -nitrotoluene and its *ortho*-substitution products, including trinitrotoluene, it may be concluded that:—(1) The sensitiveness towards alkalis increases with the number of nitro groups in the molecule. (2) The sensitiveness is greatly increased and also the complexity of the reaction by the presence of an alkyl radical in the *para*-position to a nitro-group, probably in consequence of the formation of nitroic acids. (3) The reactivity of the molecule is increased very much by introduction of electronegative groups in *ortho*-position to the alkyl radical. The salts formed by the action of alkalis on trinitrotoluene are highly explosive. Dupré (this J., 1904, 727) found that in presence of a small quantity of caustic potash, trinitrotoluene explodes when heated to 160°C . (See also this J., 1915, 1168).—A.S.

Explosives; Apparatus for studying the gases and vapours evolved from — at the ordinary temperature. D. Chiaraviglio and O. M. Corbino. *Rend. R. Accad. dei Lincei*, 1915, 24, II., 120—126. *Annali Chim. Appl.*, 1915, 4, 289.

USING an apparatus in which a very high vacuum

could be produced, it was found that gun-cotton decomposes slowly with continuous evolution of gas at the ordinary temperature. (See also this J., 1915, 637.)—A. S.

Phosphorus and liquid air; An explosive mixture of —. A. Piutti. Rend. R. Accad. Lincei, 1915, 24, 11., 252—253. Annali Chim. Appl., 1915, 4, 290.

If yellow phosphorus be immersed in liquid air it does not combine with the oxygen, but after withdrawal it explodes violently when struck, when touched with a hot iron, or when exposed to an electric spark. Red phosphorus and sulphur after similar treatment do not explode.—A. S.

New methods used in washing and distilling liquids [and for nitrating]. Borrmann. Sec I.

PATENT.

Trinitrotoluene; Process for producing pure — from crude trinitrotoluene. Oberschlesische Act.-Ges. f. Fabr. von Lignose, Schiesswollfabr. für Armee und Marine. Fr. Pat. 475,215, July 16, 1914. Under Int. Conv., Aug. 28, 1913.

SEE Ger. Pat. 277,325 of 1913; this J., 1915, 199.

XXIII.—ANALYTICAL PROCESSES.

Evaporation of aqueous extracts by means of a current of air; Apparatus for —. T. B. Aldrich. J. Biol. Chem., 1915, 23, 255—259.

WHEN a solution to be concentrated is not exceptionally sensitive to oxidation but is sensitive to heat, evaporation can be advantageously carried out at comparatively low temperatures by means of a warm blast of air blowing over the surface of the liquid contained in shallow vessels. An effective apparatus consists of a long galvanised iron inverted U-tube, one limb being connected with a fan, and the other passing into a small chamber, such as a laboratory fume chamber, and ending in one or more rectangular orifices delivering a horizontal current of air. The tube is contained in a similar larger asbestos-covered tube, containing a gas burner so arranged as to heat the inner tube and to allow the products of combustion to pass along over the inner tube and eventually escape. With the particular apparatus described, an average of 360 c.c. per hour can be evaporated at 29°—31° C., using flat dishes having a surface area of 180 sq. inches.—T. C.

Viscometer; Absolute —. W. Stone. Engineering, 1915, 100, 554.

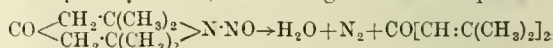
THE viscometer proper consists of a glass U-tube, the lower portion of one limb consisting of a replaceable capillary tube of suitable dimensions. The upper end of the capillary fits into a measuring burette furnished with two platinum wires sealed into the wall at different heights. The fluid is drawn by reduced air pressure into the wide limb of the U-tube and is then forced through the capillary into the burette under an applied constant air pressure, the time between the contacts of the fluid meniscus with the ends of the platinum gauge wires being measured. If the quantity of fluid is such that when it is at the same level in both legs it is also midway between the platinum points, for commercial purposes, no correction need be made for the fluid head in the apparatus, or for the density of the fluid (unless it be mercury), provided that the constant pressure be not reduced below 3 cm. of mercury. The adjustable constant-head apparatus consists of two glass vessels, the lower one connected with the viscometer by a thick-walled rubber tube, and the upper one suspended by means of a spring from a hook attached to a sliding clip which can be clamped at

any desired height. During a determination, mercury siphons over from the upper to the lower vessel through a thick-walled rubber tube, the strength of the spring being so adjusted that the upper vessel rises by an amount sufficient to maintain the difference in level of the mercury in the two vessels constant. Where P is the constant air pressure, D the distance between the platinum points, A the area of cross-section of each upper limb, K a constant for the instrument, η the coefficient of viscosity, and t the measured time, then, if the fluid head is so chosen that it can be neglected, $t = \frac{KDA\eta}{P}$. The instrument

has been used for testing the viscosity of lubricating oils, and with it the viscosity curve of an oil which varied from 7 c.g.s. units at 13° C. to 0.06 c.g.s. unit at 100° C. could be taken in one hour, 5 points on the curve being determined in duplicate. The dimensions of the capillary tube used were:—length 15 cm.; radius of bore 0.0419 cm. The capacity of the burette between the platinum points was about 2.5 c.c., and the cross-section about 1 sq. cm.—T. ST.

Hydroxyl-ions; Determination of the concentration of —. F. Franc, F. H. Geake, and J. W. Roche. Chem. Soc. Trans., 1915, 107, 1651—1673.

MEASUREMENTS of the rate of decomposition of nitrosotriacetoneamine, or of nitrosovinyl- or nitrosoisobutyl-diacetoneamine under the influence of hydroxyl ions, according to the equation



by determining the pressure of the evolved nitrogen, were utilised to determine the concentration of these ions (see also Chem. Soc. Trans., 1912, 101, 2358, and 1913, 103, 1722). The results are accurate and reproducible to within 0.7—1%. The determinations were carried out in a glass reaction vessel about 10 cm. long and 3 cm. in diameter, connected with a constant-volume burette, and fitted into a wooden cradle which could be mechanically shaken in a thermostat during the experiment. The alkali and nitrosamine solutions are introduced by means of a large hollow stopper having a cavity of 7—10 c.c. capacity corresponding in position to the inlet tube on the one side, and to the reaction vessel when rotated through 180°. The catalysis of the vinyl- and isobutyl-compounds is available for hydroxyl-ion concentrations from 0.05N to 0.35N, between which limits the unimolecular constants for the triacetoneamine compound "drift"; this drift does not commence with the former compounds till a concentration of 0.4N is reached. As the velocity of decomposition is much lower than with nitrosotriacetoneamine, the experiments were carried out at 50° C., and since the decomposition products absorb oxygen the catalysis was conducted in an atmosphere of nitrogen. A large number of kinetic measurements, using solutions of sodium and potassium hydroxide of different strengths, were made, and are tabulated and fully recorded in the paper.—G. F. M.

Gold and platinum; Separation of — from other metals. A. Christensen. Z. anal. Chem., 1915, 54, 158—159. Chem.-Zeit., 1915, 39, Rep., 374.

FROM slightly acidic solutions hydrazine salts precipitate gold immediately, and platinum after it has been reduced to the bichloride. Precipitation is complete on warming. Of other metals only mercury, and to some extent copper, are thrown down; these may be removed by boiling with nitric acid. The residue is dissolved in aqua regia, and from the solution the gold is precipitated by sulphur dioxide, and the platinum by ammonium chloride.—G. F. M.

Metalloids in organic compounds: Simple method for the detection and determination of—. J. A. Mandel and C. Neuberg. *Biochem. Zeits.*, 1915, 71, 196—213. *J. Chem. Soc.*, 1915, 108, ii., 788.

ORGANIC compounds can be oxidised by 15% hydrogen peroxide in the presence of iron salts in such a way that the metalloid is set free from combination. The reaction takes place very rapidly on warming, and is useful when employed for qualitative analysis. Compounds which are insoluble in water or dilute acids can be oxidised in glacial acetic acid. The reaction can also be used for quantitative estimation, but not in all cases. When the method is applicable, it offers a rapid means for quantitative estimation of phosphorus, arsenic, the halogens, and sulphur. When the substance under investigation is volatile, the oxidation is carried out in a vessel fitted with a reflux condenser. Substances insoluble in water or acids can be oxidised in alkaline (preferably ammoniacal) solution; when insoluble in water or aqueous solutions of acids or alkalis, they can be oxidised in glacial acetic acid. In some cases the substances are heated with sulphuric acid until charring takes place, and the oxidation is completed by hydrogen peroxide in the presence of an iron salt. In estimating the halogens, the oxidation is carried out in the presence of silver nitrate. Phosphorus and sulphur can be estimated in the same sample.

Aliphatic amino-nitrogen: Note on the microgasometric determination of—. D. D. van Slyke. *J. Biol. Chem.*, 1915, 23, 407—409.

A MODIFIED form of the author's gas burette for the micro-gasometric determination of aliphatic amino-nitrogen (this *J.*, 1911, 771; *J. Biol. Chem.*, 1912, 12, 275; 1913, 16, 121) which requires only 1 c.c. of the solution to be analysed, is described and figured.—T. C.

Proteolytic enzymes: Method of determining—. B. Neppi. *Boll. Chim. Farm.*, 1915, 54, 289—297. *J. Chem. Soc.*, 1915, 108, ii., 808.

FOR pepsin, a modification of Fuld and Levison's method (*Biochem. Zeits.*, 1907, 6, 473—501) is recommended, the solutions required being *N*/300-hydrochloric acid, 30% sodium chloride solution, and a solution containing 1 gm. of edestin in 1000 c.c. of *N*/300-hydrochloric acid. Into each of a series of test-tubes, not more than 1 cm. in width, are introduced 2 c.c. of the edestin solution, 0.9, 0.8, . . . 0 c.c. of *N*/300-hydrochloric acid, and 0.1, 0.2, . . . 1.0 c.c. of the pepsin solution. The tubes are kept at 22°—23° C. for thirty minutes, and to each is then added about 1 c.c. of the sodium chloride solution. The first tube of the series in which no turbidity appears, corresponds with complete digestion of the edestin. If this occurs with 0.5 c.c. of a 0.1% solution of pepsin, 0.0005 gm. of the latter is sufficient to digest 2 mgrms. of edestin, and the activity of the pepsin will be 2/0.0005=4000 units. The hydrochloric acid and the pepsin solution should be added to the tubes in the same order. In the case of pancreatin, a modified form of Gross's method (*Arch. Expt. Path. Pharm.*, 1907, 58, 157) is employed. 1 gm. of pure casein is dissolved in 1 litre of 0.1% sodium carbonate solution, and 10 c.c. of chloroform subsequently added. Increasing quantities of the enzyme solution are then added to a series of tubes, each containing 10 c.c. of the casein solution, the volumes equalised by addition of water, and the tubes kept at 40° C. for fifteen minutes. To each tube is then added 1 c.c. of a solution of 5 c.c. of acetic acid in 50 c.c. of water and 45 c.c. of 95% alcohol. If 0.4 c.c. of a 0.1% pancreatin solution is just able to digest 10 c.c. of the casein solution, the activity of the pancreatin is expressed as 10/0.0004=25,000 units, 1 gm. of the pan-

creatin being capable of digesting 25 grms. of casein.

Examination of steam turbine oils. Schwarz and Marcusson. See IIA.

Differentiation of natural and artificial asphalts. Marcusson. See IIA.

Determination of thiophen in benzene. Paolini and Silbermann. See III.

Interaction of perchloric acid and potassium sulphate as an example of reversible change. Davis. See VII.

Testing of plastic cement mortars. Gary. See IX.

Reduction of ferric iron solutions prior to titrating with permanganate. Hoenig. See X.

Determination of the nature and thickness of the zinc coating on galvanised iron. Bauer. See X.

Results of zinc dust precipitation tests. Herz. See X.

Determination of the acid and ester values of fats, fixed and essential oils, and waxes. Slack. See XII.

Determination of fatty acids in soap. Slack. See XII.

Viscosity of beeswax and its adulterants. Fabris. See XII.

Influence of the purity of the air of the testing room on the results of the durability test of iron-gall inks. Himrichsen and Kempf. See XIII.

Method of mechanical soil analysis. Odén. See XVI.

Action of sucrose on alkaline copper solutions. Maquenne. See XVII.

Determination of reducing sugars. Volumetric method for determining cuprous oxide without removal from Fehling's solution. Scales. See XVII.

Analysis of denatured sugar. Von Wissell. See XVII.

Rapid separation of pure fat from the non-fatty constituents of milk. Korpaczky. See XIXA.

Rapid determination of fat and water in butter and margarine. Besson. See XIXA.

Modification of Pelouze's method of determining nitrates. Letts and Rea. See XIXB.

Detection and determination of small quantities of phosphoric acid, especially in drinking water. Medinger. See XIXB.

Determination of salicylic acid compounds in urine and other body fluids. Thoburn and Hanzlik. See XX.

Measurement of toxicity. Osterhout. See XX.

Trade Report.

Recruiting and chemical industries.

A NUMBER of occupations, lists of which are being supplied to local tribunals, have been scheduled as being vitally important at the present time for war work or for other essential requirements, including the export trade. Men of military age engaged in any of these occupations who present themselves for attestation and are physically fit are to be placed in their group in the Army Reserve, but will not be called up for military

service unless it has been decided by competent authority that it is no longer necessary in the national interests to retain them in civil employment. Men with authorised war badges will be dealt with in the same way.

According to lists issued on Nov. 20th and 27th and Dec. 18th, the following occupations are included among those scheduled as "vitally important at the present time for war work or for other essential requirements":—

Workers in pig iron manufacture (blast furnaces): all classes. Workers in puddling furnaces, iron and steel rolling mills: all classes. Steel manufacture and smelting: all classes. Copper manufacture: all classes. Lead manufacture: all classes. Zinc manufacture: all classes. Brass and bronze manufacture other than foundry: all classes (including turbine blade drawer). Galvanised sheet manufacture: all classes. Aluminium manufacture: all classes. Metal alloys manufacture: all classes. Asbestos manufacture: all classes. Scientific instrument makers. Chemical, engineering, and optical glass makers. Furnace firebrick maker for metal trades. Explosives, fireworks, and cartridge manufacture: all workers. Tar distilling industry: all workers. Alkali manufacture: all workers. Shale oil workers. Chemical trades: chemist, foreman, overlooker, process man, chemist (analytical); chemical trades: lubricating oils and other lubricants (manufacture of), wholesale manufacturing druggists, chemist in the sense of a person dispensing medicines under the National Insurance Acts. Druggists (wholesale manufacturing): analytical chemist. Glass: all workers in glass house (known variously as gatherers, blowers, makers, finishers, melters, chairmen, servitors, footmakers, furnacemen), gas producer man. Leather tanning and currying: currier, foreman, tanner. Lubricating oils and other lubricants (manufacture of): chemist, greasemaker, manager, oil blender, oil blower, cooper, distiller, examiner, filler, filterer, pressman and bagman, pumpman, refiner, pitchman, tar and resin refiner. Sugar refining (all classes of workpeople). Tin smelting: all classes. Tinplate manufacture: doubler, foreman, furnaceman. Oil-cloth, linoleum, and floor-cloth manufacture: works chemists, cork millers, millstone dressers, cement makers, mixing-room foremen, foremen trowellers and coverers, foremen hangers (hanging-off men), block printers, printing-machine minders (rotary and flat machines), superintendent oil boilers, embossing machine superintendents, calender machine superintendents, inlaying machine superintendents, varnish and colour makers (see also list for paint, colour, and varnish making industry). China and earthenware manufacture (other than stoneware): overlookers, managers, and foremen, slip makers, throwers, china turners, ground layers, sanitary ware pressers, sanitary ware casters, mould makers, saggar makers and assistants, printers, biscuit oven men (placers, firemen, odd men), glost oven men (placers, firemen, odd men), packers. Paint, colour, and varnish making: works chemists, foremen, colour strikers, head grinders, head oil boilers, varnish makers (runners of varnish or gums). Machine creameries and condensed milk and milk powder factories: foremen, condensers. Bleaching, dyeing, calico printing, and textile finishing trades: departmental managers, foremen or overlookers, calender men, beetlers, driers and stovers. Paper manufacture: potchermen, beatermen, paper machinemen, back tenters on paper machines, calender men, reeler men, cutter men, head rag boilers. Hide and skin markets, and skin and bone factories: departmental managers, hide and skin classers. Margarine

manufacture: foremen, churnmen, blenders, kneaders. Preparation of edible oils and fats: foremen, pressmen, oil refiners, coopers. Grocery and provision trades: analytical, consulting, and research chemists are not to be accepted for immediate enlistment or called up for service with the colours without the consent of the Royal Society in each case. Chemical laboratories: head laboratory attendants.

Prohibited exports. Order in Council, Dec. 13, 1915.

THE exportation of "magnesite, caustic or lightly calcined, and dead burnt magnesite," and of "magnesium and its alloys," is prohibited to all destinations. The exportation of beeswax is prohibited to all destinations abroad other than British Possessions and Protectorates. The word "coke" is now used in place of "coke made in gas works" in the prohibition relating to exports of coal and coke. The export of silica bricks is prohibited to all foreign countries in Europe and on the Mediterranean and Black Seas, other than France, Russia (except through Baltic ports), Italy, Spain, and Portugal.

Books Received.

PAINTING BY IMMERSION AND BY COMPRESSED AIR. By A. S. JENNINGS. Offices of "The Managing Engineer," 93, Chancery Lane, W.C. xv. + 272 pages, 8 $\frac{1}{2}$ × 5 $\frac{1}{2}$ in. Price 10s. 6d.

THE adoption of immersion and spraying methods in the application of paints and varnishes is increasing rapidly in this country, and this book should prove of value to manufacturers and others who wish to ascertain whether these methods are suitable for their particular purposes. Provided one of these methods is applicable, there can be no question as to the saving of time and labour which they effect, whilst the results are claimed to be at least equal to those produced by brushing. The author describes all the principal appliances in use for spraying paint, enamel, varnish, etc., and also the chief types of plant used for dipping. Full reference is made to the modern process of "flowing on" enamels, and a chapter on metal spraying is also included. The number of products for which these methods are used may be gathered from the fact that they range from pins to locomotives and from artificial flowers to pianos and organs. The book contains 150 illustrations.

ANNUAL REPORT OF THE CHIEF INSPECTOR OF FACTORIES AND WORKSHOPS FOR THE YEAR 1914. [Cd. 8051.] Wyman and Sons, Fetter Lane, London, E.C. v. + 133 pages foolscap. Price 1s. 2d.

AN abstract of this Report will be found on page 1230 of this issue of the Journal.

CHLORINE AND CHLORINE PRODUCTS. By G. MARTIN and G. W. CLOUGH. Crosby Lockwood and Son, London. 94 + 6 pages. 10 × 6 $\frac{1}{4}$ in. Price 7s. 6d.

THIS is the fourth of the "Manuals of Chemical Technology" which are being edited by Dr. Martin, and contains sections on the manufacture of bleaching powder, hypochlorites, chlorates, perchlorates, bromine, iodine, and hydrofluoric acid, together with a chapter on peroxides and per-acids. Brief descriptions are given of the principal forms of process and apparatus used, and references to the literature of the subject are added.

The Society of Chemical Industry.

Founded 1881. Incorporated by Royal Charter 1907.

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 Chairman .. Prof. J. Watson Bain, University of Toronto, Canada.
 Secretary .. Alfred Burton, 114, Bedford Road, Toronto, Canada.

Liverpool :
 Chairman .. Prof. E. C. C. Baly, 14, Sunnyside, Prince's Park, Liverpool.
 Secretary .. Dr. Alex. Rule, The University, Liverpool.

London :
 Chairman .. Prof. W. R. E. Hodgkinson, 89, Shooter's Hill Road, Blackheath, S.E.
 Secretary .. T. D. Morson, 14, Elm Street Gray's Inn Road, London, W.C.

Manchester :

Chairman .. Julius Hübner, Linden, Cheadle Hulme, Cheshire.
 Secretary .. L. E. Vlies, Belmont, Gowan Road, Alexandra Park, Manchester.

Newcastle :

Chairman .. Prof. Henry Louis, Armstrong College, Newcastle-on-Tyne.
 Secretary .. E. F. Hooper, 10, The Elms West, Sunderland.

New England :

Chairman .. S. W. Wilder, 33, Broad Street, Boston, Mass., U.S.A.
 Secretary .. Alan A. Claflin, 88, Broad Street, Boston, Mass., U.S.A.

New York :

Chairman .. G. W. Thompson, 129, York Street, Brooklyn, N.Y., U.S.A.
 Secretary .. Dr. Parker C. McIlhenny, 50, East 41st Street, New York City, U.S.A.

Nottingham :

Chairman .. John White, St. Mary's Gate, Derby.
 Secretary .. John M. Wilkie, 38, South Road, West Bridgford, Nottingham.

Scotland :

Chairman .. D. J. Hamilton, Locksley, Helensburgh, Scotland.
 Secretary .. Dr. G. S. Cruikshanks, Royal Technical College, Glasgow.

Sydney, N.S.W. :

Chairman .. Prof. C. E. Fawsitt, The University, Sydney.
 Secretary .. T. U. Walton, Colonial Sugar Refining Co., O'Connell Street, Sydney.

Yorkshire :

Chairman .. F. W. Richardson, County Analyst's Office, Bradford.
 Secretary .. Thos. Fairley, 17, East Parade, Leeds.

Honorary Treasurer.

Thomas Tyrer, Stirling Chemical Works, Stratford, London, E.

Honorary Foreign Secretary.

Dr. R. Messel, F.R.S., 147, Victoria Street, London, S.W.

General Secretary.

Chas. G. Cresswell, Broadway Chambers, Westminster, S.W.
 (Telegraphic address:—"Induchem," Vic., London;
 Telephone No., 715 Victoria.)

Editor.

T. F. Burton, 63, Melbury Gardens, West Wimbledon, S.W.
 (Telephone No. 1471 Wimbledon).

LIST OF MEMBERS.

THE MEMBERSHIP ON FEBRUARY 28TH, 1915 = 3939.

NOTE: "O.M." MEANS ORIGINAL MEMBER.

A

1912. Abady, Jacques, 1, Westminster Palace Gardens, London, S.W., and (Journals) 11, Lyndhurst Road, Hampstead, N.W., Barrister-at-Law, M.Inst.Mech.E.
1912. Abegg, Dr. Fritz, 28, Gordon Street, Perth Amboy, N.J., U.S.A., Chemist.
1903. Abraham, Herbert, 13, West 89th Street, New York City, U.S.A., Chemist.
1909. Acheson, Dr. Edward G., 5, Chancery Lane, London, W.C., President, Acheson Oiltag Co.
1902. Acker, Chas. E., 80, Main Street, Ossining, N.Y., U.S.A., Manufacturer.
1913. Acland, L. H. Dyke, 55, Comeragh Road, West Kensington, W., Analytical Chemist.
1903. Acton, J. Rowland, India Store Dépôt, Belvedere Road, London, S.E., Civil Servant.
1911. Acton, Leonard T., c/o Wm. Davies Co., Ltd., 521, Front Street East, Toronto, Canada, Chemist.
1913. Acton, Walter, 9, Trees Park Avenue, Barrhead, Scotland, Works Manager and Chemist.
1912. Adam, G. H., "Lintrose," Malakoff Street, Marrickville, Sydney, N.S.W., Customs Analyst.
1914. Adam, N. K., South View, Cambridge Road, S. Farnborough, Hants, Chemist (Naval Air Service).
1907. Adam, Wm. A., c/o Mander Bros., Wolverhampton, Chemist.
1892. Adams, Arthur, Kelvin House, Edgbaston Road, Smethwick, near Birmingham, Science Lecturer.
1911. Adams, E. Bryan, c/o Curtis's and Harvey, Ltd., Explosives Works, Cliffe at Hoo, Kent, Chemist.
1897. Adams, Thos. H., 7, Douglas Street, Derby, Analyst.
1895. Adamson, G. P., The Baker and Adamson Chemical Co., Easton, Pa., U.S.A., Manufacturing Chemist.
1891. Adcock, S. R., St. Helens Smelting Co., Ltd., Atlas Court, St. Helens, Lancashire, Analytical Chemist.
1901. Addison, Leonard, Prince Regent's Wharf, Silvertown, Victoria Docks, E., Chemist.
1898. Adgate, M., Naugatuck, Conn., U.S.A., Chemist.
1913. Adkins, Linden R., 12, Fenwick Street, Rochester, N.Y., U.S.A., Oil Refinery Chemist.
1896. Adler, Dr. Leon N., Adler Colour and Chemical Works, 100, William Street, New York City, U.S.A., Manufacturing Chemist.
1907. Adley, Geo. S., Storer's Wharf, Poplar, London, E., Varnish Manufacturer.
1888. Adriance, Dr. John S., Williams College, Williamstown, Mass., U.S.A., Analytical Chemist.
1899. Adrot, Léon, 16, Palmer Avenue, Port Richmond, N.Y., U.S.A., Chemist.
1912. Aitken, James, c/o Pratt and Letchworth Co., Brantford, Ontario, Canada, Chemist.
1886. Aitken, J. B., Gerard's Fold Chemical Works, Widnes, Chemical Manufacturer.
1910. Aitken, Dr. J. M., St. Catherine, Bishopton, Renfrewshire, Chemist.
1912. Akers, Noel C., c/o I. J. Smith and Nephew, Ltd., Neptune Street, Hull, Manager-Chemist.
1883. Albright, G. S., Bromesborough Place, Ledbury, Chemical Manufacturer.
- O.M. Albright, W. A., 29, Frederick Road, Edgbaston, Birmingham, Chemical Manufacturer.
1906. Alcock, Frank H., 5, King Alfred's Place, Broad Street, Birmingham, Analyst.
1914. Alcock, W. J., c/o War Office, High Explosives Dept., Storey's Gate, Westminster, S.W., Alkali Works Manager.
1898. Alden, John, Chemical Laboratory, Pacific Mills, Lawrence, Mass., U.S.A., Chemist.
1909. Alén, Dr. J. E., Stadschemistens Laboratorium, Göteborg, Sweden, Public Analyst.
1899. Alexander, D. Basil W., 3814, Santa Fe Avenue, Los Angeles, Cal., U.S.A., Chief Chemist (General Petroleum Co.).
1913. Alexander, Jas., 2208, Allendale Street, Walbrook, Baltimore, Md., U.S.A., Research Chemist.
1900. Alexander, Jerome, c/o National Gum and Mica Co., N.E. cor. 59th Street and 11th Avenue, New York City, U.S.A., Chemist.
1912. Alexander, Walter, National Gum and Mica Co., 59th Street and 11th Avenue, New York City, U.S.A., Secretary.
1883. Alexander, W. T., Crummock, Eccles, Manchester, Drysalter.
1906. Allan, David, c/o Price's Patent Candle Co., Ltd., Bromborough Pool Works, near Birkenhead, Chemist.
1891. Allan, F. H. Tielke, c/o James S. Kirk and Co., Soap Works, Chicago, Ill., U.S.A., Technical Chemist.
1898. Allan, John, 77, Northen Grove, West Didsbury, Manchester, Chemist.
1914. Allan, John L. S., c/o Wm. Wotherspoon, Ltd., Glenfield Starch Works, Paisley, Scotland, Analytical Chemist.
1909. Allan, Maurice, 103, Burford Road, Nottingham, Soapmaker.
1907. Allard, M. L., c/o Dunlop Tire and Rubber Goods Co., Toronto, Canada, Chemist.
1902. Allbright, Wm. B., 4937, Madison Avenue, Chicago, Ill., U.S.A., Chemical Engineer.
- O.M. Alldred, C. H., 8, St. Margaret's Road, Plumstead Common, Woolwich, S.E., Technical Chemist.
1898. Alleman, Dr. Gellert, Swarthmore College, Swarthmore, Pa., U.S.A., Professor of Chemistry.
1903. Allen, Chas. A., Overdale, Sunninghurst, Darwen, Lancashire, Chemist.
1911. Allen, Harry L., 470, Morris Avenue, Elizabeth, N.J., U.S.A., Chemist.
- O.M. Allen, J., 164, Upper North Street, Poplar, E., Manufacturing Chemist.
1893. Allerton, Rt. Hon. Lord, F.R.S., (Journals) Allerton Hall, near Leeds; and c/o W. L. Jackson and Sons, Ltd., Burslingthorpe, Leeds, Tanner.
- O.M. Allhusen, A., (Jnls.) W. Russell, Allhusen Works, Gateshead-on-Tyne, Chemical Manufacturer.
1886. Allibon, G. H., The Gables, Deramore Park, Belfast, Ireland, Chemical Works Manager.
1913. Allmand, Dr. A. J., Muspratt Laboratory, The University, Liverpool, Lecturer in Chemistry.
1905. Allpass, Jas., 9, Albert Square, Manchester, Secretary.
1912. Almy, Charles, c/o American Vulcanized Fibre Co., Wilmington, Del. U.S.A., Chemical Engineer.
1889. Alpiar, Agop, Morphia Manufacturer.
1899. Alsop, Wm. K., Ridgway, Pa., U.S.A., Chemist.
1910. Amin, Bhailal D., The Alembic Chemical Works Co., Ltd., Gorwo Road Camp, Baroda, India, Chemical Agent.
1905. Amory, L. H., c/o Messrs. J. Heathcoat and Co., Tiverton, Devon, Lace Manufacturer.
1914. Anders, H. R., Dept. F. of Roessler and Hasslacher Chemical Co., Perth Amboy, N.J., U.S.A., Chemist.

1914. Anderson, Albert E., c/o Procter and Gamble Co., Ivorydale, Ohio, U.S.A., General Superintendent.
1910. Anderson, Jas. R. V., School of Mines, Bendigo, Victoria, Australia, Lecturer in Chemistry and Metallurgy.
1900. Anderson, Jas. W., c/o The Thames Portland Cement Co., Ltd., Cliffe-at-11oo, Kent, Analytical Chemist.
1914. Anderson, P. J., Marischal College, Aberdeen, Librarian.
1889. Anderson, Roht. T. R., 42, Roslea Drive, Dennistoun, Glasgow, Technical Chemist.
1894. Anderson, Dr. W. Carriek, 7, Scott Street, Garnet Hill, Glasgow, Consulting Chemist.
1905. Andrae, Dr. E. P., c/o British Glanzstoff Manufacturing Co., Ltd., Flint, North Wales, Chemist.
1907. Andrews, Chas. T., 14a, Finsbury Square, London, E.C., Chemist.
1889. Andrews, Dr. Clement W., c/o The John Crerar Library, Wabash Avenue and Washington Street, Chicago, Ill., U.S.A., Librarian.
1912. Andrews, Ernest R., "Nutfield," Druce Road, Dulwich, S.E., Analytical and Consulting Chemist.
1914. Andrews, Joseph C., 123, Vine Street, New Britain, Conn., U.S.A., Chemical Engineer.
1903. Andrews, Wm. H., 79, Tonawanda Street, Buffalo, N.Y., U.S.A., Manager (Varnish Works).
1913. Andrews, W. O., P.O. Box 2671, Johannesburg, South Africa, Analytical Chemist.
1903. Antilogoff, N. A., Thames Haven, Essex, Chemist and Petroleum Refiner.
- O.M. Angell, J., 6, Beaconsfield, Derby Road, Withington, Manchester, Chemical Lecturer.
1913. Annan, J. G., Elm Cottage, Addiewell, Midlothian, Chief Chemist (Mineral Oil Works).
1892. Annandale, C. J. R., The Briary, Shotley Bridge, Co. Durham, Paper Maker.
1894. Ansbacher, L. A., 527, Fifth Avenue, New York City, U.S.A., Colour Manufacturer.
1913. Anspach, Dr. Richard, Lyckorna, Raynham Avenue, Didsbury, Manchester, Dye-works Manager.
1902. Anthony, John, 217, King Street East, Toronto, Canada.
1900. Appleyard, Geo. H., 1, Carlton Terrace, Hornsea, East Yorks, Chemist.
1905. Appleyard, Jas. R., Royal Technical Institute, Salford, Lecturer.
- O.M. Archbutt, Leonard, The Yews, Madeley Street, Derby, Analytical Chemist.
1899. Archdale, T. Henry, 38, Whitebirk, Blackburn, Manager of Tar and Ammonia Works.
1904. Archdale, Wm., Sandhutter, Hill Lane, Blackley, Manchester, Manager of Chemical Works.
1901. Ardagh, Prof. Edw. C. R., Faculty of Applied Science, University of Toronto, Canada, Chemist.
1900. Ardern, Edw., Holmleigh, Queen's Road, Urmston, Manchester, Chemist.
1907. Armstrong, Chas. F., c/o Cawnpore Sugar Works, Ltd., Marhourah Factory P.O., Chupra, Sarun, India, Technical Chemist.
1902. Armstrong, Edward E., Pennsylvania Salt Manufacturing Co., Natrona, Pa., U.S.A., Manufacturing Chemist.
1905. Armstrong, Dr. E. Frankland, c/o J. Crosfield and Sons, Ltd., Warrington, Technical Chemist.
1912. Armstrong, Prof. H. E., F.R.S., 55, Granville Park, Lewisham, S.E., Consulting Chemist.
1899. Armstrong, Richard, Saul Street Soap Works, Preston, Lancashire, Soap Manufacturer.
1905. Arnold, Frank L., 32, School Street, North Woburn, Mass., U.S.A., Chemist.
1899. Arnott, Dr. G. W. Campbell, c/o Fertiliser Manufacturers' Association, 68-70, Fenchurch Street, London, E.C., Agricultural Chemist.
1903. Arnott, J. S. Moros, 42, 2°, Gijon, Spain, Chemist and Metallurgist.
1912. Army, H. V., 115, West 68th Street, New York City, U.S.A., Teacher and Chemist.
1911. Asahina, Koji, Uyeda Sericulture College, Uyeda, Shinano, Japan, Chemist.
1901. Asano, K., Ashio Copper Mine, Shimozuke, Japan, Consulting Mining Chemist.
1908. Ashbury, J. W., c/o John Brown and Co., Ltd., Laboratory, Atlas Works, Sheffield, Chief Chemist.
1914. Ashcroft, Edgar A., Research Laboratory, North Weald, Essex, Technical Chemist.
1903. Ashley, Frank R., c/o Western Chemical Manufacturing Co., Denver, Colo., U.S.A., Manufacturing Chemist.
1890. Ashton-Bost, W. D. *See* Bost, W. D. Ashton.
1894. Ashworth, Arthur, Fernhill Chemical Works, Bury, Lancs., Chemical Manufacturer.
1908. Ashworth, D. Irving, P.O. Box 503, Wappingers Falls, N.Y., U.S.A., Chemist.
1907. Aspey, Urban, jun., New Station Soap Works, School Close, and (Journals) 11, Nevillo Street, Leeds, Works Manager and Chemist.
1898. Aspinall, Thos., 34, Chorley New Road, Bolton, Analytical and Manufacturing Chemist.
1900. Aston, Bernard C., Box 40, P.O., Wellington, New Zealand, Chemist.
1891. Atkins, C. E., The Heath, Redbourn, Herts., Chronometer Maker.
1885. Atkinson, A. J., 10, North Church Street, Cardiff, Analytical Chemist.
1912. Atkinson, F. C., c/o American Horing Co., Gent Avenue, Indianapolis, Ind., U.S.A., Chemist.
1911. Atkinson, James E., The Sheffield Testing Works, Ltd., Blonk Street, Sheffield, Analytical Chemist.
1900. Atkinson, Jno. W., Betteravia, Santa Barbara Co., Cal., U.S.A., Manager, Union Sugar Co.
1915. Attack, F. W., 88, Claude Road, Chorltonville, Manchester, Demonstrator in Chemistry.
1905. Atteaux, F. E., 176, Purchase Street, Boston, Mass., U.S.A., Dyestuff Importer.
1900. Atwood, Frank W., 216, Milk Street, Boston, Mass., U.S.A., Chemist.
1895. Auchterlonie, Wm., c/o Clark Thread Co., Newark, N.J., U.S.A., Dye-works Manager.
1897. Auger, Chas. L., 425, Park Avenue, Paterson, N.J. U.S.A., Silk Dyer.
1911. Austin, Fred. J., 343, Sixth Avenue, Brooklyn, N.Y. U.S.A., Chemist.
1913. Austin, Wm. L., 113, Church Lane, Charlton, S.E. Analytical Chemist.
1901. Auty, Albert M., c/o John Smith and Sons, Ltd., Field Head Mills, Bradford, Works Chemist.
1902. Avery, D., 387, Barker's Road, Kew, Melbourne, Vic., Australia, Teacher of Chemistry.
1910. Ayers, Gilbert F., Dynamite Factory, Modderfontein, Transvaal, Chemist.
1899. Aylsworth, Jonas W., 223, Midland Avenue, East Orange, N.J., U.S.A., Chemist.

B

1908. Babington, Fred. W., Customs Lab., Customs Dept., Ottawa, Canada, Analyst.
1913. Backus, Cecil F., c/o Atlas Powder Co., Wilmington, Del., U.S.A., Chemist.
1913. Bacon, Raymond F., Mellon Institute of Industrial Research, The University, Pittsburgh, Pa., U.S.A., Associate Director.
1911. Baddiley, James, c/o Levinstein, Ltd., Crumpsall Vale Chemical Works, Blackley, Manchester, Research Chemist.
1897. Badoek, Stanley II., Holmwood, Westbury on Trym, near Bristol, Smelter.
1898. Backeland, Dr. Leo, Snug Rock, Harmony Park, Yonkers, N.Y., U.S.A., Research Chemist.
1912. Bagley, Fred. P., c/o George H. Morrill Co., Norwood, Mass., U.S.A., Ink Manufacturer.
1913. Bailey, Alan M., Winchester House, Singapore, S.S., Analytical Chemist.

1903. Bailey, Prof. E. H. S., The Library, Kansas State University, Lawrence, Kas., U.S.A., Professor of Chemistry.
1885. Bailey, Edwin M., Almond Hill, Pumphreston, Mid Calder, Scotland, Technical Chemist.
1908. Bailey, Frank W., 25, Lord Street, Glossop, Derbyshire.
1883. Bailey, Dr. G. H., Kinlochleven, Argyll, Scotland, Chemist.
1903. Bailey, Harold J., 10, Park Road, Pendleton, Manchester, Alkali Inspector.
1906. Bailey, Ralph W., 66, Cherry Street, Elizabeth, N.J., U.S.A., Chemist.
1888. Bailey, Dr. T. Lewis, 21, Shavington Avenue, Chester, H.M. Inspector of Alkali Works.
1910. Baillie, Dr. Thomas B., 5, Mossiel Avenue, Ainsdale, Lancashire, Analytical Chemist (Love Lane Sugar Refinery).
1902. Bain, Prof. Jas. Watson, Faculty of Applied Science, The University, Toronto, Ont., Canada, Chemist.
1911. Bainbridge, Edmund F., c/o American Alkali and Acid Co., Bradford, Pa., U.S.A., Chief Chemist.
1911. Baird, Douglas H., 14, Cross Street, Hatton Garden, London, E.C., Scientific Instrument Maker.
1908. Baird, M. M., 18, Jedburgh Avenue, Rutherglen, Glasgow, Analytical Chemist.
1891. Baird, Wm., c/o Lewis Berger and Sons, Ltd., Homerton, N.E., Technical Chemist.
1895. Baird, W. Raymond, 271, Broadway, New York City, U.S.A., Patent Lawyer.
1890. Bairstow, John, Burley, Queen's Park, Chester, Chemical Works Manager.
1903. Baker, Arthur, Mount Nod, Greenhithe, Kent, Chemist.
1913. Baker, Bertram F., Oak Villa, New Clester Road, Cheshire, Technical Chemist.
1902. Baker, Chas. F., Technical College, Sunderland, Lecturer in Chemistry.
1910. Baker, C. Kerslake, 16, Change Alley, Sheffield, Analytical Chemist.
1901. Baker, F. Guy Stirling, The Brewery, Chiswell Street, London, E.C., Brewer's Chemist.
1883. Baker, Harry, Epworth House, Moughland Lane, Runcorn, Analytical Chemist.
1904. Baker, John T., c/o J. T. Baker Chemical Co., Phillipsburg, N.J., U.S.A., Manufacturing Chemist.
1892. Baker, Julian L., Ardingley, Linden Avenue, Maidenhead, Brewing and Sugar Chemist.
1909. Baker, Robert P., Ivydene, Bexley, Kent, Technical Chemist.
1886. Baker, Theodore, 705, Du Pont Building, Wilmington, Del., U.S.A., Analytical Chemist.
1910. Baker, Dr. Thos., Westville, Doncaster Road, Rotherham, Chemist and Metallurgist.
1912. Balch, Prof. Alfred W., 416, Huntington Avenue, Boston, Mass., U.S.A., Professor of Biological Chemistry.
1914. Balcon, P. C., c/o Power Gas Corporation, Ltd., Stockton-on-Tees, Chemist.
1912. Baldracco, Cav. Prof. Dr. Giacinto, R. Conceria Scuola Italiana, Corso Cirié, ang. Via Biella, Turin, Italy, Leather Trades Chemist.
1903. Baldwin, F. H., Bergenport Chemical Works, Bayonne, N.J., U.S.A., Superintendent.
1903. Baldwin, Dr. H. B., 927, Broad Street, Newark, N.J., U.S.A., Chemist (Dept. of Public Health).
1903. Ball, S. F., 289, East 201st Street, New York City, U.S.A., Analytical Chemist.
1889. Ballantyne, Horatio, 75, Chancery Lane, London, W.C., Analytical and Consulting Chemist.
1903. Ballantyne, W. H., 111, Hatton Garden, London, E.C., Patent Agent's Assistant.
- O.M. Ballard, Edw. C., 8, Lansdowne House, Lansdowne Road, Holland Park, London, W., Alkali Works Inspector.
1915. Balmforth, Charles, 63, Thompson Street, Shipley, Yorkshire, Analytical Chemist.
1910. Baly, Prof. E. C. C., F.R.S., 14, Sunnyside, Prince's Park, Liverpool, Professor of Inorganic Chemistry,
- O.M. Bamber, H. Kelway, Outram House, Addiscombe, Surrey, Consulting Chemist.
1894. Bamber, H. K. C., Ingress House, Greenhithe, Kent, Cement Works Manager.
1898. Bamford, Harry, 70, Duckworth Terrace, Bradford, Yorks., Dyer.
1906. Baneroff, John, Wilmington, Del., U.S.A., Bleacher and Dyer.
1913. Banks, A. J., c/o The Ogilvie Flour Mills Co., Ltd., Montreal, Canada, Analyst.
1890. Banks, Jno. H., 80, Maiden Lane, New York City, U.S.A., Mining Engineer.
- O.M. Bannister, W., Dunloc, Bramley Hill, South Croydon, Manufacturing Chemist.
1910. Barbary, J. Ewart, "Vellansandry," Camborne, Cornwall, Explosives Chemist.
1909. Barber, C. Douglas, Great Nelves, Hornchurch, Essex, Chemist.
1914. Barber, Charles F. L., 33, Hesse View, Brudenell Road, Leeds, Leather Chemist.
1908. Barber, Percy S., The Reform Food Stores, 84, Whitechapel, Liverpool, Chemist.
1901. Barber, Capt. René R., Georgetown, Ont., Canada, Analytical Chemist.
1911. Barclay, Andrew, Oficina Anita, Antofagasta, Chile, Chemist.
1912. Barelay, William R., 31, Glenalmond Road, Ecclehall, Sheffield, Manager of Electroplate Factory and Lecturer in Electro-Metallurgy.
1892. Barden, Alf., Far Bank, Shelley, near Huddersfield, Glue and Size Maker.
1907. Bardorf, C. F., c/o St. Lawrence Sugar Refining Co., Maisonneuve, P.Q., Canada, Chief Chemist.
1902. Barker, Hugh S., 32, Cumberland Avenue, Sefton Park, Liverpool, Laboratory Furnisher.
1912. Barker, Dr. Jonathan T., Victoria Villa, Halkyn Street, Flint, North Wales, Chemist.
1895. Barlow, Clinton W., 104-112, East 25th Street, New York City, U.S.A., Merchant.
1901. Barlow, John J., Broadway, Accrington, Calico Printer's Chemist.
1899. Barlow, Wm., 23, Alton Terrace, Fairfield, Manchester, Analytical Chemist.
1908. Barnes, Alfred, Box 556, Pretoria, Transvaal, Dealer in Minerals.
1906. Barnes, A. G., c/o Hasland Coking Co., Grassmoor Collieries, Chesterfield, Colliery Proprietor.
1914. Barnes, Edward A., c/o The Giant Powder Co., Giant, Cal., U.S.A., Chemical Engineer.
1905. Barnes, F. V., Gas Works, Todmorden, Engineer and Manager.
1884. Barnes, H. J., Phoenix Chemical Works, Hackney Wick, N.E., Manufacturing Chemist.
1884. Barnes, Jonathan, 301, Great Clowes Street, Manchester, Analytical Chemist.
- O.M. Barnes, Jos., Green Vale, Westhoughton, near Bolton, Lancashire, Analytical Chemist.
1912. Barnett, E. de Barry, 9, Collingham Road, South Kensington, S.W., Chemist.
1897. Barnett, Robt. E., 9, Virginia Road, Leeds, Headmaster (Leeds Technical School).
1904. Baron, Wm. Briscoe, c/o Vulcan Boiler and General Insurance Co., Ltd., 26, Pall Mall, Manchester, Chemist.
- O.M. Barr, J., Dinting Vale, Dinting, near Manchester, Chemical Manager.
1914. Barraclough, Dennis H., North Brierley Sewage Works, Oakenshaw, Bradford, Chemist.
1890. Barraclough, Wm. H., Chapeltown House, Chapel-town, near Sheffield, Analytical Chemist.
1890. Barrett, Arthur A., 139, Viale San Martino, Messina, Sicily, Manufacturer of Essential Oils.
1907. Barrett, Maurice, 9, Roundhay Mount, Leeds.
1912. Barrow, Jas. V., c/o Messrs. W. H. Holmes and Sons, Portland Road, Newcastle-on-Tyne, Works Chemist.
1900. Barrow, Jos., "Woodhey," Malford Grove, South Woodford, N.E., Chemist.
1906. Barrs, Chas. E., 3a, Downshire Hill, Hampstead, N.W., Analyst.

1995. Barry, Eugene, Ayer, Mass., U.S.A., Leather Manufacturer.
1893. Barton, G. E., 227, Pine Street, Millville, N.J., U.S.A., Technical Chemist.
1903. Bartrip, Geo. F., 92, First Avenue, Bush Hill Park, N., Managing Chemist.
1905. Baruch, Edgar, 805-806, Wright and Callender Building, Los Angeles, Cal., U.S.A., Chemical Engineer.
1910. Barwick, F. W., Chamber of Commerce Testing House, Royal Exchange, Manchester.
1900. Barzano, Carlo, 6, Via Gesu, Milan, Italy, Patent Agent.
1895. Baskerville, Dr. Chas., College of the City of New York, New York City, U.S.A., Professor of Chemistry.
1884. Bassett, H., 26, Belitha Villas, Barnsbury, N.
1908. Bassett, Professor Henry, University College, Reading, Prof. of Chemistry.
1899. Bassett, Wm. H., Main Street, Cheshire, Conn., U.S.A., Chemist.
1890. Bate, William, Upton Villa, Hayle, Cornwall, Technical Chemist (National Explosives Co., Ltd.).
1903. Bateman, A. H., Eridge, Shooter's Hill, Woolwich, S.E., Chemist.
1913. Bateman, James T., 34, Bridge Avenue, Hammer-smith, W., Engineer and Works Manager.
1912. Bates, D. M., Lewiston Bleachery and Dye Works, Lewiston, Maine, U.S.A., General Manager.
1914. Bates, John S., 227, Berubé Street, Montreal, Canada, Superintendent.
1914. Battersly, W. H., Bury Corporation Gas Works, Elton, Bury, Lancs., Chief Chemist.
1885. Batty, R. B., Wharfedale, Erdington, near Birmingham, Nickel Works Manager.
1910. Battye, Horace G., 28, Roman Place, Street Lane, Roundhay, Leeds, Chemist and Works Manager.
1903. Baty, E. J., c/o Thermoelectric Ore Reduction Corporation, Cobden Street, High Town, Luton, Beds, Chemist.
1903. Bauer, Geo. W., 660, Sacramento Street, San Francisco, Cal., U.S.A., Vice-President and Chemist (Hop and Malt Co.).
1915. Baumann, Dr. L., Manufacture Emile Zündel, Moscow; and (Journals) Commission Française, India House, Kingsway, London, W.C., Managing Director of Printworks.
1910. Baxter, F. Stanley, 119, Albert Street, Regent's Park, London, N.W., Chemist.
1913. Baxter, Harold R., c/o Aktiebolaget J. and G. Cox, Östrahamngatan 17, Gothenburg, Sweden, Manager (Glue Works).
1898. Baxter, John G., Glenarn, Lennox Avenue, Gravesend, Kent, Chemist.
1912. Bayley, Francis P., c/o F. S. Bayley, Clanahan, and Co., 79, Mosley Street, Manchester, Chemical Merchant.
1915. Bayley, Frank, 14, Slade Grove, Slade Lane, Long-sight, Manchester, Technical Chemist.
1908. Bayly, Percival G. W., Mines Dept. Lab., Spring Street, Melbourne Victoria, Government Metallurgical Chemist.
1897. Beadle, Alec A., Doughton Dene, Newbury, Berks, Electro-Chemist.
1886. Beadle, Clayton, Oakbank, Lansdown Road, Sidcup, Kent, Consulting Chemist.
1911. Beard, Stanley D., Lederite Antitoxin Laboratories, Pearl River, N.Y., U.S.A., Biological Chemist.
1907. Beardsley Dr. Alling P., 165, Minerva Street, Derby, Conn., U.S.A., Chemist (New Haven Gas Co.).
1909. Bearpark, Arthur F., P.O. Box 497, Durban, South Africa, Works Manager.
1908. Beasley, Fred. C., 44, Green Street, Smethwick, near Birmingham, Metallurgical Chemist.
1905. Beasley, Jno. K., c/o The Borneo Co., Kuching, Sarawak, Metallurgical Chemist.
1905. Beekers, Dr. Wm., 105, Underhill Avenue, Brooklyn, N.Y., U.S.A., Manufacturing Chemist.
1909. Becket, Fredk. M., 31, Sugar Street, Niagara Falls, N.Y., U.S.A., Chief Metallurgist, Electro Metallurgical Co.
1912. Beckett, Dr. E. G., No. 1, Sandhills, Ardeer, Stevenston, Ayrshire, Analytical Chemist.
1899. Bedford, Alf. C., 26, Broadway, New York City, U.S.A., Chemical Merchant.
1891. Bedford, Chas. S., Rocella, Weetwood, Headingley, Leeds, Manufacturing Chemist.
1911. Bedford, G. E., Aspley Dyeware Mills, Huddersfield, Works Chemist.
- O.M. Bedson, Prof. P. Phillips, Armstrong College, Newcastle-on-Tyne, Professor of Chemistry.
1901. Beevers, Clifford J., 12, Parish Ghyll Road, Ilkley, Yorks, Analyst.
1903. Behrend, F., 54, Front Street, New York City, U.S.A., Importer of Chemical Stoneware.
- O.M. Beilby, Dr. George T., F.R.S., 11, University Gardens, Glasgow, Chemical Engineer.
1912. Belajew, Captain Nicolai, Chem. Lab., Michael Artillery Academy, Petrograd, Russia, Lecturer in Metallurgy and Chemistry.
1906. Belden, A. W., c/o Jones and Laughlin Steel Co., Aliquippa Works, Woodlawn, Pa., U.S.A., Coke Expert.
1884. Bell, Sir Hugh, Bart., Middlesbrough-on-Tees, Soda and Iron Manufacturer.
1900. Bell, Hugh P., c/o Bank of Montreal, Toronto, Canada, Chemist.
1886. Bell, J. Ferguson, Derby Gas Light and Coke Co., Derby, Gas Engineer.
1907. Bell, Marcus, Defence Dept., Melbourne, Victoria, Chemist.
1905. Bell, Miss M. M., Tulane University Library, New Orleans, La., U.S.A., Librarian.
1903. Bell, P. Carter, Millburn, N.J., U.S.A., Chemical Manufacturer.
- O.M. Bendix, D., 371, Romford Road, Forest Gate, E., Managing Chemist, British Alizarin Co., Ltd.
1897. Benfey, Dr. Hans, 36, Marché aux Oeufs, Antwerp, Belgium, Manufacturing Chemist.
1903. Benham, Keith, The Woodlands, Rowley Park, Stafford, Analytical and Consulting Chemist.
- O.M. Benjamin, Dr. M., Smithsonian Institution, Washington, D.C., U.S.A., Consulting Chemist.
1899. Bennett, Alex. H., Via Giuseppe La Farina, Messina, Sicily, Chemist.
1907. Bennett, H. Garner, 115, Grovehill Road, Beverley, Yorks, Leather Chemist.
1909. Benson, George F., Edwardsburg Starch Co., Cardinal, Ontario, Canada, President and Managing Director.
1901. Bentley, Wm. H., 12, Cromwell Terrace, Irlam, near Manchester, Technical Chemist.
1890. Bentz, Ernest, 30, Manley Road, Whalley Rango Manchester, Technical Chemist.
1913. Benzian, Dr. Rudolf, Ilche Bleichen 34, Hamburg, Germany, Assayer and Merchant.
1912. Bergius, Dr. Friedrich, Parkstrasse 1, Hannover, Germany, Privatdozent.
1912. Beringer, C. R., Magyar Onművek, Nagytétény, Hungary, Assayer.
1884. Beringer, J. J., Basset Road, Camborne, Cornwall, Metallurgist.
1893. Berk, Fred. W., 1, Fenchurch Avenue, London, E.C., Chemical Manufacturer.
1907. Berk, Paul F., 1, Fenchurch Avenue, London, E.C., Chemical Manufacturer.
1889. Bernard, Jas., jun., c/o Parry and Co., P.O. Box No. 12, Madras Presidency, India, Chemical Works Manager.
1897. Berry, Albert E., Abbotsleigh, Wanstead, Essex, Works Manager.
1911. Berry, Arthur G. V., c/o Sir Boverton Redwood, Bart., 4, Bishopsgate, London, E.C., Analyst.
1906. Berry, Arthur J., 14, Regent Street, Cambridge, Chemist.
1883. Berry, E. E., Bordighera, Italy, and (Journals) c/o C. H. Grinling, 17, Rectory Place, Woolwich, S.E., Technical Chemist.

1913. Berry, Prof. R. A., The Agricultural College, Blythwood Square, Glasgow, Prof. of Agric. Chemistry.
1903. Berry, W. G., 329, West 83rd Street, New York City, U.S.A., Chemist.
1909. Beskow, K. J., Södra Storgatan 19, Helsingborg, Sweden, Head Engineer.
1914. Best, Ronald L., 55, Derwent Road, Palmer's Green, N., Analytical Chemist.
1886. Best, Dr. T. T., Hardshaw Brook Chemical Works, St. Helens, Lancashire, Technical Chemist.
1914. Bettsworth, A. E. A., 490, St. Paul Street, Montreal, Canada, Managing Director.
1901. Betts, Anson G., Box 792, Ashville, N.C., U.S.A., Chemist.
- O.M. Bevan, E. J., 4, New Court, Lincoln's Inn, London, W.C., Public Analyst and Consulting Chemist.
1900. Bevan, Jno. W., Morriston Spelter Works, Morriston, R.S.O., Glamorgan, Manager of Metallurgical Works.
- O.M. Beveridge, Jas., Springfield House, Chatham, N.B., Canada, Pulp and Paper Manufacturer.
1909. Bewick, R. M., "Lynton," Park West, Heswall, Cheshire, Traveller.
1898. Bhattacharyya, Haripada, Gun and Shell Factory, Ishapore, Bengal, India, Chemist.
1896. Bibby, John, c/o J. Bibby and Sons, Formby Street, Liverpool, Chemist.
- O.M. Bickerdike, W. E., Bryer's Croft, Wilshire, near Blackburn, Manufacturing Chemist.
1907. Bickerstaffe, Robert, c/o J. Knowles, 128, Blackburn Road, Clayton le Moors, near Acerrington, Chemist.
1903. Bierwith, L. W., c/o Du Pont Powder Co., Haskell, N.J., U.S.A., Civil Engineer.
1910. Bigelow, Chas. A., c/o Pluto Powder Co., Ishpeming, Mich., U.S.A., Superintendent.
1912. Bigelow, Edward P., Mellin's Food Library, 291, Atlantic Avenue, Boston, Mass., U.S.A., Chemist.
1884. Biggart, J. Wm., 29, Cathcart Street, Greenock, Scotland, Analytical Chemist.
1891. Biggart, Wm. L., Rossarden, Kilmacolin, Scotland, Public Analyst.
1911. Biggins, J. E., c/o Gulf Refining Co., Port Arthur, Texas, U.S.A., Chemist.
1910. Biggs, J. W. H., 318, High Street, Plumstead, S.E., Chemist.
- O.M. Billing, H. S., 42, Kingsley Road, Mutley, Plymouth, Analytical and Managing Chemist.
1896. Billington, Chas., Heimath, Porthill, Longport, Staffordshire, Metallurgist.
1907. Bird, Charles S., jun., Messrs. F. W. Bird and Son, Library Dept., East Walpole, Mass., U.S.A., Paper Maker.
1895. Bird, Wm. R., (communications) 125, Goddard Avenue; (Journals) Laboratory, G.W.R. Works, Swindon, Wilts., Analytical Chemist.
1902. Bird, W. Robt., 217, Newport Road, Cardiff, Oil Merchant.
1915. Birley, J. Harold, c/o Chas. Macintosh and Co., Ltd., Cambridge Street, Manchester, Indianrubber Manufacturer.
1883. Bishop, A. Conway, Three Mills Lane, Bromley-by-Bow, E., Manufacturing Chemist.
1884. Bishop, Fred., c/o Burmah Oil Co., P.O. Box 67, Rangoon, Burmah, Technical Chemist.
1903. Bishop, Howard B., 1372, Union Street, Brooklyn, N.Y., U.S.A., Chemist.
1903. Bishop, J. T. F., Chemical Club, Victoria Hotel, Manchester, Secretary.
1905. Bixby, Willard G., 46th Street and 2nd Avenue, Brooklyn, N.Y., U.S.A., Blacking Manufacturer.
1905. Bjerregaard, A. P., 10724, Kimberley Avenue, Cleveland, Ohio, U.S.A., Varnish Chemist.
1912. Björnström-Stefanson, G., Bathurst, New Brunswick, Canada, Pulp and Paper Works Manager.
1909. Blacher, Prof. Carl, Polytechnicum, Riga, Russia, Chemical Engineer.
1904. Black, J. Wyclif, 67, Falcon Road, Edinburgh, Analytical Chemist.
1902. Black, W. Geoffrey, St. John's House, Christchurch Road, Norwich, Chemist.
1910. Blackie, Archibald, 223, James Street, Winnipeg, Canada, Chemist.
1894. Blackmore, H. S., P.O. Box 145, Mount Vernon, N.Y., U.S.A., Industrial Chemist.
1896. Blagden, Victor, 4, Lloyd's Avenue, London, E.C., Chemical Merchant.
1883. Blagden, W. G., Down Lodge, East Harting, near Petersfield, Hants, Chemical Merchant.
1897. Blair, Andrew A., 406, Locust Street, Philadelphia, Pa., U.S.A., Analytical Chemist.
1915. Blake, Azel F., Atlantic Sugar Refineries, Ltd., St. John, New Brunswick, Canada, Chief Chemist.
1884. Blake, Jas., Thames Sugar Refinery, Silvertown, E., Manager.
1910. Blakeley, A. G., P. and R. Coal and Iron Co., Pottsville, Pa., U.S.A., Chemist.
1913. Blane, E. R., c/o I. Levinstein and Co., Inc., 115, 5th Street, Chelsea, Mass., U.S.A., Chemist.
1893. Blears, John, c/o Langworthy Bros. and Co., Ltd., Greengate Mills, Salford Dyer and Calico Printer.
1908. Blichfeldt, S. H., Vine Cottage, Southall, Middlesex, Bacteriologist and Fermentation Chemist.
1905. Bliss, H. J. W., United University Club, Pall Mall East, London, S.W., Chemist.
1889. Bloede, Victor G., Station D., Baltimore, Md., U.S.A., Manufacturing Chemist.
1908. Blomeley, Adam Y., c/o Arbuckle Bros. Sugar Refinery, Brooklyn, N.Y., U.S.A., Chemist.
1891. Bloomer, Fred J., Penpont, Clydach, R.S.O., Glamorgan, Nickel Works Manager.
1886. Blount, Bertram, Laboratory, 76 and 78, York Street, Westminster, S.W., Analytical Chemist.
1888. Bloxam, A. G., 29, Southampton Buildings, Chancery Lane, London, W.C., Chemist and Patent Agent.
1903. Blumenthal, Lionel, Ravensholme, Merry Bower Road, Broughton Park, Manchester, Chemist.
1886. Blundstone, E. R., 79, York Street, Westminster, S.W., Consulting Chemist.
1906. Blyth, M. Wynter, Lacton House, Tankersley, near Barnsley, Yorks, Analytical and Consulting Chemist.
1908. Blythe, Jas. R., Craiglea, Audenshaw, near Manchester, Leather Trades Chemist.
- O.M. Boake, A., Warton Road, Stratford, E., Manufacturing Chemist.
1888. Boake, Edmund J., Widford Lodge, Chelmsford, Essex, Manufacturing Chemist.
1912. Boan, Robt., Laboratory, Government Railway Offices, Spencer Street, Melbourne, Vic., Australia, Engineer-in-charge.
1915. Boardman, Fred., "Knole," Burscough, near Ormskirk, Lanes, Metallurgical Chemist.
1899. Boehm, Fred., 16, Jewry Street, London, E.C., Chemical Agent and Merchant.
1910. Boehringer, Dr. R., 79, Milford Avenue, Newark, N.J., U.S.A., Chemist.
1898. Bogert, Prof. Marston T., Department of Organic Chemistry, Columbia University, New York City, U.S.A., Professor of Organic Chemistry.
1903. Boissevain, Chas. E. H., 92, Van Eeghenstraat, Amsterdam, Holland, Chemical Manufacturer.
1903. Bolam, Dr. H. W., Queen Margaret College, Glasgow, Lecturer on Chemistry.
1909. Bolden, Wm., Dalmellington Iron Works, Dunaskin, Ayrshire, Chemist.
1901. Bolton, E. Richards, 46, Stamford Brook Road, Hammersmith, W., Manufacturing Chemist.
1905. Bond, John, Crowlands, Southport, Engineer.
1905. Bond, Josiah, Alto, Arizona, U.S.A., Mining Engineer.
1912. Bone, S. C., 30, Long Lane, Garston, Liverpool, Chemical Works Manager.
1905. Bone, Prof. W. A., F.R.S., "Montrose," Harpenden Road, St. Albans, Herts, Professor of Chemical Technology.
1892. Bookman, Dr. S., 46, East 82nd Street, New York City, U.S.A., Chemist.
1914. Boon, A. Archibald, Chemistry Dept., Heriot Watt College, and (Jnls.) 87, Warrender Park Road, Edinburgh, Assistant Professor of Chemistry.

1888. Boor, Leonard G., 21, Mincing Lane, London, E.C., Chemical Merchant.
1912. Boorne, Wm. H., Bush Lane House, Cannon Street, London, E.C., Metallurgist.
1908. Booth, Jos. W., George E. Kunhardt Mills, Lawrence, Mass., U.S.A., Superintendent.
1904. Booth, N. Parr, Laboratory, Cadbury Bros. Ltd., Bournville, near Birmingham, Chemist.
1903. Borat, Robm, Rhodes Mount, Rhodes, near Manchester, Works Manager.
1897. Borland, C. R., Concord, Mass., U.S.A., Smokeless Powder Manufacturer.
- O.M. Borland, W. D., Beacon Lodge, Bean, *via* Dartford, Kent, Manufacturer of Explosives.
1908. Bose, R., 92-95, Upper Circular Road, Calcutta, India, Chemical Works Manager.
1890. Bost, W. D. Ashton, Cartvale Chemical Works, Paisley, Chemical Manufacturer.
1912. Boswell, Maitland C., Chemistry and Mining Building, University of Toronto, Canada, Lecturer on Organic Chemistry.
- O.M. Bothamley, C. H., Weston-super-Mare, Somerset, County Director of Technical Instruction.
1890. Bott, Dr. W. Norman. See Norman-Bott, Dr. W.
1884. Böttinger, Dr. H. T. von, Elberfeld, Germany; and (subs.) c/o The Bayer Co., Ltd., 19, St. Dunstan's Hill, London, E.C., Colour Manufacturer.
1901. Bottomley, Dr. J. Frank, c/o The Thermal Syndicate, Ltd., Neptune Road, Wallsend-on-Tyne, Consulting Chemist.
1906. Bottomley, W., c/o The United Alkali Co., Ltd., Chief Engineer's Office, Widnes, Engineer.
- O.M. Boulton, H. E., 64, Cannon Street, London, E.C., Chemical Manufacturer.
- O.M. Boulton, Sir Samuel B., Bart., 64, Cannon Street, London, E.C., Chemical Manufacturer.
1883. Boulton, T. S., 14, Freegrove Road, Caledonian Road, London, N., Manager.
1905. Bourne, Lyman M., c/o Goodyear Tire and Rubber Co., Akron, Ohio, U.S.A., Chemist.
1910. Bowater, J. W., Woodville, Beeches Road, West Bromwich, Works Manager.
1905. Bowen, Henry, South Street, East Aurora, N.Y., U.S.A., Secretary.
1888. Bower, Frank, Brewery House, Spitalfields, E., Analytical Chemist.
1909. Bower, Joshua, c/o Kynoch, Ltd., Arklow, Co. Wicklow, Ireland, Chemist.
1897. Bower, Wm. H., 29th Street and Gray's Ferry Road, Philadelphia, Pa., U.S.A., Chemical Manufacturer.
1892. Bowes, Harry, 9, Park Road, Heaton Moor, Stockport, Analytical Chemist.
1883. Bowley, Jos. John, Wellington Works, Battersea Bridge, London, S.W., Chemical Manufacturer.
1899. Bowley, J. Plunkett, 36, Argyll Mansions, Chelsea, London, S.W., Varnish Manufacturer.
1908. Bowman, Fred. C., 179, Marey Avenue, Brooklyn, N.Y., U.S.A., Chemist.
1884. Bowman, R., c/o Bowman's Ltd., Lythgoe's Lane, Warrington, Chemical Manufacturer.
1907. Bowman, Richard S., "Castlewood," Elm Grove, West Hartlepool, Chemist.
1896. Bowman, Walker, 39, Courtlandt Street, New York City, U.S.A., Chemist.
1904. Boyce, Framroze H., 86, Hugh's Road, Chaupaty, Bombay, India, Technical Chemist.
1893. Boyce, Frank, c/o Goodall Backhouse and Co., White Horse Street, Leeds, Technical Chemist.
1910. Boyce, James, 6647, Harvard Avenue, Chicago, Ill., U.S.A., Chemist.
1909. Boyd, Dr. Harold de H., c/o The Southern Cotton Oil Co., Ltd., Trafford Park, Manchester, Chemist.
1913. Boyd, Robert, c/o British Columbia Sugar Refining Co., Ltd., Vancouver, B.C., Canada, Chemist.
1909. Boyd, T. D., jr., P.O. Box 381, Nogales, Arizona, U.S.A., Sugar Refiner.
1885. Bradburn, J. A., 311, Montgomery Street, Syracuse, N.Y., U.S.A., Manufacturing Chemist.
1912. Bradford, Francis L. W., 52, Rotton Park Road, Edgbaston, Birmingham, Chemist and Works Manager.
1895. Bradford, Henry, Strettington, Goodwood, near Chichester, Analytical Chemist.
1896. Bragg, Everett B., 1838, Chicago Avenue, Evanston, Ill., U.S.A., Manufacturing Chemist.
1891. Braithwaite, Isaac, Ghyll Close, Kendal, Westmoreland, Drysalter.
1897. Braithwaite, Jno. O., Holme Lacey, Warren Road, Chingford, Essex, Pharmaceutical Research Chemist.
1903. Brame, J. S. S., 67, Coleraine Road, Blackheath, S.E., Demonstrator in Chemistry.
- O.M. Bramham, W., Bank Chambers, 300, Mare Street, Hackney, N.E., Chemical Engineer.
1904. Brandeis, R., Oesterreichischer Verein f. Chem. und Metall. Produktion, Aussig, Austria, Chemical Manufacturer.
1902. Brangan, Jas. Aug., 12, Park Avenue, Millbourne, Delaware Co., Pa., U.S.A., Chemical Salesman.
- O.M. Branson, F. W., Wynneholme, Far Headingley, Leeds, Pharmaceutical Chemist.
1903. Brassard, Fred. A., 46, Vicar Lane, Bradford, Yorks, Aniline Dyestuff Importer.
1901. Brearley, Harry, c/o The Amalgams Co., Ltd., Attercliffe Road, Sheffield, Analytical Chemist.
1906. Breckenridge, John E., American Agricultural Chemical Co., Carteret, N.J., U.S.A., Chemist.
1900. Brewis, E. T., 31, Belgrave Road, Leyton, E., Chemist.
1894. Breyer, Theodor, 725, Washington Avenue, Wilmette, Ill., U.S.A., Chemist.
1885. Briant, L., 24, Holborn Viaduct, London, E.C., Analytical Chemist.
1913. Bridge, Stanley W., c/o Dr. H. G. Colman, 1, Arundel Street, London, W.C., Analytical Chemist.
1890. Brierley, J. T., Highfield, Golden Hill, Leyland, near Preston, Lancs., Analytical Chemist.
1893. Briggs, J. F., Auchmuty Paper Mills, Markinch, Fifeshire, Technical Chemist.
1912. Briggs, O. W. H., Chemist.
1885. Briggs, T. Lynton, 188, Central Avenue, Flushing, Long Island, N.Y., U.S.A., Technical Chemist.
1914. Brinsley, Frank, Victoria College, Stellenbosch, South Africa, Demonstrator in Physical Chemistry.
1910. Brisbane, James W., c/o The Leather Cloth Co., Ltd., West Ham, E., Analytical Chemist.
1905. Bristol, Dr. H. Stanley, 801, Colorado Building, Washington, D.C., U.S.A., Chemist.
1886. Bristow, G. W., c/o Walter J. Crook, 10, Eastcheap, London, E.C., Chemical Manager.
1912. Britland, Wm. J., Pear Tree Cottage, Alvanley, near Helsby, Cheshire, Chemist.
1887. Broadbent, H., c/o Goodall, Backhouse and Co., Sovereign Street, Leeds, Chemist.
1889. Brock, Arthur, Firework Factory, Sutton, Surrey, Firework Manufacturer.
- O.M. Brock, J., The Cedars, Hoole, Chester, Chairman of United Alkali Co., Ltd.
1910. Brodribb, Noel K. S., Cordite Factory, Ascot Vale, Melbourne, Victoria, Australia, Chemist.
1912. Bromley, Henry S., 1000, Wissachickon Avenue, Germantown, Philadelphia, Pa., U.S.A., Laco Manufacturer.
1909. Bronnert, Dr. E., Dornach, near Mülhausen, Alsace, Germany, Artificial Silk Manufacturer.
1896. Brooke, C. B., jun., Colne House, Brantham, near Manningtree, Xylonite Manufacturer.
1900. Brooke, Jno. R., Government Opium Factory, Singapore, S.S., Superintendent.
1884. Brookes, E. A., c/o The Chilian Mills Co., Ltd., Chiguayante, Concepcion, Chile, Chemist.
1906. Brooks, Cecil J., c/o M. M. Siman, Benkoelen, Sumatra, Ned. India, Metallurgist.
1909. Brooks, Theodore, Guantanamo, Cuba, Cane Sugar Manufacturer.

1911. Brothers, Horace E., Higher Knutsford Road, Latchford, Warrington, H.M. Inspector of Factories.
1909. Brothers, Wm., Meadow House, Tunstead Milton, near Whaley Bridge, Derbyshire, Chemical Manufacturer.
- O.M. Brotherton, E. A., City Chambers, Leeds, Ammonia Distiller.
1884. Brown, Prof. A. Crum, F.R.S., 8, Belgrave Crescent, Edinburgh, Professor of Chemistry.
1905. Brown, Prof. Adrian J., West Heath House, Northfield, near Birmingham, Professor of Brewing.
1902. Brown, A. H. M., Hudson Bay Mine, Cobalt, Ont., Canada, Metallurgist.
1891. Brown, Caesar R., 141, Victoria Avenue, Prittlewell, near Southend, Works Foreman.
- O.M. Brown, D., 93, Abbey Hill, Edinburgh, Chemical Manufacturer.
- O.M. Brown, D., Donaghmore, Tyrone, Ireland, Soap Manufacturer.
1890. Brown, Edw. Hilton, c/o W. Ropes and Co., Petrograd, Russia, Analytical Chemist.
1894. Brown, Geo. E., c/o "The British Journal of Photography," 24, Wellington Street, Strand, London, W.C., Chemist.
1910. Brown, Geo Winslow, Assabet Mills, Maynard, Mass., U.S.A., Chemist.
- O.M. Brown, Henry, Benskin's Brewery, Watford, Herts., Brewing Chemist.
1899. Brown, Dr. Henry C., The Chemical Works, King's Lynn, Chemical Manufacturer.
- O.M. Brown, Dr. Horace T., F.R.S., 52, Nevern Square, Kensington, S.W., Brewing Chemist.
1905. Brown, Hugh B., c/o Jas. Robertson and Sons, Ltd., Thrushgrove Works, Paisley, Chemist.
1892. Brown, Reginald B., c/o Badische Co., Ltd., 20-26, Brunswick Place, City Road, London, N., Technical Chemist.
1901. Brown, Samuel B., Ruthven, Bowden Lane, Marple, Cheshire, Calico Printer.
- O.M. Brown, Walter, c/o Jas. H. Dennis and Co., Ltd., Widnes, Technical Chemist.
1900. Brown, Walter B., Victor Chemical Works, 1805, Fisher Building, Chicago, Ill., U.S.A., Chemist and General Superintendent.
1901. Browne, Dr. Arthur L., 215, East Fayette Street, Baltimore, Md., U.S.A., Analytical Chemist.
1906. Browne-Cave, E. J. C. See Cave-Browne-Cave, E. J.
1905. Browning, Prof. K. C., Medical College, Colombo, Ceylon, Professor of Chemistry.
- O.M. Browning, W., Broad Oak, Acerington, Calico Printer.
1902. Brownsdon, Dr. H. W., King's Norton Metal Co., Ltd., King's Norton, Birmingham, and (Jnls.) 109, Oxford Road, Moseley, near Birmingham, Works Chemist.
1902. Bruce, Alex., Laboratory, Hyde Park Corner, Colombo, Ceylon, Chemist.
1911. Bruce, Joseph, Jnls. to General Manager, Dynamite Factory, West Somerset, Cape Colony, Secretary.
1908. Bruce, Robert, c/o Clark, 191, Morningside Road, Edinburgh, Works Chemist.
1900. Bruce, Wm. T., 3, Lombard Court, London, E.C., and (Jnl.) c/o T. C. Allchin, Longfield, Kent, Director.
1892. Bruckmann, G. T., 109, 22nd Street, Guttenberg P.O., N.J., U.S.A., Chemical Engineer.
1911. Brunet, Louis, "Revue Générale des Sciences," 97, Boul. Montmorency, Paris XVI, France, Chemist and Secretary.
- O.M. Brunner, H., Holly Mount, Tarbock Road, Huyton, near Liverpool, Chemical Manufacturer.
1894. Brunner, H. Bertram, The Hollies, Hartford, Cheshire, Chemist and Electrician.
1887. Brunner, J. F. L., M.P., c/o Brunner, Mond, and Co., Ltd., Caxton House, Westminster, S.W., Chemical Manufacturer.
- O.M. Brunner, Rt. Hon. Sir J. T., Bart., Silverlands, Chertsey; and (Journals) c/o Brunner, Mond, and Co., Ltd., Northwich, Cheshire, Chemical Manufacturer.
1910. Brunner, Dr. Philipp, 2, Via Ghega, Trieste, Austria, Merchant.
1902. Brunner, Roscoe, The Winnington Hall Club, Winnington, Northwich, Alkali Manufacturer.
1894. Brunton, J. Dixon, Wire Mill, Musselburgh, Scotland, Wire Manufacturer.
1904. Bryant, Arthur P., c/o Clinton Sugar Refining Co., Clinton, Iowa, U.S.A., Chemist.
1908. Bryce, Chas. C., 43-45, Great Tower Street, London, E.C., Merchant.
1894. Bryce, Thos., Tharsis Mines, Huelva, Spain, Chemist.
1897. Bryson, Jas., Pumpherton Oil Works, Midcalders, Scotland, Oil Works Manager.
1892. Buchanan, D. G., Riverstone, John Street, Helensburgh, Glasgow, Analyst.
1908. Buchanan, Duncan G., 27, Woodlawn Avenue East, Toronto, Canada, Chemist (Rubber Works).
1904. Buchanan, E. F., 128, East Crescent Street, Marquette, Mich., U.S.A., Chemist.
1888. Buchanan, Jas., Caledonia Foundry, Brasenose Road, Liverpool, Engineer.
1904. Buchanan, John L., Brachead, Mill Road, Bromborough, Cheshire, Analytical Chemist.
1904. Buchanan, Joshua D., c/o Nobel's Explosives Co. Ltd., Polmont Station, Scotland, Chemist.
1910. Buchanan, Walter G., c/o Lantaro Nitrate Co., Taltal, Chile, Chemist.
1897. Buck, Chas. A., 521, Locust Street, South Bethlehem, Pa., U.S.A., Chief Chemist (Bethlehem Iron Co.).
1911. Budde, Dr. Carl, 1, Belford Road, Sunderland, Chemical Engineer.
1909. Buell, W. H., c/o Winchester Repeating Arms Co., New Haven, Conn., U.S.A., Chemist.
1909. Buggy, Thos., Butte, Montana, U.S.A., Assayer and Chemist.
1902. Bull, Irving C., 100, Maiden Lane, New York City, U.S.A., Chemist.
1899. Bult, Herbert J., 140, Fenchurch Street, London, E.C., Chemist.
- O.M. Bumby, H., Bellevue, Sandbach, Cheshire, Iron and Chemical Works Director.
- O.M. Bunker, H. E., 310, Kingston Road, Toronto, Ont., Canada, Technical Chemist.
1901. Bunting, Henry H., Oficina de Ensayes F. C. C. del P., Callao, Peru, Analyst.
1893. Burbridge, Jas., India-rubber Mills, Tottenham, N., India-rubber Manufacturer.
1910. Burbridge, Walter N., Denman House, Denman Street, London Bridge, S.E., Analytical Chemist.
1896. Burford, Samuel F., The Ridgeway, Rothley, near Leicester, Analytical Chemist.
1889. Bürger, Dr. J., 9, Vineat Avenue, Chorlton-cum-Hardy, Manchester, Technical Chemist.
1889. Burgess, Geo., Sydney Cottage, Halebank, Widnes, Chemist.
1913. Burgess, Herbert E., Holly House, Graham Road, Dalston, N.E., Manufacturing Chemist.
1889. Burgess, Wm. T., 26, Priory Road, Bedford Park, London, W., Analytical Chemist.
1902. Burkard, Dr. Ernst, Solothurn, Switzerland, Chemist.
1899. Burkhardt, Dr. G. A., Württembergischestrasse 32, Pölin, W. 15, Germany, Chemist.
1898. Bur's, Herbert T., 2, Verculam Buildings, Gray's Inn, London, W.C., Mechanical Engineer.
1891. Burnet, Henry K., North Brook Vitriol Works, Bradford, Yorks, Sulphuric Acid Maker.
1897. Burnet, Jno. Jas., 18, University Avenue, Glasgow, and (Journals) 1, Montague Place, Bedford Square, London, W.C., Architect.
1909. Burnett, Arthur, Clairville, Waste Lane, Pendleton, Manchester.
1893. Burnham, J. C., Cordite Factory, Aruvankad, Nilgiri Hills, India, Analytical Chemist.
1900. Burr, Edmund C., 1722, Vallejo Street, San Francisco, Cal., U.S.A., Manufacturer.

- O.M. Burrell, B. A., 8, Springfield Mount, Leeds, Analytical Chemist.
1910. Burrell, Keith, Burrell's Wharf, Millwall, London, E., Manufacturer.
1906. Burrough, Ernest J., Cale Distillery, Hutton Road, Lambeth, S.E., Rectifier.
1912. Burt-Gerrans, J. T., 46, Dewson Street, Toronto, Canada, Electro-Chemist.
1901. Burton, Alf., Canadian Dyers' Association, 2-16, Liberty Street, Toronto, Canada, Dyer and Finisher.
1914. Burton, Donald, Westbourne, St. Andrew's Avenue, Morley, near Leeds, Research Assistant.
1903. Burton, Jno., 2, Green Street, Bethnal Green, E., Dye and Chemical Manufacturer.
1914. Burton, Tom F., 63, Melbury Gardens, West Wembley, S.W., Editor.
1901. Burton, T. R., c/o Scott, Greenwood, and Son, 8, Broadway, Ludgate Hill, London, E.C., Technical Journalist.
1889. Burton, Wm., The Hollies, Clifton Junction, near Manchester, Potter's Chemist.
1906. Busby, Fred. E., Arnold Print Works, North Adams, Mass., U.S.A., Chemist.
1913. Bush, Dr. Harry T., 7, Gracechurch Street, London, E.C., Chemical Engineer.
1897. Bush, J. M., c/o W. J. Bush and Co., Ltd., Ash Grove, Hackney, E., Manufacturing Chemist.
1897. Butler, David B., 41, Old Queen Street, Westminster, S.W., Cement Expert.
1913. Butler, Geo. B., West Lyn, Hawthorne Terrace, South Bank, R.S.O., Yorks, Assistant Blast Furnace Manager.
1890. Butler, Paul, Lowell, Mass., U.S.A., Ammunition Manufacturer.
1885. Butler, Samuel, The Cedars, Compton, Wolverhampton, Brewer.
1905. Butler, Dr. T. H., c/o Wm. Butler and Co., Ltd., Crews Hole, Bristol, Chemist (Tar and Rosin Distillery).
1886. Butler, W. W., c/o Mitchells & Butlers, Ltd., The Brewery Library, Cape Hill, Birmingham, Brewer.
- O.M. Butterfield, J. C., 79, Endlesham Road, Balham, S.W., Analytical Chemist.
1892. Butterfield, W. J. A., 66, Victoria Street, Westminster, S.W., Analytical Chemist.
1897. Butters, Charles, 54, New Broad Street, London, E.C., and (Journals) 121, 59th Street, Oakland, Cal., U.S.A., Metallurgist.
1900. Butterworth, Elwell R., c/o Reversible Collar Co., 111, Putnam Avenue, Cambridge, Mass., U.S.A., Chemist.
- O.M. Byard, A. G., c/o Burt, Boulton, and Haywood, Apartado 8, Bilbao, Spain, Technical Chemist.
1905. Byrne, F. A., 2, Ludgate Hill, Birmingham, Director of Chemical Co.
1893. Byrom, T. H., Virol Research Laboratories, 10, Bedford Square, London, W.C., Analytical Chemist.
1915. Pywaters, H. W., 9, Henleaze Avenue, Bristol, Chemist.
- C
1914. Cabana, Louis, 316, Herkimer Street, Buffalo, N.Y., U.S.A., Purchasing Agent and Chemist.
1884. Cabot, Godfrey L., 940, Old South Building Boston, Mass., U.S.A., Manufacturing Chemist.
1907. Cabot, Samuel, 141, Milk Street, Boston, Mass., U.S.A., Chemical Manufacturer.
1906. Caddick, Arthur, Minas de Rio Tinto, Huelva, Spain, Works Chemist.
1889. Cadett, Jas., Ashted, Surrey, Chemical Engineer.
1905. Cain, Dr. J. C., 24, Aylestone Avenue, Brondesbury Park, N.W., Colour Chemist.
1891. Caines, G. S. A., 68, Hilldrop Crescent, Camden Road, London, N.W., Analytical Chemist.
1897. Cairns, Wm., 5, Carlton Place, Glasgow, Plumber.
1907. Caistor, J. W. Y., Ty Coch, Deganwy, North Wales, Chemist.
1905. Calder, Prof. Edwin E., Long Meadow, R.I., U.S.A., Professor of Chemistry.
1897. Calder, W. A. S., 449, Hagley Road, Birmingham, Chemical Manufacturer.
1908. Caldwell, Dr. Robert J., Rosendale, Holland Park, Belfast, Ireland, Chemist and Works Manager.
1912. Caldwell, Wallace L., 1025½, North 24th Street, Birmingham, Ala., U.S.A., Engineering Chemist.
1888. Caldwell, Wm., Murray Street, Paisley, Scotland, Drysalter.
1912. Callan, Dr. Thomas, Chemical Laboratory, 49, High Street, Paisley, Technical Chemist.
1902. Calm, Dr. Chas. E., California Club, Los Angeles, Cal., U.S.A., Manufacturing Chemist.
1913. Calvert, A. F., Royston, Eton Avenue, London, N.W., Engineer.
1904. Calvert, Dr. Harry T., West Riding of Yorkshire Rivers Board, Wakefield, Chemist.
1895. Cambier, Jacob, 1401, Carteret Avenue, Pueblo, Colo., U.S.A., Chemist.
1904. Cameron, Walter S., 239, West 136th Street, New York City, U.S.A., Manufacturing Perfumer.
1908. Cameron, Wm., Balik Pappan, Koetei, East Borneo, Sugar Refinery Manager.
- O.M. Cammaek, J., 34, Wolsley Road, St. Helens, Lancashire, Technical Chemist.
1886. Campbell, Andrew, 1, Park Road, Beckenham, Kent, Chemist (Mineral Oil).
1912. Campbell, Arthur F., 9, Fort Road, Sedgley Park, Manchester, Research Chemist.
1908. Campbell, Fred. A., The Working Men's College, Latrobe Street, Melbourne, Victoria, Australia, Principal.
1910. Campbell, James R., Chemist.
1907. Campbell, John A., c/o British South African Explosives Co., Modderfontein, Transvaal, Chemist.
1912. Campbell, Kennedy, c/o British Dyewood Co., Ltd., Parkhead, Glasgow, Chemist.
1901. Campbell, Kenneth F., M.Inst.C.E., 1, Peel Street, Huddersfield, Civil Engineer.
1911. Campbell, L. E., Dept. of Agriculture, Peradeniya, Ceylon, Chemist.
1908. Campbell, Max. E., 629, Laughlin Building, Los Angeles, Cal., U.S.A., Chemist.
1909. Campbell, Peter, Kearny, N.J., U.S.A., Linoleum Manufacturer.
1915. Campbell, W. B., Forest Product Laboratories, 700, University St., Montreal, Canada, Chemist.
1911. Campbell, Wm. E., c/o Gutta Percha and Rubber Ltd., O'Hara Avenue, Toronto, Canada, Industrial Chemist.
1914. Camus, Edward C. A., 8, Rue de Mondovi, Paris 1, France, Chemical Merchant.
1909. Candee, Chas. N., 39, South Drive, Toronto, Canada, Rubber Manufacturer.
1908. Canning, Ernest R., 137, Great Hampton Street, Birmingham, Manufacturer.
- O.M. Cannon, M., 25, Stormont Road, Clapham Common, S.W., Vinegar Works Manager.
1913. Cantelo, Robt. C., 204, Frontenac Street, Kingston, Ont., Canada, Chemist.
1891. Carden, Albert J., 20-21, Harp Lane, Gt. Tower Street, London, E.C., Distiller.
1915. Cardwell, David, 50, Alexandra Road South, Manchester, S.W., Chemist.
1893. Carey, Arthur, The Groves, Grassendale Park, near Liverpool, Chemist.
1906. Carey, W. Gordon, Fairholme, Raby Road, Stockton-on-Tees, Chemist.
1904. Cargill, J. T., c/o Finlay, Fleming, and Co., Rangoon, Burma, East India Merchant.
1896. Carmichael, Herbert, Bureau of Mines, Victoria, British Columbia, Public Analyst and Assayer.
1884. Carmody, Prof. Patrick, Department of Agriculture, Trinidad, B.W.I., Analytical Chemist.
1897. Carnell, Wm. C., 2136, North Camac Street, Philadelphia, Pa., U.S.A., Chemist.

1906. Caro, Dr. Nikodem, Meinekestrasse 20, Berlin W. 15, Germany, Analytical Chemist.
1893. Carpenter, Dr. C. C., South Metropolitan Gas Co., 709A, Old Kent Road, London, S.E., Civil Engineer.
1908. Carpenter, Edwin P., Culvert Works, Sheepcote Lane, Battersea, S.W., Manager of Casein, Ltd.
1900. Carpenter, Frank B., 11, South 12th Street, Richmond, Va., U.S.A., Chemist.
1909. Carpenter, Harry B., c/o Lister's Agricultural Chemical Works, Newark, N.J., U.S.A.
1904. Carr, Francis H., Egmont, Derby Road, Nottingham. Manufacturing Chemist.
1907. Carrier, C. F., jun., Seward, N.J., U.S.A., Manufacturing Chemist.
1904. Carter, A., Cuba Street, Petene, Wellington, New Zealand, Works Manager.
1905. Carter, Robert A., 4923 Osage Avenue, Philadelphia, Pa., U.S.A., Chemist.
1895. Carter, Stewart F., 43, Montana Street, North Adams, Mass., U.S.A., Technical Chemist.
1903. Carter, Thomas, West End View, Ravensthorpe, Dewsbury, Yorks, Works Chemist.
1886. Carter, W. Chas., c/o Dominion Iron and Steel Co., Sydney, C.B., Canada, Analytical Chemist.
1911. Carty, Ronald D., The Laboratories, Public Works Ministry Gardens, Cairo, Egypt, Analytical Chemist.
1889. Carulla, F. J. R., 84, Rose Hill Street, Derby, Chemical Manufacturer.
1906. Carveth, Dr. H. R., Niagara Electrochemical Co., Niagara Falls, N.Y., U.S.A., Works Manager.
1914. Casey, John A., Carlemont, Moy, Co. Tyrone, Ireland, Waterproof Manufacturer.
1903. Caspari, Dr. W. A., University College, Gower Street, London, W.C., Chemist and Physicist.
1899. Castro, J. Paul de, 1, Essex Court, Temple, London, E.C., Barrister-at-Law.
1895. Catlin, Chas. A., 133, Hope Street, Providence, R.I., U.S.A., Chemist (Rumford Chemical Works).
1909. Caulkin, Howard A., Mona Villa, Spencer Road, Belper, Analyst.
1906. Cave-Browne-Cave, E. J., c/o Thos. Ness, Ltd., Newcastle Tar Works, Blaydon-on-Tyne, Works Chemist.
1896. Caven, Robt. M., University College, Nottingham, Lecturer in Chemistry.
1914. Caw, Wm., c/o J. Watson and Sons, Whitehall Soap Works, Leeds, Chemist.
- O.M. Cawley, G., 82, Victoria Street, Westminster, S.W., Chemical Engineer.
- O.M. Cawley, J., 278, Passaic Street, Newark, N.J., U.S.A., Analytical Chemist.
1897. Cawley, Thos. A., British Gelatin Works, Ltd., New Bedford Road, Luton, Gelatin Manufacturer.
1906. Chadsey, Stanley B., 476, Brunswick Avenue, Toronto, Canada, Chemist.
1891. Chadwick, Walter M., Thorneycroft, Westoe, South Shields, Chemical Works Manager.
1912. Chadwick, Walter W., 186, Wellington Street North, Hamilton, Ont., Canada, Chemist.
1910. Challinor, Richard W., Chemical Laboratory, The Technical College, Sydney, N.S.W., Australia, Teacher of Chemistry.
1894. Chaloner, G. W., 26, Eagle Wharf Road, Hoxton, N., Chemical Manager.
1901. Chamberlain, G. E., 641, West Prairie Avenue, Decatur, Ill., U.S.A., Chemist.
1910. Chambliss, Prof. Hardee, Dept. of Chemistry, Oklahoma A. and M. College, Stillwater, Oklahoma, U.S.A., Professor of Chemistry.
- O.M. Chance, A. M., Lawnside, Elgbaston, Birmingham, Chemical Manufacturer.
1912. Chance, Clinton F., Messrs. Chance and Hunt, Ltd., Oldbury, near Birmingham, Managing Director.
1909. Chance, Edwin M., 61, South Penna Avenue, Wilkes-Barre, Pa., U.S.A., Chemist.
- O.M. Chandler, Dr. C. P., 51, East 54th Street, New York City, U.S.A., Professor of Chemistry.
1912. Chandler, Lee L., Research Laboratory, Pittsburgh Plate Glass Co., Creighton, Pa., U.S.A., Assistant.
1893. Chaplin, Dr. Edw. M., Public Analyst's Laboratory Wakefield, Yorks, Analytical Chemist.
1890. Chapman, A., Chaston, S, Duke Street, Aldgate, E.C., Analytical Chemist.
1906. Chapman, Arthur J., Baronsmere, Stanhope Avenue, Church End, Finchley, N., and (Journals) c/o F. Claudet, Ltd., 6 and 7, Coleman Street, London, E.C., Analytical Chemist.
1906. Chapman, E. A., c/o Robert Heath and Sons, Ltd., Norton Works, Stoke-on-Trent, Works Chemist.
- O.M. Chapman, Spencer, 36, Mark Lane, E.C., Chemical Manufacturer.
1894. Charlier, A. C. J., 3, Bedford Road, South Tottenham, N., Consulting Chemist.
1900. Chase, March F., 1114, Marquette Building, Chicago, Ill., U.S.A., Chemist.
1889. Chase, R. L., Arnold Printworks, North Adams, Mass., U.S.A., Manager.
1898. Chattock, Herbert E., 23, Apsley Road, Clifton, Bristol, Oilcake Manufacturer.
1910. Chattopadhyaya, P. C., 90, Maniktala Main Road, Harrison Road P.O., Calcutta, India, Chemist.
1905. Cheeseman, Frank P., 100, William Street, New York City, U.S.A., Paint Manufacturer.
1901. Cheetham, Howard, 18, St. Ann Street, Manchester, Chartered Patent Agent.
1894. Cheney, John P., Messrs. Cheney Bros., South Manchester, Conn., U.S.A., Chemist and Silk Manufacturer.
1913. Chiaraviglia, Dr. Dino, Via Treviso 7, Rome, Italy, Director, Royal Explosives Laboratory.
1905. Chick, Oliver, 31, Auckland Road, Cranbrook Park, Ilford, Essex, Analytical Chemist.
1890. Chorley, Jno. C., Bewsey, Oxford Road, Birkdale Lanes., Analytical Chemist.
- O.M. Christie, J., Levenfield, Alexandria, Scotland, Dyer and Printer.
1903. Christie, John, c/o The New Explosives Co., Ltd., Stowmarket, Suffolk, Analytical Chemist.
1914. Christie, John T., c/o Messrs. John Miller and Co., Sandilands Chemical Works, Aberdeen, Analytical Chemist.
1908. Christie, Malcolm, 22, Swinton Road, Baillieston, Scotland, Analytical Chemist.
1910. Christie, Dr. M. G., c/o The Otto-Hilgenstock Coke Oven Co., Post Office House, Leeds, Assistant General Manager.
1898. Christison, Geo., 2, Kelvinside Gardens, Glasgow, Engineer.
1907. Christopher, George, Walkden Works, Verney Road, South Bermondsey, S.E., Consulting Chemist.
1907. Christopher, J. E., Solvay Coke Works, Kirkless, Wigan, Assistant in Charge.
- O.M. Chrystal, W. J., 7, West George Street, Glasgow, Chemical Manufacturer.
1908. Chrystall, E. R., c/o Curtis's and Harvey, Ltd., Cliffe at Hoo, Kent, Research Chemist.
- O.M. Church, Sir Arthur, K.C.V.O., F.R.S., Shelsley, Kew, Surrey, Professor of Chemistry in the Royal Academy.
1906. Church, Sumner R., c/o Barrett Manufacturing Co., 17, Battery Place, New York City, U.S.A., Chemical Engineer.
1907. Churchill, Wm., Corning Glass Works, Corning, N.Y., U.S.A., Chemist.
1896. Clafin, Alan A., (Communications) 88, Broad Street, Boston; and (Journals) Littleton, Mass., U.S.A., Manufacturing Chemist.
1909. Clafin, Albert W., 190, Waterman Street, Providence, R.I., U.S.A., Manufacturing Druggist.
1900. Clamer, Guillian H., 46, Richmond Street, Philadelphia, Pa., U.S.A., Chemist.
1885. Clanahan, H. C., 79, Mosley Street, Manchester, Chemical Merchant.
1905. Clapp, Geo. A., 49, Federal Street, Boston, Mass., U.S.A., Chemist.
1891. Clapp, Ralph R., c/o B. P. Clapp Ammonia Co., Providence, R.I., U.S.A., Manager.

1889. Clapperton, J., jun., Analytical Chemist.
 1913. Clark, A. Stanley, 94, Sheen Park, Richmond, Surrey, Technical Chemist.
 1910. Clark, A. W., c/o Heath and Milligan Manufacturing Co., 1832, South Canal Street, Chicago, Ill., U.S.A., Superintendent.
 1904. Clark, Arthur W., c/o Johnson and Johnson, New Brunswick, N.J., U.S.A., Chemist and Bacteriologist.
 1908. Clark, Chas. T., 1303, Sixth Street, Bay City, Mich., U.S.A., Manufacturing Chemist.
 1913. Clark, Francis W., 35, Wilmington Square, London, W.C., Chemist.
 1904. Clark, Prof. Friend E., Central University of Kentucky, Danville, Ky., U.S.A., Professor of Chemistry.
 1910. Clark, Henry, 49, Eastcheap, London, E.C., Oil Refiner.
 1909. Clark, Hubert A., 83, Amherst Street, Montreal, Canada, Canner.
 1900. Clark, Jno., Broadway Works, Millwall Dock, London, E., Manufacturing Chemist.
 1906. Clark, M. H., c/o Goodyear's Metallic Rubber Shoe Co., Naugatuck, Conn., U.S.A., Chemist.
 1902. Clark, Robt. M., 138, Bath Street, Glasgow, Chemist.
 1906. Clark, Wm. B., 11, Fox Street, Greenock, Scotland, Chemist.
 1907. Clark, Wm. H., 26, Barry Street, Dunston-on-Tyne, Analytical Chemist.
 1912. Clark, William M., Niles Glass Works, Niles, Ohio, U.S.A., Chemist.
 1904. Clarke, Alfred R., 613-617, Eastern Avenue, Toronto, Canada, Leather Manufacturer.
 1908. Clarke, Arthur F., St. George's, Micheldean, Gloucestershire, Analytical Chemist.
 1897. Clarke, Wm. B., c/o Edison-Swan U.E.L. Co., Ltd., Ponders End, N., Electro-Chemist.
 1889. Claus, Wm. H., c/o Claus and Co., Ltd., Clayton, Manchester, Manufacturing Chemist.
 1909. Clayton, Ellis, 7, Deerpark Road, Belfast, Ireland, Lecturer on Bleaching, Dyeing, and Printing.
 1895. Clayton, Dr. G. C., Croughton, near Chester.
 1909. Clayton, H., "The Brac," Station Road, Clayford, Kent, Technical Chemist.
 1894. Clayton, Robt. H., 1, Parkfield Road, Didsburys Manchester, Chemist.
 1910. Clayton, Will, Cliffe House, Accrington, Works Chemist.
 1905. Clayton, W. E., Navy Victualling Yard, Kowloon, Hong Kong, Superintendent.
 1907. Clement, Leonard, 11, Agnew Street, Lytham, Lanes., Chemist.
 1893. Clemes, J. H., Cheriton, Newquay, Cornwall.
 1905. Clepton, Thos. J., 285, Congress Street, Boston, Mass., U.S.A., Manager (A. Klipstein and Co.).
 1906. Clifford, Jos., Laboratory, Public Works Ministry Gardens, Cairo, Egypt, Chemist.
 1913. Clifford, Sydney G., 51, Peak Hill, Sydenham, S.E., Analytical Chemist.
 1900. Clifford, Wm., Sewage Outfall Works, Wolverhampton, Sewage Works Manager.
 O.M. Cloud, T. C., 20, Bucklersbury, London, E.C., Metallurgist.
 O.M. Clowes, Dr. F., The Grange, College Road, Dulwich, S.E.; retain Journals; Chemist.
 1891. Clutton, J. H., Fonderie Mines de l'Aude, Villanière par Lastours (Aude), France, Assayer.
 1911. Clymer, Wm. R., Publicity Department, National Carbon Co., Cleveland, Ohio, U.S.A., Manager.
 1899. Coates, Chas. E., jun., Louisiana State University, Baton Rouge, La., U.S.A., Professor of Chemistry.
 1911. Coates, Jos. E., The University, Edgbaston, Birmingham, Lecturer.
 1888. Coats, Jno. T., 105, Broughton Street, Edinburgh, Manufacturing Chemist.
 1915. Cobb, Ernest B., c/o Standard Oil Co. (N.J.), Bayonne, New Jersey, U.S.A.
 1892. Cobb, Prof. Jno. W., The University, Leeds, Prof. of Coal Gas and Fuel Industries.
 1894. Coblenz, Dr. Virgil, 23, Vine Street, Brooklyn, N.Y., U.S.A., Research Chemist (R. R. Squibb and Co.).
 1899. Cochran, Alfred, 559, Madison Street, Brooklyn, N.Y., U.S.A., Chemist.
 1911. Cochrane, Capt. J. B., Royal Military College, Kingston, Ontario, Canada, Professor of Physics and Chemistry.
 1901. Cockburn, John A., Mayville, Stevenston, Ayrshire, Analytical Chemist.
 1902. Cocking, Allan T., c/o Kynoch, Ltd., Lion Works, Wotton, Birmingham, Ammunition Manufacturer.
 1905. Coes, Chas. S., 1024, East River Street, Hyde Park, Mass., U.S.A., Oil Chemist.
 1903. Coggeshall, Dr. G. W., 1850, Mintwood Place, Washington, D.C., U.S.A., Chemical Engineer.
 1887. Coghill, P. de G., Borax Works, Old Swan, Liverpool, Technical Chemist.
 1884. Cogswell, W. B., Syracuse, N.Y., U.S.A., Chemical Engineer.
 O.M. Cohen, Dr. J. B., 1, North Grange Mount, Headingley, Leeds, Professor of Organic Chemistry.
 1897. Cohn, Alfred I., 122, East 74th Street, New York City, U.S.A., Chemist.
 1901. Cohn, Sigmund, 13, Dutch Street, New York City, U.S.A., Metallurgical Chemist.
 1904. Cohoe, Prof. W. P., 50, East 41st Street, New York City, U.S.A., Professor of Chemistry.
 1891. Colby, Albert L., 447, Lehigh Street, South Bethlehem, Pa., U.S.A., Metallurgical Engineer.
 1899. Colby, E. A., Baker Platinum Works, Newark, N.J., U.S.A., Metallurgical Chemist.
 O.M. Colby, W. H., Cairn Villa, St. Brannock's Road, Ilfracombe.
 1893. Coleman, W. H., 1, Athole Gardens, Newlands, Glasgow, Chemical Engineer.
 1913. Colgate, R. T., 25, Denmark Road, Reading, Works Chemist.
 1905. Collett, John H., Sunnyside, Tuffley, and (Jnls.) The Librarian, Free Library, Gloucester, Chemical Manufacturer.
 1887. Collett, J. M., Wynstone Place, Brookthorpe, Gloucester, Chemical Manufacturer.
 1901. Colley, Bernard T., c/o Braden Copper Co., Rancagua, Chile, South America, Superintendent.
 1908. Collier, F. C., 457, Lansdowne Avenue, Westmount, Montreal, Canada, Analytical Chemist.
 1903. Collier, Pierre, Companhia Industrial Pernambuco, Pernambuco, Brazil, Civil Engineer.
 1893. Collin, Dr. C. A., Ferguslie Threadworks, Paisley, Textile Chemist.
 1913. Collinge, H. G., c/o Naegeli and Co., Rua Theophilo Ottoni 21 (Caixa 562), Rio de Janeiro, Brazil, Technical Chemist.
 1898. Collingridge, Frank, Highbstone, New Road, Llanelli, South Wales, Chemist.
 1899. Collins, S. Hoare, 9, Cavendish Place, Newcastle-on-Tyne, Agricultural Chemist.
 1888. Collins, W. Hepworth. See Hepworth Collins, W.
 1913. Collinson, R. W., c/o Messrs. J. and J. Colman, Ltd., Starch Dept., Carrow Works, Norwich, Starch Manufacturer.
 1899. Collis, Walter T., Parkhurst, St. Peter's Road, Harborne, Birmingham, Chemist.
 1910. Collitt, Bernard, Chem. Laboratory, Messrs. Ruston, Proctor, and Co., Ltd., Lincoln, Chemist.
 1910. Colman, Fred. J., c/o Brotherton and Co., Ltd., Wear Tar Works, Sunderland, Chemist.
 1891. Colman, Dr. H. G., Woodthorpe, New Malden, Surrey, Analytical Chemist.
 1892. Colquhoun, Ludovic, Dynamite Factory, Modderfontein, Transvaal, Analytical Chemist.
 1894. Colquhoun, W., Endcliffe, Endcliffe Crescent, Sheffield, Engineer.
 1901. Colwell, J. Kear, Finsbury Town Hall, Rosebery Avenue, E.C., Analytical and Consulting Chemist.
 1906. Comber, A. W., 23, Courtenay Gardens, Upminster Essex, Metallurgical Chemist.

1900. Comey, Dr. Arthur M., Upland Avenue, opposite Summit Street, Chester, Pa., U.S.A., Technical Chemist.
1911. Comey, Robert H., Wenonah, N.J., U.S.A., Bleacher.
1906. Compton, Miss N. J., Library, University of Nebraska, Lincoln, Neb., U.S.A., Librarian.
1901. Connah, Jas., Laboratory, Custom House, London, E.C., Government Analyst.
1891. Conradson, Pontus H., Galena Oil Works, Franklin, Pa., U.S.A., Analytical Chemist.
1889. Conroy, Dr. Jas. T., 9, The Serpentine, Grassendale, Liverpool, Chemist.
1887. Constable, W. H., Australian Alum Works, Runcorn, Analytical Chemist.
1909. Cook, E. Bernard, 23, Cross Street, Finsbury, London, E.C., Manufacturing Chemist.
- O.M. Cook, H. J., The Firs, Woodford Green, Essex, Soap Manufacturer.
1903. Cook, Jas. W., London and Provincial Dye Works, Hackney Wick, N.E., Dyer.
1898. Cook, Thos. Alex., East London Soap Works, Bow, E., Soapmaker.
1899. Cook, Walter G., 9, Hendon Lane, Finchley, N., Analytical Chemist.
1907. Cooke, J. J. Verdin, 9, James Street, Liverpool, Salt Manufacturer.
1904. Cooke, W. Ternent, The University, Adelaide, South Australia, Lecturer in Chemistry.
1910. Coombs, Frank A., Technical College, Sydney, N.S.W., Australia, Lecturer on Tanning.
1913. Cooper, G. Stanley, 92, Harcourt Road, Sheffield, Chemist.
1910. Cooper, Leonard H., Royal Crown Soap Co., Calgary, Alberta, Canada, Chemist.
1901. Cooper, T. S., Beckfoot, Birch Hall Lane, Manchester, Calico Printing Chemist.
1891. Cooper, Walter J., The Elms, Lavernock, nr. Penarth, South Wales, Cement Works Manager.
1890. Corcoran, Bryan, 43, Croyham Park Avenue, South Croydon, Chemical Engineer.
1914. Corder, Walter S., Messrs. Williamson and Corder, Ltd., Low Walker, Newcastle-on-Tyne, Chemical Manufacturer.
1899. Cornelison, Dr. Robt. W., 275, West Summit Street, Somerville, N.J., U.S.A., Consulting Chemist.
1909. Cornell, Fred, 16, Place Royal, Montreal, Canada, Chemical Merchant.
1894. Coste, J. H., 2, Savoy Hill, Victoria Embankment, W.C., and (Journals) Utopia, Gloucester Road, Teddington, Chemist (Public Health Dept., L.C.C.).
1913. Cotterill, John W., 9, Broad Street Corner, Birmingham, Analyst.
1912. Coupe, Geoffrey, 43, Hampton Road, Forest Gate, E., Chemist.
1914. Cousins, F. G., 1, St. Cuthbert's Place, North Road, Durham, Science Master.
1894. Cousins, W. J., 55, Clerkenwell Close, London, E.C., Consulting Chemist and Director.
1909. Coventry, Bernard O., Lahore, Punjab, India, Deputy Commissioner of Forests.
1903. Cowan, A. Wallace, Bayfield, Bowdon, Cheshire, Analytical Chemist.
1906. Cowan, George D., Bridge House, Bridge Road, Millwall, E., Manager, Desilverising Works.
1912. Cowan, H. W., Bell Filtration Co., Ltd., 305, Kent Building, Toronto, Canada, Water and Sewage Specialist.
1893. Cowan, W. J., 12, Park Avenue, Wood Green, N., Fine Colour Manufacturer.
1910. Coward, Hubert F., 216, Plymouth Grove, Manchester, Lecturer in Chemistry.
1897. Cowburn, Arthur W., 20, Mount Street, Manchester, Chemical Merchant and Analytical Chemist.
1907. Cowburn, J. Robert, 10, Eastwood Road, South Woodford, Essex, Technical Chemist.
1891. Cowper-Coles, Sherard Osborn, 1 and 2, Old Pye Street, Westminster, S.W., and (Jnl.) The Cottage, French Street, Sunbury-on-Thames, Metallurgical Engineer.
1905. Cox, Harold N., c/o Lalance and Grosjean Mfg. Co., Woodhaven, N.Y., U.S.A., Chemist.
1884. Craig, Geo., Chemical Laboratory, 95, Bath Street, Glasgow, Technical Chemist.
1895. Craig, Dr. Thos. J. I., c/o Peter Spence and Sons, Ltd., Alum Works, Manchester, Chemist.
1908. Craig, Wm. J., c/o Rio Tinto Co., Casa Colon, Huerva, Spain, Analytical Chemist.
1911. Crake, Ralph V., British South African Explosives Co., Dynamite Factory, Modderfontein, Transvaal, Chemist.
1901. Crane, Fred. D., 28, Hillside Avenue, Montclair, N.J., U.S.A., Consulting Chemist.
1902. Crane, Jasper E., c/o The Arlington Co., Arlington, N.J., U.S.A., Chemist.
1903. Cranmer, Ridgeway, 170, 88th Street, Bay Ridge, Brooklyn, N.Y., U.S.A., Chemist.
1902. Craven, Alfred B., Northcote, Thorpe Road, Selby, Yorks, Analytical Chemist.
1906. Craven, J. A., 119, Moorside, Armley, Leeds, Chemist.
1891. Craven, Jno., The Ark, South Bersted, Bognor, Sussex, Chemist.
1906. Craven, John I., Niederwald, Hebers Ghyll, Ilkley, Yorks, Chemist and Salesman.
- O.M. Crawford, D., Langdale's Chemical Manure Co., Ltd., St. Lawrence, Newcastle-on-Tyne, Manager.
1913. Crawford, John, c/o Lothian, 21, Briar Bank Terrace, Edinburgh, Works Chemist.
1908. Crawford, Lawrence, 4, Eastfield Road, Dumfries, Scotland, Analytical Chemist.
1890. Crawshaw, E., 25, Tollington Park, London, N., Lye Merchant.
1914. Creese, Guy T., 2, Poplar Street, Danvers, Mass., U.S.A., Leather Manufacturer.
- O.M. Cresswell, C. G., Ermyngarth, Ashtead, Surrey; and Broadway Chambers, Westminster, S.W., Chemist.
1901. Cribb, Cecil H., 136, Shaftesbury Avenue, London, W., Analytical and Consulting Chemist.
1909. Crichton, Charles, Kleinfontein Group C.A., Box 2, Benoni, Transvaal, Assayer.
1908. Crichton, Adam M., "London Place," Aggerott Print Works, Pendleton, Manchester, Calico Printer's Chemist.
1910. Crichton, David T., Nobel House, 195, West George Street, Glasgow, Buying Manager.
1905. Crichton, W. H., c/o Ore Concentration Co., Ltd., Glebe Road, Kingsland Road, London, N.E., Chemist.
1890. Cripser, Wm. R., c/o Messrs. D. Waldie and Co., Konnagar, near Calcutta, India, Manufacturing Chemist.
1911. Croasdel, Jas. F., 108, Burnt Ash Road, Lee, S.E., Engineer.
1901. Cronquist, G. W., Torekow, Sweden, Consulting Ceramic Engineer.
- O.M. Crookes, Sir Wm., O.M., F.R.S., 7, Kensington Park Gardens, Notting Hill, W., Analytical Chemist.
1896. Crosby, Thos., Llanelly Steelworks, Llanelly, South Wales, Metallurgist.
- O.M. Crosfield, A. L., 46, Bidston Road, Oxtou, Birkenhead; (Journals) c/o Prof. B. Moore, Biochemical Dept., The University, Liverpool, Analytical Chemist and Assayer.
1896. Crosfield, Capt. G. R., Lodge Lane, Warrington, Soap Manufacturer.
1908. Crosland, Percy F., Century Dye Works, Elland, Yorks, Technical Chemist.
1884. Cross, C. F., 4, New Court, Lincoln's Inn, London, W.C., Analytical Chemist.
1894. Crossley, Prof. Arthur W., F.R.S., King's College, Strand, and (Jnl.) 46, Lindfield Gardens, Hampstead, N.W., Professor of Chemistry.
1904. Crossley, T. Linsey, 318, Lagachetiere Street West, Montreal, Canada, Technical Chemist.
1908. Croston, Henry, 583, Leonard Street, Brooklyn, N.Y., U.S.A., Foreman.
1894. Crow, Henry W., Hart's Lane, North Street, Barking, E., Tar Distiller.

1884. Crow, Dr. J. K., Ivydene, Westcombe Park Road, Blackheath, S.E., Technical Chemist.
1883. Crowther, Horace W., The Beeches, West Bromwich, Technical Chemist.
1906. Crowther, R. E., c/o Ferguson Bros., Ltd., Holmo Head, Carlisle, Chemist.
1912. Cruikshanks, Dr. Geo. S., Royal Technical College, Glasgow, Chemist.
1906. Cruser, Dr. Fred. Van D., c/o The Diamond Match Co., Oswego, N.Y., U.S.A., Chemical Engineer.
1892. Cullen, Wm., Dynamite Factory, Modderfontein, Transvaal, South Africa, Chemist.
1903. Cullen, W. H., The Castner-Kellner Alkali Co., Ltd., Wallsend-on-Tyne, Engineer.
1897. Culmann, Dr. J., c/o G. Siegle Co., Rosebank, Staten Is., N.Y., U.S.A., Chemist and Colourist.
1883. Cuming, James, jun., Chemical Works, Yarraville, Melbourne, Australia, Chemical and Fertiliser Manufacturer.
1912. Cuming, Wm. F., c/o Cuming, Smith, and Co. Proprietary, Ltd., Yarraville, Victoria, Australia, Manufacturing Chemist.
1907. Cunningham, James E., Minas Peña del Hierro, Provincia de Huelva, Spain, Analytical Chemist.
1915. Cunningham, Thos. R., P.O. Box 665, Falls Station, Niagara Falls, N.Y., U.S.A., Chemist.
- O.M. Curphey, W. S., 87, Cantfield Gardens, South Hampstead, N.W., Chief Alkali Works Inspector.
1898. Curtis, Marvin, 108, Front Street, San Francisco, Cal., U.S.A., Wine Chemist.
1903. Cushing, Robt. P., 313, Saurens Street, Olean, N.Y., U.S.A., Chemist.
1902. Cutbush, Chas. G., 59, Byne Road, Sydenham, Kent, Electrical Engineer.
1899. Cutler, Fred. F., 166, Essex Street, Boston, Mass., U.S.A., Publisher.
1914. Cutler, J. Vernell, Technical Chemist.
1913. Cutts, H. Cyril, Brooklyn, Private Road, Sherwood, Nottingham, Embroidery Manufacturer.
1904. Cutts, Henry E., c/o Stillwell and Gladding, 181, Front Street, New York City, U.S.A., Technical Chemist.

D

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1911. Dager, Herman J., 278, Jarvis Street, Toronto, Canada, Dominion Food Inspector.
1897. Dains, Herbert H., c/o J. E. Ferguson, 2, Union Court, London, E.C., Analytical Chemist.
1884. Daniell, Louis C., Royal Standard Brewery, Tamworth, New South Wales, Brewer.
1904. Danker, Dan. J., 73, Dean Road, Brookline, Mass., U.S.A., Dyestuff and Chemical Merchant.
1903. Dannenbaum, Dr. H., c/o National Ammonia Co., Frankford, Philadelphia, Pa., U.S.A., Secretary and Treasurer.
1885. Darby, Jno. H., Howard Chambers, 155, Norfolk Street, Sheffield, Ironmaster.
1911. David, Edward J., 249, Wood Avenue, Tottenville, Staten Is., N.Y., U.S.A., Chemist and Assayer.
1900. Davidson, Alex., 173, Colinton Road, Edinburgh, Analytical Chemist.
1899. Davidson, Charles, 65, Cadder Street, Pollokshields, Glasgow, Analytical Chemist.
1901. Davidson, G. M., Chicago and N.W. Railroad Shops, P.O. Station E., Chicago, Ill., U.S.A., Chemist.
1883. Davidson, J. E., 40, Percy Gardens, Tynemouth, Chemical Manufacturer.
1891. Davidson, Richard, 133, Victoria Road, Dundee, Oil Merchant's Clerk.
- O.M. Davidson, R. Holden, c/o United Alkali Co., Ltd., Ammonia Soda Works, Fleetwood, Manager.
1904. Davidson, Robert, c/o Dalgety and Co., Ltd., 15, Bent Street, Sydney, N.S.W., Australia.
1911. Davidson, Thos. A., 57, Strathyre Avenue, Norbury, S.W., Chemist and Varnish Expert.

1905. Davidson, Dr. Wm. B., City Gas Works, Nechells, Birmingham, Chemist.
1906. Davies, Harry R., 80, Prince Street, Jamaica Plain, Mass., U.S.A., Chemist.
1898. Davies, Herbert E., The Laboratory, 28, Chapel Street, Liverpool, Analytical Chemist.
1907. Davies, James, 12, Harefield Road, Brockley, London, S.E., Scientific Apparatus Maker.
1912. Davies, Jas. Gordon, c/o Curtis's and Harvey, Ltd., Powder Mills, Tonbridge, Kent, Chemist.
1911. Davies, Jas. H., c/o Lever Bros., Ltd., Royal Liver Building, Liverpool, Chemist.
1896. Davies, Llewellyn J., 103, Buto Road, Cardiff, Analytical and Consulting Chemist.
1886. Davies, M. L., Standard Chemical, Iron, and Lumber Co., Toronto, Canada, General Manager.
1897. Davies, Saml. H., c/o Rowntree and Co., Ltd., The Cocoa Works, York, Research Chemist.
1908. Davies, T. H., c/o John Cox and Co.'s Successors, Stillhouse Lane, Bedminster, Bristol, Tanner.
- O.M. Davis, A. R., 27, Wellington Road, Heaton Chapel, Stockport, Analytical Chemist.
1901. Davis, Bernard F., c/o Ore Trading Co., Casilla 1120, Santiago, Chile, Metallurgical Engineer.
1902. Davis, Charles B., c/o National Brewers' Academy, 402, West 23rd Street, New York City, U.S.A., Technical Chemist.
1912. Davis, E. Gordon, c/o Messrs. Curtis's and Harvey, Ltd., Cliffe at Hoo, Kent, Research Chemist.
1914. Davis, Eric N., 4, Brookwood Avenue, Barnes, S.W., Technical Journalist.
1908. Davis, G. Keville, 265, Strand, London, W.C., Chemical Engineer.
- O.M. Davis, H. W., 18, Crescent Road, Kingston-on-Thames, Analytical Chemist.
1897. Davis, Wm. A., 7, Carlton Bank, Harpenden, Herts, Chemist.
1911. Davis, Wm. C., 6, Park Road, West Smethwick, near Birmingham, Chemist.
1900. Daw, Fred W., Duffryn House, Ebbw Vale, Mon., Metallurgical Chemist.
- O.M. Dawson, C. A., 32, Elm Hall Drive, Mossley Hill, Liverpool, Technical Chemist.
1915. Dawson, Reginald D., Chemical Dept., Southern Outfall Works, Crossness, Abbey Wood, Kent, Chemist.
1886. Dawson, W. Haywood, British Alizarin Co., Ltd., Silvertown, E., and (Journals) 15, Wrottesley Road, Woolwich, S.E., Technical Chemist.
1901. Day, Dr. David T., U.S. Geological Survey, Washington, D.C., U.S.A., Geologist.
1913. Day, Frank E., c/o Condensed Milk Co. of Ireland, Lansdowne, Limerick, Ireland, Analytical Chemist.
1912. Day, G. A. C., Casilla No. 417, Lima, Peru (via New York), Oil Mill Manager.
- O.M. Deacon, H. Wade, 8, Ulet Road, Liverpool; and (Jnls.) c/o C. E. Tyers, 186, Derby Road, Farnworth, Widnes, Alkali Manufacturer.
- O.M. Deakin, H. T., Dewhurst, Egerton, near Bolton, Dyer.
1913. Deakin, J. Bartram, c/o Guest, Keen, and Nettlefolds, Ltd., By-Product Coke Ovens, Cwmbran, Mon., Coke Oven Manager.
1911. Dean, Arthur L., College of Hawaii, Honolulu, H.I., U.S.A., Assistant Prof. of Industrial Chemistry.
1906. Dean, Harry, Armstrong College, Newcastle-on-Tyne, Demonstrator.
1892. Deaville, B., Beech Avenue, Nottingham Manufacturing Chemist.
1899. De Castro, J. Paul. See Castro, J. Paul de.
1902. De Cew, J. A., 903, McGill Building, Montreal, Canada, Chemical Engineer.
1893. De Clerck, Maurice, Henle-lez-Courtrai, Belgium.
1884. Deering, W. H., I.S.O., Beanworth, Moretonhampstead, Devon, late Chemist to War Department.
1900. Deerr, Noel F., Jobabo, Oriente, Cuba, Analytical Chemist.
1902. Deghuée, Dr. Jos. A., 39, West 38th Street, New York City, U.S.A., Chemist.

1911. Dehn, Dr. Frank B., Broad Sanctuary Chambers, Westminster, S.W., Chemist and Patent Agent.
1901. De Jonge, Cornelius, 36, Doughty Street, Brooklyn, N.Y., U.S.A., Pharmaceutical Chemist.
1893. Delahaye, Philibert, 94, Rue St. Lazare, Paris (IX.), Gas Engineer.
1909. De Laire, Edgar, 129, Quai de Moulineaux, Issy, Seine, France, Industriell.
1901. Delany, Chas., c/o Elliott Bros., Ltd., O'Connell Street, Sydney, N.S.W., Australia, Chemist.
1908. Dellschaft, Dr. F. H., Winnington, Northwich, Cheshire, Manufacturing Chemist.
1910. De Meeus, Etienne, Beacon Falls, Conn., U.S.A., Chemist.
1888. Dempsey, Geo. C., 165, Market Street, Lowell, Mass., U.S.A., Chemist.
1909. Demuth, Rudolph, 68, Salisbury Road, London, N.W., Manufacturer.
1899. Denham, Wm. S., The United College, St. Andrews, Scotland.
1913. Denington, R. C., 69, Dover Road, South Wanstead, Essex, Research Chemist.
1891. Denison, Joseph R., Valley Dyeworks, Bradford, Yorks, Analytical Chemist.
1911. Dennis, Louis, c/o Brothertons Ltd., Church Road, Litherland, Liverpool, Works Chemist.
1908. Dennis, Martin, 859, Summer Avenue, Newark, N.J., U.S.A., Manufacturing Chemist.
1907. Dennison, Henry S., c/o Dennison Manufacturing Co., Framingham, Mass., U.S.A., Manufacturer.
1898. Dent, Dr. Frankland, Government Analyst's Dept., Singapore, S.S., Government Analyst.
1912. Depierres, Gaston, The Indestructible Paint Co., King's House, King Street, Cheapside, London, E.C., Managing Director.
1905. Derby, Wallace G., c/o Nichols Copper Co., Laurel Hill, New York City, U.S.A., Assayer.
1913. Desch, Dr. Cecil H., Metallurgical Dept., The University, Glasgow, Lecturer.
1912. Dettmann, A. H., Stuart Street, Longueville, Sydney, N.S.W., Leather Manufacturer.
1914. Detwiler, Jas. G., La Tourette Hotel, Bergen Point, Bayonne, N.J., U.S.A., Chemist.
1906. Deverell, Louis C., 1, Shortlands Grove, Shortlands, Kent, Chief Chemist.
1898. Dewar, Alex. H., c/o The Linoleum Manufacturing Co., Staines, Middlesex, Chemist.
- O.M. Dewar, Sir J., F.R.S., 21, Albemarle Street, London, W., Professor of Chemistry and Physics.
1889. Dewey, Fred. P., 1801, Summit Plain, N.W., Washington, D.C., U.S.A., Metallurgist.
1904. Dewhirst, J. A., Imperial Chambers, Halifax, Yorks, Analyst.
1909. Dewhirst, Wm. B., Gen. Delivery, Cleveland, Ohio, U.S.A., Technical and Engineering Chemist.
1903. Diamond, Wm., La Norie, Marley Hill, Co. Durham, Works Manager.
1913. Diaz-Ossa, Prof. Belisario, Casilla 962, Santiago, Chile, Prof. of Chemistry.
- O.M. Dibdin, W. J., 2, Edinburgh Mansions, Howick Place, S.W., Analytical Chemist.
1913. Dick, James, c/o Canadian Explosives, Ltd., Beloeil Station, P.Q., Canada, Superintendent.
1902. Dick, John, Wharf Road, Cubitt Town, London, E., Manager and Chemist.
1904. Dick, W. D., c/o Hugh Baird and Sons, 29, St. Vincent Place, Glasgow, Analytical Chemist.
1898. Dickenson, F. M., c/o Broken Hill Proprietary Co., 3, Great Winchester Street, London, E.C., Secretary.
1904. Dickenson-Gair, C. J. *See under Gair.*
1893. Dickerson, E. N., 141, Broadway, New York City, U.S.A., Lawyer.
- O.M. Dickinson, A. J., 178, Lewisham High Road, Brockley, S.E., Tar Distiller.
1905. Dickinson, Cyril, Southwark Town Hall, Walworth Road, London, S.E., Analytical Chemist.
1914. Dickson, J. M., 36, Leopold Street, Toronto, Canada, Manager.
1898. Dickson, Samuel, 26, Tothill Street, Westminster, S.W., Analytical Chemist.
1899. Dieckmann, Dr. Otto, 1180, Harrison Avenue, Cincinnati, Ohio, U.S.A., Chemist.
1914. Diehl, Dr. L. H., 703, Salisbury House, London Wall, London, E.C., Metallurgical Chemist.
1908. Dickman, Dr. George C., 115, West 68th Street, New York City, U.S.A., Professor of Pharmacy.
1894. Diestel, Wm., 117, Hudson Street, New York City, U.S.A., Dyestuff Importer.
1908. Dill, Colby, Ranway Avenue, Woodbridge, N.J., U.S.A., Chemist.
1898. Dillon, Wm., The Lomas Gelatine Works, Prince's Rock, Plymouth, Oil, Colour, and Varnish Manufacturer.
1911. Dissosway, Thurston N., 23, Vine Street, Brooklyn, N.Y., U.S.A., Chemist.
1903. Divine, Robt. E., 63, Richton Avenue, Highland Park, Mich., U.S.A., Chemist.
1899. Dixon, Fred. W., P.O. Box 43, Jamestown, N.Y., U.S.A., Dyer.
1888. Dixon, Prof. Harold B., F.R.S., Owens College, Manchester, Professor of Chemistry.
1902. Dixon, Wm. A., Reiby Chambers, Reiby Lane, Circular Quay, Sydney, N.S.W., Australia, Public Analyst and Assayer.
1909. Dixon, W. H., c/o Bryant and May, Ltd., Fairfield Works, Bow, London, E., Match Manufacturer.
1892. Dobb, Thos., c/o J. T. Dobb and Son, West Bar, Sheffield, Pharmaceutical Chemist.
- O.M. Dobbie, Sir J. J., F.R.S., Government Laboratory, Clement's Inn Passage, London, W.C., and (Jnls.) 4, Vicarage Gate, Kensington, W., Director.
- O.M. Dobbin, Dr. L., Chemical Laboratory, University, Edinburgh, Professor of Chemistry.
1908. Dobbs, Ernest J., 16-17, Devonshire Square, Bishopsgate, London, E.C., Analytical Chemist.
1914. Dobson, Fred. W., Castle Grove, Nottingham, Lace Dyer and Dresser.
1913. Dobson, James, Holme Rook, Birch Lane, Longsight, Manchester, Technical Chemist.
1907. Dodd, Arthur J., Meadholme, Blackheath Park, S.E., Oil Manufacturer.
1915. Dodd, A. Scott, Laboratory, 20, Stafford Street, Edinburgh, Public Analyst.
1889. Dodd, W. Ralph, Burton Grange, Goff's Oak, near Cheshunt, Chemical Works Manager.
1913. Dodds, Herbert H., c/o Kynoch, Ltd., Umbogintwini, Natal, Explosives Chemist.
1906. Dodds, Thos., c/o Reckitt and Sons, Ltd., and (Journals) 7, The Oval, Garden Village, Hull, Works Manager and Chemist.
1900. Dodge, Dr. Francis D., 69, Avenue A., Bayonne, N.J., U.S.A., Chemist.
1906. Dodsworth, Walter A., Journal of Commerce, 32, Broadway, New York City, U.S.A., Editor.
1897. Doerflinger, Wm. F., Rosbank, Staten Island, N.Y., U.S.A., Research Chemist.
1897. Dohme, Dr. Alf. R. L., Messrs. Sharp and Dohme, Baltimore, Md., U.S.A., Manufacturing Chemist.
1905. Dolan, H., Westbourne, Belvoir Road, Lower Walton, Warrington, Chemist.
1914. Domingues, Adolfo, *see* Miralles, A. D.
1914. Donald, James R., 318, Lagauchetière Street West, Montreal, Canada, Chemical Engineer.
1903. Donald, Dr. Jas. T., 318, Lagauchetière Street West, Montreal, Canada, Consulting Chemist.
1912. Donald, R. M., c/o Lever Bros. Co., 174, Broadway, Cambridge, Mass., U.S.A., Soapworks Manager.
1900. Donald, Wm. Ridgefield Park, Bergen Co., N.J., U.S.A., Assayer and Chemist.
1913. Donaldson, Richard, 63, Waverley Gardens, Crossmyloof, Glasgow, Assistant Manager.
1902. Donaldson, Thos., Beechcroft, Ardrossan Road, Saltcoats, Scotland, Chemist.
1905. Donnan, Prof. F. G., F.R.S., Chemical Laboratories, University College, Gower Street, London, W.C., Professor of Physical Chemistry.
1886. Doolittle, Orrin S., 388, Palisade Avenue, Yonkers, N.Y., U.S.A., Chemist.
1905. Doolittle, Roscoe E., 109, Hillside Avenue, Glen Ridge, N.J., U.S.A., Chemist.

1890. Dore, Jas., Copper Works, High Street, Bromley-by-Bow, E., Distiller's Engineer.
1911. Dorée, Dr. Charles, 58, Gore Road, South Hackney, London, N.E., Head of Chemistry Department, Borough Polytechnic.
1896. Doremus, Dr. Chas. A., 55, West 53rd Street, New York City, U.S.A., Professor of Chemistry.
- O.M. Dott, D. B., Ravenslea, Musselburgh, Scotland, Analytical Chemist.
1911. Dougall, Jas. S. N., 305, Manufacturers Street, Montreal, Canada, Varnish Manufacturer.
1897. Douglas, Geo., Farfield Hall, Addingham, Yorks, Dyer.
1894. Douglas, London M., Douglas Wharf, Putney, S.W., Chemical Manufacturer.
1909. Douglas, Robt. P., Prudential Buildings, Nelson Square, Bolton, Consulting Chemist.
1884. Douglas, William, Grafton House, Berkhamsted, Herts., Chemical Engineer.
1900. Doulton, H. Lewis, Royal Doulton Potteries, Lambeth, S.E., Potter.
1900. Dow, Allan W., 126, Joralemon Street, Brooklyn, N.Y., U.S.A., Chemical Engineer.
1898. Dow, Herbert H., Midland, Mich., U.S.A., Manufacturing Chemist.
1908. Dow, John W., 564, Park Avenue West, Mansfield, Ohio, U.S.A., Manufacturing Chemist.
1905. Dowbiggin, James, Craiglands, Albert Park, Lancaster, Chemist.
1913. Dowell, Henry L., Brooklands, Forest Rise, Upper Walthamstow, N.E., Chemist.
1912. Doney, Carl W., c/o Whalley Abbey Printing Co., Whalley, near Blackburn, Printworks Chemist.
1901. Doxrud, Christian, Technical School, Christiania, Norway, Professor of Chemical Technology.
1907. Doyle, B. W., 245, Lindell Avenue, Leominster, Mass., U.S.A., Manufacturer.
1902. Drake, Bryant S., 5839, Colby Street, Oakland, Cal., U.S.A., Chemist.
1911. Drake, Joseph W. D., Three Mills Distillery, Bromley-by-Bow, London, E., Distillery Brewer.
1914. Drew, John M., Lower House, Burnley, Lancashire, Calico Printer.
1906. Drew, W. Newton, Raincliffe, Ecclesfield, near Sheffield, Chemical Manufacturer.
1896. Drewsen, Dr. Viggo B., 5, Beekman Street, New York City, U.S.A., Wood Pulp and Paper Expert.
- O.M. Dreyfus, Dr. C., Claremont, Fallowfield, Manchester, Dye Manufacturer.
1904. Dreyfus, Dr. L. A., Maple Avenue, Rosebank, S.I., N.Y., U.S.A., Chemist.
1893. Dreyfus, S., Thorncliffe Villa, Windmill Lane, Denton, near Manchester, Chemist.
1899. Dreyfus, Dr. Wm., 57, East 96th Street, New York City, U.S.A., Chemist.
1898. Drummond, Dr. Isaac W., 436, West 22nd Street, New York City, U.S.A., Chemist.
1910. Drury, Chas. Dru, Hendon Gas Works, Sunderland, Engineer.
1899. Ducas, B. P., 25-27, South William Street, New York City, U.S.A., Chemical and Dyestuff Importer.
1905. Duché, E., 6, Eastcheap, London, E.C., Merchant.
1909. Duchemin, René P., 6, Rue Chanoinesse, Paris IV., France, Chemical Engineer.
1897. Duckham, Alex., Phoenix Wharf, West Ferry Road, Millwall, E., and (Jnls.) Vanbrugh Castle, Blackheath, S.E., Chemical Manufacturer.
1915. Duckham, Arthur M., Palace Chambers, Westminster, S.W., Engineer.
1905. Duckworth, Harry S., Garner Printworks and Bleachery, Garnerville, Rockland Co., N.Y., U.S.A., Printworks Chemist.
1913. Duff, Alex. R., 211, Fern Avenue, Toronto, Canada, Rubber Chemist.
1899. Duff, Wm. S., Merric Lands, Westbury Road, Buckhurst Hill, Essex, Manufacturing Chemist.
1905. Duffus, W. B., Riddersk Mine, Oust Kemengorsk, Semipalatinsk District, Siberia, Russia, Chemist.
1901. Duffy, Lawrence, 92, Tom Lane, Nether Green, Sheffield, Analytical Chemist.
1905. Duggan, Edw. J., c/o Brewer and Co., 95, William Street, New York City, U.S.A., Vice-President.
- O.M. Duggan, T. R., 52, East 41st Street, New York City, U.S.A., Analytical Chemist.
1898. Duisberg, Dr. Carl, The Bayer Co., Ltd. (Journals) Farbenfabrik, Leverkusen, bei Köln a R., Germany: (subscriptions) 19, St. Dunstan's Hill, London, E.C., Chemist and Managing Director.
1888. Dukes, T. William, Box 10, Vrijheid, South Africa, Merchant.
1906. Duncalf, Roger, Forge Mills, Restwood Colliery, Nottingham, Glue Manufacturer.
1889. Duncan, Arthur W., c/o J. Woolley, Sons and Co., Ltd., Victoria Bridge, Manchester, Analytical Chemist.
1909. Duncan, Jas., c/o Steel Bros. and Co., Ltd., 6, Fenchurch Avenue, London, E.C., Merchant.
1906. Dunford, Jno. H., Trent Side Bone Works, Nottingham, Assistant Manager.
1912. Dunke'sbühler, F. S., 63, Brock Street, Grosvenor Square, London, W., Technical Chemist.
1905. Dunlop, Harry, 231, St. Vincent Street, Glasgow, Chemist.
1892. Dunn, Fred, 193, Collins Street, Melbourne, Victoria, Australia, Analytical Chemist.
- O.M. Dunn, Dr. J. T., 10, Dean Street, Newcastle-on-Tyne, Consulting Chemist.
- O.M. Dunn, P., Northern Assurance Buildings, Albert Square, Manchester, Chemical Merchant.
1914. Dunn, Ralph J., The Manor House, King's Newnham, Rugby, Chemist.
1908. Dünschmann, Dr. Max, c/o Meister, Lucius, und Brüning, Ltd., Ellesmere Port, Cheshire, Manager.
1901. Dunsford, Geo., Laboratory, Wigan Coal and Iron Co., Ltd., Wigan, Analytical Chemist.
1907. Dunstan, A. E., Technical College, East Ham, E., Head of Chemical Department.
1907. Dupré, F. H., 2, Edinburgh Mansions, Howick Place, S.W., Analytical Chemist.
1907. Dupré, P. V., 2, Edinburgh Mansions, Howick Place, S.W., Analytical Chemist.
1905. Durfee, Winthrop C., 516, Atlantic Avenue, Boston, Mass., U.S.A., Manufacturing Chemist.
1897. Durkee, Frank W., Tuft's College, Medford, Mass., U.S.A., Professor of Chemistry.
1911. Durkin, Jos. A., c/o Butterworth Judson Co., Newark, N.J., U.S.A., Chemical Superintendent.
1907. Durrans, Thos. H., 10, Titchfield Terrace, Regent's Park, London, N.W., Chemist.
1891. Dvorkovitz, Dr. P., 4, Broad Street Place, London, E.C., Technical Chemist.
1912. Dyche-Teague, F. C., 258, Gloucester Terrace, Hyde Park, London, W., Analytical Chemist and Bacteriologist.
- O.M. Dyer, Dr. B., 17, Great Tower Street, London, E.C., Analytical and Consulting Chemist.
1907. Dyes, Dr. W. A.
1911. Dyke, F. Montague, Nelson Croft, Church Road, Bebington, Cheshire, Analytical Chemist.
- O.M. Dyson, C. E., Flint, North Wales.
1902. Dyson, George W., 24, Clarkehouse Road, Sheffield, Analyst.
1892. Dyson, Septimus, Nyddcombe, Warlingham, Surrey, Manufacturing Chemist.

E

1905. Eager, Chas. E., 77, Pearl Street, Boston, Mass., U.S.A., Merchant.
1904. Eames, Charles J., 99, Water Street, New York City, U.S.A., Consulting Chemist.
1910. Eardley, J. F., 265, Glossop Road, Sheffield, Pharmaceutical Chemist.
1913. Earl, J. C., c/o F. N. Faulding and Co., 54, King William Street, Adelaide, S. Australia, Chemist.

- O.M. Earp, W. R., Preston Brook, near Warrington, Chemical Manufacturer.
1910. Easterfield, Prof. Thomas H., Victoria College, Wellington, New Zealand, Prof. of Chemistry.
1884. Eastick, C. E. 13, King Edward Street, Whitechapel, E., Sugar Refinery Director.
1909. Eastick, J. C. N., 49A, Clapton Common, London, N.E., Electrochemist.
- O M. Eastick, J. J., 2, St. Dunstan's Hill, London, E.C., Consulting Sugar Expert.
1890. Eastlake, A. W., Grosmont, Palace Road, Streatham Hill, S.W., Consulting Petroleum Engineer.
1909. Eastlake, William H., The Cable Shop, Northern Electric Co., Ltd., Montreal, Canada, Chemist.
1914. Easton, Reginald F., 76, North Street, Westminster, Bristol, Technical Chemist.
1914. Eastwood, John A., "Horbury," Gordon Square, Marickville, Sydney, N.S.W., Dyer.
1909. Eberlin, Leon W., 11, First Street, Rochester, N.Y., U.S.A., Chemist.
1892. Eddy, Harrison P., 14, Beacon Street, Boston, Mass., U.S.A., Superintendent.
1913. Edge, Alfred, Ravenhurst, Clayton Bridge, Manchester, Technical Chemist.
1885. Edge, Anthony, 79, West Milton Street, Readville, Mass., U.S.A., Chemist.
1909. Edge, J. Harold, "Great Marld," Smithills, Bolton, Lancashire, Technical Chemist.
1902. Edison, Thos. Alva, Edison Laboratory, Orange, N.J., U.S.A., Inventor and Manufacturer.
1908. Edmunds, Wm. T., 25, Church Road, Burry Port, South Wales, Assayer.
1911. Edwards, Alfred, The Laboratory, Meadow Lane Gas Works, Leeds, Analytical Chemist.
1909. Edwards, George M., 241, Pine Avenue West, Montreal, Canada, Paintworks Manager.
1915. Edwards, H. C., "Neotsbury," Laton Road, Hastings, Chemist.
1902. Edwards, H. Leaton, The Shanty, Banks Avenue, Meols, Hoylake, Cheshire, Analyst.
1895. Ehrenfeld, Prof. Chas. H., York Collegiate Institute, York, Pa., U.S.A., Professor of Chemistry.
1896. Ehrhardt, Ernest F., The Mersey Chemical Co., Bromborough Port, New Ferry, Cheshire, Research Chemist.
1910. Eilsberger, Dr. Ernst, Deutsche Solvaywerke, Bernburg (Anhalt), Germany, Director.
1913. Elipper, William R., 1594, Elbur Avenue, Lakewood, Ohio, U.S.A., Chemist.
1909. Eisenhart, M. H., c/o Eastman Kodak Co., Kodak Park, Rochester, N.Y., U.S.A., Chemist.
1901. Elkan, Leo A., Tannery, 1511, Webster Avenue, Chicago, Ill., U.S.A., Tanner.
1901. Elkins, Arthur W., 116, Prospect Street, East Orange, N.J., U.S.A., Civil Engineer.
1884. Elliott, Dr. A. H., College of Pharmacy, 115, West 68th Street, New York City, U.S.A., Consulting Engineer and Chemist.
1912. Elliott, Edward, c/o Reckitts (Over-Sea), Ltd., Burke Street, Redfern, N.S.W., Australia, Chemical Engineer.
1907. Elliott, George K., c/o Lunkenheimer Co., Cincinnati, Ohio, U.S.A., Chief Chemist.
1896. Elliott, Dr. J. F., O'Connell Street, Sydney, N.S.W., Manufacturing Chemist.
1902. Elliott, Victor G., Chemical Works, Rozelle, Sydney, N.S.W., Australia, Manufacturing Chemist.
1905. Ellis, Carleton, 143, Gates Avenue, Montclair, N.J., U.S.A., Chemical Engineer.
1893. Ellis, E. Victor, c/o J. McLellan, 25, York Place, Edinburgh, Analytical Chemist.
1894. Ellis, G. Beloe, 70, Chancery Lane, London, W.C., Patent Agent.
1913. Ellis, Henry D., 30, Blackheath Park, S.E., Metallurgical Engineer.
1912. Ellis, Percival W., 90, Tooley Street, London Bridge, S.E., Tanning Material Merchant.
1910. Ellis, Ridsdale, 723, Monadnock Building, Chicago, Ill., U.S.A., Patent Agent.
1910. Ellis, Rowland H., c/o Olympia Oil and Cake Co., Barby Road, Selby, Yorks, Analytical Chemist.
1891. Ellison, Henry, Moor Lane House, Gonersal, near Leeds, Manufacturing Chemist.
- O.M. Elmore, A. S., 72, Gloucester Terrace, Hyde Park, London, W., Electro-Metallurgist.
1907. Elsdon, A. Vincent, 10, Gourock Road, Eltham, Kent, Analytical Chemist.
1911. Elsdon, Geo. D., Municipal Chemical Laboratory, 141, Regent Road, Salford, Manchester, Public Analyst.
1904. Elson, J. Hugh, Monroe Drug Co., Quincy, Ill., U.S.A., General Manager.
1909. Ely, Benjamin, The Limes, Pye Bridge, near Alfreton, Tar Distiller.
1910. Emanuel, Louis V., 165, Rector Street, Perth Amboy, N.J., U.S.A., Metallurgical Engineer.
1910. Embley, Dr. E. H., 245, Latrobe Street, Melbourne, Victoria, Australia.
1902. Emery, Arthur L., c/o Smith, Emery, and Co., 651, Howard Street, San Francisco, Cal., U.S.A., Chemical Engineer.
1907. Emmons, Frank W., c/o Washburn Crosby Co., Minneapolis, Minn., U.S.A., Chemist.
1907. Emslie, B. Leslie, 1102-1105, Temple Building, Toronto, Canada, Agricultural Chemist.
1894. Enequist, John, 3710, Avenue J., Brooklyn, N.Y., U.S.A., Chemical Engineer.
1904. Englehard, Charles, 30, Church Street, New York City, U.S.A., Platinum Importer.
1895. English, Frank H., 89, Belgrave Road, Wanstead, N.E., Analytical Chemist.
1906. Ephraim, Dr. Julius, II, Königgrätzerstrasse 69, Berlin, S.W., Germany, Chemist and Patent Agent.
1911. Epps, James W., Holland Street, London, S.E., Chemist.
1909. Epstein, Harry M., 175, Front Street, New York City, U.S.A., Works Manager.
1914. Erbslöh, S. II., Hafen 29, Düsseldorf, Germany, Engineering Chemist.
1907. Erdoes, Julius, 1100, Brook Avenue, New York City, U.S.A., Chemical Engineer.
1902. Erhart, Wm. H., 81, Maiden Lane, New York City, U.S.A., Manufacturing Chemist.
1904. Ermen, Walter F. A., The Cranbery, Juiz de Fora, Minas Geraes, Brazil, Analytical Chemist.
1888. Erskine, J. K., P.O. Box 88, Benoni, Transvaal, Analytical Chemist.
1897. Escher, Paul, c/o Swift and Co., Chemical Laboratory, Union Stock Yards, Chicago, Ill., U.S.A., Chemist.
1884. Esilman, A., 38, Norwood Avenue, Southport, Lancashire, Analytical Chemist.
1913. Esling, Fred., c/o Burmah Oil Co., Ltd., Gresham House, Old Broad Street, London, E.C., Chemical Engineer.
1912. Espenhahn, E. V., c/o Metropolitan Gas Co., 186, Flinders Street, Melbourne, Victoria, Australia, Works Chemist.
- O.M. Estcourt, C., 5, Seymour Grove, Old Trafford, Manchester, Consulting Chemist.
1903. Euler, C. G., 18-20, Platt Street, New York City, U.S.A., Chemical Agent.
1912. Evans, Edward V., South Metropolitan Gas Co., Old Kent Road, London, S.E., Chief Chemist.
1883. Evans, Enoch, 660, Coventry Road, Birmingham, Accountant.
1903. Evans, F. Sparke, Avonside Tannery, Bristol, Tanner.
1905. Evans, Geo. A., 832, Yonge Street, Toronto, Canada, Pharmacist.
1913. Evans, George A., c/o Australian Explosives and Chemical Co., Ltd., 135, William Street, Melbourne, Victoria, Australia, General Manager.
1905. Evans, John, 67, Surrey Street, Sheffield, Analytical Chemist.
1908. Evans, Prof. Nevil Norton, Redpath Library, McGill University, Montreal, Canada, Associate Professor of Chemistry.

1912. Evans, Sam, 4, Whickham Avenue, Dunston-on-Tyne, Chemist.
 1912. Evans, Ulick R., 28, Victoria Street, Westminster, S.W., Consulting Electrochemist.
 1898. Evans, Wm. Perceval, Canterbury College, Christchurch, New Zealand, Professor of Chemistry.
 1909. Everette, Dr. W. E., 3512, South 11th Street, Tacoma, Wash., U.S.A., Consulting Chemical Engineer.
 1904. Everitt, Walter, Norwood Wharf, Southall, Middlesex, Analyst.
 1912. Evers, Norman, c/o Allen and Hanbury's, Ltd., Bethnal Green, London, E., Analytical Chemist.
 1907. Eves, Archie, P., 762, East Buchtel Avenue, Akron, Ohio, U.S.A., Chemist.
 1894. Ewan, Dr. Thos., c/o Cassel Cyanide Co., Shuna Street, Maryhill, Glasgow, Chemist.
 1905. Eynon, Lewis, 4, Stag Lane, Buckhurst Hill, Essex, Chief Chemist (London Beetroot Sugar Association).

F

1898. Fadé, Louis, c/o Dr. F. Stockhausen, Weissfrauenstrasse 7-9, Frankfurt a/M., Germany, Chemist and Director.
 1902. Faill, Jas., 52, Robertson Street, Glasgow, Technical Chemist.
 1902. Fairchild, Benj. T., P.O. Box 1120, New York City, U.S.A., Manufacturing Chemist.
 1911. Fairchild, B. Tappen, 74, Laight Street, New York City, U.S.A., Analytical Chemist.
 1910. Fairclough, Lt.-Col. Brereton, Quarry House, Hill Cliffe, Warrington, Cheshire, Miller.
 1911. Fairfield, Thos. J., c/o W. T. Glover and Co., Trafford Park, Manchester, Analytical Chemist.
 1903. Fairhall, E. J., Lindfield, Windmill Lane, Southall, Middlesex, Chemist.
 O.M. Fairley, T., 17, East Parade, Leeds, Analytical Chemist.
 1901. Fairlie, Jas., Camelon Chemical Works, Falkirk, Manufacturing Chemist.
 1911. Farcy, F. O., 905, McGill Building, Montreal, P.Q., Canada, Chemist.
 1910. Farr, Harry, Free Library, Cardiff, Librarian.
 O.M. Farrant, N., c/o J. Nickolson and Sons, Ltd., Chemical Works, Hunslet, Leeds, Chemist.
 1913. Farrar, Stanley C., c/o John Wright and Co., Essex Works, Aston, Birmingham, Chemical Technologist.
 1897. Farrell, Frank J., Shanrahan, Beccles, Suffolk, Artificial Silk Manufacturer.
 O.M. Farrington, T., 4, Waterloo Place, Cork, Ireland, Chemical Engineer.
 1913. Farrow, F. D., Rhodes University College, Grahamstown, South Africa, Lecturer in Chemistry.
 1909. Fath, Dr. Arthur, Chemical Engineer.
 1903. Fawcitt, Prof. Chas. E., The University, Sydney, N.S.W., Australia, Prof. of Chemistry.
 1914. Fearnley, C. A., 1, Alcester Terrace, Shepherd's Lane, Leeds, Technical Chemist.
 1903. Feilmann, Dr. M. E., c/o Osram Lamp Works, Ltd., Brook Green, Hammersmith, W., Chemist.
 1913. Feldenheimer, Wm., 20, Holborn Viaduct, London, E.C., Clay Merchant.
 1914. Fell, Henry, Londesborough Hotel, Selby, Yorks, Chemist.
 1909. Fell, Wm. M. W., 27, Clarendon Road, Garston, Liverpool, Chemist.
 1905. Felton, Herbert L., 516, East Second Street, South Boston, Mass., U.S.A., Distiller.
 1900. Ferguson, Prof. Geo. A., 121, West 42nd Street, New York City, U.S.A., Professor of Analytical Chemistry.
 1914. Ferguson, Jas., Luton Road, Harpenden, Herts, Technical Chemist.

- O.M. Ferguson, Prof. J., The University, Glasgow, Professor of Chemistry.
 1902. Fergusson, Donald M., c/o Acadia Sugar Refining Co., Halifax, N.S., Canada, Analytical Chemist.
 1883. Fergusson, H., Prince Regent's Wharf, Victoria Docks, E., Technical Chemist.
 1893. Fiebing, John H., 238, Reed Street, Milwaukee, Wis., U.S.A., Leather Trade Chemist.
 1911. Field, Allan J., c/o G. Siegle Co., Rosebank, Staten Island, N.Y., U.S.A., Chemist.
 1885. Field, E. W., Brewer.
 1887. Field, S. S., 3, Glenluce Road, Blackheath, S.E., Manufacturing Chemist.
 1891. Field, Wm. Eddington, Martin Street, Elsternwick, Melbourne, Victoria, Chemist.
 1900. Filhis, Frank, 106, London Road, Neath, South Wales, Cement Works Manager.
 1907. Finch, Archibald M., Vitriol and Chemical Works, Cattedown, Plymouth, Chemical Manufacturer.
 1910. Findlater, James, c/o Price's Patent Candle Co., Ltd., Bromborough Pool, near Birkenhead, Chief Chemist.
 1910. Findley, Albert E., Dept. of Applied Science, The University, St. George's Square, Sheffield, Lecturer.
 1899. Finland, Jno. J., Kaslo, B.C., Canada, Analytical Chemist.
 1911. Fink, F. W., 420, Riverside Drive, New York City, U.S.A., Manufacturing Chemist.
 1904. Finn, Cornelius P., Hemsworth Colliery, near Wakefield, Yorks, Coke Ovens Manager.
 1903. Fischer, Dr. Carl, 213-215, Water Street, New York City, U.S.A., Chemist.
 1903. Fish, Chas. C. R., 439, Boylston Street, Boston, Mass., U.S.A., Chemist.
 1911. Fish, Charles W., Rose Hill, Rawcliffe Bridge, S.O., Yorks, Chemist and Paper Technologist.
 1900. Fisher, Henry, 16, East 96th Street, New York City, U.S.A., Teacher of Chemistry.
 1915. Fisher, L. E., The Laboratory, Messrs. Ardol, Ltd., Barlhy Road, Selby, Yorks, Works Chemist.
 1895. Fison, Jno., Messrs. Jas. Fison and Sons, Thetford, Norfolk, Chemical Manufacturer.
 1904. Fitch, A. J., 67, Branstone Road, Burton-on-Trent, Brewer's Chemist.
 1900. Fitz-Randolph, R.B., State Laboratory of Hygiene, Trenton, N.J., U.S.A., Bacteriologist and Chemist.
 1896. Flammer, E., c/o Kraemer und Flammer, Heilbronn a/N., Wurttemberg, Germany, Manufacturing Chemist.
 1913. Fleming, M. D., 26, Aytoun Road, Pollokshields, Glasgow, Analyst.
 1893. Fletcher, E. Morley, 30, Grosvenor Place, Newcastle-on-Tyne, Alkali Works Inspector.
 O.M. Fletcher, F. W., c/o Fletcher, Fletcher, and Co., Ltd., Holloway, N., Manufacturing Chemist.
 1891. Fletcher, R. Jaques, North Geelong, Victoria, Manufacturing Chemist.
 1904. Fletcher, Wm. E., 411, West Broad Street, Tamaqua, Pa., U.S.A., Chemist.
 1912. Flürscheim, Dr. Bernhard J., Rushmoor, Fleet, Hampshire, Research Chemist.
 1899. Foelt, Louis, 12, Atterbury Avenue, Trenton, N.J., U.S.A., Civil Engineer.
 1890. Foden, Alfred, 19, Lancaster Avenue, Sefton Park, Liverpool, Metallurgical Chemist.
 1900. Foersterling, Dr. H., c/o Roessler Hasslacher Chem. Co., Perth Amboy, N.J., U.S.A., Chemist.
 1895. Forbes, Paul R., c/o Geo. I. Watson, 86, Cannon Street, London, E.C., Chemist and Assayer.
 1911. Ford, Edward J., 36, Rue Vandermaelen, Molenbeck St. Jean, Brussels, Chemist.
 1893. Ford, J. B., jun., Michigan Alkali Co., Wyandotte, Mich., U.S.A., Secretary and Treasurer.
 1889. Ford, Jno. S., Abbey Brewery, Edinburgh, Analyst.
 1914. Ford, Joseph James, c/o Skinner and Holdford, Ltd., Waleswood Collieries, Waleswood, near Sheffield, Analytical Chemist.
 1885. Formoy, J. Arthur, Fairlight, Limpsfield, Surrey, (Jnls.) 16, Pulteney Street, Bath, Oil Expert.

- 1904 Forrest, Chas. N., Maurer, N.J., U.S.A., Chemist.
 1898. Forrest, J. Kerr, Brae Lea, Austen Road, Guildford, Surrey, Manufacturing Chemist.
 1890. Forrester, A. M., c/o Richmond Guano Co., Richmond, Va., U.S.A., Analytical Chemist.
 1905. Forrester, Il. A., Fabrica do Gaz, Recife, Pernambuco, Brazil, Chemical Works Manager.
 1909. Forshaw, Arthur, c/o John Wright and Co., Ltd., Essex Works, Aston, Birmingham, Works Chemist.
 1902. Forstall, Alf. E., 84, William Street, New York City, U.S.A., Consulting Gas Engineer.
 1902. Forster, Ferdinand E. P., c/o Messrs. Bass and Co., 19, Guild Street, and (Jnls.) The River House, Burton-on-Trent, Brewer's Chemist.
 1907. Forster, Francis, c/o Champion, Druce, and Co., Ltd., 6, Laurence Pountney Hill, London, E.C., Lead Manufacturer.
 1899. Forster, Dr. M. O., F.R.S., 84, Cornwall Gardens, South Kensington, S.W., Chemist.
 1884. Forster, Sir Ralph C., Bart., c/o Messrs. Bessler, Waechter, and Co., Salisbury House, Finsbury Circus, London, E.C., Chemical Merchant.
 1915. Forster, Dr. R. B., University College, Galway, Ireland, Chemist.
 1884. Forth, Henry, Stoke Lacy, Marple, Cheshire, Drysalter.
 1907. Forward, Charles C., Dept. of Inland Revenue Laby., 50, Bedford Road, Halifax, N.S., Canada, Chemist.
 1906. Foster, Robt. K., Church Street, Middle Brighton, Melbourne, Victoria, Pharmaceutical Chemist.
 O.M. Foster, R. Le Neve, Fulshaw Cottage, Wilmslow, Cheshire, Manufacturing Chemist.
 1888. Foster, Wm., St. Martin's Terrace, Newton Park, Leeds, Manufacturing Chemist.
 1906. Foucar, J. Louis, 15, Morden Road, Blackheath, S.E., Chemist.
 1891. Fowler, Dr. Gilbert J., Frankland Laboratory, Chem. Dept., Victoria University, Manchester, (Manchester Corporation Rivers Committee).
 1896. Fox, A. Stanley, Uplees, Faversham, Kent, Explosives Works Manager.
 1912. Fox, Charles P., 395, Doyle Street, Akron, Ohio, U.S.A., Chemist.
 1913. Fox, Edward Carey, 27, Scarth Road, Toronto, Canada, Pork Packer.
 1898. Fox, Jno., Varuna, Grappenhall, Cheshire, Analyst.
 1911. Fox, Dr. John J., 6, Alkham Road, Stamford Hill, N., Government Analyst.
 O.M. Fox, T., jun., c/o Fox Bros. and Co., Ltd., Welling-ton, Somerset, Wool Manufacturer.
 1905. France, Edward W., Philadelphia Textile School Broad and Pine Streets, Philadelphia, Pa., U.S.A., Director.
 O.M. Francis, E. G., 29, Matheson Road, West Kensington, W., and (Jnls.) c/o T. Fitzgibbon, 115, Harbour Street, Fulham Palace Road, S.W., Glucose Works Manager.
 O.M. Francis, G. Bult, The British Drug Houses, Ltd., 22-30, Graham Street, City Road, London, N., Wholesale Druggist.
 O.M. Francis, W. H., 11, Bramham Gardens, South Kensington, London, S.W., Wholesale Druggist.
 1906. Frank, Prof. Dr. A., Bismarckstrasse 10, Charlottenburg, Germany, Chemist.
 1908. Frank, Dr. Fritz, Lützowstrasse 96, Berlin, W., 68, Germany, Public Analyst.
 1894. Frank, Jerome W., 29, Broadway, New York City, U.S.A., Chemist.
 1886. Frankenburg, Isidor, Greengate Rubber Works, Salford, Manchester, Indiarubber Manufacturer.
 1912. Frankenburg, Sydney, Hefferston Grange, Weaverham, Cheshire, Indiarubber Manufacturer.
 1895. Frankforter, Dr. G. B., University of Minnesota, Minneapolis, Minn., U.S.A., Prof. of Chemistry.
 1904. Frankl, A., Clothilde Chemical Works, Nagy Boeskö, Hungary, Manager.
 O.M. Frankland, H., Streonshalh, The Crescent, Linthorpe, Middlesbrough, Analytical Chemist.
 O.M. Frankland, Prof. P. F., F.R.S., The University, Edgbaston, Birmingham, Professor of Chemistry.
 1901. Frasch, Hans A., 52, Broadway, New York City, U.S.A., Manager.
 1910. Fraser, Arthur, Casilla 1464, Valparaiso, Chile, Analyst.
 1891. Fraser, L. McG., Engineering Works, Dagenham, Essex, Chemical Engineer.
 1902. Frederick, Geo. E., jun., P.O. Box 762, New York, City, U.S.A., Chemical Merchant.
 1900. French, Thos., 806, Stanley Street, Nelson, B.C., Canada, Chemist.
 1911. French, Wm., Wheatfield, Dallas Road, Lancaster, Manager.
 1903. Frerichs, Dr. F. W., 4320, Washington Boulevard, St. Louis, Mo., U.S.A., Manufacturing Chemist.
 1913. Frew, John, Box 1, Johannesburg, South Africa, Chemist.
 1907. Freytag, Henry, c/o O. Isler and Co., 35, Dickinson Street, Manchester, Chemical Merchant.
 1886. Fries, Dr. Harold H., 92, Reade Street, New York City, U.S.A., Chemical Manufacturer.
 1899. Fritzsche, Karl, c/o Schimmel und Co., Miltitz, near Leipzig, Germany, Manufacturer of Essential Oils.
 1915. Frost, Charles E., 259, Metcalfe Avenue, Westmount, P.O., Canada, Manufacturing Chemist.
 1884. Frost, Joe, Rocky Mount, Somerset Road, Huddersfield, Manufacturing Chemist.
 O.M. Fryer, Dr. A. C., 13, Eaton Crescent, Clifton, Bristol, Alkali Works Inspector.
 1904. Fryer, P. J., The Firs, Nettlestead Green, Kent, Analyst.
 1889. Fuerst, Jos. F., 17, Philpot Lane, London, E.C., Chemical and Oil Merchant.
 1895. Fuerst, W. F., 87, Nassau Street, New York City, U.S.A., Chemical Merchant.
 1913. Fulks, Elbridge B., American Tar Products Co., 208, South La Salle Street, Chicago, Ill., U.S.A., Vice-President.
 1894. Fuller, Chas. J. P., 603, Chorley New Road, Horwich, near Bolton, Analytical Chemist.
 1914. Fuller, Cyril D., Aspinall's Enamel, Ltd., New Cross, S.E., Works Manager.
 1902. Fuller, Henry C., Institute of Industrial Research, Washington, D.C., U.S.A., Analytical Chemist.
 O.M. Fuller, Wm., Vanbrugh Cottage, Maze Hill, S.E., Chemist.
 1898. Fulmer, Elton, Pullman, Wash., U.S.A., Professor of Chemistry.
 1909. Fulweiler, W. H., 1706, North Broad Street, Philadelphia, Pa., U.S.A., Engineer.
 1885. Fyfe, Jno., 7, West George Street, Glasgow, Oil Works Director.

G

1915. Gaby, F. A., Hydro-Electric Power Commission of Ontario, 709, Continental Life Building, Toronto, Canada, Chief Engineer.
 1909. Gaede, Chas. W., c/o National Silk Dyeing Co., Williamsport, Pa., U.S.A., Silk Dyer.
 1913. Gage, Roscoe M., The Oaks, Springfield, Mass., U.S.A., Chemical Engineer.
 1906. Gagnebin, Chas. L., 140, Oliver Street, Boston, Mass., U.S.A., Dyestuff Merchant.
 1907. Gaines, Richard H., 147, Varick Street, New York City, U.S.A., Chemist (Board of Water Supply).
 1904. Gair, C. J. Dickenson, 39, Cranston Road, Forest Hill, S.E., Analytical Chemist.
 1912. Gajjar, M. J., Techno-chemical Laboratory, Girgaum, Bombay, India, Consulting Chemist.
 1912. Gale, Corp. R. C., 38, Scarsdale Villas, Kensington, W., and (Jnls.) London Electrical Engineers, Drake's Island, Plymouth, Technical Chemist.
 1884. Gall, Henry, 2, Rue Blanche, Paris, France, Technical Chemist.

1905. Gall, J. B., c/o Callender's Cable and Construction Co., Belvedere, Kent, Chemist.
1911. Gallagher, Jas. L., c/o Lever Bros. Ltd., Sydney, N.S.W., Australia, Chemist.
1897. Gallotly, J. C., c/o Newlands and Warner, 135, St. Vincent Street, Glasgow, Rubber Chemist.
1901. Gallivan, Dr. Frank B., 113, Third Street, South Boston, Mass., U.S.A., Chemist.
1903. Gallum, Albert F., 1000, North Water Street, Milwaukee, Wis., U.S.A., Tanner.
1901. Gallup, W. Arthur, Arnold Printworks, North Adams, Mass., U.S.A., Printer.
1901. Galpin, Harry T., 57, West 57th Street, New York City, U.S.A., Chemist.
1891. Galt, Hugh Allen, Columbia Chemical Co., Barberton, Ohio, U.S.A., Works Manager.
1894. Gane, Eustace H., 91, Fulton Street, New York City, U.S.A., Pharmaceutical Chemist.
1901. Gansser, Dr. A., c/o Messrs. Lepetit, Dollfus, & Gansser, Garcesio-Ponte (Provincia di Cuneo), Italy, Chemical Engineer.
1911. Garbutt, C. Durham, 43, Island Road, Garston, Liverpool, Analytical Chemist.
1896. Gardair, Aimé 51, Rue St. Ferréol, Marseilles, France, Director of Chemical Co.
1910. Gardner, Arthur L., 233, Water Street, Perth Amboy, N.J., U.S.A., Chemical Engineer.
1907. Gardner, Edward, The Tryst, Bigwood Road, Meadway, Hendon, N.W., Metallurgical Chemist.
1909. Gardner, Henry A., 19th and B Streets N.W., Washington, D.C., U.S.A., Chemist.
1913. Gardner, Henry D., jun., 11, Glenmore Road, Belsize Park, London, N.W., Technical Chemist.
1891. Gardner, Prof. Walter M., Technical College, Bradford, Director of Chemical and Dyeing Departments.
1897. Garfield, Jos., Thackley, Bradford, Yorks, Civil Engineer.
1888. Garibaldi, Joachim A., 21, Church Place, Gibraltar, Chemist.
1910. Garland, Charles S., 57, Garratt Lane, Wandsworth, S.W., Chemist and Works Manager.
1911. Garner, John H., Sewage Works, Deighton, Huddersfield, Chemist.
1890. Garrett, Col. Dr. F. C., Armstrong College, Newcastle-on-Tyne, Teacher of Science.
1906. Garroway, Major John, 58, Buchanan Street, Glasgow, Chemist.
1908. Garson, Jas. W., Lancaster Court Hotel, Lancaster Gate, London, W., Managing Director, Lewis Berger and Sons, Ltd.
- O.M. Garton, Sir Richard, Messrs. Hill, Garton, and Co., Southampton Wharf, Battersea, S.W., Glucose Manufacturer.
1886. Gascoyne, Dr. W. J., 27, South Gay Street, Baltimore, Md., U.S.A., Analytical Chemist.
- O.M. Gaskell, Holbrook, Erindale, Frodsham, Cheshire, Alkali Manufacturer.
1902. Gaskell, Holbrook, jun., Hillcroft, Church Road, Woolton, near Liverpool, Engineer.
1915. Gatecliff, John, 32, Delf Lane, Leeds, Works Chemist.
1908. Gatehouse, Frank B., "Maristowe," Butts Green Road, Hornchurch, Essex, Chemist and Technical Journalist.
1912. Gates, Alfred E., c/o Messrs. T. Lye and Sons, Luton, Beds. Works Chemist.
- O.M. Gathral, Geo., Beechwood, Sherbourne Road, Acocks Green, near Birmingham.
1906. Gaunt, Percy, Macclesfield Corporation Sewage Works, Prestbury, near Macclesfield, Chemist.
1912. Gee, Wm. J., 48, Kingsmead Road, Tulse Hill, London, S.W., Chemical Engineer.
1891. Geisler, Dr. Jos. F., New York Mercantile Exchange Building, 6, Harrison Street, New York City, U.S.A., Consulting Chemist.
1901. Gemmell, G. H., 4, Lindsay Place, George IV Bridge, Edinburgh, Analytical Chemist.
1907. Gemmell, Wm., 3, East Parade, Newcastle-on-Tyne, Analytical Chemist.
1901. Gent, Percy W., Trentholme, Misterton, near Gainsboro', Chemist.
1897. Gent, Wm. T., Springfield, Misterton, near Gainsboro', Metallurgical Chemist.
1913. Gepp, Herbert W., c/o Amalgamated Zinc (De Bavay's), Ltd., Broken Hill, N.S.W., Australia, General Manager.
1906. Gorkensmeyer, Henry H., 207, Mississippi Avenue, Joliet, Ill., U.S.A., Chemist.
- O.M. Gerland, Dr. B. W., 105, Plantation Street, Accrington, Consulting Chemist.
1912. Ghislain, Raoul, 18, Rue du Mont de Piété, Mons, Belgium, Chemical Engineer.
1908. Gianoli, Prof. Giuseppe, Via Porlezza 2, Milano, Italy, Chemical Engineer and Editor (L'Industria).
1912. Gibb, W. Doig, South Metropolitan Gas Co., 709, Old Kent Road, London, S.E., Chief Engineer.
1911. Gibbings, W. Alan, P.O. Box Sannomiya 174, Kobe, Japan, Works Manager and Chemist.
1903. Gibbings, Wm., Woodside, Halebank, Widnes, Works Manager.
1910. Gibbins, Roland B., 18, Wheelley's Lane, Birmingham, Chemical Manufacturer.
1902. Gibbon, Edw., Belvedere, Park Road, Clydach, R.S.O., Glam., Works Chemist.
1915. Gibbon, John, The British Explosives Syndicate, Ltd., Factory, Pitsey, Essex, Chemist.
1904. Gibbs, A. E., c/o Pennsylvania Salt Manufacturing Co., Greenwich Point, Philadelphia, Pa., U.S.A., Manufacturing Chemist.
1913. Gibbs, Victor G., c/o Wm. Pearson, Ltd., Clough Road, Hull, Works Manager.
- O.M. Gibbs, Wm. P., The Sulphito Pulp Mills, Hjerpen, Sweden, Analytical Chemist.
- O.M. Gibson, J. M., c/o Buckley Brick and Tile Co., Buckley, via Chester, Brick and Tile Manufacturer.
1905. Gibson, John, 360-366, Collins Street, Melbourne, Vic., Australia, Concrete Manufacturer.
1913. Gibson, R. M., 58, Chester Road, Buckley, via Chester, Clay Goods Manufacturer.
1913. Gibson, Stanton, 28, Lordship Park, Stoke Newington, N., Factory Chemist.
1905. Gibson, Wm. F., 72, Woodstock Avenue, Golders Green, N.W., Works Chemist.
1914. Gidden, W. T., Woodside, Abbey Road, Smethwick, near Birmingham, Technical Chemist.
1899. Gifford, Wm. E., c/o Baker and Co., 408, New Jersey Railroad Avenue, Newark, N.J., U.S.A., Chemist.
1892. Gilbard, J. Francis H., 245, Dalston Lane, Hackney, N.E., Analytical Chemist.
1905. Gilbertson, Isaac H., 33, Broad Street, Rhodes, near Middleton, Lancs., Calico Printer.
1903. Gilby, Joseph W., 58, Beecha Road, West Bromwich, Staffs, Works Chemist.
- O.M. Gilchrist, Percy Carlyle, F.R.S., A.R.S.M., M.Inst.C.E. & M.E., Reform Club, Pall Mall, London, S.W., Metallurgist.
1884. Gilchrist, Peter S., Charlotte, N.C., U.S.A., Chemical Engineer.
1900. Gildersleeve, W. H., Johnson City, Tenn., U.S.A., Chemist.
- O.M. Giles, W. B., The Grange, Leyton, Essex, Chemical Manufacturer.
1886. Gill, Dr. Aug. H., Massachusetts Institute of Technology, Boston, Mass., U.S.A., Professor of Technical Analysis.
1913. Gill, Harold W., South African School of Mines and Technology, Johannesburg, South Africa, Lecturer on Chemistry.
1915. Gill, Hubert A., 55-56, Chancery Lane, London, W.C., Chartered Patent Agent.
1909. Gill, John H., 16, Premier Road, Gregory Boulevard, Nottingham, Soapworks Chemist.
1901. Gill, Wm. S., c/o Farquhar and Gill, North of Scotland Colour Works, Aberdeen, Colour and Varnish Manufacturer.
1901. Gilles, Wm. S., The Cottage, Bocking, near Braintree, Essex, Technical Chemist.
1888. Gillman, Gustave, Ferrocarril de Murcia á Granada, Aguilas, Prov. de Murcia, Spain, Civil Engineer.

1891. Gimmingham, Edw. A., Croyland, Clapton Common, N., Technical Electrician.
1886. Girdwood, Dr. G. P., 615, University Street, Montreal, Canada, Professor of Chemistry.
1906. Girtin, Thomas, H. L. Raphael's Refinery, 48, Thomas Street, Burdett Road, London, E., Bullion Refiner.
1903. Gladding, Thos. S., 181, Front Street, New York City, U.S.A., Analytical Chemist.
1886. Glaeser, F. A., Carpenters' Road, Stratford, E., Varnish Manufacturer.
1906. Glass, A. Melville, "Copley Dene," Park Avenue, Hampstead, N.W., Patent Agent.
1901. Glegg, Robt., Agricultural Laboratory, Marischal College, Aberdeen, Analytical Chemist.
1894. Glen, Chas., Glengowan Printworks, Caldercruix, Scotland, Calico Printer.
1884. Glendinning, H., Winnington House, Northwich, Cheshire, Technical Chemist.
1888. Gloag, Robt. F., Lothian Road, Middlesbrough, Secretary.
1912. Gloag, Vivian F., Millbury House, Darlington Road, Ferryhill, Co. Durham, Chemical Works Manager.
1896. Glover, H., 6445, Emlen Street, Germantown, Philadelphia, Pa., U.S.A., Chemical Works Superintendent.
- O.M. Glover, William, Albareda 27, Seville, Spain, Technical Chemist.
1911. Gmach, Ludwig T., Kew Bridge Label Works, Waldeck Road, Chiswick, W., Manufacturer.
1911. Goetchius, John M., c/o General Chemical Co., 25, Broad Street, New York City, U.S.A., Sales Manager.
1915. Golding, Geo., "Haverthwaite," Litherland Park, Liverpool, Analytical Chemist.
1898. Golding, Jno., University College, Reading, Agricultural Chemist.
1906. Goldschmidt, Dr. Karl, Chemical Works, Essen-Ruhr, Germany, Manufacturing Chemist.
- O.M. Goldschmidt, Dr. S. A., 11, Broadway, New York City, U.S.A., President (Columbia Chemical Works).
1897. Goldschmidt, Dr. Guido, Wasagasse 9, Wien IX, Austria, Professor of Chemistry, University of Vienna.
1895. Goldsmith, Byron B., 19, East 74th Street, New York City, U.S.A., Vice-President (American Lead Pencil Co.).
1899. Goldsmith, Dr. Jno. N., 67, Chancery Lane, London, W.C., Chemist.
1914. Goldsmith, L. D., 31, Colvestone Crescent, West Hackney, N.E., Research Chemist.
1906. Goodall, Wm. Leslie, Finboro' Road, Stowmarket, Suffolk, Works Chemist.
1909. Goodban, Leonard, 43, Addison Gardens, Kensington, London, W., Works Chemist.
1912. Gooderham, J. Leys, 49, Wellington Street East, Toronto, Canada, Chemist.
1904. Gooding, E. Claude, Willow House, Washford, Somerset, Chemist.
1913. Goodman, Alexander, c/o Lever Bros., Ltd., Sunlight Wharf, Upper Thames Street, London, E.C., Manager.
1915. Goodman, V. E., c/o Waterlow and Sons, Ltd., 68-70, Worship Street, Finsbury, E.C., Manager of Cheque Department.
1898. Goodrich, Chas. C., 60, Broadway, New York City, U.S.A., Rubber Manufacturer.
1884. Goodwin, C. C., Racefield, St. Margaret's Road, Altrincham, Cheshire, Soapmaker.
1913. Goodwin, H. W., c/o Charles Case and Sons, Westbury, Wilts, Analytical Chemist.
1894. Goodwin, Dr. W. L., Library Dept., Gordon Hall, School of Mining, Kingston, Canada, Professor of Chemistry.
- O.M. Goppelsroeder, Prof. Dr. F., Leimenstrasse 51, Basel, Switzerland, Professor of Chemistry.
1884. Gordon, J. G., Queen Anne's Mansions, Westminster, S.W., Steel Manufacturer.
1904. Gotthelf, August H., Hastings-on-Hudson, N.Y., U.S.A., Chemist.
1914. Gotts, H. S., Corrisson Works, Carnwarth Road, Fulham, S.W., Sugar Manufacturers.
1890. Goulding, Sir Wm. J., Bart., c/o W. and H. M., Goulding, Ltd., Alexandra Road, East Wall, Dublin, Manure Manufacturer.
- O.M. Gowland, Prof. W., F.R.S., 13, Russell Road, Kensington, W., Professor of Metallurgy (Royal School of Mines).
1886. Goyder, G. A., 110, Gawler Place, Adelaide, South Australia, Chemist and Assayer.
1890. Grabfield, Dr. J. P., c/o Morris and Co., Chemical Laboratory, Union Stock Yards, Chicago, Ill., U.S.A., Chemist.
1906. Graesser, Norman H., Argoed Hall, Llangollen, N. Wales, Manufacturing Chemist.
- O.M. Graham, C. C., Oriel House, Scarborough, Yorks, Technical Chemist.
1913. Graham, Jos. I., Chemist.
1883. Grandage, H., c/o S. Smethurst and Sons, Woolfold Dye and Bleach Works, Bury, Lancashire, Dyer.
1914. Grandel, Paulin, Managing Director.
1897. Granger, Dr. J. Darnell, 57, Holmwood Street, Newtown, Sydney, N.S.W., Australia, Analytical Chemist.
1905. Grant, Alexander, 15, Hermitage Drive, Edinburgh, Baker.
1896. Graves, Geo. H., 219, West 81st Street, New York City, U.S.A., Manufacturing Chemist.
1896. Graves, Walter G., 1950, East 90th Street, Cleveland, Ohio, U.S.A., Chemist.
1914. Gray, George, 3, Victoria Drive, Rock Ferry, Cheshire, Technical Chemist.
1884. Gray, G. Watson, 8, Inner Temple, Dale Street, Liverpool, Consulting Chemist and Assayer.
1911. Gray, Dr. G. W., c/o The Texas Co., Houston, Texas, U.S.A., Chairman, Manufacturing Committee.
1910. Gray, H. Le Breton, c/o Eastman Kodak Co., Rochester, N.Y., U.S.A., Superintendent, Film Department.
1904. Gray, Jas., P.O. Box 5254, Johannesburg, Transvaal, Chemist.
1901. Gray, J. Campbell, The Cottage, Strines, near Stockport, Printworks Chemist.
1886. Gray, Jno., 3, Victoria Drive, Rock Ferry, near Birkenhead, Technical Chemist.
1896. Gray, Prof. Thos., Royal Technical College, Glasgow, Professor of Technical Chemistry.
1905. Gray, W. B., Messrs. Lever Bros., Durban, Natal, South Africa, Analytical Chemist.
1903. Gray, Wm. S., 76, William Street, New York City, U.S.A., Chemical Merchant.
1908. Gray, Wm. T., Port Credit, Ontario, Canada, Starch Manufacturer.
1909. Greeff, R. H., Thames House, Queen Street Place, London, E.C., and (Juls.) "Arima," Denbridge Road, Bickley, Kent, Chemical Merchant.
1894. Greeff, R. W., Thames House, Queen Street Place, London, E.C., and (Juls.) Elm Bank, Bromley, Kent, Chemical Merchant.
- O.M. Green, Prof. Arthur G., 49, Cardigan Road, Headingley, and The University, Leeds, Professor of Tinctorial Chemistry.
1907. Green, Clarence, c/o Nicholson's Raincoat Co., Beaumont Works, St. Albans, Herts, Chemist.
1906. Green, Ernest, 98, Cheadle Road, Cheadle Hulme, Cheshire, Science Teacher.
- O.M. Green, H., Hayle Mill, Maidstone, Paper Manufacturer.
- O.M. Green, L., Lower Tovil, Maidstone, Paper Manufacturer.
1915. Green, William, 206, Peel Mount, Burnley Road, Accrington, Lancs, Pottery Manager.
1908. Green, Dr. W. Heber, Chemical Laboratory, The University, Melbourne, Victoria, Lecturer in Chemistry.
- O.M. Greenaway, A. J., The Orchard, Chertsey, Surrey, Sub-Editor of Chemical Society's Journal.
1914. Greene, S. G., 10, Carlton Road, Sidcup, Kent, Analytical Chemist.
1909. Greenhough, George D., 21, Mincing Lane, London, E.C., Chemical Broker.

1913. Greenough, Thomas R., Beechwood, Leigh, Lancashire, Analytical Chemist.
1902. Greenwood, Conrad V., Noyna, Dowhills Road, Blundellsands, Liverpool, Cotton Mill Manager.
1907. Greenwood, Herbert W., c/o The Boundary Chemical Co., Ltd., Cranmer Street, Liverpool, Metallurgical Chemist.
- O.M. Greenwood, Holmes, Regent House, Hartmann Street, Accrington, Technical Chemist.
1897. Gref, Anthony, 117, Hudson Street, New York City, U.S.A., Patent Lawyer.
1909. Gregory, Cecil H., The Morgan Crucible Co., Battersea, London, S.W., Crucible Manufacturer.
1907. Gregory, Joshua C., 128, Wellington Street, Glasgow, Analytical and Consulting Chemist.
1912. Gresham, Harold E., County Laboratories, 36, Danksie Street, Liverpool, Analytical Chemist.
1915. Greville, Henry, 30, Empress Road, Liseard, Cheshire, Research Chemist.
1890. Griffin, Jno. R., Kemble Street, Kingsway, London, W.C., Chemical Apparatus Maker.
1886. Griffin, Martin L., c/o Oxford Paper Co., Rumford, Maine, U.S.A., Manager of Chemical and Electro-Chemical Department.
1912. Griffiths, Clement S., Central Queensland Meat Export Co., Ltd., Lake's Creek, Rockhampton, Queensland, Chemist.
1909. Griffiths, E., 136, George Street N., Sydney, N.S.W., Australia, Chemist.
1902. Griffiths, Manfred E., Caizley House, Temple Road, Stowmarket, Suffolk, Explosives Chemist.
1912. Grimké-Drayton, Norman, Royal Mint Refinery, 19, Royal Mint Street, London, E., Metallurgist.
1902. Grimwade, Wilfrid R., 335-343, Spencer Street, West Melbourne, Vic., Australia, Manufacturing Chemist.
1900. Grimwood, Robt. G., 43, Leaside Avenue, Muswell Hill, N., Analytical Chemist.
- O.M. Grindley, J., Upper North Street, Poplar, London, E., Tar Distiller.
1905. Grip, August E., 495, Columbia Street, Brooklyn, N.Y., U.S.A., Chemical Engineer.
1888. Gripper, Harold, Great Central Railway, Gorton, Manchester, Analytical Chemist.
1909. Grist, John M., c/o Curtis's and Harvey, Ltd., Explosives Works, Cliffe-at-Hoo, Kent, Chemist.
1912. Groeling, Alb. von, 3, Lombard Street, London, E.C., Civil and Consulting Engineer.
1906. Groenewoud, Sidney H., 36, Grosvenor Road Highbury, N., Analytical Chemist.
- O.M. Grossmann, Dr. J., 157, Plymouth Grove, Manchester, Consulting Chemist and Chemical Engineer.
1896. Grosvenor, Dr. W. M., Chemists' Building, 50, East 41st Street, New York City, U.S.A., Consulting Chemical Engineer.
1909. Grove, Daniel, "Yambo," Inverell, N.S.W., Australia, Diamond Buyer and Mine Owner.
- O.M. Groves, C. E., F.R.S., 352, Kennington Road, London, S.E., Chemist (Thames Conservancy).
1907. Groves, J. Stuart, c/o E. I. du Pont de Nemours Powder Co., Georgetown, S.C., U.S.A., Chemist.
1899. Gudemann, Dr. E., 903, Postal Telegraph Building, Chicago, Ill., U.S.A., Chemist.
1915. Guelpa di Luigi, G., 41, Corso Dante, Turin, Italy, Manufacturer and Engineer.
1911. Guild, Edward J., Craiglea, Hartington Street, Leek, Staffs, Analytical Chemist.
1899. Guild, Frank N., University of Arizona, Tucson, Arizona, U.S.A., Professor of Chemistry.
1909. Gullick, Wm. A., Government Printing Office, Sydney, N.S.W., Government Printer.
1906. Gulline, Percy, c/o Columbia Textile Co., Lowell, Mass., U.S.A., Agent.
1904. Gundlach, Walter, 249, West 104th Street, New York City, U.S.A., Superintendent of Colour Works.
1905. Gundlich, Dr. Charles, c/o Thorium Chemical Co., Maywood, N.J., U.S.A., Technical Chemist.
1903. Gunn, Gilbert, 181, Bury New Road, Heywood, Lanes, Paper Mill Chemist.
1900. Gunther, Chas. E., Third Floor, Thames House, Queen Street Place, London, E.C., Merchant.
1910. Günther, C. M., Condong Mill, Tweed River, N.S.W., Sugar Chemist.
1903. Guthrie, Alan, Dept. of Industries, Post Box 454, Madras, India, Leather Chemist.
1901. Guthrie, John M., 199, Ferry Road, Leith, Scotland, Analytical Chemist.
1909. Guttman, Camillo J., 60, Mark Lane, London, E.C., Chemical Engineer.
1903. Guttman, Dr. Leo F., School of Mining, Queen's University, Kingston, Ont., Canada, Professor of Physical Chemistry and Chemical Engineering.
1912. Guy, Wm. W., 6, Cecil Road, Upton Manor, E., Analytical Chemist.
1913. Gytton, Walter J., British Standard Cement Works, Rainham, Kent, Chemist.

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1904. Hacking, D. H., Enfield Soap Works, Clayton-le-Moors, near Accrington, Soap Manufacturer.
1900. Haddock, Arthur G. See Haydock.
1887. Hadfield, Sir Robert A., F.R.S., Heala Works, Sheffield; 22, Carlton House Terrace, London, S.W.; and (Journals) c/o J. E. Motimer, 220, Newhall Road, Attercliffe, Sheffield, Steel Founder.
1904. Hadley, Geo., Waterfall Lane, Blackheath, Staffs, Spelter Works Manager.
1887. Haig, Robert, Dollarfield, Dollar, Scotland, Chemical Engineer.
1904. Haigh, B. Wilson, By-Product Coke Oven Dept., Barnsley Main Colliery, Barnsley, Yorks, Chemical Engineer.
1896. Haigh, De Lagnel, 39, Hill Crest, Summit, N.J., U.S.A., Chemist.
1888. Hailes, A. J. de, 15, Red Lion Square, London, W.C., Analytical Chemist.
1910. Hailstone, Harold J., 44, Cordley Street, West Bromwich, Works Chemist.
- O.M. Hake, C. Napier, Jnls. to c/o Dr. A. W. Hake, Medical School, Caxton Street, Westminster, S.W., Chemical Advisor.
1903. Halbert, Thos., c/o British South African Explosives Co., Modderfontein, Transvaal, Chemist.
1888. Halo, Edw. P., Endmoor, near Kendal, Analytical Chemist.
1887. Hall, Allan T., c/o Sissons Bros. and Co., Ltd., Hull, Oil Refiner and Varnish Manufacturer.
1905. Hall, Archibald A., Armstrong College, Newcastle-on-Tyne, Demonstrator in Chemistry.
1898. Hall, Clarence A., 167, West Durham Street, Mount Airy, Philadelphia, Pa., U.S.A., Chemist.
1909. Hall, Harold, 98, Birkin Avenue, Hlyson Green, Nottingham, Analyst.
1885. Hall, Lt.-Col. Jno. A., Longstone, Esquimault Old Road, Victoria, B.C., Canada, Analytical Chemist.
1912. Hall, Robert H., Weardale Tar Works, Spennymoor, Co. Durham, Chemical Works Manager.
1896. Hall, Capt. S. Godfrey, East London Soap Works, Bow, E., Soap Maker.
1914. Hall, William A., Hall Motor Fuel, Ltd., Wilson's Wharf, Angel Road, Edmonton, N., Chemical Engineer.
1886. Haller, Geo., Sussex House, 52, Leadenhall Street, London, E.C., Chemical Merchant.
1893. Haller, H. Loft, 26, Seale Lane, Hull, Analytical Chemist.
1912. Halliday, McDonald, Oficina Buen Retiro, Pozo Almonte, Iquique, Chile, Analytical Chemist.
1895. Halliwell, Edw., c/o Ribble Joint Committee, 2, Stanley Place, Preston, Chief Inspector.
1900. Hallock, Dr. Albert P., 3, James Street, Yonkers, N.Y., U.S.A., Chemist.

1892. Hamaguchi, Gihei, IV., Toyoharacho, Komatsubaratori, Wakayamashi, Japan, Soy Manufacturer.
1897. Hambly, Fred J., Buckingham, Quebec, Canada, Chemist.
1901. Hambuechen, Carl, 4, Pennsylvania Avenue, Bellevue, Ill., U.S.A., Secretary (American Carbon and Battery Co.).
1910. Hamburg, Dr. Max, c/o The British Diamalt Co., Sawbridgeworth, Herts, Chemist and Manager.
1911. Hamilton, David J., Locksley, Helensburgh, Dumbartonshire, Oil Refiner and Paint Manufacturer.
1904. Hamilton, Edward H., Virginia Smelting Works, West Norfolk, Va., U.S.A., Manager.
1912. Hamilton, James, 9, Esplanade Avenue, Whitley Bay, Northumberland, Analytical Chemist.
1884. Hamilton, Robert, Glengarnock Chemical Co., Ltd., Glengarnock, Ayrshire, Works Manager.
1892. Hamilton, Robt., 40, Sefton Terrace, Beeston Hill, Leeds, Analytical Chemist.
1898. Hammersley, W. Stanley, Rue Champbertrand, Sens (Yonne), France, Tanner.
- O.M. Hammill, M. J., The Gables, St. Helens, Alkali Manufacturer.
- O.M. Hammond, J., Gas Works, Eastbourne, Sussex, Gas Manager.
1905. Hancock, Thos. J., 8011, Panola Street, New Orleans, La., U.S.A., Chemist.
1900. Hancock, Walter C., 10, Upper Chadwell Street, Myddelton Square, London, E.C., Chemist.
1896. Hand, Daniel, 30, Mount Pleasant Avenue, Newark, N.J., U.S.A., Chemist.
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1901. Hanna, Charles E., P.O. Box 600, Montreal, Canada, Secretary.
1905. Hanson, H. Norman, The Oaks, Huddersfield Road, Brighouse, Yorks, Research Assistant.
1908. Hanson, W. G., c/o United States Glue Co., Milwaukee, Wis., U.S.A.
1909. Harbord, F. W., 16, Victoria Street, Westminster, S.W., Consulting Metallurgist.
1905. Harcourt, Prof. E., Ontario Agricultural College, Guelph, Ont., Canada, Professor of Chemistry.
1904. Hard, Dr. James M. B., 422, Gravier Street, New Orleans, La., U.S.A., Chemist and Pathologist.
1901. Hardcastle, G. Fred., 307, East Park Road, Leicester, Teacher of Science and Technology.
1894. Harden, Dr. Arthur, F.R.S., 5, Cambridge Gardens, Marlborough Road, Richmond, Surrey, Lecturer in Chemistry.
1910. Hardie, Thos., Newcastle and Gateshead Gas Co., Tyneside Road, Newcastle-on-Tyne, Gas Engineer.
1915. Harding, Gilbert, I, Holmewood Gardens, Brixton Hill, S.W., Chemist.
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1900. Hardwick, W. Roscoe, 13, Batavia Buildings, Hackins Hey, Liverpool, Chemist.
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1907. Harfeld, Louis E., c/o Messrs. Ohlenschlager Bros., Shanghai House, Botolph Lane, London, E.C., Merchant.
1913. Harger, Dr. John, Grange Hollies, Gateacre, Liverpool.
1914. Hargreaves, C. H., Houghton House, Worsley Road, Swinton, Manchester, Analyst.
1906. Hargreaves, Frank, Hough Green, Widnes, Chemist.
- O.M. Hargreaves, Jno., Widnes, Alkali Manufacturer.
1904. Harker, Dr. George, Mount Errington, Hornsby, Sydney, N.S.W., Australia, Chemist.
1909. Harland, Robert M., 37, Lombard Street, London, E.C., Analytical Chemist and Assayer.
1893. Harlock, E. B., Newton House, Middlewich, Chemical Manufacturer.
1898. Harman, Edw. A., Gas Works, Huddersfield, Gas Engineer, M.Inst.C.E.
1905. Harper, Dr. Henry W., University of Texas, 2216, Rio Grande Street, Austin, Texas, U.S.A., Professor of Chemistry.
1912. Harper, J. G., Kynochtown, Stanford le Hope, Essex, Managing Chemist.
1913. Harper, William, P.O. Box 174, Sannomiya, Kobe, Japan, Works Chemist.
1912. Harran, Dr. Edward B., Abbey Field, Sandbach, Cheshire, Chemist.
1893. Harris, Arthur, 22, Marsh Gate Lane, Stratford, E., Soap Maker.
1885. Harris, Booth, jun., Beeleigh, Victoria Road, Buckhurst Hill, Essex, Soap Maker.
1897. Harris, Fred. W., 20, Trongate, Glasgow, Public Analyst.
1906. Harris, Jonathan W., c/o Western Electric Co., 463, West Street, New York City, U.S.A., Chemist.
1914. Harris, J. W., Lindum House, Swallowbeck, Lincoln, Chemist.
1914. Harris, Joseph, H., 994, Danforth Avenue, Toronto, Canada, Superintendent.
1907. Harris, Thos. E., c/o The Union Acid Co., 17, Cooper Street, Manchester, Chemical Merchant.
1906. Harris, Wm. G., jun., 35, Fraser Avenue, Toronto, Canada, Metallurgist.
1905. Harrison, E. F., Langholm, Edgar Road, South Croydon, Analytical Chemist.
1909. Harrison, Edwin D., 86, Harrison Place, Irvington, N.J., U.S.A., Celluloid Manufacturer.
1883. Harrison, G. Herbert, Hagley, Stourbridge, Firebrick Maker.
1892. Harrison, Prof. John B., C.M.G., Government Laboratory, Georgetown, British Guiana, Chemist.
1907. Harrison, W., 3, Regent Terrace, Hyde Park, Leeds, and (Jnls.) Fuel Dept., The University, Leeds, Technical Investigator.
1896. Hart, Bertram, c/o Tennants and Co., Clayton, Manchester, Analyst.
1886. Hart, Bertram H., Rosslyn, High Street, Sidcup, Kent, Analytical Chemist.
- O.M. Hart, Dr. E., Gayley Hall, Lafayette College, Easton, Pa., U.S.A., Professor of Chemistry.
1890. Hart, H. W., Wintthrop, Ansdell Road, Lytham, Lancashire, Analytical Chemist.
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1883. Hartley, Joseph, 73, East Road, Stockport Road, Longsight, Manchester, Technical Chemist.
1912. Hartley, Thos., 64, Westlecot Road, Swindon, Wilts, Teacher of Technical Chemistry.
1905. Hartshorne, Wm. D., Arlington Mills, Methuen, Mass., U.S.A., Agent.
1901. Hartwell, S. Warren, 120, North Fourth Street, Easton, Pa., U.S.A., Chemist.
1908. Harvey, Arthur J., 16, Acresfield Road, Pendleton, Manchester, Chemist.
1885. Harvey, Ernest W., 36, Arthur Road, Wimbledon Park, London, S.W., A.R.S.M., Engineer.
1913. Harvey, Hildebrand W., Hutton Mount, Brentwood, Essex, Research Chemist.
1891. Harvey, Sidney, South-Eastern Laboratory, Canterbury, Analytical Chemist.
1899. Harvey, Thos. F., 69, North Road, West Bridgford, Nottingham, Analyst (Drug Co.).
1883. Harvey, T. H., Cattedown, Plymouth, Chemical Manufacturer.
1903. Hasenclever, Max, Chemische Fabrik Rhenania, Aachen, Prussia, Chemical Manufacturer.
1906. Haskell, Walter F., 234, Bridge Street, Westbrook, Maine, U.S.A., Textile Chemist and Colonist.
1900. Haslwanter, Chas., 447, Spruce Street, Richmond Hill, Long Is., N.Y., U.S.A., Analytical Chemist.
1897. Hasslacher, Jacob, P.O. Box 1999, New York City, U.S.A., President, Roessler-Hasslacher Chemical Co.

1903. Hatschek, Emil, c/o S. Bornett and Co., Ltd., 19, St. Dunstan's Hill, London, E.C., Engineer.
1887. Hatton, Wm. P., c/o W. R. Hatton and Sons, Wormwood Scrubbs, W., Starch Works Manager.
1906. Havercroft, Arthur E., Glenholme, Westbourne Road, Ilornsea, Yorks, Chemist.
1899. Hawdon, H. S., Cleadon, near Sunderland, Chemical Works Manager.
1895. Hawker, E. W., Gladstone Chambers, Adelaide, South Australia, Metallurgist.
1910. Hawkes, Cornelius A., 43, Painswick Road, Gloucester, Analytical Chemist.
1902. Hawkins, Clement C., c/o The Texas Co., Port Neches, Texas, U.S.A., Chemist.
1897. Hawkins, Ernest M., Watling Chambers, Canterbury, Analytical Chemist.
1905. Hawkins, Henry, Moyola Villa, Lansdown, Limerick, Ireland, Gas Engineer.
1887. Hawliczek, Josef, c/o United Alkali Co., Intelligence Dept., Widnes, Consulting Chemical Expert.
1899. Haworth, Dr. Edw., Ivy Bank, Moughland Lane, Runcorn, Cheshire, Chemist.
1910. Haworth, John, 117, Millhouses Lane, Sheffield, Chemist and Sewage Works Superintendent.
1904. Hawthorn, J. H., Municipal Technical School, Leicester, Head Master.
1915. Hay, Alex H., Essex Wharf, Narrow Street, Limehouse, E., Caramel Manufacturer.
1914. Hay, George S., 24, Chetwynd Road, Highgate, N., Analytical Chemist.
1910. Hay, J. Gordon, 37, Worcester Road, Bootle, Liverpool, Analytical Chemist.
1915. Hay, William, 121, St. Vincent Street, Glasgow, Secretary.
- O.M. Haydn-Morris, J., 22, Largo das Fontanhas, Lisbon, Portugal, Technical Chemist.
1900. Haydock, A. G., c/o The Castner-Kellner Alkali Co., Wallsend-on-Tyne, Technical Chemist.
1909. Haydon, James R., 91, Amphill Road, Aigburth, Liverpool, Works Manager and Chemist.
1894. Haynes, David O., 82, Fulton Street, New York City, U.S.A., Proprietor, "Pharmaceutical Era."
1902. Hays, B. F., c/o E. R. Squibb and Sons, 80, Beekman Street, New York City, U.S.A., Pharmaceutical Chemist.
1906. Hayworth, W. P., 24, Tower Road, Dartford, Kent, Chemist.
1905. Hazard, Fred R., P.O. Box 2, Syracuse, N.Y., U.S.A., President (Solvay Process Co.).
1903. Hazen, Chas. R., 258, Prince Albert Avenue, Westmount, Quebec, Canada, Chemist.
1894. Heal, Carlton B., Hill Crest, Runcorn, Cheshire, Tanner.
1912. Healey, E., jun., St. Mary's Mills, Leicester, India-rubber Manufacturer.
1905. Heathcote, Henry L., c/o Rudge-Whitworth, Ltd., Coventry, Research Chemist.
1904. Heaton, Lieut. Noel, 72, Abbey Road, London, N.W.; (Jnls.) Imperial Hotel, Tenby, South Wales, Colour Manufacturer.
1905. Heberlein, Dr. Edw., c/o H. T. Enthoven and Sons, Ltd., 247, Rotherhithe Street, London, S.E., Works Manager.
1889. Hecht, Jos. L., c/o French and Hecht, Davenport, Iowa, U.S.A., Analytical Chemist.
1900. Heckman, J. Conrad, Larkin Soap Manufacturing Co., Seneca Street, Buffalo, N.Y., U.S.A., Chemist.
1914. Hector, Alex. B., c/o Burroughs, Wellcome and Co., 481, Kent Street, Sydney, N.S.W., Australia, Manager.
1885. Hedley, Armorer, Durrant House, Bournemouth, Hants.
1912. Hedley, Dr. Edgar P., Cape Explosives Works, Somerset West, C.C., South Africa, Chemist.
1902. Hechner, Prof. C. F., Ontario College of Pharmacy, Toronto, Canada, Professor of Chemistry.
- O.M. Hehner, Otto, 11, Billiter Square, London, E.C., Analytical and Consulting Chemist.
1908. Heilmann, Dr. Ernst, Güstrow, Mecklenburg, Germany, Chemical Manufacturer.
1914. Heinemann, Dr. A., The D.R. Syndicate, Ltd., Ryder's Green, West Bromwich, Research Chemist.
1887. Hellier, E. A., Avonside Varnish Works, St. Philip's Marsh, Bristol, Varnish Manufacturer.
1885. Hellen, Dr. R., 40, New Lowther Street, Whitehaven, Analytical and Consulting Chemist.
1903. Helps, D. H., c/o Reading Gas Co., King's Road Works, Reading, Engineer and Manager.
1898. Hemingway, Frank C. R., 1, Broadway, New York City, and (Journals) 6, East Union Avenue, Bound Brook, N.J., U.S.A., Chemical Manufacturer.
1883. Hemingway, H., 9, Albemarle Mansions, Heath Drive, Hampstead, N.W., Chemical Manufacturer.
1903. Hemstreet, George P., Hastings-on-Hudson, N.Y., U.S.A., Mechanical Engineer.
1910. Henderson, Ernest G., c/o Canadian Salt Co., Ltd., Windsor, Ont., Canada, Vice-President and Manager.
1883. Henderson, Prof. G. G., Royal Technical College, George Street, Glasgow, Professor of Chemistry.
1902. Henderson, Dr. Jas. A. Russell, Stranord, West Kilbride, Ayrshire, Professor of Chemistry and Physics.
1894. Henderson, Jos., Eskbank Ironworks, Lithgow, N.S.W., Australia, Blast Furnace Manager.
1894. Henderson, Norman M., Broxburn Lodge, Broxburn, Scotland, Oil Works Manager.
1915. Henderson, T. A., 93, Roxborough Street West, Toronto, Canada, Chemical Works Manager.
- O.M. Henderson, W. F., Moorfield, Claremont Gardens, Newcastle-on-Tyne.
1893. Hendrick, Prof. Jas., Marischal College, Aberdeen, Professor of Agriculture.
1906. Henins, Dr. Max, 1135-1147, Fullerton Avenue, Chicago, Ill., U.S.A., Secretary, Brewers' School.
1912. Henley, Andrew T., Lady's Well Brewery, Cork, Ireland, Technical Chemist.
1904. Henley, Hon. F. R., 49, Montagu Square, London, W., Brewer's Chemist.
1905. Henning, Albert, c/o Hedley and Co., 92, Harrow Road, Leytonstone, N.E., Ester Manufacturer.
1906. Henning, C. I. B., c/o E. I. du Pont de Nemours Powder Co., Experimental Station, P.O. Henry Clay, Del., U.S.A., Chemist.
1914. Henshaw, D. M., c/o W. C. Holmes and Co., Ltd., Whitestone Ironworks, Huddersfield, Chemical Engineer.
1894. Henshaw, Sam., Glenthorne, Wolstanton, Stoke-on-Trent, Chemical Works Manager.
1910. Hepburn, Edward, Priory Works, Dartford, Kent, Tanner.
1888. Hepworth-Collins, W., Junior Constitutional Club, Piccadilly, London, W.; retain Journals, Civil Engineer.
1914. Herdsman, Frank, 144, Wellington Street, Glasgow, Consulting Chemist and Metallurgist.
1906. Herig, Harry W., c/o General Chemical Co., Hudson River Works, Edgewater, N.J., U.S.A., Chemist.
1897. Heriot, T. H. P., Royal Technical College, Glasgow, Lecturer in Sugar Manufacture.
- O.M. Herman, W. D., Holm Lea, Rainhill, Lancashire, Glass Works Chemist.
1903. Herreshoff, J. B. F., 620, West End Avenue, New York City, U.S.A., Chemical Engineer.
1887. Herriot, Wm. Scott, Clarewood, Thorntonhall, Lanarkshire, Mechanical Engineer.
- O.M. Herrmann, R. W., 59, Mark Lane, London, E.C., Chemical Merchant.
1891. Hersam, Ernest A., University of California, Berkeley, Cal., U.S.A., Associate Professor of Metallurgy.
1898. Hersey, Dr. Milton L., P.O. Box 1086, Montreal, Canada, Consulting Chemist.
1906. Herty, Prof. Chas. H., University of N. Carolina, Chapel Hill, N.C., U.S.A., Professor of Chemistry.
1906. Herz, Dr. Albert, c/o John Crossley and Sons, Ltd., Halifax, Yorks, Chemist.

1907. Hess, Arthur F., c/o A. Hess and Bro., Ltd., Kirkstall Road, Leeds, Oil Distiller.
1905. Hesse, Dr. Bernhard C., 90, William Street, New York City, U.S.A., Chemist.
1891. Hetherington, Dr. Albert E., Ammonia Soda Works, Fleetwood, Lancashire, Analytical Chemist.
1894. Hewitt, A. H., The Green Island Cement Co., Ltd., Hong Kong, China, Engineer.
1910. Hewitt, Arthur, c/o Consumers' Gas Co., 19, Toronto Street, Toronto, Canada, General Manager.
- O.M. Hewitt, Dr. D. B., 28, Queen's Gardens, Hyde Park, London, W., Alkali Manufacturer.
1896. Hewitt, Dr. J. Theo., F.R.S., Clifford House Bedford, Middlesex, Lecturer.
1890. Hewlett, John C., 40—42, Charlotte Street, Great Eastern Street, London, E.C., Manufacturing Chemist.
1907. Hewson, Geo. W., Grasmere, Field Terrace, Jarrow-on-Tyne, Analytical Chemist.
1893. Hey, Harry, 2, Ash Terrace, Savile Town, Dewsbury, Dyer.
1894. Heyl, G. Edward, 61-62, Lincoln's Inn Fields, London, W.C., Chemical and Electrical Engineer.
1906. Heys, Charles H., Toronto Arcade, Toronto, Canada, Consulting Chemist.
1915. Hibbert, Gilbert S., Backton Vale Print Works, Stalybridge, Cheshire, Printworks Manager.
1901. Hiby, Dr. Walter, c/o The Otto Hilgenstock Coke Oven Co., Ltd., Post Office House, Leeds, Chemical Engineer.
1906. Hicking, W. Norton, Queen's Road Works, Nottingham, Lace Dresser.
1906. Hickman, T. Moore, Oakleigh, Tettenhall Wood, Wolverhampton, Analyst.
1897. Hicks, Edwin F., 4837, Fairmount Avenue, Philadelphia, Pa., U.S.A., Analytical Chemist.
- O.M. Higgin, W. H., c/o C. J. Schofield, Ltd., Alkali Works, Clayton, Manchester, Chemical Manufacturer.
1913. Higgins, A. Howard, Metallurgist.
1915. Higgins, C. A., c/o The New Explosives Co., Ltd., 62, London Wall, London, E.C., Works Chemist.
1886. Higgins, C. L., 41, Knowsley Road, Cressington Park, Liverpool, Manufacturing Chemist.
1905. Higgins, Dr. Eric, Chemist.
1905. Higgins, John M., 39, Queen Street, Melbourne, Vic., Australia, Consulting Metallurgist.
1908. Higgins, S. H., Luncarty Bleachfield, Perth, Chemist and Asst. Manager.
1909. Higson, Frank, 52, Chapel Street, Salford, Manchester, Analytical Chemist.
1909. Higuchi, Ken-ichi, Central Laboratory, South Manchuria Railway Co., Dairen, Manchuria, Chemical Engineer.
1911. Hilditch, T. P., Birchdene, Cross Lane, Grappenhall, Warrington, Research Chemist.
1903. Hill, Chas. Alex., c/o British Drug Houses, Ltd., 22—30, Graham Street, City Road, N., Chemist.
1897. Hill, Dr. Herbert M., 20, West Eagle Street, Buffalo, N.Y., U.S.A., City Chemist.
1907. Hill, James A., 8, Highfield Crescent, Rock Ferry, Cheshire, Technical Chemist.
1908. Hill, J. H. F., c/o Broken Hill Proprietary Co., Steel Works, Newcastle, N.S.W., Australia, Superintendent, Coke and By-Product Plant.
- O.M. Hill, J. K., 13, Osborne Place, Ibrox, Glasgow, Manufacturing Chemist.
1892. Hill, Sydney, c/o Blundell, Spence, and Co., Ltd., Hull, Analytical Chemist.
1903. Hill, W. Basil, Foss Islands Tannery, York, Tanner.
1902. Hill, Wm. G., jun., c/o Apsley Rubber Co., Hudson, Mass., U.S.A., Chemist.
1898. Hill-Jones, Thos., Invicta Mills, Bow Common Lane, London, E., Manufacturing Chemist.
1894. Hills, Harold F., Commercial Gas Works, Stepney, London, E., Analytical Chemist.
- O.M. Hills, W., Oxford Works, Tower Bridge Road, London, S.E., Pharmaceutical Chemist.
1899. Hinchley, J. W., 55, Redcliffe Road, London, S.W., Chemical Engineer.
1904. Hinchley, J. F., 69, Rugby Road, Brooklyn, N.Y., U.S.A., Chemical Engineer.
- O.M. Hindle, J. H., 8, Cobham Street, Accrington, Dye-works Manager.
1909. Hinks, Edward, 16, Southwark Street, London, S.E., Analyst.
1899. Hinks, Percy J., Danger Building Dept., Royal Laboratory, Woolwich Arsenal, S.E., Chemist.
1891. Hinman, Bertrand C., Coventry House, South Place, Finsbury, London, E.C., Metallurgical Chemist.
1912. Hinman, Jack J., jun., 1, Bloom Terrace, Iowa City, Iowa, U.S.A., Laboratory Director.
1909. Hirsch, Fritz, 51, Ferndale Avenue, Wallsend-on-Tyne, Analytical Chemist.
1914. Hirschberg, Dr. Leon, 20, Birchington Road, Crouch End, N., Chemical Engineer.
1914. Hirst, A. Norman, Box 1141, Durban, South Africa, Consulting Chemist.
1895. Hirst, H. Reginald, Bank House, Staincliffe, Batley, Yorks, Works Chemist.
1907. Hirt, Wilhelm B., c/o Cuming, Smith, and Co., Ltd., Yarra Junction, Vic., Australia, Analytical Chemist.
1896. Hislop, Geo. R., (Journals) Gas Works, (communications) Greenhill House, Underwood Road, Paisley, Gas Engineer and Manager.
1913. Hitchcock, Thos. J., 28, Albany Road, Manor Park, Essex, Technical Chemist.
1914. Hoare, Capt. F. R. J., 27, Eccleston Square, London, S.W., Ordnance Dept., South African Forces.
1906. Hobsbaum, I. B., c/o Messrs. Anthony Gibbs & Sons, 22, Bishopsgate, London, E.C., Chemist.
1905. Hobson, Alfred, Dantzic Brewery, Imperial Street, Regent Street, Leeds, Brewer and Wine Manufacturer.
1909. Hodgart, Matthew, Vulcan Works, Paisley, Engineer.
1894. Hodge, Andrew, Glenariff, Whaley Bridge, near Stockport, Printworks Chemist.
1913. Hodgetts, E. A. Brayley, 36, Elvaston Place, Queen's Gate, S.W.
1915. Hodgkinson, S. E., Tobacco Factory, Sharp Street, Rochdale Road, Manchester, Works Analyst.
- O.M. Hodgkinson, Dr. W. R., 89, Shooter's Hill Road, Blackheath, S.E., Professor of Chemistry.
- O.M. Hodgson, Chris., 33, Oakdale Road, Nether Edge, Sheffield, Metallurgical Chemist.
1913. Hodgson, Cyril V., 52, London Road, Chesterton, North Staffordshire, Works Chemist.
1897. Hodgson, Matthew, Ardmore, Church Hill, Wicklow, Ireland, Technical Chemist.
1890. Hodgson, Wm., 69, Deansgate, Manchester, Oil and Colour Broker.
1910. Hodsman, Henry J., Dept. of Fuel and Coal Gas Industries, The University, Leeds, Chemist.
1906. Hogarth, Julius W., The University, Sydney, N.S.W., Australia, Demonstrator of Chemistry.
1886. Hogben, W., Lampeter House, Exeter Park, Bournemouth, Celluloid Works Manager.
- O.M. Hogg, T. W., c/o John Spencer and Sons, Newburn Steelworks, Newcastle-on-Tyne, Metallurgical Chemist.
1905. Holcroft, Harold, Parkdale, Wolverhampton, Iron founder.
1887. Holden, G. H., Manchester Oxide Co., Ltd., Canal Street, Miles Platting, Manchester, Chemist.
1904. Holden, Norman N., c/o Hardman and Holden, Ltd., Miles Platting, Manchester, Manufacturing Chemist.
1902. Holdsworth, Ernest T., "Holme Dene," Crossley Hall, Bradford, Dyer.
1885. Holgate, T. E., 173, Hollins Grove, Darwen, Lancashire, Metallurgist.
- O.M. Holland, Philip, 22, Tavinton Street, Gordon Square, London, W.C., Analytical Chemist.
1892. Holland, Philip H., 546, Sherbrooke Street West, Montreal, Canada, Merchant.
1909. Holliday, F.E., 81, Fulton Street, New York City, U.S.A.

1896. Hollings, J. Spencer, Brymbo, North Wales, Works Manager.
1909. Hollingworth, David V., Birchenwood Collieries, Kildgrove, Stoke-on-Trent, Gas Analyst.
1903. Hollinshead, Peter, The Beeches, Weston Road, Runcorn, Cheshire, Chemist.
1900. Hollinshead, Dr. Warren H., Wingrove Avenue, Nashville, Tenn., U.S.A., Teacher of Chemistry.
1904. Holloway, E. G., c/o Jas. S. Kirk and Co., 360, North Water Street, Chicago, Ill., U.S.A., Chemist.
1890. Holloway, G. T., 9-13, Emmett Street, Limehouse, London, E., Chemist and Metallurgist.
1883. Holmes, Ellwood, Wyneote, Jesmond Park East, Newcastle-on-Tyne, Colour Manufacturer.
- O.M. Holmes, F. G., Thames Tar Works, Lower Road, Northfleet, Kent, Tar and Ammonia Distiller.
1914. Holroyd, Thomas A., Carnatie House, Perambore Barracks, Madras, India, Colour Chemist.
1913. Holt, Dr. Alfred, Dowsfield, Allerton, Liverpool, University Reader in Physical Chemistry.
1900. Holthouse, Harold B., 106, Radcliffe Road, West Bridgford, Notts, Chemist.
1902. Holton, Alf. L., Chemical Dept., Gas Works, Bradford Road, Manchester, Chemist.
1892. Holton, E. C., 601, Canal Road, N. W., Cleveland, Ohio, U.S.A., Chemist.
1893. Holzapfel, Max, c/o Holzapfels, Ltd., Felling-on-Tyne, Manufacturer.
1893. Homfray, D., Analytical Chemist.
1909. Hook, Russell W., 8, Holton Street, West Medford, Mass., U.S.A.
1904. Hooker, A. H., c/o Hooker Electrochemical Co., Niagara Falls, N.Y., U.S.A., Manufacturing Chemist.
- O.M. Hooper, E. Grant, 16, Royal Avenue, Sloane Square, London, S.W., Chemist.
1889. Hooper, Ernest F., c/o Brotherton and Co., Ltd., Wear Tar Works, South Dock, Sunderland, Technical Chemist.
1888. Hope, Jas., The Knoll, Lenzie, near Glasgow, and (Journals) The Nickel Co., Kirkintilloch, by Glasgow, Nickel Works Manager.
1904. Hopewell, Fredk., 59, William Street, Montreal, Canada, Manager.
1892. Hopkins, Erastus, "The Warrington," 161, Madison Avenue, New York City, U.S.A., Consulting Chemist.
1905. Hoppenstedt, A. W., c/o Schoellkopf and Co., Perry and Mississippi Streets, Buffalo, N.Y., U.S.A., Chemist.
1895. Horne, Dr. W. D., 175, Park Avenue, Yonkers, N.Y., U.S.A., Consulting Chemist.
1904. Hornsey, J. W., 233, Broadway, New York City, U.S.A., and (Journals) Summit, N.J., U.S.A., Chemical Engineer.
1913. Horrocks, Herbert, 253, Jelliff Avenue, Newark, N.J., U.S.A., Chemist.
1914. Horrocks, John M., "Maywood," Osborne Road, Levenshulme, Manchester, Tar Distiller and Manufacturing Chemist.
1900. Horsfall, Jno., 4, Grange Avenue, Rawtenstall, Manchester, Analytical and Consulting Chemist.
1901. Horton, Edw., jun., Rothamsted Experimental Station, Harpenden, Herts, Chemist.
1906. Hoscason, Jas. H., Sun Buildings, 2, Bridge Street, Manchester, Chemical Manufacturer.
1890. Hoskins, A. Percy, Clonlee, Rosetta Park, Belfast, Ireland, Analytical Chemist.
1899. Hoskins, Wm., 2009, Harris Trust Building, 111, West Monroe Street, Chicago, Ill., U.S.A., Chemist.
1914. Hough, Alex. T., 95, Abbeyfield Road, Rotherhithe, S.E., Chemist.
1911. Hough, Samuel, c/o Lever Bros., Ltd., Balmain, Sydney, N.S.W., Australia, Chemist.
1899. Houlder, Bertram E., 50, Lady Margaret Road, Southall, Middlesex, Chemist.
1892. Houston, John, 30, Princess Street, Manchester, Drysalter
- O.M. Howard, A. G., Burnt House, Chigwell, Essex, Chemical Manufacturer.
1901. Howard, Bernard F., Pirbank, Loughton, Essex, Chemist.
- O.M. Howard, D., Devon House, Buckhurst Hill, Essex, Chemical Manufacturer.
1887. Howard, D. Lloyd, Uphall Works, Ilford, Essex, Chemical Manufacturer.
1898. Howard, Henry, 36, Amory Street, Brookline, Mass., U.S.A., Chemical Engineer.
1902. Howard, Nelson A., c/o General Chemical Co. of California, 705, Royal Insurance Building, San Francisco, Cal., U.S.A., General Manager.
1915. Howard, O. McG., Paint, Oil and Drug Review, 212, West Washington Street, Chicago, Ill., U.S.A., President and Journalist.
1913. Howard, Tom, 320, Wellington Road, Heaton Chapel, Stockport, Cheshire, Chemist.
1906. Howe, Chester A., 135, Oliver Street, Boston, Mass., U.S.A., Dyestuff Merchant.
1903. Howe, Jas. Lewis, Washington and Lee University, Lexington, Va., U.S.A., Professor of Chemistry.
1912. Howe, Dr. Percy R., 536, Pleasant Street, Belmont, Mass., U.S.A., Dentist.
1904. Howell, Walter L., Room 314, Custom House, New Orleans, La., U.S.A., Chemist.
1899. Howles, Fred., c/o McDougall Bros., 66-68, Port Street, Manchester, Chemist.
1889. Howorth, F. Wise, 10, New Court, Lincoln's Inn, W.C., Technical Chemist and Chartered Patent Agent.
1907. Howroyd, Richard R., c/o Calder Mersey Extract Co., Ltd., Ditton, near Widnes, Chemist.
1914. Howson, Herbert G., 286, New Chester Road, Port Sunlight, Birkenhead, Analytical Chemist.
1906. Hoyler, Fritz, 93, Market Street, Perth Amboy, N.J., U.S.A., Chemist.
1896. Hoyte, Percy S., Gas Works, Coxside, Plymouth, Gas Engineer.
1900. Hübner, Julius, Linden, Cheadle Hulme, Cheshire, Director of Dyeing and Papermaking Departments (Municipal School of Technology).
1909. Hudson, Baker, Public Library, Middlesbrough, Librarian.
1899. Hudson, Dr. Edw. J., c/o Pioneer Iron Co., Marquette, Mich., U.S.A., Chemist.
1914. Hudson, Norman, S. W., Eskbank Iron and Steel Works, Lithgow, New South Wales, Analytical Chemist.
1905. Hudson, O. F., The University, Edgbaston, Birmingham, Lecturer on Metallurgy.
- O.M. Hughes, J., 79, Mark Lane, London, E.C., Agricultural Chemist.
1908. Hughes, Wm. E., Electro Chemist.
1906. Hulme, Robert B., 1162, Union Avenue, Memphis, Tenn., U.S.A., Chemical Engineer and Manager.
1909. Hultman, G. H., St. Paulsgatan 31, Stockholm, Sweden, Chemical Engineer.
1905. Hulton, H. F. E., 15, Oak Hall Court, Putney, S.W., Chemist.
1905. Humel, Edward J., 13315, Detroit Street, Lakewood, Cleveland, Ohio, U.S.A., Chemist.
1893. Humphrey, Chas., Homewood, Hartford, Cheshire, Alkali Works Manager.
1902. Humphrey, Richard L., 1001, Harrison Building, Philadelphia, Pa., U.S.A., Civil Engineer.
1903. Humphreys, A. C., 165, Broadway, New York City, and (Jnls.) Stevens Inst. of Technology, Hoboken, N.J., U.S.A., Engineer.
1908. Humphries, Albert E., Coxes Lock Mill, Weybridge, Surrey, Flour Miller.
1912. Humphries, Herbert B. P., Queen Anne's Chambers, Westminster, S.W., Consulting Chemist.
- O.M. Humphrys, N. H., Gasworks, Salisbury, Wilts., Gas Engineer.
1900. Hunt, Arthur V., 19, Park Road, Port Sunlight, Cheshire, Analytical Chemist.
- O.M. Hunt, Chas., 17, Victoria Street, Westminster, London, S.W., Civil Engineer.
1883. Hunt J. S., Appleton, Widnes.

1903. Hunt, P. C. Holmes, 99, Queen Street, Melbourne, Vic., Australia, Gas Engineer.
- O.M. Hunt, W., Hampton House, Wood Green, Weynesbury, Staffordshire, Chemical Manufacturer.
1893. Hunter, Prof. Matthew, Rangoon College, Rangoon, Burmah, Professor of Chemistry.
- O.M. Huntington, Prof. A. K., King's College, Strand, London, W.C., Professor of Metallurgy.
1902. Huntly, Geo. N., 14, Old Queen Street, Westminster, S.W., Analytical and Consulting Chemist.
1904. Hurren, F. H., c/o The Rover Co., Ltd., Coventry, Analytical Chemist.
1894. Hurry, E. H., Llanover, Churt, Farnham, Surrey, Mechanical Engineer.
1894. Hutcheson, Jno. F., 39, St. Enoch Square, Glasgow, Chemical Manufacturer.
1912. Hutchin, C. D., c/o Messrs. Meredith and Drew, Ltd., High Street, Shadwell, London, E., Biscuit Manufacturer.
- O.M. Hutchinson, T. J., Aden House, Manchester Road, Bury, Analytical and Consulting Chemist.
1909. Hutehison, Chas. F., Eastman Kodak Co., Kodak Park, Rochester, N.Y., U.S.A., Photographic Emulsion Maker.
1909. Hütz, Dr. R., 32, India Street, Boston, Mass., U.S.A., Colour Chemist.
- O.M. Huxley, Jas. H., c/o Vickers, Son, and Maxim, Ltd., River Don Works, Sheffield, Metallurgical Chemist.
1906. Huyett, Miles C., 1005, Morgan Building, Buffalo, N.Y., U.S.A., Mechanical Engineer.
1897. Hyams, Godfrey M., 312, Sears Building, Boston, Mass., U.S.A., Mines Manager.
1902. Hyde, Austin T., Box 98, Rumford Falls, Maine, U.S.A., Chemical Engineer.
1897. Hyde, B. T. Babbitt, 11, Broadway, New York City, U.S.A., Soap Manufacturer.
1899. Hyde, Fred. S., 215, Schermerhorn Street, Brooklyn, N.Y., U.S.A., Research Chemist.
1899. Hyde, Wm. Grantley, Garden Wharf, Church Road, Battersea, S.W., Assayer.
1901. Hyman, Leonard W., 342, South Pearl Street, Albany, N.Y., U.S.A., Analytical Chemist.
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1900. Ichioka, Dr. Tajiro, 19, Maruyama, Shinmachi, Hongo, Tokio, Japan, Chemist (Imperial Japanese Navy).
1906. Iddings, Richard P., Arlington Mills, Lawrence, Mass., U.S.A., Chemist.
1885. Idris, T. H. W., M.P., 120, Pratt Street, Camden Town, N.W., Mineral Water Manufacturer.
1913. Illingworth, S. R., c/o Gas Lighting Improvement Co., Ltd., Pacific Wharf, West Ham, E., Works Chemist.
1909. Imison, C. S., The Cottage, Runcorn, Cheshire, Chemist, United Alkali Co.
1900. Imrie, John, 83, Horndean Road, Firth Park, Sheffield, Producer Gas and By-Products Plant Manager.
1900. Ingalls, Walter R., "Engineering and Mining Journal," 10th Avenue at 36th Street, New York City, U.S.A., Mining Engineer and Metallurgist.
1889. Ingle, Dr. Harry, 26, Bond Street, Leeds, Organic Chemist.
1909. Ingleby, G. W., c/o John L. Seaton and Co., Ltd., Sculcoates, Hull, Director.
1906. Inghis, Dr. Jno. K. H., University of Otago, Dunedin, New Zealand, Professor of Chemistry.
1912. Inglis, Robert J. C., c/o Curtis's and Harvey, Ltd., Powder Mills, Dartford, Kent, Analytical Chemist.
1911. Innes, Dr. Alfred G., 14, Great Queen Street, Kingsway, London, W.C., Technical Chemist.
1909. Innes, R. Faraday, c/o The British Chrome Tanning Co., St. Andrew's Tannery, Northampton, Chemist.
1906. Innes, Dr. Wm. Ross, 19, St. James' Avenue, Cricklewood, N.W., Chemist.
1910. Irvine, Prof. J. C., Chemical Research Laboratory, The University, St. Andrews, Scotland, Professor of Chemistry.
1884. Irving, J. M., 17A, Dickinson Street, Cooper Street, Manchester, Chemical Merchant.
1911. Irwin, George C., c/o S. H. Johnson and Co., Ltd., Carpenter's Road, Stratford, E., Manager (Engineering Works).
- O.M. Irwin, W., Derwent Lodge, Cockermouth, Analytical Chemist.
1901. Isakovics, Alois von, Synflour Scientific Laboratories, Monticello, N.Y., U.S.A., Manufacturing Chemist.
1915. Isherwood, Dr. Percy C. C., c/o W. J. Bush & Co., Ltd., Hackney, N.E., and (Journals) Moss Cottage, Bushey Heath, Herts, Chief Chemist.
1900. Ittner, Dr. Martin H., c/o Colgate and Co., Jersey City, N.J., U.S.A., Soap and Essential Oil Chemist.
1912. Ivatt, Albert, The Engadine, Histon, Cambridge, Chemist (Foods).
1908. Ives, Herbert, 125, Pearl Street, Boston, Mass., U.S.A., Manager (Dyestuffs, etc.).
- J
1890. Jackman, E. J., 60, Belgrave Road, Ilford, Essex, Technical Chemist.
- O.M. Jackson, Edward, Raven's Cliff, Oxford Road, Moseley, Birmingham, Alkali Works Inspector.
1904. Jackson, Ernest W., Godrevy, Salthurn, Yorks, Analytical Chemist.
1991. Jackson, F., Smedley Bridge Works, Cheetham, near Manchester, Bleacher and Dyer.
1883. Jackson, Frederick, 44, Chapel Street, Salford, Manchester, Laboratory Furnisher.
1886. Jackson, John, 98, Dobbie's Loan, Glasgow, Lubricant Manufacturer.
1901. Jackson, Percy G., c/o National Boiler Insurance Co., St. Mary's Parsonage, Manchester, Chemist.
1914. Jackson, Robert E., Tynholme, Dartford, Kent, Works Chemist.
1890. Jackson, Saml., c/o L. H. Horsfall, Buckingham Mills, Perambore Barracks, Madras, N., India, Analytical Chemist.
1902. Jackson, Samuel, c/o Wm. Metcalf, Ltd., Church near Accrington, Director (Tar Distillery).
1898. Jackson, Thos., 31, Brownsville Road, Heaton Moor, near Stockport, Chemical Manufacturer.
1900. Jackson, Victor G., 17, Doughty Street, London, W.C., Chemist.
1900. Jackson, Dr. W. Hatchett, Radcliffe Library, Oxford, Librarian and Science Tutor (Keble College).
1893. Jackson, Rt. Hon. W. L., F.R.S. See Allerton, Rt. Hon. Lord.
1899. Jackson, W. Morton, c/o British Oxygen Co., Ltd., Great Marlborough Street, Manchester, Manager.
- O.M. Jackson, W. P., Saxilby, near Lincoln, Chemical Works Manager.
1915. Jacobs, Lionel L., The Dominion Tar and Chemical Co., Box 445, Sault Ste. Marie, Ontario, Canada, Works Manager.
1900. Jacoby, Areli H., c/o American Dyewood Co., 80, Maiden Lane, New York City, U.S.A., Chemist.
1900. Jäger, B. M., c/o Geo. Jäger and Sons, 77, Burlington Street, Liverpool, Sugar Chemist.
1886. Jago, Wm., 17, Wilbury Avenue, Hove, Sussex, Barrister-at-Law.
1883. James, E. T., British Alizarin Co., Ltd., Silvertown, Victoria Docks, E., Secretary.
1915. James, Hugh W., South Metropolitan Gas Co., Tar Works, Ordnance Wharf, East Greenwich, S.E., Technical Chemist.

1905. James, Oscar S., 227, George Street, Toronto, Canada, Analytical Chemist.
1914. Jaques, John, 66, Grove Road, Wanstead, N.E., Rubber Technologist.
1890. Jarmain, Geo. S., Dalton Lodge, Huddersfield, Wool Extractor.
- O.M. Jarnay, G., Hartford Lodge, Hartford, Cheshire, Alkali Manufacturer.
1911. Jarrom, Harry G., 14, Goodwyn Avenue, Mill Hill, Middlesex, Managing Director (Gallenkamp and Co.).
1900. Jarvie, Jas., Ferndale, Kenmure Avenue, Bishopbriggs, Scotland, Chemist.
1914. Jaubert, Dr. Geo. F., 155, Boulevard Malesherbes, Paris, France, Technical Journalist.
1910. Jayno, David W., c/o Barrett Manufacturing Co., Frankford, Philadelphia, Pa., U.S.A., Manager.
1913. Jeans, Harold, 165, Strand, London, W.C. Metallurgist.
1892. Jenkin, W. A., 12, Bella Vista, Minas de Rio Tinto, Provincia de Huolva, Spain, Metallurgical Chemist.
1905. Jenkins, Chas. D., 1368, Commonwealth Avenue, Allston, Mass., U.S.A., Chemist.
1894. Jenkins, John H. B., Laboratory, G.E.R. Works, Stratford, E., Analytical Chemist.
1912. Jenkins, Leslie C. W., 26, Ulundi Road, Blackheath, S.E., Chemist (Wood Dyeing).
1912. Jenkins, Rees, 124, Foleshill Road, Little Heath, Coventry, Analytical Chemist.
1894. Jonks, Robt. L., 1, Charnock Place, Calcutta, India, Chemist.
1905. Jennison, Jas., Mountfield, London Road, Greenhithe, Kent, Chemist.
1904. Jepson, John Elliott, c/o Star Paper Mill Co., Ltd., Feniscowles, near Blackburn, Chemist.
1899. Jerdan, Dr. David S., Temora, Colinton, Midlothian, Chemist (Gelatin Works).
1899. Jessop, Louis V., Holmlea, 23, Woodville Road, Leytonstone, Essex, Chemist.
1904. Jewson, F. T., Earith, near St. Ives, Hunts, Chemist.
1896. Job, Robt., 649, Roslyn Avenue, Westmount, Quebec, Canada, Analytical Chemist.
1886. Johnson, A. E., 24, Parkdale, Wolverhampton, Analytical Chemist.
1908. Johnson, Arthur, 25, Nursery Street, Pendleton, Manchester, Chemist.
1904. Johnson, Cedric, Winnington Park, Northwich, Cheshire, Chemical Engineer.
1891. Johnson, Edmond E., c/o Adcocks, Drayton Park Works, Highbury, N., Chemical Engineer.
1904. Johnson, Dr. F. M. G., 286, Peel Street, Montreal, Canada, Chemist.
1904. Johnson, G. B., 7, Church Street, Liverpool, Wholesale Chemist.
1907. Johnson, H. Finnis, c/o Borax Consolidated, Ltd., 16, Eastcheap, London, E.C., Sales Manager.
1900. Johnson, John, c/o John Johnson and Co., 37th Street and Second Avenue, Brooklyn, N.Y., U.S.A., Chemical Engineer.
1913. Johnson, J. Carroll, 9, Well Road, Hampstead, N.W., Chemist.
- O.M. Johnson, J. E. J., 133, Earham Grove, Forest Gate, E., Manufacturing Chemist.
1900. Johnson, Jno. W. Haigh, West Riding Rivers Board, Wakefield, Yorks, Chemist.
1906. Johnson, Oliver L., c/o The Aspinook Co., Jewett City, Conn., U.S.A., Dye Works Manager.
1904. Johnson, S. Hearon, 7, Church Street, Liverpool, Wholesale Chemist.
1895. Johnston, Alex. R., 18, Percy Street, Ibrox, Glasgow, Analytical Chemist.
1906. Johnston, A. McA., Box 108, Germiston, Transvaal, Metallurgical Chemist.
1894. Johnston, G. Lawson. *See* Lawson-Johnston, G.
1904. Johnston, J. H., 8, Leopold Road, Wimbledon, S.W., Chemist and Bacteriologist.
1904. Johnston, Thos. J., 12, Garrioch Drive, Maryhill, Glasgow, Chemist.
1890. Johnston, Wm. A., The S. S. White Dental Manufacturing Co., Prince Bay, N.Y., U.S.A., Dental Enamel Manufacturer.
1894. Johnston, W. E. Lawson. *See* Lawson-Johnston, W. E.
- O.M. Johnston, Wm. G., Anchor Chemical Works, 1005, Garngad Road, Glasgow, Technical Chemist.
1910. Johnstone, E. J., Factory Square, Watertown, N.Y., U.S.A., Consulting Engineer and Industrial Chemist.
- O.M. Johnstone, Jas., Shawfield Works, Rotherglen, Glasgow, Technical Chemist.
1905. Johnstone, J. Swanston, Natal Distilleries Co., Bond Street, Durban, Natal, Distiller.
1903. Johnstone, S. J., 15, Springfield Road, New Southgate, N., Research Chemist.
1907. Jolliffe, Ernest H., Central Technical School, Toronto, Canada, Works Chemist.
1905. Jolliffe, Frank, 80, Shell Road, Lewisham, S.E., Chemist.
1904. Jones, Arthur B., 981, Central Avenue, Plainfield, N.J., U.S.A., Superintendent.
1912. Jones, B. Vaughan, P.O. Box 27, Petersburg, Va., U.S.A., Chemist and Manufacturer.
1912. Jones, Charles, 23, Bristol Road, Shetfield, Coke Plant Manager.
1908. Jones, D. Trevor, "Mountain Ash," Ravensglass, Cumberland, Works Chemist.
1911. Jones, Edgar D., 3, Neville Road, Waterloo, near Liverpool, Analytical Chemist.
1912. Jones, E. Gabriel, City Analyst's Laboratories, Ashton Street, Liverpool, Assistant Public Analyst for Liverpool.
1910. Jones, E. Protheroe, The Golden Horseshoe Estates Co., Salisbury House, London Wall, London, E.C., Secretary.
1902. Jones, E. Strangways, Sulphide Corporation, Ltd., Cockle Creek, N.S.W., Australia, Metallurgical Chemist.
1909. Jones, E. Willis, 22, Coleshill Terrace, Llanelly, South Wales, Chemical Manufacturer.
- O.M. Jones, E. W. T., 10, Victoria Street, Wolverhampton, Analytical Chemist.
1897. Jones, Fred. W., 35, Addiscombe Road, Croydon, Technical Chemist.
1896. Jones, G. Cecil, 41, London Road, Forest Hill, S.E., Consulting Chemist.
1912. Jones, G. P., Cameron Powder Manufacturing Co., Emporium, Pa., U.S.A., General Manager.
1905. Jones, Harold, Morro Velho, Villa Nova do Lima, Minas Geraes, Brazil, Analyst and Assayer.
1893. Jones, Herbert. *See* Selton-Jones, H.
1901. Jones, Herbert J., 40, Reginald Road, Forest Gate, E., Chemist.
1910. Jones, Ivor R., 54, Atlantic Chambers, Manchester, Chemical Merchant.
1905. Jones, J. E. Stacey, Hearsall Works, Coventry, Consulting Chemist and Technical Metallurgist.
1904. Jones, J. Shirley, Moscow, Idaho, U.S.A., Chemist.
1894. Jones, M. W., Stonebeck, Brislington, Bristol, Manager (Oil and Colour Works).
- O.M. Jones, Walter Norris, Llancahire Metal Works, Widnes, Technical Chemist.
1903. Jones, Wm. App, c/o Boston Artificial Leather Co., 200, Fifth Avenue, New York City, U.S.A., Chemist.
1905. Jones, W. Ellis, 80, Arundel Avenue, Liverpool, Sugar Refiner.
1908. Joselin, Percy H., 81, Bennerley Road, New Wandswoth, S.W., Chemist.
1905. Joseph, A. F., Ceylon Technical College, Colombo, Ceylon, Lecturer on Chemistry.
1900. Josephson, Edgar, c/o Pantasote Leather Co., Passaic, N.J., U.S.A.
1891. Joslin, Omar T., 3223, Spring Grove Avenue, Cincinnati, Ohio, U.S.A., Chemical Engineer.
1887. Jöüct, Dr. C. H., 238, East 2nd Avenue, Roselle, N.J., U.S.A., Technical Chemist.
1904. Jowett, Dr. H. A. D., Phoenix Mills, Dartford, Kent, Research Chemist.

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1903. Joyce, Clarence M., c/o Dr. J. M. Matthews, 50 East 41st Street, New York City, U.S.A., Consulting Chemist (Nitrocellulose).
- O.M. Justice, Philip M., 55-56, Chancery Lane, London, W.C., Patent Agent.
1896. Kalbfleisch, Franklin H., 31, Union Square West, New York City, U.S.A., Chemical Manufacturer.
1908. Kaliski, Dr. Maximilian S., 17, Battery Place, New York City, U.S.A., Technical Chemist.
1884. Kalle, Dr. Wm., Biebrich-am-Rhein, Germany, Colour Manufacturer.
1913. Kastle, Dr. Joseph H., Kentucky Agricultural Experiment Station, Lexington, Ky., U.S.A., Director.
1901. Kauder, Dr. E. c/o Merck and Co., Rahway, N.J., U.S.A., Chemist.
1903. Kauffman, Milton H., American Smelting and Refining Co., Durango, Colo., U.S.A., Chemist.
1910. Kaufmann, George von, 2, Rondell Neu-Wittelsbach, München, Bavaria, and (Juls.) Christ's College, Cambridge, Director (Austrian Petroleum Co.).
1892. Kaufmann, Dr. Herbert M., c/o Mutual Chemical Co., Jersey City, N.J., U.S.A., Chemist.
1904. Kaus, Dr. Emil, c/o Roessler and Hasslacher Chemical Co., Perth Amboy, N.J., U.S.A., Chemist.
1915. Kawakami, Kaichi, 23, Fellows Road, Hampstead, N.W., Chemical Engineer.
1885. Kawakita, Prof. Michitada, Imperial Engineering College, Tokio, Japan, Professor of Applied Chemistry.
1912. Kay, Jas. H., Fair Fields, Dundee Lane, Ramsbottom, Lancashire, Soap Manufacturer.
- O.M. Kay, Wm. E., 349, The Cliffs, Broughton Park, Manchester, Printworks Chemist.
1910. Kaye, Henry R., c/o Cuming, Smith, and Co., Port Melbourne, Vic., Australia, Analytical Chemist.
1904. Kaye, Thos., 26, Rose Crescent, Perth, Scotland, Analytical Chemist.
1884. Keane, Dr. Chas. A., Sir John Cass Technical Institute, Jewry Street, Aldgate, E.C., Principal.
- O.M. Kearns, H. W., Boothroyd, Brooklands, near Manchester, Dyer.
1897. Kearns, Jno. S., Cowpe Mills, Waterfoot, near Manchester, Chemist and Dyer.
1894. Kehler, Lyman F., 1322, Park Road, Washington, D.C., U.S.A., Chief of Drug Laboratory, Department of Agriculture.
1910. Keeler, Warren L., 441, Arch Street, New Britain, Conn., U.S.A., Analytical Chemist.
1911. Keenan, Thomas J., 117, East 24th Street, New York City, U.S.A., Paper Chemist.
1915. Keetland, C. G., c/o The Standard Chemical Iron and Lumber Co., 524, St. Ambrose Street, Montreal, Canada, Montreal Manager.
1908. Keith, Jas. W., c/o H. D. Pochin and Co., Ltd., Bank Quay, Warrington, Analytical Chemist.
1907. Keller, Dr. Edward, P.O. Box 363, Perth Amboy, N.J., U.S.A., Chemist and Metallurgist.
1905. Keller, Robt. J., 89, Barelay Street, New York City, U.S.A., Dyestuff and Chemical Merchant.
1885. Kellner, Dr. Wm., 135, Victoria Road, Old Charlton, S.E., Chemist to War Department.
1908. Kellogg, H. W., c/o National Electrolytic Co., Niagara Falls, N.Y., U.S.A., General Manager.
1910. Kemmerich, Dr. Wm. E., c/o The Bayer Co., 117, Hudson Street, New York City, U.S.A., Chemist.
1907. Kendall, G. F., Chemical Works, Stratford-on-Avon, Chemical Manufacturer.
1912. Kennedy, Carl D., c/o General Rubber Co., Kisanan Asahan, Sumatra, D.E.I., Chemist.
1912. Kent, Raymond W., East Palistine, Ohio, U.S.A., Chemist.
1914. Kenyon, James, Kagura-Cho, Fukai-Mura, Hiogo-Ken, Japan, Analytical Chemist.
1903. Kenyon, Percy S., Park House, Cheadle Hulme, Cheshire, Drysalter.
1889. Kenyon, Thos., The Shrubbery, Hilton Park, Prestwich, near Manchester, Manufacturing Chemist.
1899. Kern, Walter P., 266, Paulison Avenue, and (Journals) c/o General Chemical Co., Dundee Works, Passaic, N.J., U.S.A., Chemist.
1906. Kerr, Charles H., c/o Pittsburg Plate Glass Co., Tarentum, Pa., U.S.A., Ceramic Research Chemist.
1912. Kerr, R. Vaughan, Fabrica de Aceites y Jaboneria Inglesa, Mislata, Valencia, Spain, Technical Chemist.
1890. Kerr, Saml. T., 516, North Delaware Avenue, Philadelphia, Pa., U.S.A., Salt Manufacturer.
1897. Kerr, Wm. M., 712, La Fayette Building, Philadelphia, Pa., U.S.A., Manufacturing Chemist.
1896. Kershaw, Jno. B. C., West Lancashire Laboratory, Waterloo, Liverpool, Analytical Chemist.
1909. Kesava-Menon, A., Chittur-Palghat, South Malabar, Madras, India, Chemist.
1902. Kessler, Henry W., 720, Electric Building, Cleveland, Ohio, U.S.A., Manufacturing Chemist.
1893. Kestner, Paul, 37, Parliament Street, Westminster, S.W., Chemist.
1900. Kewley, Jas., c/o Anglo-Egyptian Oilfields, Ltd., Suez, Refinery Manager.
1890. Keys, W. H., Hall End Works, West Bromwich, Oil and Chemical Manufacturer.
1900. Kilgore, Benj. W., Raleigh, N.C., U.S.A., Chemist.
1901. Kilmer, Fred. B., c/o Messrs. Johnson and Johnson, New Brunswick, N.J., U.S.A., Chemical Manufacturer.
- O.M. Kinch, E., Royal Agricultural College, Cirencester, Professor of Chemistry.
1912. Kind, Georg E., 33, King Street, Covent Garden, London, W.C., Bookseller and Publisher.
- O.M. King, A. J., Ellaray, Windermere, Bleacher and Finisher.
1907. King, C. A., c/o The Farnley Iron Co., Farnley, near Leeds, Technical Chemist.
1913. King, Edward W., New Liverpool Rubber Works, Walton, Liverpool, Analytical Chemist.
1905. King, Frank E., 75, Gracechurch Street, London, E.C., Analytical Chemist.
1911. King, Harold, 24, The Brent, Dartford, Kent, Chemist.
- O.M. King, J. Falconer, 43, Stirling Road, Edinburgh, Consulting Chemist.
1910. King, John, Summerville Gardens, Latchford, Warrington, Lancashire, Works Manager.
1913. King, Dr. Robert C., Aptekarsky Prospect Sa., Petrograd, Russia, Chemist.
1895. King, Sidney J., Brean, Upton Road, Bexley Heath, Kent, Analytical Chemist.
- O.M. King, Walter R., 16, Mincing Lane, London, E.C.; and (Journals) Torville, The Cliffs, Southend-on-Sea, Chemical Manufacturer.
1905. King, Warren C., 72, Front Street, New York City, U.S.A., President, Independent Chemical Co.
1896. Kingdon, Holman, c/o Joseph Crosfield and Sons, Warrington, Technical Chemist.
1908. Kingsbury, Percy C., German-American Stoneware Works, 50, Church Street, New York City, U.S.A., Chief Civil Engineer.
1883. Kingsford, T. P., Oswego, N.Y., U.S.A., Starch Manufacturer.
- O.M. Kingzett, C. T., "Maplin," Frinton on Sea, Essex, and (Journals) Sanitas Co., Ltd., Locksley Street, Limehouse, E., Chemical Manufacturer.
1906. Kinnersley, H. W., Branscombe, Merry Hill Road, Bushey, Herts, Chemist and Manufacturer.
1897. Kipping, Dr. F. Stanley, F.R.S., University College Nottingham, Prof. of Chemistry.
1914. Kirby, William, 50, Mayhill Road, Charlton, Kent, Chemist.
1908. Kirkhope, T. Bertram, Sandbank, Gwithian, Hayle, Cornwall, Explosives Works Chemist.
1905. Kirkland, John, 105, Holmdene Avenue, Herne Hill, S.E., Technical Instructor.

1900. Kirkpatrick, Prof. Stafford F., 84, Goro Street, Kingston, Ont., Canada, Professor of Metallurgy.
1913. Kirsebom, Gustave, Braden Copper Co., Molino, Rancagua, Chile, Metallurgical Engineer.
1911. Kirsten, H. C., 7, Gracechurch Street, London, E.C., Consulting Engineer.
1902. Kitehen, Wm. J., Port Melbourne North, Vic., Australia, Soap and Candle Manufacturer.
1883. Kitto, B., 26, Lancaster Road, Finsbury Park, London, N., Analytical Chemist.
1900. Kittredge, H. G., c/o The Kay and Ess Co., Dayton, Ohio, U.S.A., Chemist.
1908. Klaber, Wm., c/o Castle Kid Co., Camden, N.J., U.S.A., Chemist.
1900. Kleber, Dr. Clemens, Clifton Chemical Laboratory, Passaic, N.J., U.S.A., Director.
1911. Klein, C. A., 4, Brimsdown Avenue, Enfield Highway, Middlesex, Works Chemist.
1909. Klemm, Wilfred E., 25, Marmion Road, Liverpool, Chemist.
1908. Klien, Dr. J. L., 7, King Street, Cheapside, London, E.C., Works Manager.
- 1903 Kline, Clarence M., 429, Arch Street, Philadelphia Pa., U.S.A., Wholesale Druggist.
1889. Klipstein, A., Messrs. A. Klipstein and Co., 644-654, Greenwich Street, New York City, U.S.A., Chemical Manufacturer.
1902. Klipstein, Ernest C., 93, Prospect Street, East Orange, N.J., U.S.A., Chemical Merchant.
1913. Klotz, W. C., Canadian Ammonia Co., Ltd., Toronto, Canada, Chemist.
1891. Knaggs, Alfred B., c/o Dr. Knaggs, Oak House, New North Road, Huddersfield, Technical Chemist in Dyeworks.
1911. Knapp, Harry P., c/o Talbot Dyewood and Chemical Co., 38-44, Middle Street, Lowell, Mass., U.S.A., Chemical Manufacturer.
1911. Knapp, Harry P., Chemical Manufacturer.
1892. Knecht, Dr. E., Beech Mount, Marple, Cheshire, Professor of Tinctorial Chemistry.
1904. Kniffen, Frederick, 823, North Franklin Street, Wilmington, Del., U.S.A., Chemist.
1887. Knight, A. H., 51, Highfield Street, Liverpool, Assayer.
1903. Knight, Harley F., 14, Old Queen Street, Westminster, S.W., Analyst.
- O.M. Knight, J. Baillie, Soap Manufacturer.
1887. Knights, J. West, 67, Tenison Road, Cambridge, Analytical Chemist.
1885. Knipler, F., "Strathberg," Greensborough, near Melbourne, Victoria, Starch Manufacturer.
1907. Knoedler, E. L., c/o Welsbach Co., Gloucester City, N.J., U.S.A., Factory Foreman.
1910. Knott, E. Anthony F., The Priestman Collieries, Ltd., Ottovale Coke Works, Blaydon-on-Tyne, Works Chemist.
1911. Knowland, Daniel P., 89, Barclay Street, New York City, U.S.A., Chemist.
1904. Knowles, W. R., The Hollies, Wood Green, Weynesbury, Chemical Works Manager.
1886. Knox, E. W., Colonial Sugar Refining Co., Sydney, N.S.W.; and (subs.) c/o Parbury, Henty, and Co., 20, Eastcheap, London, E.C., Sugar Manufacturer and Refiner.
1906. Knudsen, Kristian Ilv., 96, Maiden Lane, New York City, U.S.A., Chemist.
1905. Koch, Dr. Geo. W., 905, Willoughby Avenue, Brooklyn, N.Y., U.S.A., Chemist.
1904. Koch, J. A., Bluff and Pride Streets, Pittsburg, Pa., U.S.A., Chemist.
1911. Kochs, A. Victor, 301, Glossop Road, Sheffield, Gas Engineer.
1904. Koebig, Dr. J., Suite 1026, Union Oil Building, Los Angeles, Cal., U.S.A., Consulting Chemical Engineer.
1909. Koekkoek, Patrick R., c/o J. W. and T. A. Smith, Ltd., Imperial Colour Works, 249, Old Ford Road, London, E., Works Chemist.
1911. Koelle, Dr. G., Metallbank und Metallurgische Gesellschaft, Bockenheimer Anlage 45, Frankfurt a/M., Germany, Chemist.
1884. Kohn, Dr. Charles A. See Keane, Dr. Chas. A.
1902. Kohnstamm, Lothair S., 87, Park Place, New York City, U.S.A., Chemist.
1913. Kondo, K., 136, Yoyogi, Tokyo, Japan, Chemical Engineer.
- O.M. Kraftmeier, E., Bank Buildings, St. James's Street, London, S.W., Explosives Manufacturer.
1906. Kraiss, Dr. Paul, Lustnauer Allee, Tuebingen, Germany, Chemist.
1894. Krause, Dr. Albert H., 1444, West 98th Street, Cleveland, Ohio, U.S.A., Chemist (Grasselli Chemical Co.).
- O.M. Krause, Prof. Dr. G., Cöthen (Anhalt), Germany, Chemist.
1898. Krebs, H. J., 806, Franklin Street, Wilmington, Del., U.S.A., Manufacturing Chemist.
1908. Kress, Otto, 438, West 116th Street, New York City, U.S.A., Teacher of Science.
1900. Kunheim, Dr. Erich, Jnls. to c/o C. Hilt, Worlands Wharf, Wharf Street, Canning Town, E., Chemist.
1904. Kunz, Dr. George F., c/o Tiffany and Co., 409, 5th Avenue, New York City, U.S.A., Gem Expert.
1905. Kurt, Franklin T., 553, Boylston Street, Boston, Mass., U.S.A., Professor of Chemistry, B.Y.M.C.A.
1907. Kutsch, Dr. Wm. A., c/o Corn Products Manufacturing Co., Pekin, Ill., U.S.A., Chemist.
1900. Kuttroff, Fred., 128, Duane Street, New York City, U.S.A., Merchant.
1909. Kwoh, See Kwain, Municipal Technical College, Mukden, Manchuria, China, Chemical Engineer.
- O.M. Kynaston, J. W., 3, Oak Terrace, Beech Street, Liverpool, Chemical Engineer.
1907. Kynaston, Wm. C. R., 9, Harland Road, Higher Tranmere, Birkenhead, Analyst.

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1906. Lacell, Harold G., Ardoch, Nether Street, Finchley, N., Chemist.
1890. Lacey, E. C., St. Julian's Lodge, St. Julian's Farm Road, West Norwood, Manufacturing Chemist.
1903. Lachman, Dr. Arthur, 1926 Lake Street, San Francisco, Cal., U.S.A., Chemical Engineer.
1913. Laib, Walter, Rittman, Wayne Co., Ohio, U.S.A., Chemist (Ohio Salt Co.).
- O.M. Laidler, C. P., 20, Noble Terrace, Gateshead-on-Tyne, Analytical Chemist.
- O.M. Lake, G., jun., Leo Mount, Glossop, Derbyshire, Analytical Chemist.
1907. Lake, Henry B., c/o Kemball, Bishop and Co., Three Mills Lane, Bromley-by-Bow, E., Works Manager.
1900. Lamar, Wm. R., 327, North 18th Street, East Orange, N.J., U.S.A., Chemical Manufacturer.
1898. Lamb, Morris Chas., Leathersellers' Technical College, 176, Tower Bridge Road, London, S.E., Chemist.
1912. Lancaster, Harry C., 39, Ladbroke Grove, Kensington, W., Managing Director.
1907. Lancaster, Harry M., Laboratory, Provincial Board of Health, 5, Queen's Park, Toronto, Canada, Chemist.
1911. Lander, Dr. G. D., Royal Veterinary College, Camden Town, London, N.W., Consulting Chemist.
1910. Landrum, R. D., c/o The Harshaw, Fuller and Goodwin Co., Electric Building, Cleveland, Ohio, U.S.A., Chemical Engineer.
1904. Lane, C. Cyril P., Chemist.
1910. Lane, J. Henry, 3, Arbour Square, Stepney, London, E., Chemist.
1903. Lane, Nathaniel J., U.S. Laboratory, 641, Washington Street, New York City, U.S.A., Chemist.
1893. Lang, Dr. Wm. R., University of Toronto, Canada, Professor of Chemistry.

1892. Langer, Dr. Carl, Ynyspenllwch, Clydach, R.S.O., Glamorganshire, Analytical Chemist.
1914. Langlands, S. H. B., Glasgow Corporation Lighting Dept., 20, Trongate, Glasgow, Chief Inspector of Lighting.
1897. Langmuir, Arthur C., c/o Marx and Rawolle, 9, Van Brunt Street, Brooklyn, N.Y., U.S.A., Factory Manager.
1902. Langmuir, F. Leighton, 350, Bloor Street West, Toronto, Canada, Chemist.
1898. Langstaff, Wm., 39, Orchard Street, Elizabeth, N.J., U.S.A., Chemist.
1900. Lant, Herbert, "Ivy Bank," Wath-on-Dearne, near Rotherham, Yorks, Chemist and Manager.
1909. Lantsberry, Fred. C. A. H., Birmingham Small Arms Co., and (Journal) 63, Walford Road, Sparkbrook, Birmingham, Metallurgical Chemist.
1914. Laplante-Courville, H., Laval Dental School, Montreal, Canada, Lecturer.
1903. Larter, Alfred T., 5, Rookfield Avenue, Muswell Hill, N., Chemist.
1904. Lasher, F. G., 251, Bush Street, Brooklyn, N.Y., U.S.A., Chemist.
1884. Latham, Baldwin, Parliament Mansions, Victoria Street, Westminster, S.W., Civil Engineer.
1889. Latham, J. J., Mill House, Bold, Widnes, Chemical Works Manager.
1907. Lathwood, Arthur, c/o Borax Consolidated, Ltd., 16, Eastcheap, London, E.C., and (Jnls.) The Briars, Maidstone Road, Bounds Green, N., Chemist.
1914. Lauder, Dr. Alex., College of Agriculture, 13, George Square, Edinburgh, Lecturer in Chemistry.
1914. Laurie, Dr. A. P., Heriot Watt College, Chambers Street, Edinburgh, Principal.
1909. Law, Douglas J., 9, Seely Road, Lenton Sands, Nottingham, Chemist.
1913. Law, John A., c/o Barry, Ostlere, and Shepherd, Ltd., Forth Works, Kirkcaldy, Scotland, Linoleum Works Director.
1907. La Wall, Chas. H. 39, South 10th Street, Philadelphia, Pa., U.S.A., Analytical Chemist.
- O.M. Lawrence, Jas., c/o Dr. T. P. Grant, Montrave, Blantyre, Scotland, Explosives Manufacturer.
1911. Lawrence, Wm. A., Laboratory, 11, Vandewater Street, New York City, U.S.A., Director.
1904. Lawson, Jos. H. S., Rodney Street Works, Oldham Road, Manchester, Salesman.
1894. Lawson-Johnston, G., (Journals) 29, Portman Square, W., and 1, King's Arms Yard, London, E.C., Chairman of Bovril, Ltd.
1894. Lawson-Johnston, W. E., c/o Bovril, Ltd., 152, Old Street, London, E.C., Director.
1907. Leach, Dr. F. P., Briarswood, Chester Road, Erdington, Birmingham, Research Chemist.
1908. Leake, Percy C., Deanbank Terrace, Ferryhill Village, Co. Durham, Tar Works Manager.
1898. Lean, Geo., 3, Park Quadrant, Glasgow, Chemist.
- O.M. Leather, J. Walter, Agricultural Research Institute, Pusa, Behar and Orissa, India, Government Chemist.
1913. Lebach, Dr. Hans, c/o The Bakelite Co., Ltd., Orb Works, Cowley, near Uxbridge, Middlesex, Chief Chemist.
1893. Le Boutillier, Clement, c/o Taylor Iron and Steel Co., High Bridge, N.J., U.S.A., Chemist.
1907. Lecco, Prof. Marco T., Vasinia 15, Belgrade, Serbia, Professor of Chemistry.
1904. Le Chatelier, Prof. H., 75, Rue Notre Dame des Champs, Paris, France, Professor (l'Ecole des Mines).
1896. Lecomber, W. G., Cambridge Works, Knott Mill, Manchester, Engineer.
1896. Lederle, Dr. E. J., 39, West 38th Street, New York City, U.S.A., Chemist.
1892. Ledoff, Prof. A., Technological Institute, Kharkoff, Russia, Professor of Chemistry.
1895. Ledoux, Dr. Albert R., 99, John Street, New York City, U.S.A., Chemist.
1903. Ledoux, Aug. D., 15, William Street, New York City, U.S.A., Importer of Pyrites.
1915. Ledwidge, Jos. G., Municipal Technical School, Drogheda, Ireland, Analytical Chemist.
1905. Lee, Ashton, Lawrence, Mass., U.S.A., Manufacturing Chemist.
1905. Lee, Frank W., Lawrence, Mass., U.S.A., Manufacturing Chemist.
1905. Lee, John C., Wellesley, Mass., U.S.A., Assistant Engineer (American Telegraph and Telephone Co.).
1898. Lee, Jno. L., Woodfield, Lytham, Lancashire, Dyer and Bleacher.
1885. Lee, S. Wright, 6-10, Whitechapel, Liverpool, Wholesale Druggist.
1906. Lee, William, 28, Sherard Gardens, Eltham, Kent, Works Chemist.
1912. Lees, Arnold, "Hazellhurst," Town Street, Beeston, Leeds, Analytical Chemist.
1901. Leffler, Rudolf L., c/o Thos. Firth and Sons, Ltd., Norfolk Works, Sheffield, Metallurgical Chemist.
1914. Legg, Bertram, Greenheys, Murray Rd., Northwood, Middlesex; Jnls. to 61-62, Chancery Lane, London, W.C., Chemist and Assayer.
1907. Lehmann, Dr. Adolf, University of Alberta, Strathcona, Alberta, Canada, Professor of Chemistry.
1888. Leigh, Cecil, Birmingham Metal and Munition Co., Adderley Park Rolling Mills, Birmingham, Technical Chemist.
1902. Leighton, A. E., Commonwealth Cordite Factory, Maribyrnong, Victoria, Australia, Analytical Chemist.
1894. Leitch, Jno. W., Milnsbridge Chemical Works, near Huddersfield, Aniline Dye Manufacturer.
1904. Le Maistre, Fred J., Room 781, Du Pont Building, Wilmington, Del., U.S.A., Research Chemist.
1898. Leman, Wm. T., P.O. Box 747, Chicago, Ill., U.S.A., Oil and Asphalt Agent.
1883. Lennard, F., c/o Forbes Abbott, and Lennard, Ltd., Chemical Works, Shoreham, Sussex, Chemical Manufacturer.
1884. Leonard, Wm. J., 1, Lindfield Gardens, Hampstead, N.W., Naphtha Distiller.
1888. Lequin, E., Directeur Général des Usines de Produits Chimiques de la Société de St. Gobain, 1, Place des Saussaies, Paris (VIII^e), France.
1904. Lesley, R. W., 604, Pennsylvania Building, Philadelphia, Pa., U.S.A., Cement Manufacturer.
1907. Leslie, Dr. Fred. A., College of Pharmacy, 115, West 68th Street, New York City, U.S.A., Chemist.
1904. Lessing, Dr. Rudolf, Southampton House, 317, High Holborn, London, W.C., Consulting Chemist.
1912. Lessner, C. B., Carril, Spain, Metallurgical Chemist.
1892. Lester, J. H., Grange Drive, Monton Green, Eccles, Lancs, Analytical Chemist.
1899. Le Sueur, Dr. Henry R., Chemical Laboratory, St. Thomas' Hospital, London, S.E., Demonstrator.
1891. Lever, Sir Wm. H., Bart., Thornton House, Thornton Hough, Cheshire, Soap Manufacturer.
1909. Lever, W. Hulme, Heathfield, Bebington, Cheshire, Soap Manufacturer.
1901. Levett, Walter, Holmlands, Stanford-le-Hope; and (Journals) Mines Safety Explosives Co., Stanford-le-Hope, Essex, Factory Manager.
1903. Levi, Dr. Louis E., 781, Sherman Boulevard, Milwaukee, Wis., U.S.A., Chemist.
1912. Levin, Isaac H., 95, Weeguahic Avenue, Newark, N.J., U.S.A., Chemist.
1906. Levinstein, Edgar, 74, India Street, Boston, Mass., U.S.A., Chemical Manufacturer.
1901. Levinstein, Dr. Herbert, c/o Levinstein, Ltd., Blackley, near Manchester, Chemist.
- O.M. Levinstein, Ivan, Hawkesmoor, Fallowfield, Manchester, Colour Manufacturer.
1903. Levy, Arthur G., 1927, Madison Avenue, New York City, U.S.A., Chemist.
1909. Levy, Louis S., 80, Maiden Lane, New York City, U.S.A., Editor "American Perfumer."

1901. Levy-Mond, Dr. Albert. *See* Mond, Dr. Albert L.
 1887. Lewes, Prof. Vivian B., Royal Naval College, Greenwich, S.E., Professor of Chemistry.
 1898. Lewin, H. James, Royal Clarence Yard, Gosport, Hants, Analytical Chemist.
 1914. Lewis, C. Preston, 223, Brixton Hill, London, S.W., Technical Chemist.
 1896. Lewis, Daniel C., c/o Millville Manufacturing Co., Millville, N.J., U.S.A., Dye Works Chemist.
 1904. Lewis, Edw. W., c/o J. G. Ingram and Sons, London India Rubber Works, Hackney Wick, N.E., Chemist.
 1900. Lewis, Ernest A., 310, Dudley Road, Birmingham, Chemist and Metallurgist.
 1905. Lewis, F. W., Actna Powder Co., 143, Dearborn Street, Chicago, Ill., U.S.A., Secretary.
 1900. Lewis, John, 76, Underhill Road, Lordship Lane, S.E., Cashier (Paint Works).
 1909. Lewis, Reginald J., Govt. Explosives Office, 423, Flinders Lane, Melbourne, Australia, Chemist.
 1900. Lewis, Dr. S. Judd, The Laboratories, Staple Inn Buildings, High Holborn, London, W.C., Analytical Chemist.
 1914. Lewis, Prof. W. C. McC., Muspratt Laboratory, The University, Liverpool, Professor of Physical Chemistry.
 1913. Lewkowitsch, Mrs. K. J., The Lewkowitsch Laboratories, 71, Priory Road, West Hampstead, N.W.
 1907. Leyson, Lewis T., c/o Standard Bank of South Africa, Johannesburg, Transvaal, Analytical Chemist.
 1901. Lichtenstein, Alf. F., c/o Geisenheimer and Co., P.O. Box 994, New York City, U.S.A., Chemist.
 1913. Lichtenstein, L. M., Royal Albert and Victoria Docks Chemical Works, Silvertown, London, E., Manufacturing Chemist.
 1904. Lichtenthaler, Robt. A., Rhode Island Agricultural Experiment Station, P.O. Box 112, Kingston, R.I., U.S.A., Chemist.
 1913. Lidholm, J. H., c/o Alby United Carbide Factories, Ltd., 308, Winchester House, Old Broad Street, London, E.C., Chemical Engineer.
 O.M. Liebmam, Dr. A., The Whim, Weybridge, Surrey, Consulting Chemist.
 1913. Liebreich, Dr. Erik, 30, Kronprinzen Ufer, Berlin, Germany, Chemist.
 O.M. Lightfoot, T. E., Fernleigh, Acerington, Calico Printer's Chemist.
 1905. Liley, Thos. A., 46, Westover Road, Bramley, Leeds, Chemist.
 1898. Lilly, Josiah K., c/o Eli Lilly and Co., Indianapolis, Ind., U.S.A., Manufacturing Pharmacist.
 1904. Lindemann, Ottocar, 53, Victoria Street, Westminster, S.W., Managing Director (Korting Bros., Ltd.)
 1908. Lindfield, James H., c/o Messrs. Martineau, King Edward Street, Whitechapel, E., Technical Chemist.
 1897. Lindsay, Robt., Transvaal G.M. Estates, Pilgrim's Rest, Lydenburg, Transvaal, Chemist.
 1890. Ling, Arthur R., Laboratory, 74, Great Tower Street, London, E.C., Consulting Chemist.
 1905. Lips, Dr. Carl H., 99, Hart Street, Brooklyn, N.Y., U.S.A., Chemist.
 1896. Lishman, Geo. P., Lambton Coke Works, Fence Houses, Co. Durham, Colliery Chemist.
 1905. Little, Arthur D., 93, Broad Street, Boston, Mass., U.S.A., Consulting Chemist.
 O.M. Littlejohn, Jas., c/o Littlejohn and Whitby, P.O. Box 849, Johannesburg, Transvaal, Analytical Chemist.
 1904. Livermore, W. D., Washington Mill, Lawrence, Mass., U.S.A., Chemist.
 1886. Liversedge, A. J., 63, Northampton Road, Croydon, Mechanical Engineer.
 1914. Liversedge, John A., May Morn Mills, Mangaron, near Wellington, New Zealand, Assistant Lead Mill Manager.
 1904. Liversedge, J. F., Analytical Dept., 44, Broad Street, Birmingham, City Analyst.
 O.M. Liversedge, Prof. A., F.R.S., Field Head, Coombe Warren, Kingston, Surrey, Professor of Chemistry.
 1907. Liversidge, Bernard, 6, Nelson Street, Rotherham, Yorks, Analytical Chemist.
 1883. Livingston, W. J., 30, Fountayne Road, Stoke Newington Common, London, N., Analytical Chemist.
 1903. Llewellyn, Ivor P., 149, Moorland Road, Stockport, Chemist.
 1907. Llewellyn, W. B., 114, Belgrave Road, New Moston, Manchester, Chemist.
 1909. Lloyd, Edward, 27, Broomgrove Road, Sheffield, Chemical Engineer.
 1913. Lloyd, Prof. Francis E., Dept. of Botany, McGill University, Montreal, Canada, Prof. of Botany.
 1904. Lloyd, Leonard B., Broadford Tannery, Broadford, Victoria, Australia, Tanner.
 1907. Lloyd, Dr. Lorenzo L., Technical College, Bradford, Yorks, Lecturer in Chemistry.
 1909. Lobley, A. G., Mill Bank, Trefriw, North Wales, Chemist.
 1914. Lockett, William T., 74, Victoria Road, Urmston, near Manchester, Research Chemist.
 1888. Lodge, Edw., 35, Scale Hill, Cowcliffe, Huddersfield, Teacher of Wool Dyeing.
 1891. Loewenthal, Dr. R., Uhlandstrasse 39, Frankfurt a/M., Germany, Lecturer on Dyeing.
 1907. Lomax, E. Lawson, Mowbreck, Farington, near Preston, Chemist.
 1901. Long, Eugene J., c/o E. O'Callaghan and Son, City Tannery, Limerick, Ireland, Tanner.
 1909. Long, George, Cudahy, Wis., U.S.A., Glue Maker.
 1898. Longstaff, Dr. Jas. P., Chemical Department, The University, Edinburgh, Assistant.
 1908. Longwell, Alex., 404, Lumsden Building, Toronto, Canada, Mining Engineer.
 1890. Lord, F. J., Wiumarkleigh, Southborne, Bournemouth, Hants, Analytical Chemist.
 1896. Lord, Jno. Lloyd, Wellington Cement Works, Elton, Bury, Lancs, Chemist and Manager.
 O.M. Lorenz, H., 7 and 8, Idol Lane, London, E.C., Chemical Merchant.
 1904. Lorimer, John H., 280, West Walnut Lane, Germantown, Philadelphia, Pa., U.S.A., Textile Machinist and Merceriser.
 1905. Loring, Lindsley, 40, Central Street, Boston, Mass., U.S.A., Vice-President (Cochrane Chemical Co.).
 1909. Lorieberg, C., c/o R. W. Greeff and Co., Thames House, Queen Street Place, London, E.C., Chemical Merchant.
 O.M. Lorrain, Jas. G., Staple Inn Buildings, Holborn, London, E.C., Chartered Patent Agent.
 1904. Loasen, Dr. Clemens F., Boulevardul Independentei 8, Ploesti, Roumania, Chemist.
 O.M. Lott, F. E., The Laboratory, Bridge Chambers, Burton-on-Trent, Consulting Brewing Chemist.
 O.M. Louis, D. A., 123, Pall Mall, London, S.W., Metallurgist and Mining Engineer.
 1894. Louis, Prof. Henry, Armstrong College, Newcastle-on-Tyne, Professor of Mining.
 O.M. Love, Dr. E. G., 124, East 15th Street, New York City, U.S.A., Analytical Chemist.
 1899. Love, Wm., 28, Royal Exchange Square, Glasgow, Managing Director (Brosburn Oil Co., Ltd.).
 O.M. Lovibond, T. W., West Jesmond House, Newcastle-on-Tyne, Brewer.
 1913. Low, Frank S., c/o Cutler-Hammer Manufacturing Co., 144th Street and Southern Boulevard, New York City, U.S.A., Chemical Engineer.
 1900. Low, Prof. Wilson H., Cudahy Packing Co., South Omaha, Neb., U.S.A., Chemist.
 1911. Lowcock, J. Harold, 39, Wickham Way, Park Langley, Beckenham, Kent, Chemist.
 1913. Lowe, Austin, 39, Chelverton Road, Putney, S.W., Research Chemist.
 1887. Lowe, Clement W., Thorneyholme, Knutsford, Cheshire, Manufacturing Chemist.
 O.M. Lowe, W. F., 18, Hough Green, Chester, Analytical Chemist.
 1906. Lowson, Wm., The University, Leeds, Chemical Lecturer.
 1895. Lucas, Alf., Laboratories, Public Works Ministry Gardens, Cairo, Egypt, Analyst.

1892. Lucas, Bernard R., Winnington Park, Northwich, Alkali Works Manager.
1914. Lucas, Wm. A., c/o Chile Exploration Co., Chuorci Cainata, vii Antofagasta, Chile, Chemist.
- O.M. Luck, A. Courtenay, San Martin 475, Buenos Aires, Argentina, Explosives Chemist.
1913. Lucy, Arthur J., c/o Angelo Bros. Ltd., Cossipore, Calcutta, India, Consulting Engineer.
1900. Lumms, Walter E., 39, Bassett Street, Lynn, Mass. U.S.A., Manager.
1903. Lumsden, Alex. A., Forth Chemical Works, Bo'ness, Scotland, Technical Chemist.
1910. Lumsden, William W., 39, Caledonia Road, Salt-coats, Scotland.
1888. Lund, Jas., 142, Hawthorne Street, Malden, Mass., U.S.A., Ammonia Works Manager.
1888. Lundholm, Carl O., 220, Winchester House, Old Broad Street, London, E.C., Explosives Works Manager.
1913. Lunge, Ernest, 2, Plowden Buildings, Temple, London, E.C., Barrister-at-Law.
- O.M. Lunge, Dr. G., Carmenstrasse 37, Zürich, Switzerland, Professor of Chemistry.
1885. Lupton, Sydney, 102, Park Street, Grosvenor Square, London, W.
1884. Lüthy, Otto, P.O. Box 63, Maywood, N.J., U.S.A., Analytical Chemist.
1903. Lye, Ernest B., Leagrave Hall, near Luton, Beds, Straw Plait Dyer and Bleacher.
1885. Lye, W. T., Leagrave Hall, near Luton, Beds, Straw Dyer.
1915. Lyle, C. E. Leonard, 21, Mincing Lane, London, E.C., Sugar Refiner.
1884. Lyle, James, Ardesco, West Silvertown, E., Sugar Refiner.
1896. Lynn, Arthur H., Sanctuary House, Tothill Street, Westminster, S.W., (Jnls.) to 53, Hampstead Way, Golders Green, N.W., Consulting Chemical and Gas Engineer.
1899. Lynn, R. Rankine, 7, Highburgh Terrace, Dowanhill, Glasgow, Chemical Engineer.
- O.M. Lyon, J. G., The Aire Tar Works, Knottingley, Yorks, Tar Distiller.
1906. Lyons, Robert H., c/o Canadian Explosives, Ltd., Belair Station, Quebec, Canada, Chemist.
- O.M. Lytle, A. M., North of Ireland Chemical Co., Ltd., 34, Victoria Street, Belfast, Ireland, Chemical Manufacturer.
- M
1908. Maas, Milton A., 92, William Street, New York City, U.S.A., Manufacturing Chemist.
1911. Mabbitt, Alan T., 3, Wallwood Road, Leytonstone, N.E., Analytical Chemist.
1887. Mabery, Prof. Chas. F., Case School of Applied Science, Cleveland, Ohio, U.S.A., Professor of Chemistry.
1891. Macadam, Herbert E., Dalkeith, Glengall Road, Woodford Green, Essex, Manure Works Manager.
1894. Macadam, Stevenson, 55, York Place, Edinburgh, Analytical Chemist.
1912. McAfee, Dr. A. M., c/o The Gulf Refining Co., Port Arthur, Texas, U.S.A., Chemist.
1894. McAlley, Robt., Bankside, Falkirk, Scotland, Paint Works Manager.
1892. Macara, Thos., jun., 20, Denton Road, Stroud Green, N., Chemist.
1912. McArlly, T. P., Mount Lyell Mining and Railway Co., Queenstown, Tasmania, Chemist and Assayer.
1887. McArthur, James B., Price's Patent Candle Co., Limited, Belmont Works, Battersea, S.W., Chemist.
- O.M. McArthur, J. S., 74, York Street, Glasgow, Consulting Chemist and Metallurgist.
1901. Macarthur, Jno. S., 15, St. John's Road, Pollokshields, Glasgow, Paint and Varnish Manufacturer.
1892. McArthur, Thos., 711, Tower Building, Water Street, Liverpool, Drysalter and Dyewood Extractor.
1912. Macaulay, J. W., The Laboratory, Holwell Iron Co., Ltd., Ashfordby, near Melton Mowbray, North-umberland, Metallurgical Chemist.
1911. McBride, K. R., Glens Falls, N.Y., U.S.A., Colour Chemist.
1898. MacCallum, D. A., 389, Central Chambers, 93, Hope Street, Glasgow, Chemist.
- O.M. McCallum, J. M., Southdenc, Paisley, Scotland, Soap Manufacturer.
1914. McCarthy, Robt. A., Bertram Street, Mortlake, Sydney, N.S.W., Australia, Gas Chemist.
1905. McCaw, Lt.-Col. W. D., Library, Surgeon General's Office, Washington, D.C., U.S.A., Officer, Medical Department, U.S. Army.
1905. McCleary, Wm., 61, Station Road, Pendlebury, near Manchester, Finisher.
1910. McColl, A. L., North Brazilian Sugar Factories, Ltd., Tiuna Recife, Pernambuco, Brazil, Chemist.
1907. McConnan, Sergt. Jas., Chemist.
1914. McCormick, J. T., Laboratory Dept. of Defence, Melbourne, Australia, Chemist.
1903. McCourt, Cyril D., 45, Braxted Park, Streatham Common, S.W., Chemist.
1912. McCoy, James P. A., Research Division, Westinghouse Electric and Manufacturing Co., East Pittsburgh, Pa., U.S.A., Analytical Chemist.
1913. McCrady, McH., 9, St. James' Street, Montreal, Canada, Chemist and Bacteriologist.
1897. McCrae, Dr. John, Government Laboratories, P.O. Box 1080, Johannesburg, Transvaal, Government Analyst.
1898. McCreath, Wm. D., Quantock Vale Cider Works, North Petherton, Bridgwater, Cider Manufacturer.
1900. McCulloch, John, Glencoe, Lostock Gralain, near Northwich, Cheshire, Chemical Engineer.
1911. McCulloch, Norman G., Rhodes Works, Rhodes, Manchester, Chemist and Calico Printer.
1903. McCully, R. E. J., c/o Indian Cement Co., Norbandar, Kathiawar, India, and (Jnls.) 13, Lance Lane, Wavertree, Liverpool, Analytical Chemist.
1910. Macdonald, Alexander, Netherlea, Matilda Road, Pollokshields, Glasgow, Manufacturing Chemist.
1912. McDonald, Allan D., "Belgrano," Milngavie, near Glasgow, Manufacturing Chemist.
- O.M. Macdonald, Andrew, 72, Great Clyde Street, Glasgow.
1912. McDonald, Donald, 95, Clarence Gate Gardens, Regent's Park, London, N.W., Analytical Chemist.
1897. MacDonald, G. W., Whitefriars, Rochester, Kent, Chief Explosives Research Chemist (Curtis's and Harvey, Ltd.).
1919. Macdonald, J. L. A., 13, Howard Place, St. Andrews, Fife, Scotland.
- O.M. Macdonald, J. W., 8, Prince of Wales Terrace, Kensington, W., Analytical Chemist.
- O.M. McDonald, T. McG., Wallabo Estate, St. Vincent, West Indies, Sugar Chemist.
1906. Macdougald, Geo. D., 140, Perth Road, Dundee, City Analyst.
1890. McDougall, J. T., Dunolly, Morden Road, Blackheath, S.E., Manufacturing Chemist.
1906. McDowall, Wm., 42, Herriet Street, Pollokshields, Glasgow, Analytical Chemist.
1889. MacEwan, Peter, 64, Southwood Lane, Highgate, N., Editor of "Chemist and Druggist."
1901. McEwen, Duncan C., c/o Chosen Gold Mines, Ltd., Kok-Kang-Kol Mine, Chung-An, Korea, Metallurgical Chemist.
1914. McFadyen, F. H., Canadian Rubber Co., Cor. Notre Dame and Papineau, Montreal, Canada, Chemist.
1902. McFarland, Alan R., c/o Solvay Process Co., Syracuse, N.Y., U.S.A., Alkali Works Manager.
1910. McFarlane, John, 6, Gordon Terrace, Shettleston, Glasgow, Metallurgist.
1893. McGhie, T. Burns, Bengate House, Appleby, West-morland, Metallurgist.
1904. McGill, Dr. A., 317, Queen Street, Ottawa, Canada, Analytical Chemist.

4899. MacGillivray, Wm. A., c/o Swansea Safety Fuse Co.,
Pipe House Wharf, Swansea, Analytical Chemist.
1887. McGlashan, John, Post Office, Tolodi Balapur,
Dist. Chanda, C.P., India, Technical Chemist.
1906. McGregor, Russell, 15, Fordingham Road, Scun-
thorpe, Lincolnshire, Analytical Chemist.
1896. Melhiney, Dr. Parker C., 50, East 41st Street, New
York City, U.S.A., Chemist.
- O.M. Mellwaine, Alf. W., Stoneferry, Hull, Oil Manu-
facturer.
- O.M. MacIndoe, G. D., Ness Street, Invercargill, New
Zealand, Public Analyst and Consulting Chemist.
1914. MacInnes, Wm., 126, Dixon Avenue, Crosshill,
Glasgow, Fire Surveyor.
1903. Macintire, Benj. Gould, 2226, West 17th Street,
Wilmington, Del., U.S.A., Chemist.
1913. MacIntosh, George, 352, Elm Avenue, Westmount,
Montreal, Canada, Glycerin Works Manager.
1914. McIntyre, A. Gordon, Bathurst, New Brunswick,
Canada, Manager, Paper Mills.
1909. McIntyre, George D., c/o Morris and Co., National
Stock Yards, Oklahoma City, Okla., U.S.A.,
Technical Chemist.
1914. MacIvor, R. W. Emerson, c/o Metals Recovery,
Ltd., 47, Victoria Street, Westminster, S.W.,
Consulting Chemist.
1910. Mackay, Angus, Laboratory, Wellpark Brewery,
Glasgow, Brewer's Chemist.
1911. Mackay, F., Oficina Agua Santa, Iquique, Chile,
Analytical Chemist.
1914. McKay, Gordon P., 13, Prince Arthur Avenue,
Toronto, Canada, Chemist.
1912. McKechnie, Alex., Chad Hill Cottage, Edgbaston,
Birmingham, Copper Smelter.
1904. McKechnie, R. D., c/o British Aluminium Co.,
Ltd., Larne Harbour, co. Antrim, Ireland,
Chemical Engineer.
1887. McKellar, W. G., c/o United Alkali Co., Ltd.,
St. Rollox Works, Glasgow, Technical Chemist.
1899. McKenzie, Alex. H., 17, North Street, North Adams,
Mass., U.S.A., Colour Mixer.
1909. Mackenzie, Kenneth G., c/o The Texas Co., Bayonne,
N.J., U.S.A., Chemist.
1893. McKerraw, C. A., 8, Berners Street Mansions,
London, W.; and (Journals) c/o Mitchells, Ash-
worth, and Co., 23-24, Old Bailey, London, E.C.
Consulting Chemist.
1893. McKesson, John, 91, Fulton Street, New York City,
U.S.A., Manufacturing Chemist.
1911. McKey, Arthur W., 216, Milk Street, Boston, Mass.,
U.S.A., Sales Agent.
1891. Mackey, W. McD., Victoria Chambers, Leeds,
Analytical Chemist.
1912. McKillop, G. F., Oilworks, Broxburn, West Lothian,
Scotland, Works Chemist.
1890. McKillop, Jno., 32, Aynho Road, Hammersmith,
W., and (Jnls.) c/o W. Müller, 69A, Great Queen
Street, Kingsway, W.C., Metallurgist.
1902. McKim, Wm., 37, Fairview Street, Yonkers, N.Y.,
U.S.A., Colour Maker.
1908. McLaren, Alex., 22, Moss Lane, Walton, Liverpool,
Analytical Chemist.
1908. McLaren, Alex. W., 3, Hayfield Terrace, Langside,
Glasgow, Analytical Chemist.
1898. McLaurin, Robt., Homesteads, Cambusbarron,
Stirling, Chemist.
1905. McLellan, Basil G., c/o Rowntree and Co., Ltd.,
The Cocoa Works, York, Technical Chemist.
1910. MacLellan, George A., 1, Montague Terrace, Glasgow,
W., Rubber Manufacturer.
1908. Macleod, Alex., Mount Pleasant, Old Kilpatrick,
Dumbartonshire, Analytical Chemist.
1914. MacLeod, Fred, L., 694, Duke Street, Glasgow,
Chemical Manufacturer.
1892. McLeod, Jas., Gas Works, Greenock, Manager.
1912. McMaster, Prof. Le Roy, Washington University,
St. Louis, Mo., U.S.A., Assoc. Prof. of Chemistry.
1904. McMullen, Alan, Saint James' Gate, Dublin, Ireland,
Brewer.
1895. McMurtry, G. C., Templemore, Richmond, Nelson,
New Zealand, Manager.
- O.M. Macnab, W., 10, Cromwell Crescent, London, S.W.,
Analytical Chemist.
1907. McNaughton, Wm. G., Port Edwards, Wis., U.S.A.,
Chemist.
1908. McQueen, James, jun., Phoenix Chemical Works,
Pollokshaws, Glasgow, Chemical Manufacturer.
1912. McRae, J. A., 184, University Avenue, Kingston,
Ont., Canada, Research Chemist.
1914. McTavish, D. D., 626, Roslyn Avenue, Westmount,
Quebec, Canada, General Manager, Canada
Carbide Co.
1909. McWhirter, James, c/o Wm. Beardmore and Co.,
Laboratory, Parkhead Forge, Glasgow, Metal-
lurgical Chemist.
1910. Madge, Norman, c/o Continental Rubber Co. of
New York, 11, Vandewater Street, New York
City, U.S.A., Chemist.
1895. Magnus, Isidor, 52, Leadenhall Street, London,
E.C., Chemical Merchant.
1901. Magruder, Egbert W., Department of Agriculture,
Richmond, Va., U.S.A., Chemist.
1912. Main, Hugh, Almondale, Buckingham Road, South
Woodford, N.E., Analytical Chemist.
1898. Main, Wm., Piermont, N.Y., U.S.A., Chemist.
1905. Major, Ernest, "Seafield," Day Street, Drummoyne,
Sydney, N.S.W., Manufacturing Chemist.
- O.M. Major, J. Lewis, Welton Garth, Brough, East Yorks,
Tar Distiller and Chemical Manufacturer.
1910. Male, C. E., c/o Bankoku Toryo Seizoshu, P.O.
Box No. 141, Kobe, Japan, Chemist.
1886. Mallinckrodt, Edw., Library, Mallinckrodt Chemical
Works, St. Louis, Mo., U.S.A., Manufacturing
Chemist.
1912. Manley, Chas. E., 8, Wilmington Gardens, Barking,
Essex, Paint and Colour Works Manager.
1893. Mann, Harold H., Agricultural College, Poona,
Bombay, India, Research Chemist.
1899. Mann, Jas. S., 19, Stopford Road, Upton Manor,
Essex, Analyst.
1891. Mann, John C., 33, Nicholls Street, West Bromwich,
Staffs, Chemist.
1914. Mann, Wilfred G., 37, Parliament Street, West-
minster, S.W., Chemical Engineer.
1914. Mann, William, Messrs. Mann and Cook, 27, St.
Mary Axe, London, E.C., Oil and Chemical
Merchant.
1903. Mannhardt, Hans, 1104, Oakdale Avenue, Chicago,
Ill., U.S.A., Chemical Engineer.
- O.M. Mannington, H. T., Marshlea, Beaconsfield Road,
Farnworth, Widnes.
1892. Mansbridge, Wm., 4, Norwich Road, Wavertree,
Liverpool, Chemist.
1904. Marekworth, O. S., Ohio Testing Laboratory, 426,
Chamber of Commerce, Columbus, Ohio, U.S.A.,
Director.
1883. Markel, Dr. K. E., 20, Queen's Gate Terrace, South
Kensington, S.W., Technical Chemist.
1905. Marland, Percy, c/o Brotherton and Co., Ltd.,
Provan Chemical Works, Glasgow, Technical
Chemist.
1905. Marlatt, Wilbur T., Oakville, Ont., Canada, Leather
Manufacturer.
1912. Marly, Dr. Simon M., 34, Arbour Street, Southport,
Analytical Chemist.
1914. Marples, Morris E., 7, Alfred Road, Birkenhead,
Chemist.
1904. Marris, H. C., 68, Schlüsselburg Prospect, Petrograd,
Russia, Analytical Chemist.
1901. Marsden, Dr. Fred., Technical Institute, Madura,
South India, Chemist.
1906. Marsden, Oliver, Manor Road Mill, Victoria Road,
Leeds, Cashier.
- O.M. Marsh, J. T., Ammonia Soda Works, Fleetwood,
Lancashire, Chemist.
1883. Marsh, W., Union Alkali Co., Soho Works, Ancoats,
Manchester, Chemical Manufacturer.
1895. Marshall, Arthur, Waverley Cottage, Naini Tal,
India, Chief Chemical Examiner.
1895. Marshall, Francis G., 56, Bewick Road, Gateshead,
Technical Chemist.

1908. Marshall, John, Cudbear Street, Hunslet, Leeds, Dyeware Manufacturer.
1913. Marshall, Philip W., c/o The Fred. Crane Chemical Co., Armoury Close, Bordesley Green, Birmingham, Lacquer Manufacturer (retired).
1883. Marshall, Wm., Laboratory, Ladybrook Road, Cheadle Hulme, Cheshire, Dyer.
1884. Marshall, Wm., 9, Castello Avenue, Putney Park, S.W., Analytical Chemist.
1904. Marston, John P., 247, Atlantic Avenue, Boston Mass., U.S.A., Merchant.
1894. Martin, Alex. M., Hillview, Twechar by Glasgow, Analytical Chemist.
1895. Martin, Chas. H., 50, Longmead Road, Clarendon, Pendleton, Manchester, Oil and Soap Works Manager.
1913. Martin, Edwin J., c/o Jas. Martin and Sons, Luton, Beds, Bleacher and Dyer.
1911. Martin, Dr. G., 4, Bertram Road, Hendon, N.W., Science Teacher and Industrial Chemist.
- O.M. Martin, N. H., Ravenswood, Low Fell, Gateshead-on-Tyne, Manufacturing Chemist.
1899. Martin, Wm. E., 111, Belle Vue Road, Durban, Natal, South Africa, Chemist.
1887. Martineau, Sydney, Streatham Grove, Norwood, S.E., Sugar Chemist.
1907. Martins, Dr. C. A. von, Voss Strasse 12, Berlin, Germany, Dyestuff Manufacturer (retired).
1894. Martyn, T. Graham, Box 5, Maraisburg, Transvaal, South Africa, Metallurgist.
1909. Marx, Robert J., 133-139, Finsbury Pavement, London, E.C., Engineer.
1908. Mason, Capt. Douglas H. C., Manufacturer.
1904. Mason, Dr. Edward D., 32, Vernon Road, Edgbaston, Birmingham, Scientific Apparatus Dealer.
1911. Mason, Francis A., c/o Murphy and Lonsdale, 4, Queen Square, Leeds, Analytical Chemist.
1915. Mason, Dr. Fredk. A., 21, Queen Square, London, W.C., Demonstrator in Chemistry.
1906. Mason, Dr. Frederic S., 90, Beekman Street, New York City, U.S.A., Manufacturing Chemist.
1904. Mason, Glen F., c/o H. J. Heinz Co., Pittsburg, Pa., U.S.A., Chemist.
1887. Mason, J. Francis, Eynsham Hall, Witney, Oxon.
1906. Mason, M. Edgar, 268, Fox Street, Aurora, Ill., U.S.A., Consulting Chemist.
1914. Mason, William O. S., The Woodbines, Staines Road, Sunbury Common, Middlesex, Analytical Chemist.
1906. Massa, Corradino, Castelnello Parmense, Parma, Italy, Sulphuric Acid and Fertiliser Manufacturer.
- O.M. Masson, Prof. D. Orme, University of Melbourne, Victoria, Australia, Professor of Chemistry.
1908. Masson, R. Duncan, c/o Messrs. R. Silcock and Sons, Stanley Hall, Union Street, Liverpool, Analytical Chemist.
1902. Masujima, Prof. Bunjiro, c/o K. Takebe, 16, Gazonbocho, Azabuku, Tokyo, Japan, Prof. of Applied Chemistry.
1910. Matchet, Andrew S., 13, Bute Gardens, Muirend, Cathcart, Glasgow, Analytical Chemist.
1911. Mather, Hubert, Lonsdale Terrace, Whitefield, Lancashire, Chemist.
- O.M. Mather, J., Blaydon Chemical Works, Blaydon-on-Tyne, Manager.
1900. Mather, Wm., c/o The Standard Chemical Iron and Lumber Co., Montreal, Canada, Chemist.
1915. Mathesius, Ant., P., c/o E. I. du Pont de Nemours Powder Co., 20, Bishopsgate, London, E.C., Representative.
1907. Matheson, A. Greville E., Hawkesbury, Chinley, Derbyshire, Engineer.
1890. Matheson, W. J., c/o Cassella Color Co., 182, Front Street, New York City, U.S.A., Chemical Merchant.
1901. Mathew, W. E. B. de Vere, Dinham, Hillside Gardens, Wallington, Surrey, Analytical Chemist.
1900. Mathews, Dr. Jno. A., c/o Halcombe Steel Co., Syracuse, N.Y., U.S.A., Managing Director.
1898. Mathewson, E. P., Anaconda, Mont., U.S.A., Metallurgist.
1888. Mátyos, Dr. Louis J., (Comms.) 103, North 19th Street, East Orange, N.J., and (Jnls.) c/o Cassella Color Co., 182-4, Front Street, New York City, U.S.A., Chemist.
1896. Matsui, G., 10, Nishikatamachi, Tokio, Japan, Chemical Engineer.
1912. Matthewman, Fred. P., Analyst's Office, L.B. and S.C. Railway Co., Brighton, Chief Chemist.
- O.M. Matthews, Chas. G., 31, Stapenhill Road, Burton-on-Trent, Brewing Chemist.
1907. Matthews, Dr. F. E., Ashlawn, The Glebe, Blackheath, S.E., Technical Research Chemist.
1899. Matthews, Dr. J. Merritt, 5, Berwyn Street, East Orange, N.J., U.S.A., Professor of Chemistry and Dyeing.
1889. Mawdsley, W. H., G.P.O., Rockhampton, Queensland, Chemist.
1903. Maxim, Hudson, 698, St. Mark's Avenue, Brooklyn, N.Y., U.S.A., Chemist and Mechanical Engineer.
1894. Maxwell, Jno., Solway Chemical Works, Silloth, Cumberland, and (communications) English Street, Carlisle, Chemical Manure Manufacturer.
1903. Maxwell, Orin P., c/o West Virginia Pulp and Paper Co., Luke, Md., U.S.A., Chemist.
1911. May, Clarence E., 320, South Walnut Street, Bloomington, Ind., U.S.A.
1897. May, George H., 35, Graycliff Road, Newton Centro, Mass., U.S.A., Assistant Chemist.
1914. May, Percy, 123, Cazenove Road, Stamford Hill, London, N., Chemist.
1884. Mayenfeld, Dr. E. von Salis. *See* Salis-Mayenfeld, Dr. E. von.
1903. Mayer, Andrew, jun., 176, Sixth Avenue, Brooklyn, N.Y., U.S.A., Chemist.
1896. Mayfield, A. S., Oakdene, Newland Park, Hull, Analyst.
1892. Mayfield, H. B., Normanhurst, Mundy Street, Heanor, near Nottingham, Dyer.
1885. Mayhew, E. W. A., Manufacturing Chemist.
1909. Meanwell, Chas. W., 15, Woodlands Crescent, Muswell Hill Road, London, N., Analytical Chemist.
1898. Meeds, Alonzo D., 2424, Harriet Avenue, Minneapolis, Minn., U.S.A., Analytical Chemist.
1896. Meggitt, Loxley, Wheatsheaf Works, Alexandria, Sydney, N.S.W., Australia, Analytical Chemist.
1901. Meier, Dr. Franz, c/o Society of Chemical Industry in Basle, Basle, Switzerland, Chemist.
1888. Meikle, Jno., 8, Melrose Street, Great Western Road, Glasgow, Journalist.
1915. Meister, Fred, Laboratory Distiller Co., Ltd., Menstrie, Scotland, Analytical Chemist.
1902. Melcher, Arthur C., 58, Bowen Street, Newton Centre, Mass., U.S.A., Research Chemist.
- O.M. Meldola, Prof. R., F.R.S., 6, Brunswick Square, London, W.C., Professor of Chemistry.
1911. Mellerio, Lucien P., 5, Coburg Mansions, Brunswick Square, London, W.C., Technical Assistant.
1912. Melling, S. E., Bank House, The Cliff, Higher Broughton, Manchester, Analytical Chemist.
- O.M. Mellon, W. W., Woodlands, Blackrock, Co. Dublin, Ireland, Manufacturing Chemist.
1910. Mellor, Dr. Jos. W., 19, Villas, Stoke-on Trent, Ceramic Chemist.
1912. Mennell, Harold, 41, Wolverton Road, Stony Stratford, Bucks, Analytical Chemist.
1893. Mensching, Dr. C., Journals to Mersey Chemical Works, Bromborough Port, Birkenhead, Chemist.
1915. Menzies, R. C., Chemical Dept., The University, St. Andrews, Scotland, Chemist.
1892. Mercer, C. A., 34, Camomile Street, London, E.C., Chemical Apparatus Maker.
1890. Merck, Dr. E. Darmstadt, Germany, Jnls. to 66, Crutched Friars, E.C., Manufacturing Chemist.
1905. Merck, George, Merck and Co., 45, Park Place, New York City, U.S.A., Manufacturing Chemist.
1899. Merrill, Frank H., 2420, Ocean View Avenue, Los Angeles, Cal., U.S.A., Factory Superintendent.

1906. Merrills, Fred. J., 25, Figtree Lane, Sheffield, Analytical Chemist.
1999. Merriman, C. E. B., 74, Trent Boulevard, West Bridgford, Nottingham, Technical Chemist.
1909. Merriman, H. J., 244, Victoria Park Road, South Hackney, N.E., Research Chemist.
1905. Merrin, A. C., 194-200, Bishopsgate, London, E.C., Assistant Editor and Analyst.
1904. Merry, Jno. B., 74, Park Hill Road, Harborne, Birmingham, Metallurgical Chemist.
1903. Mersan, Ferdinand de, Fairfield, Chestnut Avenue, Boston Spa, Yorks, Chemist.
1905. Merz, Eugene, Newark, N.J., U.S.A., Superintendent, Heller and Merz Co.
1897. Meslans, Prof. M., 6, Rue de Navarin, Paris, France, Professor of Chemistry.
- O.M. Messel, Dr. R., F.R.S., 147, Victoria Street, London, S.W., Chemical Manufacturer.
1913. Metcalf, Frederick A., 16, Oford Street, Passaic, N.J., U.S.A., Chemist.
1899. Metcalf, Howard F., Farr Alpaca Co., Holyoke, Mass., U.S.A.
1886. Metcalf, Jno., Moorfield Chemical Works, Altham, near Accrington, Tar Distiller.
1908. Metcalf, Ernest D., Messrs. Cuttis's and Harvey, Ltd., Cannon Street House, London, E.C., Secretary.
1906. Methley, Bernard, Ferndale, Moorgate, Rotherham, Yorks, Engineering Chemist.
1898. Metz, Herman A., P.O. Box 753, New York City, U.S.A., Chemical Merchant.
1905. Metzls, Josef, Angliacia Petroleum Co., Drohobycz, Galicia, Austria, Manager of Refinery.
1900. Mewborne, Robt. G., c/o Kentucky Tobacco Products Co., Louisville, Ky., U.S.A., Chemist.
1907. Meyer, Dr. Erwin, c/o Morgan and Wright, Detroit, Mich., U.S.A., Chemist.
1898. Meyer, Dr. Franz, c/o R. Wedekind und Co., Uerdingen a/Rhein, Germany, Metallurgical and Chemical Engineer.
1904. Meyer, Prof. Dr. Richard, Technische Hochschule, Braunschweig, Germany, Professor of Chemistry.
1902. Meyrick, L. J., 137, City Road, Birmingham, Assistant Analyst.
1912. Michie, Arthur C., The Wallsend Laboratories, Wallsend-on-Tyne, Technical Chemist.
1909. Michie, John L., 13, Falside, Paisley.
1907. Micklethwait, Miss Frances M. G., 15, St. Mary's Square, Paddington, W., Chemist.
1911. Middlemass, Alphonso, 59, Promenade, Portobello, Midlothian, Works Chemist.
1904. Mighill, Dr. Thos. A., 15, Exchange Street, Boston, Mass., U.S.A., Chemist.
1896. Miles, G. Wellington, Room 214, 88, Broad Street, Boston, Mass., U.S.A., Analytical Chemist.
1889. Milestone, W. C., 45, Heathfield Road, Wandsworth Common, S.W., Chemical Works Manager.
1912. Millar, Chas. J., 23, James Street, Greenhead, Glasgow, Analytical Chemist.
1899. Millar, Jas. H., P.O. Box 4975, Johannesburg, Transvaal, Manufacturing and Analytical Chemist.
1909. Millar, Jas. Hill, Chief Chemist's Laboratory, St. James' Gate Brewery, Dublin, Chemist.
1883. Miller, Dr. A. K., Kilvert's Buildings, Withy Grove, Manchester, Analytical Chemist.
- O.M. Miller, E. V., Sugar Works, Chelsea, Auckland, New Zealand, Sugar Works Chemist.
1914. Miller, Eric J., Carnbuck Club, Perambur Barracks, Madras, India, Chemist.
1889. Miller, Geo., Thornlea, Beaconfield Road, Farnworth, Widnes, Technical Chemist.
1893. Miller, Dr. Harry E., 305, Palm Avenue, Oakland, Cal., U.S.A., Chemist.
1883. Miller, Dr. H. von. See Miller-Aichholz, Dr. H. von.
1894. Miller, Dr. John A., 44-45, Lewis Block, Buffalo, N.Y., U.S.A., Consulting Chemist, State Analyst.
1888. Miller, J. Hopkins, 86, North Frederick Street, Glasgow, Dyeworks Chemist.
1889. Miller, Jno. Poynter, Sandilands Chemical Works, Aberdeen, Technical Chemist.
1901. Miller, Stuart B., c/o Du Pont Powder Co., High Explosives Operating Dept., Wilmington, Del., U.S.A., Chemical Engineer.
1901. Miller, Dr. W. Lash, 50, St. Alban Street, Toronto, Canada, Associate Professor of Physical Chemistry.
1884. Miller, W. M., Caledonia Estate, Prov. Wellesley, Penang, S.S., Sugar Chemist.
1883. Miller-Aichholz, Dr. H. von, Beatrixgasse 32, Wien, Austria, Chemical Manufacturer.
1902. Milligan, R. E., New York Continental Jewell Filtration Co., 15, Broad Street, New York City, U.S.A., Chemical Engineer.
- O.M. Mills, Prof. E. J., F.R.S., 64, Twytford Avenue, West Acton, W., Emeritus Professor of Technical Chemistry and Consulting Chemist.
1904. Mills, Dr. J. E., University of South Carolina, Columbia, S.C., U.S.A., Analytical and Consulting Chemist.
1905. Mills, Wm. Henry, 45, Wall Street, New York City, U.S.A., Merchant.
1905. Milne, Thomas, c/o The Gas Light and Coke Co., Ltd., Finsbury Court, Finsbury Pavement, London, E.C., Chemical Products Salesman.
1903. Milnes, Cresswell, The Cedars, Holborough, near Rochester, Cement Works Manager.
1887. Milnes, Edmund, Seedfield, Bury, Lancashire, Dyeing Extract Maker.
1902. Milnes, Ernest E., Park Print Works, Halifax, Yorks, Chemist.
1909. Mindeleff, Chas., c/o American Smelting and Refining Co., Maurer, N.J., U.S.A., Chemist.
1895. Miner, Harlan S., c/o Welsbach Light Co., Gloucester City, N.J., U.S.A., Technical Chemist.
1914. Miralles, A. D., Calle Pallars No. 29, Barcelona, Spain, Tanner and Leather Trades Chemist.
1895. Mitchell, Chas. A., c/o Beaufoy and Co., South Lambeth Road, S.W., Analyst.
1898. Mitchell, G. D. H., 559, Summer Avenue, Newark, N.J., U.S.A., Chemist.
1904. Mitsugi, R., c/o Tokio Gas Co., Senju Works, Senju, Tokio, Japan, Chemist.
- O.M. Mitting, E. Kennard, 38, Harold Road, Norwood, S.E., Technical Chemist.
1909. Miyoshi, K., Osaka Gas Works, Iwakishio, Nishiku, Osaka, Japan, Engineer.
1905. Modi, Dr. E. M., Meher Buildings, Tardeo, Bombay, India, Manufacturing and Analytical Chemist.
1940. Moe, Carl, Poydras, La., U.S.A., Chemist.
1906. Moe, Eldor H., Box 266, Salt Lake City, Utah, U.S.A., Chemist.
1914. Moffitt, Francis A., 61, South Pennsylvania Avenue, Wilkes Barre, Pa., U.S.A., Chemist.
1911. Mohan, Richard T., c/o The Douglas Packing Co., Granite Building, Rochester, N.Y., U.S.A., Chemist.
- O.M. Mohr, Dr. B., 69A, Parliament Hill, Hampstead, N.W., Consulting Chemist and Metallurgist.
1894. Mole, Herbert B., Royal Albert Brewery, Queen's Road, Reading, Brewer.
1901. Mond, Dr. Albert L., c/o Hubers and Mond, 19, Southampton Buildings, Chancery Lane, London, W.C., Chemical Engineer.
1899. Mond, Emile S., 22, Hyde Park Square, London, W., Technical Chemist.
1891. Mond, Dr. Robt. L., Combe Bank, near Seven Oaks, Kent, Chemist.
1906. Monier-Williams, G. W., 32, St. Leonard's Terrace, Chelsea, S.W.
1908. Monk, Chas. W., 102, Bloomfield Road, Plumstead, Kent, Chemist.
1909. Monk, Reginald H., 388, Grosvenor Avenue, Westmount, P.Q., Canada, Chemical Engineer.
1890. Moodie, Wm. E., Alexandria Works, Alexandria, Scotland, Analytical Chemist.
1905. Moody, Dr. Gerald T., Lorne House, North Dulwich S.E., Barrister-at-Law.
1898. Moody, Dr. Herbert R., College of the City of New York, and (Journals) 330, Convent Avenue, New York City, U.S.A., Professor of Chemistry.

1903. Mooney, F. Morgan. 118, Pembroke Road, Dublin. Chemical Manure Manufacturer.
1915. Mooney, Frank M., 32, St. Matthew Street, Montreal, Canada, Chemist.
1902. Mooney, Luke, 820, Granger Street, Fort Worth, Texas, U.S.A.
1887. Moore, Chas. C., 33, Clarendon Road, Garston, Liverpool, Chemist.
1901. Moore, Dr. Chas. W., c/o Crosfield and Sons, Ltd., Laboratory, Warrington, Chemist.
1907. Moore, Ernest P., c/o The Steel Co. of Canada, Hamilton, Ont., Canada, Chemist.
1911. Moore, Ernest W., c/o Messrs. T. G. Tickler, Ltd., Southall, Middlesex, Analytical Chemist.
1902. Moore, Fred., Victoria Chemical Co., Ltd., Victoria, B.C., Canada, Manufacturing Chemist.
1906. Moore, F. H., Messrs. G. H. Ogston and Moore, 87-89, Aldgate, London, E., Analytical Chemist.
1892. Moore, Dr. Geo. D., 201, Salisbury Street, Worcester, Mass., U.S.A., Professor of Chemistry.
1914. Moore, Harold, c/o Mirreles, Bickerton, and Day, Hazel Grove, Stockport, Chemist.
1912. Moore, Joseph W., Kinderton House, Runcorn, Works Chemist.
1914. Moore, Lawrence, 26, Welbeck Street, Wakefield, Dyer.
1905. Moore, Leslie R., 14, Elm Street, Concord, Mass., U.S.A., Chemist.
1899. Moore, Quintin, jun., c/o Wm. Beardmore and Co., Ltd., Parkhead Forge, Glasgow, Works Manager.
1885. Moore, R. T., 142, St. Vincent Street, Glasgow, Mining Engineer.
1899. Moore, Dr. Russell W., 121, Madison Avenue, New York City, U.S.A.; and Journals to University Library, Princeton, N.J., U.S.A., Chemist.
1890. Moore, Thos., 213, Heathfield Road, Birmingham, Analytical Chemist.
1910. Moorhouse Samuel, 138, New Road, Blackley, Manchester, Secretary and Oil Specialist.
1905. Moorwood, F. Colin, c/o W. H. Dyson, The Amalgams Co., Ltd., Attercliffe Road, Sheffield, Steel Manufacturer.
1903. Moran, Geo. A., 98, Massachusetts Avenue, North Andover, Mass., U.S.A., Chemist.
1902. More, Andrew, Ellesmere, King's Road, Walton-on-Thames, Analytical Chemist.
1908. Morfey, Harold, c/o The Mitchell Main Colliery Co., Wombwell, near Barnsley, Yorks, Manager of By-Products Works.
1901. Morgan, Dr. Gilbert T., Royal College of Science for Ireland, Dublin, Ireland, Professor of Chemistry.
1912. Morgan, Sidney, Petaling Estate, Selangor, Federated Malay States, Analytical Chemist.
1906. Morgan, Thos., "Meirion," Dovedale Road, Mossley Hill, Liverpool, Manufacturing Chemist.
1898. Morgan, T. M., 370, Wood Avenue, Westmonnt, Quebec, Canada, Cement Works Manager.
- O.M. Moritz, Dr. E. R., 45, Great Tower Street, London, E.C., Brewing Chemist.
1885. Morley, Dr. H. Forster, 5, Lyndhurst Road, Hampstead, N.W., Professor of Chemistry.
1902. Morrell, Dr. R. S., Messrs. Mander Bros., Colour and Varnish Works, Wolverhampton, Chemist.
1884. Morrice, Jas. A., 1, Prince's Terrace, Dowanhill, Glasgow, Starch and Gum Manufacturer.
1906. Morris, A. H., 152, Chorley New Road, Bolton, Lancs, Brewer.
1898. Morris, Edgar F., Osney House, Brinnington, Stockport, Research Chemist.
1897. Morris, Harry, The Hall, Hexthorpe, Doncaster, Chemical Merchant.
1890. Morris, Herbert N., Gorton Brook Chemical Works, Manchester, Technical Chemist.
- O.M. Morris, J. Haydn. See Haydn-Morris, J.
1908. Morris, Wm. J., 31, Prince Alfred Road, Wavertree, Liverpool, Chemist.
1911. Morrison, G. R., 318, Bath Street, Glasgow, Chemist.
1910. Morrison, J. A. S., c/o Clark, Son, and Morland, Ltd., Glastonbury, Somerset, Leather Chemist.
1910. Morrison, John W., Gas Offices, Sheffield, Gas Engineer.
1906. Morrow, Jas. M., 71, Tache Avenue, Norwood Grove, St. Boniface, Man., Canada, Analytical Chemist.
1901. Morse, Willard S., Seaford, Del., U.S.A., Manager.
1904. Morson, Thos. D., 14, Elm Street, Gray's Inn Road, London, W.C., Chemist.
1906. Morson, T. Pierre, 14, Elm Street, Gray's Inn Road, London, W.C., Chemical Manufacturer.
1907. Morton, George A., "Allindale," Upper Shirley Avenue, Shirley, Southampton, Chemist and Works Manager.
1897. Morton, Jno., North Road, St. Helens, Lancashire, Analytical Chemist.
1902. Mosbaugh, F. R., c/o Anglo-Canadian Leather Co., Huntsville, Ont., Canada, Chemist.
1911. Mosenthal, E. Macqueron de, 9, Rue Neuve, Versailles, France, Chemist.
1894. Moszczenski, J. B., 216, Ovington Avenue, Brooklyn, N.Y., U.S.A., Consulting Chemist.
1897. Motion, Jno., c/o The Joseph Dixon Crucible Co., Jersey City, N.J., U.S.A., Assistant Superintendent.
1887. Moul, Frank, Aldersgate Chemical Works, Southall, Technical Chemist.
1884. Moul, J., 3, Gladstone Terrace, Gateshead-on-Tyne, Secretary.
1898. Moulton, Prof. Chas. W., Vassar College, Poughkeepsie, N.Y., U.S.A., Professor of Chemistry.
1905. Moulton, Rt. Hon. Lord, F.R.S., 57, Onslow Square, London, S.W.
1892. Mount, Edw., Oaklands, Aughton, near Ormskirk, Assistant Secretary (United Alkali Company).
1905. Mrazsek, F. M., 31, West Cromwell Road, London, S.W., Consulting Chemist.
1907. Mueller, Dr. Carl, Alte Weinsteige 48, Stuttgart, Germany, Chemist.
1890. Muir, Jas. Stanley, 23, Lilybank Gardens, Glasgow, Chemist.
- O.M. Müller, Dr. H., F.R.S., 13, Park Square East, Regent's Park, London, N.W., Research Chemist.
1913. Mumford, Capt. E. Moore, Bio-chemist.
1896. Mundy, Lionel, 27, Merton Road, Kensington, W., Importer of Unfermented Wines.
1914. Munn, W. F., 518, Main Street, East Orange, N.J., U.S.A., Chemist.
1887. Munroe, Prof. Chas. E., George Washington University, Washington, D.C., U.S.A., Professor of Chemistry and Dean.
1900. Munton, Fred. T., Craigmere, Winsford, Cheshire, A.R.S.M., Analytical Chemist.
1904. Murdoch, Alexander, Garden Suburb, Westerton, Glasgow, Analytical Chemist.
1886. Murdoch, R. H. M., Norwood, Saltecoats, Ayrshire, Explosives Chemist.
1899. Murphy, Albert J., 3 and 4, Queen Square, Leeds, Brewer's Chemist.
1901. Murray, Benjamin L., c/o Merck and Co., Rahway, N.J., U.S.A., Chemist.
1903. Murray, Chas. B., 407, Perry Payne Building, Cleveland, Ohio, U.S.A., Chemist.
1914. Murray, James P., The Canadian Oil Producing and Refining Co., Ltd., Petrolea, Ont., Canada, Mining Director.
1914. Murray, John E., c/o Emerson Dng Co., 64, Spadina Avenue, Toronto, Canada, Laboratory Superintendent.
1898. Murray, Rd., c/o Brotherton and Co., Ltd., Ammonia Works, Holmes Street, Leeds, Analyst.
1908. Murray, Dr. Thos. J., Municipal Technical School, Wolverhampton, Lecturer on Chemistry.
1905. Murrill, Dr. Paul I., c/o U.S. Rubber Co., 11th Avenue and 58th Street, New York City, U.S.A., Representative.
- O.M. Muspratt, Dr. E. K., Seaforth Hall, near Liverpool, Alkali Manufacturer.
1894. Muspratt, Max, The Grange, Fulwood Park, Liverpool, Technical Chemist.
- O.M. Muspratt, S. K., Alkali Manufacturer.
1907. Musso, Louis A., Box 956, G.P.O., Sydney, N.S.W., Australia, Technical Chemist.

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1911. Myers, Ernest M., Sharrow, Basford Park, Stoke on Trent, Coke Oven Manager and Chemist.
 1891. Myers, Dr. Wm. S., 25, Madison Avenue, New York City, U.S.A., Director.
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1902. Naef, Dr. Ernest E., 17, Park Road, Clydach, Swansea, South Wales, Chemist.
 1913. Nagase, Denzo, 36, Flanchford Road, Ravenscourt Park, W., Engineer.
 1908. Nagle, J. C., c/o Nicholls, Nagle and Co., Ltd., Trafford Park, Manchester, Glucose and Starch Manufacturer.
 1913. Nair, Valliyil G., Calico Mills, Ahmedabad, India, Chemist and Colourist.
 1897. Nairn, Michael, Dysart House, Fife, Linoleum Manufacturer.
 1909. Nakai, S., Miike Colliery Office, Omuta-machi, Chikugo, Japan, Engineer.
 1903. Nakayama, T., c/o Fuji Paper Co., Mill No. 5, Yebetsu, Hokkaido, Japan, Chemist.
 1912. Nanavati, Balabhai J., Rickey Road, Ahmedabad, India, Oil Manufacturer.
 1893. Napier, Jno. W., Gas Works, Alloa, Scotland, Manager and Chemist.
 1904. Napper, Sidney S., c/o S. Courtauld and Co., Ltd., Foleshill Road, Coventry, Chemist.
 1897. Nash, L. Myddleton, Westlands, Princess Road, Finsbury Park, N., Industrial Chemist.
 1910. Nash, N. C., Treleven, Darling Street, Balmain East, Sydney, N.S.W., Works Chemist.
 1908. Nasmith, M. E., c/o The Standard Chemical Co., Longford, Ontario, Canada, Chemist.
 1914. Nathan, Albert F., Liberty Tower, 55, Liberty Street, New York City, U.S.A., Patent Lawyer.
 1900. Nathan, Col. Sir Frederic L., 37, Cornwall Gardens, South Kensington, S.W., Superintendent Nobel's Explosives Works.
 O.M. Naylor, W. A. II., The British Drug Houses, Ltd., 22-30, Graham Street, City Road, London, N., Manufacturing Chemist.
 1909. Neal, C. S., Acme White Lead and Colour Works, Detroit, Mich., U.S.A., Manager.
 1899. Neate, Percy J., 49, Frognaal, Hampstead, N.W., Director of Cement Co.
 1905. Neech, Herbert R., Doddington Lane, Swallowbeck, Lincoln, Chemical Engineer.
 1905. Needham, Edward R., c/o The Northern Chemical Co., 16, Blythswood Square, Glasgow, Manufacturing Chemist.
 1905. Neff, Robert W., 22, India Square, Boston, Mass., U.S.A., Chemical Manufacturer.
 1906. Neil, Dr. Archibald A., c/o Brunner, Mond, and Co., Caxton House, Westminster, S.W., Chemical Engineer.
 1890. Neill, Geo. D., 78, Drum Frochar Road, Greenock, Sugar Refiner.
 1898. Neilson, Alex. McG., Umbilo, Durban, Natal, Analytical Chemist.
 1911. Neilson, R. G., c/o Anglo-Persian Oil Co., Mohammedrah, Persia (vii Bombay), Assistant Works Manager.
 1902. Neish, Dr. Arthur C., Columbia University, New York City, U.S.A., Chemist.
 1911. Nello, Vincent, Baldwin's Hill, Loughton, Artists' Colour Manufacturer.
 1897. Nelson, Walter, Emscote Mills, Warwick, Gelatin Manufacturer.
 1913. Nesbitt, Cosby T., 17, Rupert Road, Nether Edge, Sheffield, Metallurgical Chemist.
 1906. Nestell, Raymond J., c/o Western Precipitation Co., 1016, West Ninth Street, Los Angeles, Cal., U.S.A., Analytical Chemist.
 1902. Neumann, Dr. Edgar, 7 and 8, Idol Lane, London, E.C.
 1903. Neumann, Dr. Max, Dambachthal 9, Wiesbaden, Germany.
- O.M. Newall, F. S., Washington Station R.S.O., Co. Durham, Chemical Manufacturer.
 1905. Newall, Jos., Hill Cliffe, Heath Road, Runcorn, Cheshire, Chemist.
 1889. Newberry, Spencer B., Sandusky Portland Cement Co., Baybridge, Erie Co., Ohio, U.S.A., Manager.
 O.M. Newlands, W. P. R., 10, Cricklade Avenue, Streatham Hill, S.W., Sugar Chemist.
 1914. Newman, Alex. R., Havering House, Lewisham Hill, Lewisham, S.E., Chemical Engineer.
 O.M. Newton, Jno., Verney Road, Rotherhithe New Road, London, S.E., Manure Manufacturer.
 1912. Newton, Leonard O., 41, Bennett Park, Blackheath, S.E., Analytical Chemist.
 1901. Nibelius, Axel W. T., c/o Neptune National Powder Co., Emporium, Pa., U.S.A., Chemist.
 1904. Nichols, C. W., 25, Broad Street, New York City, U.S.A., Manufacturing Chemist.
 1905. Nichols, E. Remington, 25, Broad Street, New York City, U.S.A., Treasurer (Nichols Chemical Co.).
 1888. Nichols, Dr. Wm. H., 25, Broad Street, New York City, U.S.A., Chemical Manufacturer.
 1905. Nichols, W. H., jun., 25, Broad Street, New York City, U.S.A., Chemical Manufacturer.
 1904. Nicholson, Wilfred E., Hunslet Chemical Works, Leeds, Chemical Manufacturer.
 1897. Nicholson, Wm. J., Ardeer, Stevenston, Ayrshire, Chemist.
 1903. Nicoll, Frank, 28, Coudray Road, Southport, Chemist.
 1905. Nieghorn, Albert, 120, Mill Street, Toronto, Canada, Agent.
 1900. Nield, J. H., c/o General Chemical Co., Edgewater, N.J., U.S.A., Superintendent.
 1898. Nightseales, Geo., 642, Holderness Road, Hull, Oil Merchant.
 1899. Nihoul, Dr. Edw., 204, Rue St. Laurent, Liège, Belgium, Director of the Liège Tannery School.
 O.M. Nimmo, Jas., 35, Whitworth Road, South Norwood, S.E., Analytical Chemist.
 1907. Nims, H. E., c/o The Fiberloid Co., Indian Orchard, Mass., U.S.A., Chemist.
 1885. Nishigawa, T., 5, Hikawa Cho, Akasaka, Tokyo, Japan, Works Director and Chemical Engineer.
 1898. Nishikawa, Dr. T., Dept. of Applied Chemistry, Kyushu Imp. University, Fukuoka, Japan, Prof. of Applied Chemistry.
 1908. Noble, Sir Andrew, Bart., K.C.B., F.R.S., Jesmond Dene House, Newcastle-on-Tyne.
 O.M. Nörling, Prof. Dr. E., 27, Lazarethstrasse, Mülhouse, Alsace, Germany, Professor of Chemistry.
 O.M. Norman, Sir Frederick J., Lyndhurst, Higher Runcorn, Cheshire, Chemical Manufacturer.
 1892. Norman, J. T., 23, Leadenhall Street, London, E.C., Consulting Chemist.
 1913. Norman, T. Stanley, Lyndhurst, Runcorn, Cheshire, Chemical Manager.
 1890. Norman-Bott, Dr. Wm., 17, St. Helen's Place, London, E.C., Consulting Chemist.
 1908. Norris, Wm. H. II., 16, Perham Road, West Kensington, W., Chemist.
 1902. North, Barker, 33, Ashgrove, Great Horton Road, Bradford, Assistant Professor of Chemistry.
 1909. Northcote, Reginald S., 28, Wellington Street East, Toronto, Chemist.
 1905. Norton, Arthur L., 36, Purchase Street, Boston, Mass., U.S.A., Dyestuff Merchant.
 O.M. Norton, Dr. S. A., 363, East Town Street, Columbus, Ohio, U.S.A., Professor of Chemistry (Ohio State University).
 1911. Norton, Samuel J., 22, Bushnell Road, Balham, S.W., Engineer and Manager.
 1887. Norton, Dr. T. H., c/o Wm. Bryce, 54, Lothian Street, Edinburgh, U.S. Consul.
 1899. Noyes, Henry, 499-501, Bourke Street, Melbourne, Victoria, Engineer.
 1901. Noyes, Prof. Wm. A., University of Illinois, Urbana, Ill., U.S.A., Editor (J. Amer. Chem. Society).
 1915. Nuttall, W. H., The Cooper Laboratory for Economic Research, Watford, Herts, Research Chemist.

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1910. Oakden, W. E., 2, Gledhow Terrace, South Kensington, S.W., Director of Research Laboratory.
1905. Oakes, F. J., jun., 141, Milk Street, Boston, Mass., U.S.A., Secretary, Oakes Manufacturing Co.
1904. Oberländer, Dr. Otto, 29, Queen Street, London, E.C., Research and Consulting Chemist.
1904. O'Brien, Claude H., Malgrave, Cairns, North Queensland, Supervising Chemist.
1900. O'Brien, Frederick, Pineleigh, Saltford, near Bristol, Analytical Chemist.
1905. Oburg, W. F., 33, Broad Street, Boston, Mass., U.S.A., Assistant Treasurer (Merrimac Chem. Co.).
1901. O'Connor, Chas. P., 7, Fairfield Street, Montclair, N.J., U.S.A., Analytical Chemist.
1908. O'Day, John, 15, Custom House Street, Boston, U.S.A., Dyestuff and Chemical Merchant.
1888. Oddy, Robert W., Abbey Street, Toad Lane, Rochdale, Chemist.
1911. Oehler, Prof. John, Carlstadt, N.J., U.S.A., Assoc. Professor of Chemistry (Columbia University).
1908. Ogilvie, Jas. P., Homedale, Hendon Lane, Church End, Finchley, N., Chemist.
1901. Ogston, Alex. G., Heath Park, near Aberdeen, Soap Manufacturer.
1903. Ohlenschlager, J. G., jun., Shanghai House, Botolph Lane, London, E.C., Chemical Merchant.
1905. Ohliger, Willard, c/o F. Stearns and Co., Detroit, Mich., U.S.A., Chemist.
1907. Oke, Alfred W., 32, Denmark Villas, Hove, Sussex, Solicitor.
1884. Oliver, F., 31, Horsley Hill Road, Westoe, South Shields, Analytical Chemist.
1912. Oliver, Ralph R., c/o Southern Fibre Co., Portsmouth, Va., U.S.A., Paper Chemist.
1888. Oliver, Wm. Letts, 251, Vernon Street, Oakland, Cal., U.S.A., Mining Engineer.
1910. Oliver, Willie, 30, Woodstock Street, Spotland, Rochdale, Works Chemist.
1914. Ollé, Arch. D., "Kareema," Charlotte Street, Ashfield, N.S.W., Australia, Electro-therapist.
- O.M. Ollerenshaw, S., 94, Davyhulme Lane, Urmston, Manchester, Technical Chemist.
1906. Olmsted, Fred. A., c/o Willamette Pulp and Paper Co., Oregon City, Oregon, U.S.A., Chemical Engineer.
1904. Olney, Prof. L. A., 118, Riverside Street, Lowell, Mass., U.S.A., Professor of Chemistry and Dyeing.
1902. O'Neill, Chas., c/o Bleachers' Association, Ltd., 4, Norfolk Street, Manchester, Chemist and Colourist.
1907. Oppen, Wm. A., Vera Chemical Co., Stenham, Mass., U.S.A., Chemist and Superintendent.
1905. Ormandy, Dr. W. R., Imperial House, Kingsway, London, W.C., Consulting Chemist.
1898. Ormerod, Dr. Ernest, 62, Dale Street, Liverpool, Consulting and Analytical Chemist.
1894. Ormerod, John, Globe Leather Works, Castleton, Manchester, Tanner and Currier.
- O.M. Orr, A., 80, Hunter Street, Sydney, New South Wales, Analytical Chemist.
- O.M. Orr, J. B., Crossieres, Woolton, Liverpool, Chemical Manufacturer.
1907. Orved, Niels C., c/o Hiram Walker and Sons, Ltd., Walkerville, Ont., Canada, Chemist and Fermentologist.
1900. Osbourne, Jno. P., 6, Garrioch Drive, Maryhill, Glasgow, Analytical Chemist.
1900. O'Shaughnessy, Francis R., 42, Temple Street, Birmingham, Consulting Chemist.
1885. O'Shea, Prof. L. T., Dept. of Applied Science, St. George's Square, Sheffield, Professor of Applied Chemistry (University of Sheffield).
1912. Osius, George, Canadian Ammonia Co., Ltd., Foot of Meldrum Street, Detroit, Mich., U.S.A., Secretary and Treasurer.
1883. O'Sullivan, J., High Bank, Burton-on-Trent, Brewing Chemist.
1912. Oswald, Jacob, c/o Messrs. Fels and Co., 73rd Street and Woodland Avenue, Philadelphia, Pa., U.S.A., Soap Works Technical Manager.
1905. Otsuki, Prof. Chiri, Chemical Laboratory, Kyoto Imperial University, Kyoto, Japan, Professor of Applied Chemistry.
1898. Oushkoff, John P., Warwarka 5, Moscow, Russia, Chemical Manufacturer.
1906. Oxley, Horace F., c/o Jos. Crosfield and Sons, Ltd., Warrington, Chemist.
1908. Oxley, John C., Claycroft, Gnisley, near Leeds, Aniline Colour Merchant.

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1904. Packard, C. T., Millbank, Bramford, near Ipswich, Manager of Chemical Works.
1886. Pagès, Albert, 34, Boulevard Henri IV., Paris, Technical Chemist.
1892. Paine, Augustus G., 200, Fifth Avenue, New York City, U.S.A., President of Paper Making Co.
1906. Palm, Otto G., 41, Colborne Street, Toronto, Canada, President (Atteaux Dye and Chemical Co.).
1903. Palmenberg, O. W., 50, East 41st Street, New York City, U.S.A., Consulting Chemist and Fuel Engineer.
1902. Palmer, Fred. G., c/o Curtis's and Harvey, Cliffe, Kent, Chemist and Acid Superintendent.
1887. Palmer, T. Chalkley, c/o American Dyewood Co., Chester, Pa., U.S.A., Manufacturing Chemist.
1887. Palmer, Thos. C., c/o W. J. Fraser and Co., Ltd., Dagenham, Essex, Engineer.
1907. Palmer, Wm. J., 25, Beech Hill Road, Eltham, Kent, Analytical Chemist.
1911. Paniker, Ramni, Consejo de Ciento 288, 2^a, 2^a, Barcelona, Spain, Leather Trades Chemist.
1891. Parker, Edw., Laburnum House, Rushford Avenue, Levenshulme, Manchester, and (Jnls.) 142, Manchester Road, Denton, Manchester, Analytical Chemist.
1894. Parker, Dr. J. Gordon, Leathersellers' Technical College, 176, Tower Bridge Road, London, S.E., Principal.
1897. Parker, Prof. Matthew A., University of Manitoba, Winnipeg, Canada, Professor of Chemistry.
1901. Parker, Richard H., 147, Seymour Avenue, Newark, N.J., U.S.A., Analytical Chemist.
1894. Parker, Thos. J., 25, Broad Street, New York City; and (Journals) Bayonne, N.J., U.S.A., Chemical Works Manager.
1903. Parker, Wm. B., 1, Murray Road, Rugby, Chief Chemist (British Thomson-Houston Co., Ltd.).
1901. Parker, Dr. Wm. Huntington, c/o U.S. Appraisers, General Delivery, Boston, Mass., U.S.A., Chemist.
1901. Parkes, Albert E., 43, Whitehorse Street, Stepney, E., Analytical Chemist.
1898. Parrish, Saml., 80, Grange Avenue, Chapeltown Road, Leeds, Teacher of Chemistry.
1914. Pascoe, Charles F., Canadian Steel Foundries, Ltd., Longue Pointe Works, Montreal, Canada, Metallurgist.
1909. Passmore, Dr. Francis W., 81, Queen Victoria Street, London, E.C., Consulting Chemist.
1902. Patch, Prof. Jas. A., Professor of Chemistry.
1897. Patchett, Col. Jas., Oakworth, Hadley, Wellington, Salop, Ironmaster.
1915. Paterson, J. H., 40, Blandford Street, Sunderland, Analytical Chemist.
1884. Paterson, John, Belle Isle Place, Workington, Cumberland, Mechanical Engineer.
1887. Paton, J. M. C., Messrs. Manlove, Alliott, and Co., Ltd., Nottingham, Mechanical Engineer.
1901. Patterson, Chas. A., Woodbury, N.J., U.S.A., Analytical Chemist.
- O.M. Patterson, Geo., c/o The Manbré Saccharine Co., Ltd., Fulham Palace Road, Hammersmith, W., Technical Chemist.

1893. Patterson, Harry J., College Park, Prince George's Co., Md., U.S.A., Agricultural Chemist.
O.M. Patterson, T. L., Maybank, Finnieston Street, Greenock, Sugar Works Manager.
1902. Patterson, Wm., Hamilton, Monk'sferry Chemical Laboratory, Birkenhead, Technical Chemist.
O.M. Pattison, Jas., Drimnamona, Kilmalcolm, Chemical Merchant.
1889. Pattison, Percy J., St. Budeaux, Devonshire Road, Hornchurch, Essex, Technical Chemist.
1909. Patton, H. G., c/o Fred Rueping Leather Co., Fond du Lac, Wis., U.S.A., Chemist.
1908. Paul, David M., c/o Japanese Explosives Co., Hiratsuka, Sagami, Japan, Chemist.
1891. Paul, Jas. H., 11, Glenluce Road, Blackheath, S.E., Analytical Chemist.
1900. Paul, Dr. L. Gordon, Market Hall Chambers, King Street, Huddersfield, Consulting Chemist.
1904. Payne, A. G. C., 6, Bradford Place, Penarth, near Cardiff, Chemist.
O.M. Payne, J. B., 13, Mosley Street, Newcastle-on-Tyne, Manufacturing Chemist.
1912. Peachey, S. J., "Tullamore," Priestnall Road, Heaton Mersey, Manchester, Lecturer in Chemistry.
1894. Pearce, Jas. Stanley, Priest's Merc, Tadworth, Surrey, Chemical Manufacturer.
1897. Pearce, Richard, 6, Beach Lawn, Waterloo, Liverpool, Metallurgist.
1883. Pearce, W., M.P., 14, Park Crescent, Portland Place, W., Chemical Manufacturer.
1903. Pearcey, A. C., 43, Marlborough Mansions, Finchley Road, London, N.W., Director, Explosives Co.
1904. Pease, Fred N., P.O. Box 503, Altoona, Pa., U.S.A., Chemist.
O.M. Péchincy, A. R., Villa Les Rochers, Hyères (Var), France, Chemical Engineer.
1898. Peck, Dr. Ernest L., High Lawn, Bromborough, Cheshire, Chemist.
1894. Peden, Jno., 11, Duff Street, Greenock, Analytical Chemist.
O.M. Pedler, Sir Alexander, C.I.E., F.R.S., 28, Stanhope Gardens, Queen's Gate, London, S.W., Director of Public Instruction (retired).
1886. Pedler, J. R., 47, Tregunter Road, South Kensington, S.W., Clerk.
1906. Peile, Henry, Millburn House, Newcastle-on-Tyne, and (Journals) c/o F. J. Willott, Victoria Garesfield Colliery, Rowlands Gill, Co. Durham, Colliery Owner.
1897. Pellaw, Chas. E., 111, East 78th Street, New York City, U.S.A., Adjunct Professor of Chemistry.
1912. Pellizza, Dr. A., Sta. Rosa, Necoxtla, Estado Vera Cruz, Mexico, Colourist.
1904. Pelly, Russell George, 3, Wingate Road, Hammer-smith, W., Analytical Chemist.
1914. Penfold, A. R., Sydney Technical College, Harris Street, Sydney, N.S.W., Australia, Chemist.
1896. Penney, Mulgrave D., 11, High Street, Hull, Analytical Chemist.
1890. Pennock, J. D., c/o Solvay Process Co., Syracuse, N.Y., U.S.A., Technical Chemist.
1885. Pentecost, S. J., Alexandra Mount, Mapperly Hill, and (Journals) Lenton Works, Nottingham, Lace Dresser.
1892. Peplow, D. H. T., Underriver House, Sevenoaks, Kent.
1885. Perkin, A. G., F.R.S., Grosvenor Lodge, Grosvenor Road, Leeds, Technical Chemist.
1898. Perkin, Dr. F. Mollwo, 199, Piccadilly, London, W., Head of Chemical Department, Borough Polytechnic.
1887. Perkin, Dr. W. H., F.R.S., 5, Charlbury Road, Oxford, Professor of Chemistry.
1893. Perkins, T. S., 30, Tiffany Place, Brooklyn, N.Y., U.S.A., Chemist.
1912. Perrin, Wm. R., jun., 530, King Street East, Toronto, Canada, Secretary and Treasurer.
1901. Perry, Chas. M., Greene, Kent County, R.I., U.S.A., Bleach and Dyeworks Chemist.
1887. Perry, David, 15, Woodlands Terrace, Glasgow, and (Journals) Forth and Clyde Chemical Works, Nitshill, near Glasgow, Manufacturing Chemist.
1895. Perry, Jos. H., 276, Highland Street, Worcester, Mass., U.S.A., Teacher of Chemistry.
1903. Perry, M. J. T., Australian Drug Co., O'Connell Street, Sydney, N.S.W., Australia, Manufacturing Chemist.
1903. Perry, Robt. Swain, 3500, Grays Ferry Road, and (Journals) Station D., Philadelphia, Pa., U.S.A., President (Harrison Bros. and Co.).
1914. Perry, R. W., 419, Keele Street, Toronto, Canada, Superintendent and Chief Analyst, Gums, Ltd.
1897. Peter, D. A. H., 2508, Broadway, New York City, U.S.A., Chemist.
1908. Peters, John M., c/o National Lead Co., 111, Broadway, New York City, U.S.A., White Lead Manufacturer.
1909. Petric, A. Swanston, 6, Florida Street, Mount Florida, Glasgow, Analytical Chemist.
1903. Petrie, Dr. Jas. M., The University, Sydney, N.S.W., Australia, Chemist.
1902. Petsche, B. W., 60, Glenwood Avenue, Yonkers, N.Y., U.S.A., Chemist.
1906. Pettee, Chas. L. W., c/o Hartford Laboratory Co., Hartford, Conn., U.S.A., Chemist.
1892. Pettigrew, Robert, c/o Mersey and Irwell Joint Committee, 44, Mosley Street, Manchester, Electro-Chemist.
1902. Pettitt, Alf., c/o Chestnut Ridge Brick Co., 7, West 45th Street, New York City, N.Y., U.S.A., Chemist.
1912. Pfeiderer, Kurt, Westwood Works, Peterborough, Mechanical Engineer.
1888. Philip, Arnold, Chemical Laboratory, H.M. Dockyard, Portsmouth, Electro-Metallurgist and Electrical Engineer.
1908. Philip, Prof. James C., Imperial College of Science and Technology, South Kensington, S.W., Professor of Physical Chemistry.
1903. Philipp, Herbert, 152, High Street, Perth Amboy, N.J., U.S.A., Chemist and Electrochemical Engineer.
1912. Phillips, G. A., Laboratory, The Powell Duffryn Co., Aberdare, Mon., Chemist.
1911. Phillips, Henry A., Royal Gunpowder Factory, Waltham Abbey, Essex, Chemist.
1910. Phillips, Prof. Percy P., Thomason College, Rurki, United Provinces, India, Professor of Chemistry.
1895. Phillips, S. Chas., 47, Cannon Street, London, E.C., Chemical Engineer.
1911. Phillips, Capt. William E., Canada.
1898. Phillips, Wm. H., 100, Milton Avenue, East Ham, E., Soap Works Chemist.
1911. Philpotts, Wilfred C., 35, Sandford Avenue, Toronto, Canada, Gasworks Chemist.
1894. Picard, Hugh F. K., 44, London Wall, London, E.C., Metallurgist.
1904. Pickard, Glenn H., c/o American Linseed Co., 110th Street and Torrence Avenue, South Chicago, Ill., U.S.A., Manager of Oils Dept.
1905. Pickard, Greenleaf W., Amesbury, Mass., U.S.A., Electrical Engineer.
1914. Pickard, J. Allen, 50, Crooms Hill, Greenwich, S.E., Consulting Metallurgical Chemist.
1902. Pickard, Dr. R. H., Billinge View, Blackburn, Teacher and Analyst.
1914. Pickering, Walter J., Central Laboratory, City Gas Works, Nichells, Birmingham, Works Chemist.
1904. Pickup, Edgar H., 348, Great Clowes Street, Higher Broughton, Manchester, Calico Printer.
1913. Pierce, Jas. B., jun., Lock Box 932, Charleston, W. Va., U.S.A., Chemist, Barium Products Co.
1888. Pilkington, G., 9, Knowsley Street, Bury, Lancashire, Analytical Chemist.
1893. Pilley, Thos. W., 33, Grove Hill Road, Denmark Hill, S.E., Analytical Chemist.
1894. Pilling, John E., 229, Hornby Road, Blackpool, Chemist.
1906. Pincott, Emile S., 222, St. James' Street, Montreal, Canada, Manager (Nichols Chemical Co. of Canada, Ltd.).

1914. Pinkerton, Andrew, Vista Alegre 6, Minas de Rio Tinto, Huelva, Spain, Analytical Chemist.
1910. Pinnoek, Douglas R., c/o The Nuccoa Butter Co., 4th Street and Avenue A, Bayonne, N.J., U.S.A., Chemist.
1905. Pinnoek, H. T., 11, Fountain Road, Edgbaston, Birmingham, Chemist.
1883. Pipe, Jas., Woodburn, Irvine, Scotland, Chemical Manufacturer.
1896. Piper, Walter E., Boston Rubber Shoe Co., Malden, Mass., U.S.A., Chemist.
1910. Pisart, F., 74, Avenue Blonden, Liège, Belgium, Chemical Engineer.
1907. Pitman, Brig.-Gen. John, 167, Berkeley Avenue, Orange, N.J., U.S.A., U.S. Army (retired).
1913. Pitt, Septimus A., Central Public Library, Coventry, Librarian.
1902. Pittard, Jno., West Ham Chemical Works, West Ham, E., Chemical Manufacturer.
1884. Pittuck, F. W., 19, Stratford Grove, Heaton, Newcastle-on-Tyne, Technical Chemist.
1909. Piutti, Prof. Dr. Arnaldo, Instituto Chimico-farmacutico, R. Università, Napoli, Italy, Director.
1899. Pizey, Jas. H., c/o S. Pearson and Son, The Refinery, Minatitlan, Vera Cruz, Mexico, Chemist.
1915. Platt, J. H., 17, Lansdowne Road, Crumpsall, Manchester, Technical Chemist.
1894. Platten, Frank, c/o Elliot's Metal Co., Selly Oak Works, near Birmingham, Metallurgical Chemist.
1890. Platts, Jno. C., "Sandygat," Chapel Lane, Wilmslow, Cheshire, Metallurgical Chemist.
1896. Plaut, Albert, P.O. Box 380, New York City, U.S.A., Wholesale Druggist.
1888. Playfair, David J., 7, Victoria Crescent, Downhill, Glasgow, Manufacturing Chemist.
1914. Plews, George, jun., c/o Braden Copper Co., Molino, Rancagua, Chile, Chemist.
1907. Poetschke, Paul, c/o L. D. Caulk Co., Milford, Del., U.S.A., Chemist.
1914. Pollard, Henry, 1832, Lamont Street, Washington, D.C., U.S.A., Engineer.
1901. Pollard, Wm., Oakfield, Hitchin, Herts Chemist.
1904. Pollitt, Dr. Geo. P., 4, Whitehall Court, London, S.W., Chemist.
1902. Pollitt, Jas. C. T., 7, Grosvenor Road, Handsworth, Birmingham, Managing Chemist.
1883. Pollock, A., Kirkland, Bonhill, Dumbartonshire, Dyeworks Manager.
1890. Pomeroy, Dr. Chas. T., R. F. D. No. 1, Scotch Plains, N.J., U.S.A., Ink Manufacturer.
1909. Pond, Dr. Francis J., Stevens Institute of Technology, Hoboken, N.J., U.S.A., Professor of Chemistry.
1896. Pond, Prof. G. G., State College, Centre Co., Pa., U.S.A., Professor of Chemistry.
- O.M. Pond, J. A., 99, Queen Street, Auckland, New Zealand, Analytical Chemist.
1914. Pondal, Prof. M. Leguizámon, 726, Str. Mexico, Buenos-Aires, Argentina, Doctor of Chemistry.
1906. Pont, A. Felix du, Box 31, Wilmington, Del., U.S.A., Explosives Manufacturer.
1895. Pont, Pierre S. du, c/o Dr. C. L. Reese, E. I. du Pont de Nemours Powder Co., Wilmington, Del., U.S.A., Explosives Manufacturer.
1912. Pope, Chester H., 39, Waldemar Avenue, Winthrop, Mass., U.S.A., Ink Manufacturer.
- O.M. Pope, S., 49, Provis Road, Chorlton-cum-Mardy, Manchester, Chemical Works Manager.
1899. Pope, Thos. H., The University, Edmund Street, Birmingham, Chemist and Lecturer on Brewing.
1900. Pope, Prof. W. J., F.R.S., University Chemical Laboratory, and (Journals) Holmesdale, Brooklands Avenue, Cambridge, Professor of Chemistry.
1912. Porritt, B. D., c/o North British Rubber Co., Ltd., Castle Mills, Edinburgh, Chief Chemist.
1911. Porteous, Jas. W., c/o Bolckow, Vaughan, and Co., Ltd., Grange Hill, Bishop Auckland, Co. Durham, Chemist and Coke Oven Manager.
1902. Porter, J. Edw., P.O. Box 785, Syracuse, N.Y., U.S.A., Chemist.
1901. Porter, Jno. L., 8401, Panola Street, New Orleans, La., U.S.A., Chemist.
1884. Potter, Chas. E., Love Lane Sugar Refinery, Liverpool, Sugar Works Chemist.
1888. Potter, Chas. J., Heaton Hall, Newcastle-on-Tyne, Cement Manufacturer.
- O.M. Potter, E. P., Chemical Works, Little Lever, near Bolton, Alkali Manufacturer.
1910. Potts, Harold E., 66, Leasowe Road, Wallasey, Cheshire, Patent Agent.
1915. Poulenc, Camille, 122, Boulevard St. Germain, Paris, France, Chemical Manufacturer.
1900. Powell, Harry J., 125, Thurlow Park Road, Dulwich, S.E., Glass Manufacturer.
1897. Power, Dr. Fred. B., 535, Warren Street, Hudson, N.Y., U.S.A., Research Chemist.
1907. Powers, Wm. A., c/o A. T. and S. F. R. Co., Topeka, Kans., U.S.A., Chief Chemist.
1902. Powney, Wm. E. F., 35, Priory Avenue, Hornsey, N., Analytical Chemist.
1912. Prasad, Prof. H., Government College, Ajmer, India, Professor of Science.
1897. Prentice, Dr. Bertram, Royal Technical Institute, Salford, Lecturer on Chemistry.
1902. Prentice, Dr. David, The Nook, Whitefield Road, Stockton Heath, Warrington, Chemist.
1903. Prentice, Jas., Cossipore Sugar Works, Cossipore, Calcutta, India, Chemist.
1911. Prescott, Alfred, 63, Corporation Street, Manchester, Chemical Agent.
1900. Prescott, Prof. Saml. C., 585, Boylston Street, Boston, Mass., U.S.A., Prof. of Ind. Biology.
1905. Preston, Jas. F., 403, Andover Street, Lowell, Mass., U.S.A., Manufacturing Chemist.
- O.M. Price, Arthur F., 2503, Broadway, San Francisco, Cal., U.S.A., Analytical Chemist.
1905. Price, Dr. T. Slater, The Technical School, Birmingham, Lecturer on Chemistry.
1904. Prichard, Norman B., 40, Quebec Street, Sherbrooke, Quebec, Canada, Superintendent.
1905. Priest, Geo. Wesley, 78, Beech Street, East Orange, N.J., U.S.A., General Manager.
1899. Princen-Geerhigs, H. C., Wanningstraat 17, Amsterdam, Holland, Director of Sugar Cane Experimental Station.
1912. Pritchard, Thos. W., Wilmington, N.C., U.S.A., Wood Distiller.
1912. Prittie, Frank H., Southern Pacific Railway Laboratory, Sacramento, Cal., U.S.A., Assistant Chemist.
1896. Prochazka, Dr. Geo. A., c/o Central Dyestuff and Chemical Co., Newark, N.J., U.S.A., Colour Manufacturer.
- O.M. Procter, Prof. H. R., The Grange, Ilkley, and (Juls.) The University, Leeds, Emeritus Professor of Tanning.
1884. Procter, J. W., Skeldergate Bridge, York, Manure Manufacturer.
1890. Procter, Miss Anne J., Free Library, Widnes, Librarian.
- O.M. Proctor, C., 118, Grosvenor Road, London, S.W., Analytical Chemist.
1901. Propach, C., 146, West Kinzie Street, Chicago, Ill., U.S.A., Colour Merchant.
1912. Propach, Dr. Wilhelm, Dynamit Act.-Ges. vorm. A. Nobel und Co., Alsterdamer 391, Hamburg, Germany, Chemist.
1913. Prosser, Richard, c/o C. Tennant, Sons & Co., C.P.R., Telegraph Building, Montreal, Que., Canada, Chemical Agent.
1906. Pudney, S. H., 156, Bellwood Avenue, Toronto, Canada, Chemist.
1905. Pugh, John V., Guiting House, Allesley, near Coventry, Works Director (Rudge-Whitworth, Ltd.).
1899. Pullar, Edmund, Keirfield, Bridge of Allan, Scotland, Manufacturer.
- O.M. Pullar, R. D., Pullar's Dyeworks, Perth, Scotland, Dyer.

1913. Pulsifer, Lanson V., c/o Messrs. Valentine and Co., 364, Manhattan Avenue, Brooklyn, N.Y., U.S.A., Chemist.
1902. Puntan, H. H. C., 10, London Chambers, Durban, Natal, Public Analyst.
1894. Purdie, Dr. Thos., F.R.S., 14, South Street, St. Andrews, Professor of Chemistry.
1913. Purves, G. Thomson, Coke Owens Dept., Auchengiech Colliery, Chryston, Scotland, Manager.
1905. Pyman, Dr. Frank Lee, "Sedgley," Selborne Road, Sidcup, Kent, Chemist.

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1903. Queney, Jno. F., Monsanto Chemical Works, 1800, South 2nd Street, St. Louis, Mo., U.S.A., Chemical Manufacturer.
1903. Queneau, Augustin L. J., Jemeppe sur Meuse, Belgium, Metallurgical Engineer.
1887. Quibell, Oliver, Shalem Lodge, Newark-on-Trent, Manure Manufacturer.
1902. Quinan, Kenneth B., Cape Explosives Works, Somerset West, C.C., South Africa, and (subscriptions) c/o Cape Explosives Works, Ltd., 15, St. Swithin's Lane, E.C., Superintendent.

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1911. Race, Joseph, City Hall, Ottawa, Canada, City Bacteriologist.
1904. Rademacher, Dr. Ferdinand, Prag-Carolinenthal, Austria, Chemical Manufacturer.
1900. Radley, Ernest G., 49, Ernest Street, West Norwood, S.E.
1902. Ramsay, A. Alexander, Laboratory, Department of Agriculture, 136, George Street, Sydney, N.S.W., Australia, Assistant Chemist.
- O.M. Ramsay, Sir William, K.C.B., F.R.S., Hazelmere, Bucks, Professor of Chemistry.
1885. Ramsay, W., c/o Cammell, Laird, and Co., Ltd., Birkenhead Ironworks, Birkenhead, Chemist and Assayer.
1913. Ramsbottom, Dr. J. E., 98, Peabody Road, South Farnborough, Hants, Chemist.
1906. Ranck, Samuel H., Ryerson Public Library Building, Grand Rapids, Mich., U.S.A., Librarian.
1909. Randall, George, Severn Bank Tannery, Worcester, Tanner.
1910. Ranken, Charles, 19, Stockton Road, Sunderland, Analytical and Consulting Chemist.
1901. Ransom, Francis, The Chilterns, Hitchin, Herts, Manufacturing Pharmaceutical Chemist.
1905. Ransom, H. B., St. Stephen's House, Victoria Embankment, Westminster, S.W., Consulting Engineer.
1910. Ransome, A. Oswald, Beechwood, Greenock Road, Paisley; and (Journals) Emlin Hall, Torver, Coniston, R.S.O., Lancashire, Works Chemist.
1898. Raschen, Dr. Julius, The Highlands, Runcorn, Cheshire, Consulting Chemist (United Alkali Co.).
1905. Raschig, Dr. F., Ludwigshafen a/Rhein, Germany, Manufacturing Chemist.
1908. Rassow, Prof. Dr. Berthold, Stephanstrasse 8, Leipzig, Germany, General Secretary, Vereins Deutscher Chemiker.
1893. Ratcliff, Frank D., Stourbank House, Stourport, Vinegar Brewer.
1904. Ratcliffe, C. F., Haigh Park Chemical Works, Stourton, near Leeds, Tar Distiller.
1914. Ratcliffe, Henry, Leeds Phosphate Works, Ltd., Midland Road, Hunslet, Leeds, Technical Chemist.
1898. Ratcliffe, Walter, 21, Mawdsley Street, Bolton, Analytical Chemist.
1901. Rawlins, Herbert J. L., The Crossways, Rainhill, Lancashire, Managing Director.
1903. Rawolle, Frederick C., c/o Marx and Rawolle, 100, William Street, New York City, U.S.A., Chemist.
- O.M. Rawson, Chris., 22, Cumberland Street, Manchester, Consulting Chemist.

1909. Rawson, H. Wyatt, c/o Chartered Bank of India, Taiping, Perak, Fed. Malay States.
1909. Rayner, Arthur B., Normanhurst, Alexandra Park Road, Muswell Hill, N., Chemical Broker.
1912. Rayner, Edgar A., c/o Messrs. Johnson and Sons, 23, Cross Street, Finsbury, E.C., Analytical Chemist.
1895. Read, E. J., c/o Pretoria Portland Cement Co., Ltd., P.O. Box 405, Pretoria, South Africa, Analyst.
1914. Read, Harold M., Waltham, Newlay Wood, Ilkworth, Leeds, Manufacturing Chemist.
1913. Read, Dr. John, University Chemical Laboratory, Cambridge, Assistant to Prof. of Chemistry.
1890. Reade, Thos., 118, Tettenhall Road, Wolverhampton, Manufacturing Chemist.
1908. Reavell, J. Arthur, 37, Parliament Street, Westminster, S.W., Engineer.
1912. Reddie, J. A., Sewage Disposal Works, Halifax, Yorks, Chemist.
1902. Redfern, C. G., 15, South Street, Finsbury, London, E.C., Patent Agent.
1914. Redpath, G. C., 10, Dean Street, Newcastle-on-Tyne, Analytical Chemist.
- O.M. Redwood, Sir Boverton, Bart., 4, Bishopsgate, London, E.C., Petroleum Expert.
1887. Redwood, Robt., 4, Bishopsgate, London, E.C., Secretary.
1886. Rée, Dr. A., 15, Mauldeth Road, Withington, Manchester, Aniline Dye Manufacturer.
1902. Reed, Herbert C., 227-229, Fulton Street, New York City, U.S.A., Cons. Tanning Chemist.
1906. Reed, William, c/o El Oro Mining and Railway Co., El Oro, Estado de Mexico, Works Manager.
1893. Reekie, J. A., Buckton Grange, Stalybridge, Calico Printer's Colour Mixer.
1883. Reeks, T. H., 106, Queen Victoria Street, London, E.C., Analytical and Consulting Chemist.
1906. Rees, Walter J., 36, Holly Lane, West Smethwick, near Birmingham, Glass Works Chemist.
1900. Reese, Dr. Chas. L., Eastern Laboratory, P.O. Box 424, Chester, Pa., U.S.A., Chemist.
1913. Regan, Colston J., 14, Penderley Road, Catford, S.E., Analytical Chemist.
1897. Reid, Andrew, c/o L. and J. McLellan, 65, Port Dundas Road, Glasgow, Chemist.
1909. Reid, David E., Kodak Park, Rochester, N.Y., U.S.A., Chemist.
1906. Reid, James, Caldercruix Mills, by Airdrie, Scotland, Chemist.
1913. Reid, J. Meston, Vernon Lodge, Gateacre, Liverpool, Manufacturing Chemist.
1905. Reid, Dr. John H., Westgarth, Eccles Road, Formby, Lanes, Chemist.
1907. Reid, Robert, Agencia de Tharsis, Huelva, Spain, Analytical Chemist.
1896. Reid, Robt., Oil Mills, Horbury Bridge, near Wakefield, Chemist.
- O.M. Reid, Walter F., Fieldside, Addlestone, Surrey, Technical Chemist.
1893. Reid, Wm., jun., Bombay Dyeworks, Dadur, Bombay, India, Dyer.
1910. Reiter, Dr. Kaspar, Bayrischzell, Hochkient, Bavaria, Chemist.
1898. Reitmeyer, Robt. E. D., 63, Crutched Friars, London, E.C., Chemical Merchant.
1904. Remington, Prof. Joseph P., 1832, Pine Street, Philadelphia, Pa., U.S.A., Author, U.S. Pharmacopœia.
1900. Remington, J. Stewart, Aynsme, Grange-over-Sands, R.S.O., Lanes, Consulting Chemist.
1903. Remsen, Professor Ira, Johns Hopkins University, Baltimore, Md., U.S.A., Professor of Chemistry.
1911. Renaud, Paul, 8, Rue Nouvelle, Paris (9^e), France, Consulting Engineer.
- O.M. Rennie, Dr. E. H., University of Adelaide, South Australia, Professor of Chemistry.
1911. Rentschler, Mahlon J., c/o Oakland Chemical Co., Rossville, Staten Is., N.Y., U.S.A., Bacteriologist.

1901. Renwick, Frank F., Sunny Side, Weald Road, Brentwood, Essex, Chemist (Photographic Works).
1907. Reoch, Robert A. S., Pacific Mills Printworks, Laurence, Mass., U.S.A., Printworks Superintendent.
1894. Rettie, Theodore, 10, Donne Terrace, Edinburgh, Metallurgical Chemist.
1895. Reubens, Chas. M., 68, Cliff Street, New York City, U.S.A., Chemist.
1912. Renter, Dr. L., Apartado 6, Torreón, Coahuila, Mexico, Technical Director, "La Union S.A."
1905. Revis, Cecil, 5, Carlton Villas, Station Road, Barnes, S.W., Analyst.
1904. Reynard, Otto, 3, Selborne Villas, Manningham, Bradford, Yorks, Chemist.
- O.M. Reynolds, Dr. J. Emerson, F.R.S., 3, Inverness Gardens, Kensington, W., Professor of Chemistry.
1912. Reynolds, Wm. Colebrook, "Wharfelale," Upminster, Essex, Manufacturing Chemist.
1913. Rhead, T. F. Eric, Sunnyside, Polygon Avenue, Levenshulme, Manchester, Research Chemist.
1908. Rhoads, J. Edgar, 2211, Shalleross Avenue, Wilmington, Del., U.S.A., Leather Chemist.
- O.M. Rhodes, E., c/o Thos. Vickers and Sons, Widnes, Technical Chemist.
1892. Rhodes, P. J., Bridge House, Church, Accrington, Dye and Print Works Manager.
1889. Richards, Edgar, 60, Ayrault Street, Newport, R.I., U.S.A., Analytical Chemist.
1888. Richardson, Dr. Clifford, Room 1615, Woolworth Building, 233, Broadway, New York City, U.S.A., Chemical Engineer.
1903. Richardson, F. J., Chemical Works, Ringsend Docks, Dublin, Ireland, Chemical Manure Manufacturer.
1884. Richardson, F. W., County Analyst's Office, Bradford, Yorkshire, Analytical Chemist.
1900. Richardson, Jno. H., 57, Cavendish Drive, Rock Ferry, Cheshire, Manager.
1891. Richardson, Walter W., Aldingham, Park View Crescent, Roundhay, Leeds, Manufacturing Chemist.
1903. Richardson, Wm., Linfield, Wood Lane, Headingley, Leeds, Drysalter.
1894. Richardson, Wm. H., Newsky Thread Mills, Malaja, Bolotnaja, Petrogr d, Russia, Textile Chemist.
1898. Richmond, Jno. R., The Hollies, Blurton, Longton, Staffs, Alkali Works Manager.
1901. Richmond, Sylvester O., Royal William Yard, Plymouth, Analytical Chemist.
1884. Rideal, Dr. Samuel, Laboratory, 28, Victoria Street, Westminster, S.W., Consulting Chemist.
1905. Ridge, H. M., 62, London Wall, London, E.C., Mining Engineer.
- O.M. Ridsdale, C. H., Laboratory, 3, Wilson Street, Middlesbrough, Analytical Chemist.
1899. Riederer, Emil J., Forcite Works, Landing, N.J., U.S.A., Superintendent.
1902. Riederer, Dr. Herman S., 251, West 95th Street, New York City, U.S.A., Chemist.
1907. Rigg, Gilbert, c/o New Jersey Zinc Co., Palmerton, Carbon Co., Pa., U.S.A., Chemist.
1892. Riker, Jno. J., 19, Cedar Street, New York City, U.S.A., Merchant.
1913. Riley, George, Effra Works, South Lambeth Road, London, S.W., Chemical Engineer.
1905. Riley, Louis J., 8, Newton Road, London, W., Chemist.
1912. Riley, Walter A., 100, King Street, Norwich, Brewer.
1899. Rink, Arnold, 11, Bridgewater Street, Barbican, London, E.C., Tannin Extract Manufacturer.
1889. Rintoul, Wm., "Lauriston," Ardrossan, Ayrshire, Explosives Chemist.
1901. Ripley, Philip F., 7, Abbott Street, Andover, Mass., U.S.A., Chemist.
1914. Ritchie, P. B., Box 894 G.P.O., Sydney, N.S.W., Australia, Manufacturer.
1907. Roberts, Chester, Swarthmore College, Swarthmore, Pa., U.S.A., Superintendent.
- O.M. Roberts, F. G. Adair, Oak Hill Lodge, Hampstead, N.W., and Jnls. to H. Shankster, 57, Balfour Road, Iford, Chemical Manufacturer.
1901. Roberts, H. E. U., c/o British Explosives Synd., Pitsea, Essex, Chemist.
1911. Roberts, H. W., Dynamite Factory, Somerset West, Cape Province, South Africa, Chemist.
1902. Roberts, Wm. H., City Analyst's Office, Ashton Street, Liverpool, Analytical Chemist.
1891. Robertson, Alex. A., Riversdale, Cressington Park, Liverpool, Technical Chemist.
1910. Robertson, Charles, c/o Messrs. S. Allsopp and Sons, Ltd., Burton-on-Trent, Brewer.
1900. Robertson, Jas., Barneraig, South Medrox, by Glenboig, Scotland, Analytical Chemist.
1910. Robertson, Dr. Joseph G., 19, Broomhill Terrace, Partick, Glasgow, Manufacturer.
1891. Robertson, Dr. Robt., Research Dept., Royal Arsenal, Woolwich; and (Journals) 29, Charlton Road, Blackheath, S.E., Research Chemist.
1910. Robertson, William, 21, Worfield Street, Battersea Park, S.W., Research Chemist.
1913. Robins, Edmund A., c/o Messrs. Kodak, Ltd., Wealdstone, Middlesex, Assistant Works Manager.
1913. Robinson, C. Stanley, Fern Villa, South Normanton, Alfreton, Works Chemist.
1897. Robinson, Clarence J., 708, Jewett Avenue, West New Brighton, N.Y., U.S.A., Chemist.
1902. Robinson, Hy. Fishwick, Culcheth Chemical Works, Newton Heath, Manchester, Manufacturing Chemist.
- O.M. Robinson, H. H., 42, Penywern Road, Earl's Court, S.W., Analytical Chemist.
1907. Robinson, Herbert W., Robinson Bros., Ltd., Ryders Green, West Bromwich, Staffordshire, Tar Distiller.
1911. Robinson, Jas. H., 11, East Street, Rugby, Analytical Chemist.
- O.M. Robinson, Jos., Farnworth, Widnes, Chemical Manufacturer.
1887. Robinson, Thomas, (Journals) 401, West Street, Glasgow; and (communications), The Villa, Nithill, Chemical Works Manager.
1902. Robitschek, Carl, 200, Worth Street, New York City, U.S.A., Scientific Brewer.
1915. Rocha, Joao, Villa Nova de Lima, Minas Geraes, Brazil, Assayer and Chemist.
1884. Rodger, Edw., 1, Clairmont Gardens, Glasgow, W.
1914. Rodger, Lawton H., Avonholm, Rutherglen, near Glasgow, Chemist.
1904. Rodger, Robert, Government Laboratory, Clement's Inn Passage, Strand, London, W.C., Chemist.
1905. Rodger, R. L., The Peña Copper Mines, Ltd., 736, Salisbury House, London Wall, E.C., Manager.
1909. Rody, Franz A., 258, Van Buren Street, Newark, N.J., U.S.A., Chemist.
1903. Roelofsen, Dr. J. A., c/o Coal Distillation Co., Middlesbrough, Yorks. Works Manager.
1910. Roessler, Dr. F., 89, High Street, Perth Amboy, N.J., U.S.A., Chemist.
1905. Rogers, Dr. Allen, Pratt Institute, Brooklyn, N.Y., U.S.A., Research Chemist.
1915. Rogers, Dr. F. M., c/o Standard Oil Co., Whiting, Ind., U.S.A., Chemist.
1900. Rogers, Geo. J., 32, Chudleigh Road, Brockley, S.E., Chemist.
1908. Rogers, Harry V., Ash Street, Ilkeston, Derbyshire, Engineer.
1907. Rogers, Henry L., Casilla 1118, Buenos Aires, Argentina, Analytical Chemist.
1909. Rogers, Herbert, c/o James Lyne Hancock, Ltd., 266, Goswell Road, London, E.C., Rubber Works Chemist.
1899. Rogers, John, c/o Nobel's Explosives Co., Ltd., Nobel House, Glasgow, Chemist.
1910. Rogers, L. Joslyn, Chemical and Mining Building, The University, College Street, Toronto, Canada.
1911. Röhm, Dr. Otto, Weiterstädterstrasse 4/6, Darmstadt, Germany, Chemist.
1898. Roller, H. C., 493, Central Avenue, Newark, N.J., U.S.A., Superintendent.

1899. Rollin, Chas., Bylton, East Jarrow-on-Tyne, Chemical Manufacturer.
1900. Rollin, Hugh, (subs.) 1, St. Nicholas Buildings, Newcastle-on-Tyne, and (Inls.) 1558, Kanawha St., Charleston, West Va., U.S.A., Chemical Manufacturer.
1907. Rolph, George M., c/o California and Hawaiian Sugar Refining Co., Crockett, Cal., U.S.A., Sugar Refiner.
1905. Romanes, J. W., Craig Knowe, Slatford, Edinburgh, Chemical Engineer.
- O.M. Roscoe, Rt. Hon. Sir Henry, P.C., F.R.S., Woodcote Lodge, West Horsley, Leatherhead, Surrey, Consulting Chemist.
1904. Rose, Jno., Wicken House, Stretton, near Warrington, Technical Chemist.
1901. Rose, Jno. Leonard, 14, St. Vincent Road, Westcliff-on-Sea, Chemist.
1902. Rosebrugh, Prof. T. R., 2425 South State Street, Syracuse, N.Y., U.S.A., Professor of Electrical Engineering.
1897. Rosengarten, Dr. Geo. D., P.O. Box 1625, Philadelphia, Pa., U.S.A., Manufacturing Chemist.
1913. Rosenplaeter, Carlos B., c/o Henry S. King and Co., 65, Cornhill, London, E.C., Petroleum Technologist.
1893. Ross, Arthur, 1, Glengall Road, Old Kent Road, London, S.E., Analytical Chemist.
1900. Ross, Raymond, Public Analyst's Office, Burnley, Lancashire, Analytical Chemist.
1910. Ross, Thos. M., c/o Burmah Oil Co., Ltd., Yenangyat Refinery, Upper Burmah, Analytical Chemist.
1910. Rossati, Guido, 226, Lafayette Street, New York City, U.S.A., Agricultural Chemist.
1911. Rossi, Dr. Carlo, 29, Via Leopardi, Milano, Italy, Electro-chemist.
1906. Rossi, Louis M., c/o General Bakelite Co., Perth Amboy, N.J., U.S.A., Works Manager.
1913. Rossini, Jas. L., c/o Anglo-American Oil Co., Purfleet, Essex, Oil Works Manager.
1906. Rossiter, E. C., Brougham, West Hagley, Worcester-shire, Chemical Engineer.
1888. Rothwell, C. F. Seymour, Photographic Works, Mobberley, Cheshire, Chemist.
- O.M. Rottenburg, Dr. Paul, 55, West Regent Street, Glasgow, Chemical Merchant.
1903. Rouse, Wm., The Knowe, Carlibar Street, Barrhead by Glasgow, Chemist.
1906. Rowell, Herbert W., 36, Thornbury Road, Osterley Park, W., Analytical Chemist.
- O.M. Rowland, W. L., 2815, Gray's Ferry Road, Philadelphia, Pa., U.S.A., Chemist.
1904. Rowley, Ernest W., Chemical Laboratory, C.M.E. Department, North Eastern Railway, Darlington, Analytical Chemist.
1908. Rowley, Frank, c/o J. T. Nottidge, 8, Tufnell Park Road, London, N., Metallurgist.
1901. Rowley, Walter Eugene, c/o National Aniline and Chemical Co., 100, William Street, New York City, U.S.A., Chemist.
1904. Rowling, S. R., 1, Beechwood, Kendal, Westmoreland, Chemist.
1913. Rowse, Walter W., 39, Oliver Street, Boston, Mass., U.S.A., Representative of Cassella Color Co.
1915. Roy, Dr. Charles S., Summerfield Chemical Works, Wharf Road, Ponders End, Middlesex, Chemist.
1896. Royal-Dawson, H., Fernley House, Morrill Street, Hull, Chemist.
1898. Royle, Chas. L., c/o Cartavio Sugar Co., Trujillo, Peru, Sugar Chemist.
- O.M. Royle, Sir Samuel W., St. Andrew's Chambers, 20, Albert Square, Manchester, Chemical Engineer.
1913. Rubinstein, I. H., 164, Cheetham Hill Road, Manchester, Technical Chemist.
1902. Rücker, Dr. Hermann von, 91, Lancaster Avenue, Buffalo, N.Y., U.S.A., Chemist.
1896. Ruddock, Fred. G., Corporation Street, Warrington, Analytical Chemist.
1895. Rudge, Alfred, United Alkali Co., Ltd., Allhresen Works, Gateshead-on-Tyne, Analytical Chemist.
1911. Rudnick, Paul, c/o Armour and Co., Union Stock Yards, Chicago, Ill., U.S.A., Chemist.
1908. Rudolf, Prof. Norman S., Post Box 12A, Royal Automobile Club, London, S.W., Professor of Applied Chemistry.
1909. Rudolf, Dr. G., 52, Cranley Gardens, Muswell Hill, N., Manufacturing Chemist.
1884. Ruffle, Jno., Musley, Ware, Herts, Consulting Chemist and Electrician.
1898. Ruhl, Louis, c/o Roessler and Hasslacher Chemical Co., 100, William Street, and (Inls.) Box 0101, New York City, U.S.A., Chemical Merchant.
1909. Ruiloba, J. A., c/o U.S. Steel Corporation, 71, Broadway, New York City, U.S.A., Engineer.
1910. Rule, Dr. Alexander, The University, Liverpool, Lecturer in Chemistry.
- O.M. Rumble, C., 169, Gleneldon Road, Streatham, S.W., Chemist.
1899. Rumbold, Wm. R., Electro-metallurgist.
1913. Rumi, Dr. Tomás J., Salta 947, Buenos Aires, Argentina, Doctor of Chemistry.
1911. Runckles, A. R., c/o Brotherton and Co., Ltd., Litherland Tar Works, Liverpool, Technical Chemist.
1903. Runyan, Elmer C., Hutches Building, Washington, D.C., U.S.A., Chemist and Gas Inspector.
1899. Rushby, Wm., Oak View, Batley, Yorks, Analyst.
1906. Russell, David, Rothes, Markinch, Fife, Scotland, Paper Maker.
1912. Russell, George H., c/o Michaelis, Hallenstein, and Co. Propy., Ltd., Footscray, Vic., Australia, Leather Trades Chemist.
1913. Russell, Stanley, Seifenfabrik Sunlight, Olten, Switzerland, Works Manager.
1912. Russell, Thomas F., 131, Steado Road, Sheffield, Analytical Chemist.
1910. Russell, William, 21, Erie Street, Widnes; Inls. to c/o United Alkali Co., Pilkington-Sullivan Works, Widnes, Lancashire, Chemist.
1905. Ruttan, Prof. R. F., Medical Faculty, McGill University, Montreal, Canada, Professor of Chemistry.
1909. Ryall, W. E., c/o North-West Soap Co., 63, Garden Reach, Calcutta, India, Soapworks Chemist.
1905. Ryan, Prof. F. G., c/o Parke, Davis, and Co., Detroit, Mich., U.S.A., Manufacturing Chemist.
1910. Ryan, L. G., 194, Cote Saint Antoine Road, Montreal, Canada, Druggist.

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1905. Sabin, Alvali H., 432, Sandford Avenue, Flushing, N.Y., U.S.A., Chemist, Varnish Works.
1883. Sadler, A. E., Sand Hall, Ulverston, Lancashire, Manufacturing Chemist.
1884. Sadtler, Dr. S. P., 145, North 10th Street, Philadelphia, Pa., U.S.A., Consulting Chemist.
1896. Sadtler, Dr. S. S., c/o Samuel P. Sadtler and Son, 39, South 10th Street, Philadelphia, Pa., U.S.A., Analytical and Consulting Chemist.
1897. Sage, C. Edward, 10, London Street, London, E.C., Consulting Chemist.
1902. Sahn, Louis N., c/o The Heller and Merz Co., 505, Hudson Street, New York City, U.S.A., Chemist.
1884. Salamon, A. Gordon, 1, Fenchurch Avenue, London, E.C., Consulting Chemist.
1885. Salamon, Jno., Ferry Road, Rainham, S.O., Essex, Manufacturing Chemist.
1911. Salamon, Maurice S., 79, Mark Lane, London, E.C., Consulting Analyst.
1884. Salis-Mayenfeld, Dr. E. von, 24, South Allen Street, Albany, N.Y., U.S.A., Technical Chemist.
1907. Samuel, Marcus R. A., c/o Compania General de Tabacos Filipinas, 37, Fenchurch Street, London, E.C., Merchant.

- O.M. Samnel, W. Cobden, 66, Croxsted Road, West Dulwich, S.E., Analytical Chemist.
1896. Samuelson, Francis A. E., Sir B. Samuelson and Co., Ltd., Middlesbrough, Ironmaster.
1904. Sand, Dr. Henry J. S., Sir John Cass Technical Institute, Jewry Street, Aldgate, E.C., Lecturer and Demonstrator.
1910. Sandeman, Archibald, Ruchill Oil Works, Glasgow, Chemist.
1906. Sanders, J. McConnell. Analytical and Consulting Chemist.
1895. Sanderson, John, c/o B. S. Cohen, Ltd., Neasden Lane, London, N.W., Chemist.
1890. Saniter, E. H., Trafford Villa, Moorgate, Rotherham, Analytical Chemist.
1901. Sargent, Dr. Geo. W., c/o Crucible Steel Co. of America, Oliver Building, Pittsburgh, Pa., U.S.A., Chemist and Metallurgist.
1910. Sargent, R. N., c/o Roessler and Hasslacher Chem. Co., Perth Amboy, N.J., U.S.A., Chemical Engineer.
1911. Sauer, J., 121, Van Breestraat, Amsterdam, Holland, Sugar Chemist.
1903. Saunders, Lewis E., 123, Buffalo Avenue, Niagara Falls, N.Y., U.S.A., Electro-Chemical Engineer.
1896. Saunders, Walter M., 20, Dewey Street, Olneyville, R.I., U.S.A., Analytical Chemist.
1911. Saville, W. B., 5, Howard Street, Horton Lane, Bradford, Yorks, Analytical Chemist.
1895. Sawers, Wm. D., 7, Minard Road, Partick Hill, Glasgow, Chemist.
1907. Saxe, Joel B., P.O. Box 1086, Montreal, Canada, Chemist.
1898. Saxe, Sigmund, 107, Manhattan Avenue, New York City, U.S.A., Manufacturing Chemist.
1890. Sayers, Jos. J., c/o Nobel's Explosives Co., Kingsway House, Kingsway, London, W.C., Explosives Chemist.
1913. Scarfe, H. Crespin, "Chikattoo," Willifield Way, Hendon, W.W., Public Officer.
1899. Schaak, Dr. Milton J., 108, Penn Street, Brooklyn, N.Y., U.S.A., Chemist.
- O.M. Schack-Sommer, Dr. G., 87, Victoria Street, London, S.W., Sugar Refiner.
1908. Schad, Dr. Philip, The Gables, Hartford, Cheshire, Manufacturing Chemist.
1910. Schaefer, Dr. George L., New York Quinine and Chemical Works, 105, North 11th Street, Brooklyn, N.Y., U.S.A., Chemist and Technical Manager.
1912. Schapiro, Hugo H. B., Wadsworth, Ohio, U.S.A., Chemist.
1908. Schatzmann, Dr. Paul, Isleben bei Fluelen, Switzerland, Chemist.
1908. Scheele, Edward H., 3, Lloyds Avenue, London, E.C., Chemical Merchant.
1903. Scheidel, Dr. Aug., c/o Commonwealth Portland Cement Co., 4, O'Connell Street, Sydney, N.S.W., Australia, Managing Director.
1886. Schellhaas, Henry Alf., Thornhill, Beech Road, Hartford, Northwich, Mechanical Engineer.
1904. Schenck, Henry, c/o Merck and Co., Box 1443, New York City, U.S.A.
1894. Schidrowitz, Dr. P., 57, Chancery Lane, London, W.C., Research Chemist.
1905. Schill, Dr. Emil, 603, West 111th Street, New York City, U.S.A., Chemist.
1909. Schlagintweit, Theo., 94, Market Street, Manchester, Imperial German Consul.
1902. Schlegel, Jno. Wm., New York Sugar Refinery, Long Island City, N.Y., U.S.A., Chemist.
1893. Schleicher, Francis J., 38, West Tenth Street, Long Island City, N.Y., U.S.A., Technical Chemist.
1901. Schlichting, Emil, 38, Cranberry Street, Brooklyn, N.Y., U.S.A., Chemist.
1906. Schmidt, J., 52, Camberwell Green, London, S.E., Works Manager.
1907. Schmitt, Charles A., The Carter's Ink Co., Cambridge "C." Boston, Mass., U.S.A., Chemist.
1906. Schneible, Joseph, 934-6, People's Gas Building, Chicago, Ill., U.S.A., Chemical Engineer.
1904. Schniewind, Heinrich, jun., Susquehanna Silk Mills, 18, West 18th Street, New York City, U.S.A., Vice-President and Treasurer.
1904. Schoeller, Dr. Walter R., 10, Bedford Place, London, W.C., Metallurgical Research Chemist.
1902. Schofield, Prof. Jas. A., The University, Sydney, N.S.W., Australia, Lecturer in Chemistry.
- O.M. Scholefield, H. E., Edge Hill Chemical Works, Liverpool, Chemical Manufacturer.
1906. Schroeder, C. M. E., Rutherford, N.J., U.S.A., Analytical Chemist.
1895. Schroeder, E. August, c/o Church and Dwight Co., 1416, Willis Avenue, Syracuse, N.Y., U.S.A., Chemist.
1908. Schüll, Gustav, Messrs. Carl Schleicher und Schüll, Düren, Rheinland, Germany, Filter Paper Manufacturer.
1904. Schultz, Carl R., 440, First Avenue, New York City, U.S.A., Mineral Water Manufacturer.
1901. Schultze, Wm., c/o General Chemical Co., Laurel Hill, Long Island, N.Y., U.S.A., Chemist.
1893. Schwab, Dr. L. C., Sedanstrasse 53, Bernburg, Anhalt, Germany, Technical Chemist.
1908. Schwalbe, Dr. Carl G., Neue Krengstrasse 17, Eberswalde, bei Berlin, Germany, Professor (Kgl. Forstakademie).
1907. Schwamm, Chas. A., c/o Antoine Chiris, 20, Platt Street, New York City, U.S.A., Chemist.
1889. Schweich, Emile. See Mond, Emile S.
1894. Schweitzer, Dr. H., Riverside Mansions, corner 113th Street and Riverside Avenue, New York City, U.S.A., Chemical Expert.
1906. Schwerin, Lorenz R., c/o Casein Co. of America, Bainbridge, N.Y., U.S.A., Vice-President.
1906. Scott, Alex. C., Explosives Manufacturer.
1891. Scott, Andrew, Royal Gunpowder Factory, Waltham Abbey, Essex, Analytical Chemist.
1889. Scott, Ernest G., c/o Ernest Scott and Co., Ltd., Kingsway House, Kingsway, London, W.C., Chemical Engineer.
1912. Scott, Harold M., 32, Woodfield Road, Cheadle Hulme, Cheshire, Works Chemist.
1898. Scott, Jas., Cawnpore Woollen Mills, Cawnpore, India, Chemist.
1894. Scott, Jno. Gillespie, Annislea, Clermiston Road, Corstorphine, Edinburgh, Analytical Chemist.
1912. Scott, Jno. William, 576, Church Street, Toronto, Canada.
1913. Scott, Wm. Chas., c/o The Bay View Foundry Co., Sandusky, Ohio, U.S.A., Chemist.
1907. Scott, Wm. F., c/o Madison Woollen Co., Madison, Maine, U.S.A., Manager.
1894. Scott-Smith, G. E., 67, Surrey Street, Sheffield, Analytical and Consulting Chemist.
1904. Scoville, Wilbur L., c/o Parke, Davis, and Co., Detroit, Mich., U.S.A., Analytical Chemist.
- O.M. Scudder, F., Mersey and Irwell Joint Committee, 44, Mosley Street, Manchester, Chemist.
1889. Searl, Albert, 7, Palmeira Avenue, Westcliff-on-Sea, Technical Chemist.
1898. Searle, Alfred B., The White Building, Sheffield, Consulting Chemist (Classes VIII. and IX.).
1905. Seeker, A. F., 160, Midwood Street, Brooklyn, N.Y., U.S.A., Food Analyst.
1907. Seelmann, Dr. A., c/o Sprengstoffwerke Dr. R. Nahnson and Co., Mönckebergstrasse 31, Hamburg, Germany, Managing Director.
1896. Seldner, Rudolph, 383, St. John's Place, Brooklyn, N.Y., U.S.A., Manufacturing Chemist.
1904. Seligman, Dr. Richard, Point Pleasant, Putney Bridge Road, Wandsworth, S.W., Chemist.
1908. Sellen, Elijah, Gasworks Laboratory, M.L.H. & P. Co., Elm Station, Montreal, Canada, Chemist.
1905. Sellers, Geo. E., Hopton Lane, Mirfield, near Huddersfield, Aniline Colour Maker.
1898. Sen (Gupta), Nagendra Nath, 18, Lower Chitpur Road, Calcutta, India, Physician and Chemist.
1910. Sen, Prof. Rajendra Nath, Engineering College, Sibpur, Bengal, India, Professor of Tinctorial Chemistry.

1905. Sewell, B. F. Brooke, P.O. Box 1334, Washington, D.C., U.S.A., Chemical Engineer.
1896. Seyler, Clarence A., Public Analysts' Office, Nelson Terrace, Swansea, Chemist and Assayer.
1907. Seymour, Tom G., Kilton, Northway, Wavertree, Liverpool, Analytical Chemist.
1911. Seymour-Jones, Lieut. R.A., Research Chemist.
1903. Shacklady, T. G., Hoop Point, Cliffe at Hoo, Kent, Technical Chemist.
1911. Shah, Prof. P. G., 759, Sankdi Sheri, Ahmedabad, India, Professor of Chemistry, Forman Christian College.
1906. Shah, Prof. S. J., Dhanasutar's Street, Ahmedabad, India, Consulting Chemist.
1892. Shanks, Arch., 5, Green Lodge Terrace, Greenhead, Glasgow, Chemist.
1908. Shanks, John, Dalmeny Park Barrhead, near Glasgow, Sanitary Engineer.
1904. Sharples, G. H., Newton Gardens, Middlewich, Cheshire, Works Chemist.
1905. Sharples, Philip P., 110, Edgemont Road, Montclair, N.J., U.S.A., President (Natl. Coal Tar Co.).
1884. Sharples, Stephen P., 22, Concord Avenue, Cambridge, Mass., U.S.A., Analytical Chemist.
1911. Sharrook, Charles W., Lion Works, West Thurrock, Grays, Essex, Cement Manufacturer.
1900. Sharwood, Dr. Wm. J., c/o Homestake Mining Co., Lead, South Dakota, U.S.A., Metallurgical Chemist.
1900. Shattuck, A. F., c/o Solvay Process Co., Detroit, Mich., U.S.A., Chemist.
1915. Shaw, John H., Public Library, Bury, Lancashire, Librarian.
1913. Shaw, T. W. A., "Springfield," Dee View Road, Heswall, Cheshire, Process Manager.
1912. Shearman, Cecil H., The Tees Bone Mill, Thornaby-on-Tees, Managing Director.
1904. Shedden, Frank, 25, Middleborough Road, Coventry, Science Master.
1903. Sheldon, Dr. N. L., Cordite Factory, Aruvankad, Nilgiri Hills, India, Works Manager.
1912. Shelley, F. F., Apothecaries' Hall, Blackfriars, London, E.C., Analytical Chemist.
1912. Shelley, Wm. E., 20, Mount Street, Manchester, Engineer.
1911. Shelton, James, Government Laboratories, Singapore, S.S., Chemist.
1913. Shengle, J. C., c/o Major Bros., Ltd., Kiangsu Chemical Works, Shanghai, China, General Manager.
1892. Shenton, Jas. P., 37, Torbay Road, Chorlton-cum-Hardy, near Manchester, Analytical Chemist.
1906. Shepard, Jas. H., Experiment Station, Brookings, S. Dak., U.S.A., Agricultural Chemist.
1907. Shephard, Fred. G., Hotland Cottage, Ruthwell, Dumfriesshire, Chemist.
1904. Shepherd, A. B., Copenhagen Oil Mills, Limehouse, London, E., Analytical Chemist.
1893. Shepherd, H. H. B., 8, The Park, Sideup, Kent, Chemist.
1898. Shepherd, Reginald des F., Central Laboratory, Rhodes, Manchester, Printworks Chemist.
1909. Shepherd, Stephen W., c/o Brotherton and Co., Ltd., Nchells Chemical Works, Birmingham, Works Manager.
1899. Shero, John E., c/o Aluminium Co. of America, Niagara Falls, N.Y., U.S.A., Chemist.
1893. Shields, Dr. John, Minas de Rio Tinto, Prov. de Huelva, Spain, Chemist.
1896. Shimomura, Prof. K., Shinkarasumaru Kojinguchi Sagaru, Kyoto, Japan, Professor of Chemistry.
1905. Shollstall, Arthur S., 269, Second Street, New Brighton, Staten Is., N.Y., U.S.A., Chemist.
1899. Sholes, Chas. E., 80, Maiden Lane, New York City, U.S.A., Chemical Agent.
1900. Shonk, Albert, 12, Delamere Road, Wimbledon, Analytical Chemist.
1897. Shores, Dr. Jeff. H., 20, Saltwell View, Gateshead-on-Tyne, Chemist.
1904. Short, Andrew, 3, Prudhoe Terrace, Tynemouth, Northumberland, Works Chemist.
1902. Shoubridge, Sydney Y., M.I.C.E., Gasworks, Lower Sydenham, S.E., Gas Engineer.
1901. Shukoff, Dr. Alexis A., Borowaja No. 86, Petrograd, Russia, Technical Chemist.
1899. Shuler, Darius P., Fredericktown, Mo., U.S.A., Chemist.
1890. Shutt, Frank T., Central Experimental Farm, Ottawa, Canada, Agricultural Chemist.
1906. Shuttleworth, E. B., 220, Sherbourne Street, Toronto, Canada, Chemist.
1901. Siau, Raymond L., Springfield Brewery, Wolverhampton, Research Chemist.
1902. Sibley, Samuel E., Hawthorne, King Street, Raudwick, Sydney, N.S.W., Australia, Technical Chemist.
1907. Siebel, Fred. P., 960-962, Montana Street, Chicago, Ill., U.S.A., Analytical Chemist.
1902. Siebold, Alfred, c/o Lactose Ltd., Hibernia Works, Tipperary, Ireland, Technical Chemist.
1901. Silberrad, Dr. Oswald, Sunny Croft, Buckhurst Hill, Essex, Research Chemist.
1912. Sillars, Daniel, The Laboratory, Bolekow, Vaughan, and Co., Ltd., South Bank, S.O., Yorks, Metallurgical Chemist.
1892. Silvester, Harry, 78, Holyhead Road, Handsworth, Birmingham, Analytical and Consulting Chemist.
1901. Sim, Wilfrid A., c/o Wm. Sim and Sons, 40, Jane Street, Leith, Scotland, Colour Manufacturer.
1912. Simmanee, John F., 25a, Westminster Palace Gardens, Victoria Street, Westminster, S.W., Managing Director (Alexander Wright and Co.).
1911. Simmons, Thos. A., c/o British Aluminium Co., Larne Harbour, Co. Antrim, Ireland, Analytical Chemist.
1903. Simmons, Wm. H., Oakleigh, Stoke Newington Common, N., Analytical Chemist.
1898. Simon, Dr. A., 80, Bishopsgate, London, E.C., Chemical Engineer.
1905. Simons, Albert J., Pontianak, Dutch West Borneo, via Singapore, S.S., Engineer.
1902. Simonson, Wm., 126, West 9th Street, Cincinnati, Ohio, U.S.A., Chemist.
1905. Simpson, Henry, 26, Austen Avenue, Sherwood Rise, Nottingham, Works Chemical Assistant.
- O.M. Simpson, W. S., The Gables, Cannon Hill, Southgate, N., Analytical Chemist.
1900. Sims, W. Edgar, Colinswell House, Burntisland, Fifeshire, Manager (British Aluminium Co., Ltd.).
1894. Sinclair, Dr. W., 250, Ferry Road, Leith, Scotland, Chemist.
1890. Sindall, R. W., 2, Oxford Court, Cannon Street, London, E.C., Paper Chemist.
1911. Singh, Shersingh W., N.W. Railway, Sultanpur, Punjab, India, Engineer.
1899. Singmaster, J. Arthur, c/o New Jersey Zinc Co. of Penna., Palmerton, Pa., U.S.A., Chemist.
1901. Sinnatt, Frank S., 321, Great Clowes Street, Higher Broughton, Manchester, Demonstrator of Chemistry.
1914. Sjöbladh, H.A., c/o The Chatfield Manufacturing Co., Station P., Cincinnati, Ohio, U.S.A., Chemist.
1912. Skellon, Herbert, Ajax Rubber Mills, Leyland, near Preston, Chemist.
1894. Skelton, John R., c/o Norwich Crape Co. (1856), Ltd., St. Augustine's, Norwich, Managing Director.
1897. Skertchly, W. P., Laboratory, 11, Billiter Square, London, E.C., Analytical Chemist.
1891. Skilton, C. F. E., c/o Beamish and Crawford, Ltd., Cork, Ireland, Brewer.
1901. Skinner, Hervey J., 71, West Chestnut Street, Wakefield, Mass., U.S.A., Chemist.
1908. Skinner, Wm., 38, Sauchiehall Street, Glasgow, Analytical Chemist.
1904. Skirrow, Dr. F. W., State University of Utah, Salt Lake City, Utah, U.S.A., Assistant Professor of Chemistry.
1911. Skjold, E., Erith Oil Works, Erith, Kent, Technical Manager and Chemist.
1904. Skowronski, S., c/o Raritan Copper Works, Perth Amboy, N.J., U.S.A., Chemist.

1891. Skurray, Thos., The Brewery, 40, Ock Street, Abingdon, Berks, Brewer.
1913. Slade, Dr. Roland E., University College, Gower Street, London, W.C., Lecturer in Physical Chemistry.
1904. Slator, Dr. Arthur, 174, Ashby Road, Burton-on-Trent, Lecturer and Demonstrator.
1912. Slattery, F. J., 42, Mathews Park Avenue, Stratford, E., Analytical Chemist.
1906. Sleeper, Robt. R., 112, Charles Street, Lowell, Mass., U.S.A., Instructor in Dyeing.
1895. Slocum, Dr. Frank L., 401, South Linden Avenue, E.E., Pittsburg, Pa., U.S.A., Chemist.
1913. Slusser, Holland B., 318, Sixth Street N.W., Canton, Ohio, U.S.A., Analytical Chemist.
1833. Small, J. I., Warren Wood, Hayes Common, Beekenhams, Kent, Chemical Manufacturer.
1898. Small, Fritz H., 28, Berwick Street, Worcester Mass., U.S.A., Chemist.
1915. Smalley, Oliver, Park Villa, Thrybergh, Rotherham, Yorks, Metallurgist.
1904. Smart, Bertram J., Government Testing Laboratory, Lithgow, N.S.W., Australia, Chemist.
- O.M. Smetham, A., 16, Brunswick Street, Liverpool, Analytical Chemist.
1905. Smith, Prof. Albert W., Case Library, Cleveland, Ohio, U.S.A., Professor of Chemistry.
1898. Smith, Alf. B., Ryecroft, Glossop, Derbyshire, Bleacher and Dyers' Manager.
1897. Smith, Allan, 30, Fountainhall Road, Edinburgh, Chemist.
1914. Smith, Andrew, c/o Leech, Neal, and Co., Ltd., Spondon, Derby, Colour Manufacturer.
1896. Smith, Andrew T., c/o Castner-Kellner Alkali Co., Ltd., 257, Royal Liver Building, Liverpool, General Manager.
1905. Smith, Arthur, Town End Chemical Works, Bramley, Leeds, Chemical Manufacturer.
1912. Smith, Arthur R., c/o Messrs. J. Watson and Son, Ltd., Whitehall Soap Works, Leeds, Chemist.
1893. Smith, Edgar B., c/o Dominion Tar and Chemical Co., Box D, Transcona, Manitoba, Canada, Manager.
1906. Smith, E. A. Cappelen, c/o American Smelting and Refining Co., 165, Broadway, New York City, U.S.A., Metallurgical Engineer.
1913. Smith, Edward C., 18, Constance Street, and c/o Canadian National Carbon Co., Ltd., 99, Paton Road, Toronto, Canada, Superintendent.
1895. Smith, Dr. E. Ellsworth, Suite 80, Chemists' Building, 50, East 41st Street, New York City, U.S.A., Consulting Physiological Chemist.
1892. Smith, Ernest A., The Assay Office, Leopold Street, Sheffield, Assayer.
1911. Smith, E. Woodhouse, Central Laboratory, City Gasworks, Neehells, Birmingham, Chief Chemist.
1903. Smith, Ewing, c/o Dunlop Tire and Rubber Goods Co., Toronto, Canada, Analytical Chemist.
1891. Smith, Francis P., 131-133, East 23rd Street, New York City, U.S.A., Chemist.
1907. Smith, Frank Morse, 100, William Street, New York City, U.S.A., Chemical Merchant.
1908. Smith, George A., 1433, President Street, Brooklyn, N.Y., U.S.A., Chemist (Printing Ink Manufacturing).
1907. Smith, George D., 247, Atlantic Avenue, Boston, Mass., U.S.A., Salesman.
1890. Smith, Harry E., 36, Beersford Place, East Cleveland, Ohio, U.S.A., Analytical Chemist.
1904. Smith Henry, 83, Brownlow Road, Horwich, Bolton-le-Moors, Lancs., Analytical Chemist.
1902. Smith, Hy. Geo., Technological Museum, Harris Street, Ultimo, Sydney, N.S.W., Australia, Assistant Curator and Chemist.
1905. Smith, H. Melville, Ammunition Works, Abbey Wood, Kent, Engineer and Superintendent.
1901. Smith, H. Procter, Highfield, Shotton Lane, Shotton, Flintshire, Metallurgical Chemist.
- O.M. Smith, H. R., J., Aubert Park, Highbury, London, N., Analytical Chemist.
1905. Smith, Hugh Dunford, 7 and 9, The Side, Newcastle-on-Tyne, Analytical Chemist.
1906. Smith, Irwin J., P.O. Box 506, Troy, N.Y., U.S.A. Salesman.
- O.M. Smith, Jas., Ash Grove House, Radcliffe, Manchester.
1897. Smith, James, Sunnyside, Groes Road, Cressington, near Liverpool, Analytical Chemist.
1903. Smith, James, "Lyndhurst," Frodsham, and (Jnls.) Ditton Copper Works, Widnes, Metallurgist.
1907. Smith, Jas. C., c/o Edward Ripley and Son, Ltd., Bowling Dyeworks, Bradford, Dyer.
1893. Smith, Jas. F., 9, Alexandra Park, Scarborough, Yorks, Analytical Chemist.
1901. Smith, J. Cruickshank, King's House, King Street, London, E.C., Technical Chemist.
- O.M. Smith, Dr. J. H., Villa Cornelia 2, Lausanne, Switzerland, Chemist.
1888. Smith, J. Tertius, Richmond House, Plaistow, Essex Technical Chemist.
- O.M. Smith, Jno. W., 7, Brookfield Street, Roshindale, Boston, Mass., U.S.A., Analytical Chemist.
1890. Smith, J. Wm., 1615, West Genesee Street, Syracuse, N.Y., U.S.A., Alkali Works Manager.
1911. Smith, N. Garrett, Heathside, Treville Street, Rochampton, S.W., Analytical Chemist.
1898. Smith, R. F. Wood, 90, Lower Thames Street, London, E.C., Consulting Chemist.
1890. Smith, Dr. R. Greig, Linnean Society's House, Elizabeth Bay, Sydney, N.S.W., Bacteriologist and Chemist.
1890. Smith, Robert Watson, c/o The New Transvaal Chemical Co., Ltd., Delmore, Transvaal, South Africa, Chemical Works Manager.
1914. Smith, Stanley, The Ammonia Soda Co., Ltd., Lostock Gralam, near Northwich, Chemist.
1907. Smith, Thorn, 49, West Larned Street, Detroit, Mich., U.S.A., Chemist.
1910. Smith, Vincent, Athlone, Eagle Road, Wembley, Middlesex, Technical Chemist.
1903. Smith, Dr. Warren R., Lewis Institute, Chicago, Ill., U.S.A., Teacher.
- O.M. Smith, Watson, 34, Upper Park Road, Haverstock Hill, N.W., Retired Editor and Chemist.
1908. Smith, Dr. Watson, jun., Cape Explosives Works, Somerset West, C.C., South Africa, Chemist.
- O.M. Smith, Wilfred, 182, West Street, Glasgow, Chemical Manufacturer.
1910. Smith, W. C., c/o The Anchor Cable Co., Leigh, Lancashire, Analytical Chemist.
1909. Smith, Wm. G., 23, Wickham Way, Park Langley, Beckenham, Kent, Chemical Merchant.
- O.M. Smithells, Prof. A., F.R.S., The University, Leeds, Professor of Chemistry.
- O.M. Smithers, F. O., 171, Adelaide Road, London, N.W., and (Jnls.) c/o W. E. Harrison, Technical School, Goldhill Road, Handsworth, near Birmingham, Chemical Agent.
1902. Smoot, Albert M., 99, John Street, New York City, U.S.A., Analytical Chemist.
1909. Smoot, Chas. C., III., c/o C. C. Smoot and Sons Co., North Wilkesboro', N.C., U.S.A., Tanning Chemist.
1888. Snape, Dr. H. Lloyd, Balholm, Latham Road, Southport, Director of Education for Lancashire.
1908. Snell, Professor John F., Macdonald College P.O., Prov. Quebec, Canada, Professor of Chemistry.
1896. Snowden, J., jun., Messrs. Snowden, Sons and Co., Millwall, E., Chemical and Oil Manufacturer.
1900. Sodeau, Dr. Wm. H., Torpedofabrik, Fiume, Hungary, Chemist.
1903. Sohlman, Ragnar, Bofors, Sweden, Manager (A. B. Bofors Nobelkrut).
1894. Sohn, Chas. E., 31, Mattison Road, Hornsey, N., Analyst.
1912. Solomon, J. Berard, 56, Priory Road, Hampstead, London, N.W., Tannery Chemist.
1906. Solomon, M., Birmingham Carbon Works, Witton, Birmingham, Manager.
1895. Solvay, Armand, 25, Rue Prince Albert, Brussels, Gérant de la Société Solvay et Cie.

1914. Somerville, C. Winthorpe, South Metropolitan Gas Company, East Greenwich, S.E., Works Chemist.
1884. Sommer, Adolf, Corner 1st and Binney Streets, East Cambridge, Boston, Mass., U.S.A., Pharmaceutical Chemist.
1909. Sommer, Dr. Albert, Munchnerplatz 14 pt., Dresden, Germany, Engineer Chemist.
1912. Sorley, Jas., Novara, Mount Vernon, Glasgow, Analytical Chemist.
1904. Southall, A. W., Lower Priory, Birmingham, Manufacturing Chemist.
1904. Southerden, F. H., Gordon Road, Exeter, Teacher of Chemistry.
1890. Sowerby, Thos. H., Canal Soap Works, Verney Road, Rotherhithe, S.E., Soap Manufacturer.
- O.M. Sowerby, W. M., c/o United Alkali Co., Ltd., Allhusen Works, Gateshead-on-Tyne, Manager.
1887. Spackman, Chas., Rosehaugh, Clitheroe, Lancashire, Portland Cement Manufacturer.
1910. Spackman, Henry S., 2211, Chestnut Street, Philadelphia, Pa., U.S.A., President of Engineering Co.
1904. Sparre, Fin, c/o E. I. du Pont de Nemours Powder Co., Experimental Station, Henry Clay P.O., Del., U.S.A., Director.
1913. Speedy, Alan, 1, Creighton Avenue, East Ham, Essex, Technical Chemist.
1904. Speiden, C. C., 46, Cliff Street, New York City, U.S.A., Chemical Merchant.
1905. Speight, W. E., Hacken Sewage Works, Great Lever, Bolton, Chemist.
1883. Spence, D., Manchester Alum Works, Manchester, Alum Manufacturer.
1911. Spence, Dr. David, Norwalk, Conn., U.S.A., Research Chemist.
1900. Spence, Howard, (Journals) Audley, Broad Road, Sale, Cheshire; and Alum Works, Manchester, Chemical Manufacturer.
1909. Spence, Jno., 74, Buchanan Street, Glasgow, Analyst.
1883. Spence, Jno. W., Tiviot Colour Works, Manchester Road, Stockport, Drysalter.
1903. Spencer, A. Gordon, 601—603, Canadian Express Building, Montreal, Canada, Chemist.
1913. Spencer, Richard D., Works Chemist.
1884. Spiegel, Dr. Adolf, Messel bei Darmstadt, Germany, Analytical Chemist.
1903. Spielmann, Dr. P.E., 21, Cadogan Gardens, London, S.W., Chemist.
1906. Spiera, Dr. V. G., c/o Inchiostroificio-Veneto, Treviso, Italy, Chemist.
1889. Spies, Adolph, 21, Broadwater Down, Tunbridge Wells, Chemical Merchant.
1885. Spiller, A., 20, Holly Avenue, Newcastle-on-Tyne, Electrician.
- O.M. Spiller, J., 2, St. Mary's Road, Canonbury, London, N., Consulting Chemist.
1914. Spilman, G. H., c/o The Chiswick Polish Co., Chiswick, W., Works Chemist.
1896. Spoor, J. L., Rede Court, Rochester, Kent, Portland Cement Manufacturer.
1909. Sprague, F. O., c/o Cattarangus Tanning Co., Olean, N.Y., U.S.A., Chemist.
1912. Sprent, Dr. Colin, Chemical Engineer.
- O.M. Squire, P. W., 413, Oxford Street, London, W., Pharmaceutical Chemist.
1910. Stadler, Hans, c/o Herr Kommerzienrat J. Stadler, Prague, Austria, Technical Chemist.
- O.M. Stahl, Dr. K. F., 57th Street and A. V. Ry., Pittsburgh, Pa., U.S.A., Consulting Chemist.
1914. Staley, Homer F., Iowa State College, Ames, Iowa, U.S.A., Technical Director.
1904. Standfast, Jno. T., Prince Regent's Wharf, Silver-town, E., Chemist.
1906. Stanley, Wm., Great Barrington, Mass., U.S.A., Engineer.
1888. Stantial, Frank G., c/o Cochrane Chemical Co., Everett, Mass., U.S.A., Technical Chemist.
1885. Staples, H. J., The Old Hall, Spondon, Derby, Colour Manufacturer.
- O.M. Stark, J. F., Rosedale, Bromborough, Cheshire, Works Manager.
1896. Statham, Noel, c/o West Virginia Pulp and Paper Co., 200, Fifth Avenue, New York City, U.S.A., Engineer.
1907. Staud, Joseph E., c/o W. W. Lawrence and Co., Pittsburg, Pa., U.S.A., Chemist.
1904. Stauffer, W., 61, Oberwilerstrasse, Basle, Switzerland, Chemical Works Manager.
1895. Stead, J. Christopher, 57, Chancery Lane, London, W.C., Technical Chemist.
- O.M. Stead, J. E., F.R.S., 11, Queen's Terrace, Middlesbrough-on-Tees, Analytical Chemist.
- O.M. Stebbins, Dr. J. H., 50, East 41st Street, New York City, U.S.A., Analytical Chemist.
1915. Steedman, Geo., Kinerton, Kilwinning, Ayrshire, Chemical Manufacturer.
1896. Steel, Fred. W., c/o General Chemical Co., Ltd., Auburn, Sydney, Australia, Works Manager.
1909. Steel, Jno. S., Achernar, Blackburn, Melbourne, Vic., Australia, Chemist.
- O.M. Steel, Thos., Colonial Sugar Refining Co., O'Connell Street, Sydney, N.S.W., Australia, Sugar Chemist.
1914. Steele, George Francis, Room 7, 1358, East 47th Street, Chicago, Ill., U.S.A., Paper Manufacturer.
1915. Steger, Prof. Alph. M. A. A., Technical University of Delft, and (Jnl.) 58, Olden Barneveldlaan, The Hague, Holland, Chemical Technologist.
1912. Steiner, Bernard C., Enoch Pratt Free Library, Baltimore, Md., U.S.A., Librarian.
1897. Steinhart, Dr. Oscar J., c/o Twite and Steinhart, 65, London Wall, London, E.C., Consulting Metallurgist.
1912. Steinhoff Fred., 24, Walbrook, London, E.C., Chemical Manufacturer.
1887. Stenhouse, T., 166, Drake Street, Rochdale, Analytical Chemist.
1908. Stenhouse, Thos., jun., Chemical Laboratory, H.M. Dockyard, Portsmouth, Analytical Chemist.
1904. Stephen, A. E., 67, Castlereagh Street, Sydney, N.S.W., Australia, Analytical Chemist.
1911. Stephens, C. E., Messrs. Stephens and Morgan, 2, Bury Court, St. Mary Axe, London, E.C., Chemical Merchant.
1884. Stephens, H. Chas., Avenue House, Finchley, N., Ink Manufacturer.
1892. Stephens, M. E., 57—60, Aldersgate Street, London, E.C., Ink Manufacturer.
1913. Stephenson, Guy, Bankfoot Laboratory, Crook, Co. Durham, Analyst.
1909. Stephenson, Henry H., 22, Claremont Avenue, New Malden, Surrey, Technical Chemist.
1909. Stephenson, Herbert F., 8, The Park, Mitcham, Surrey, Analytical Chemist.
1889. Stern, Arthur L., 148, High Street, Burton-on-Trent, Brewing Chemist.
1912. Sterne, Edward T., School of Mining, Queen's University, Kingston, Ont., Canada, Chemist.
- O.M. Stenart, D. R., Osborne Cottage, Broxburn, West Lothian, Oilworks Chemist.
1903. Steven, A. B., Royal Technical College, Glasgow, Lecturer on Dyeing.
1914. Steven, George, 23, Denstone Road, Pendleton, Manchester, Pharmaceutical Chemist.
1907. Steven, Michael M., c/o The East India Distilleries, and Sugar Factories, Ltd., Kanham Bridge P.O., C.P., India, Analytical Chemist.
1899. Stevenot, G. A., 280, Baltic Street, Brooklyn, N.Y., U.S.A., Chemist.
1902. Stevens, Dr. Hy. P., Laboratory, 15, Borough London Bridge, S.E., Consulting Chemist.
1894. Stevens, Jno. H., c/o Librarian, The Celluloid Co., 3, Westcott Street, Newark, N.J., U.S.A., Manufacturing Chemist.
1908. Stevens, J. Venn, 147a, Clapton Common, London, N.E., Analytical Chemist.
1902. Stevens, M. White, H.M. Patent Office, Chancery Lane, London, W.C., Chemist.
- O.M. Stevenson, W., Standard Works, 95a, Southwark Street, London, S.E., Chemical Manufacturer.

1913. Steward, H. Bernard, Rose Hill House, Coseley, near Bilston, Staffs, Enamel Chemist.
1912. Stewart, Allan E., 136, Bedford Road, Toronto, Canada, Chemist.
1901. Stewart, David B. D., Aberdeen Comb Works, Hutcheon Street, Aberdeen, Managing Director.
1903. Stewart, Jas., "The Gas World," S. Bonverie Street, Fleet Street, London, E.C., Editor.
1909. Stewart, Jeffrey, India Refining Co., McKean and Swanston Streets, Philadelphia, Pa., U.S.A., Works Manager.
1890. Stewart, Robt., 46, Westbourne Road, Lnton, Chemical Works Manager.
- O.M. Stewart, S., c/o Michael Nairn and Co., Ltd., Kirkcaldy, Fife, Technical Chemist.
1914. Stiasny, Prof. E., S. Monk Bridge Road, Headingley, Leeds, Professor of Applied Chemistry.
1906. Stickland, Oliver W., c/o The New Explosives Co., Ltd., Stowmarket, Suffolk, Works Chemist.
1904. Stieglitz, Dr. Julius, University of Chicago, Chicago, Ill., U.S.A., Associate Professor of Chemistry.
1904. Stiff, John T., 68, Dover Road, Northfleet, Kent, Works Chemist.
1903. Stillwell, Albert G., 76½, Pine Street, New York City, U.S.A., Chemist.
1914. Stock, Cyril J. H., 9, Houndgate, Darlington, Analytical Chemist.
1900. Stockdale, Edgar, c/o R. Dewhurst and Co., Ltd., Printworks, Batley, Yorks, Colour Mixer.
1888. Stockdale, Wm., Rosebank Printworks, Ramsbottom, near Manchester, Calico Printer.
1887. Stocks, H. B., 33, Prenton Park Road, Birkenhead, Cheshire, Analytical Chemist.
1903. Stoddard, Jesse D., 674, Woodward Avenue, Detroit, Mich., U.S.A.
1885. Stoddart, F. Wallis, Grafton Lodge, Sneyd Park, Bristol, Analytical Chemist.
1899. Stokes, Alf. W., Laboratory, Town Hall, Paddington Green, W., Public Analyst.
1910. Stokes, Edward S., c/o Metropolitan Board of Water Supply and Sewerage, Pitt Street, Sydney, N.S.W., Australia, Medical Officer.
1900. Stone, Geo. C., c/o New Jersey Zinc Co., 55, Wall Street, New York City, U.S.A., Engineer.
1899. Stone, I. F., 100, William Street, New York City, U.S.A., Chemical Merchant.
1914. Stone, O. J., c/o Messrs. Day and Martin, Carpenter's Road, Stratford, E., Analytical Chemist.
- O.M. Storey, I. H., Haverbreaks, Lancaster, Chemical Manufacturer.
1914. Storie, George B., 62, Vineyard Hill Road, Wimbledon, S.W., Works Manager.
1902. Storr, Bertram V., 26, The Square, Garden Suburb, Ilford, Essex, Chemist.
1914. Stott, Augustus P., 20-26, Brunswick Place, City Road, London, N., Manager.
1909. Strachan, Jas. T., c/o Price Bros. and Co., Ltd., Kenogami, Quebec, Canada, Technical Chemist.
1912. Strange, E. Halford, 7, Staple Inn, Holborn, London, W.C., Technical Research Chemist.
1903. Strayer, D. W., 428, West King Street, York, Pa., U.S.A., Chemist.
1912. Stevens, J. E., c/o New Zealand Sulphur Co., Ltd., Room 31, Smeaton's Building, Auckland, New Zealand, Technical Chemist.
1903. Strickler, Emerson H., c/o General Chemical Co., 25, Broad Street, New York City, U.S.A., Chemist.
1909. Strivens, Percy R., 20, Cartmel Road, St. Annes-on-Sea, Lancs., Analytical Chemist.
1896. Stuart, Harry T. R., Fir Bank, Woolfold, near Bury, Printworks Manager.
- O.M. Stuart, T. W., 7, Livingston Drive, Sefton Park, Liverpool, Alkali Works Manager.
1896. Stubbs, Augustus J., Castellon de la Plana, Spain.
1903. Sturrock, Capt. G. C., R.A., Indian Cordite Factory, Aruvankad, Nilgiris, India, Assistant Superintendent.
1908. Suart, Arthur B., c/o Johnson and Sons' Smelting Works, Paul Street, Finsbury, London, E.C., Bullion Refiner.
1895. Sudborough, Dr. J. J., Indian Institute of Science, Bangalore, India, Lecturer in Chemistry.
1889. Sulman, H. L., 44, London Wall, London, E.C., Chemist and Metallurgist.
1910. Sulzer, Albert F., 16, Beverly Street, Rochester, N.Y., U.S.A., Chemical Engineer.
1895. Summers, Bertrand S., c/o The Summers Fiber Co., Port Huron, Mich., U.S.A., Electro-Chemist.
1907. Sundar-Ram, Minakshi, c/o Parry and Co., Ranipettai, N. Arcot, Madras, India, Agricultural Chemist.
1913. Sundeman, G., c/o C. E. Davis' Packing Co., Fleeton, Va., U.S.A., Chemist.
1912. Sutchiffe, J. A. L., c/o Price's Co., Ltd., Blyedere, Kent, Analytical Chemist.
1906. Sutermeister, Edwin, c/o S. D. Warren and Co., Cumberland Mills, Westbrook, Maine, U.S.A., Chemist.
1884. Sutherland, D. A., 26, Victoria Street, Westminster, S.W., and (Juls.) Fairfield Lodge, Twickenham, Consulting Technical Chemist.
1909. Sutherland, Daniel M., Ashgrove, Sunbry Common, Middlesex, Works Manager.
1894. Sutherland, Geo., Croft Cottage, Bonhill, Scotland, Chemist.
1887. Sutherland, Jas., c/o British Aluminium Co., Ltd., Larne Harbour, Co. Antrim, Ireland, Chemist.
1906. Sutherland, John, c/o The Bauxite Refining Co., Ltd., Hebburn-on-Tyne, Manager.
- O.M. Sutherland, R. M., Lime Wharf Chemical Works, Falkirk; and Solsgirth, Dollar, Chemical Manufacturer.
1886. Sutton, F. Napier, 21, Lydford Road, Cricklewood, N.W., Alkali Works Inspector.
1900. Sutton, W. Lincoln, Redwell Street, Norwich, Public Analyst.
1913. Swan, J. Waldron, 211, Castle Street, Luton, Beds, Gas Works Chemist.
1906. Sweet, Everell F., 52, Union Street, Boston, Mass., U.S.A., Importer.
1905. Swenarton, W. Hastings, 2, Rector Street, New York City, U.S.A., Patent Lawyer.
1904. Swindells, Seth, Liverpool Road, Kildsgrove, Stoke-on-Trent, Chemist.
1912. Swinden, Dr. Thos., 12, Nether Edge Road, Sheffield, Metallurgist.
1901. Swinton, Ralph S., c/o W. J. Bush and Co., Inc., Linden, N.J., U.S.A., Analytical Chemist.
1912. Sykes, Charles D., Ivy House, Langley, near Birmingham, Chemical Works Manager.
1902. Sylow, Paul L. P. G., New Farm Sugar Refinery, Brisbane, Queensland, Analytical Chemist.
1906. Symes, Langford P., Belfast Freezing Works, Christchurch, New Zealand, Chemist.
1906. Symonds, Abram E., Wick Lano Colour Works Old Ford Road, Bow, E., Colour Manufacturer.
1910. Szilagyi, L. F., 39, Belsize Avenue, London, N.W., Consulting Engineer.

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1895. Taber, G. H., 814, Frick Building, Pittsburg, Pa., U.S.A., General Manager (Gulf Refining Co.).
1914. Tack, Howarth K., Bella Vista, 5, Minas de Rio Tinto, Prov. de Huelva, Spain, Chemical Engineer.
1910. Tainsh, Peter, 36, Green Lawn, Rock Ferry, Cheshire, Technical Chemist.
1909. Tait, Walter Scott, Innellan, Bebbington, Cheshire, Works Manager.
1896. Takagi, T., 10, Nishikatamachi, Hongo, Tokyo, Japan, Chemical Engineer.
- O.M. Takamatsu, T., 13, Nishikatamachi, Hongo, Tokyo, Japan, Analytical Chemist.
- O.M. Takamine, Dr. Jokichi, 550, West 173rd Street, New York City, U.S.A., Engineer.
1912. Talley, Herbert, c/o Hercules Powder Co., Wilmington, Del., U.S.A., General Manager.
1910. Tanahashi, Dr. T., 486, Sendamachi, Fukagawa, Tokyo, Japan, Manufacturing Chemist.

1898. Tanaka, Keishin, Matsuba Hotel, Kudansaka, Uye, Tokyo, Japan. Chemist.
1900. Tankard, Arnold R., 67, Ferens Avenue, Cottingham Road, Hull, Analytical Chemist.
1911. Tarver, Percy, 2095, East 36th Street, Cleveland, Ohio, U.S.A., Chemist.
- O.M. Tate, F. H., 9, Hackins Hey, Liverpool, Analytical and Technical Chemist.
1910. Tatlock, Chas. S. A., c/o The Standard Chemical Products Co., Ltd., Irvine, Scotland, Analytical Chemist.
- O.M. Tatlock, R. R., 156, Bath Street, Glasgow, Consulting Chemist.
1902. Tatters, Hugh Lee, 21, Park Road, Hebburn-on-Tyne, Analytical Chemist.
1906. Tattersfield, Frederick, 96, Bewick Road, Gateshead-on-Tyne, Analyst.
1905. Taveau, René de Mortemer, 1809, North Calvert Street, Baltimore, Md., U.S.A., Chemist.
1903. Taylor, Alvin M., c/o General Chemical Co., Hegewisch, Ill., U.S.A., Chemist.
1902. Taylor, Arthur P., c/o John Taylor and Co., 531, Front Street East, Toronto, Ont., Canada, Soap Manufacturer.
1907. Taylor, C. Marshall, Port Reading, N.J., U.S.A., Chemist.
1886. Taylor, G. Crosland, Crane House, Crane Wharf, Chester, Electrical Engineer.
1894. Taylor, G. Midgley, Caxton House, Westminster, S.W., Analytical Chemist.
- O.M. Taylor, H. E., 1, Alexandra Park Gardens, Glasgow, Lead Works Manager.
1883. Taylor, Jas., "Cartref," Brierley Street, Mosman, N.S.W., Australia, Government Metallurgist.
1898. Taylor, Jas. M., Tynevale, Groes Road, Cressington, Liverpool, Analytical Chemist.
1888. Taylor, J. Scott, North London Colour Works, Spring Place, Kentish Town, N.W., Technical Chemist.
1896. Taylor, Martin, 11, Park Road, Clydach, Glamorgan, Chemical Works Manager.
1901. Taylor, Sidney H., 63, Wolstenholme Road, Sharrow, Sheffield, Works Chemist.
1898. Taylor, Walter, 475, Grosvenor Place, Limefield, Bury, Lancs, Technical Chemist.
1905. Taylor, Wm. H., 36, Glenhouse Road, Eltham Park, Kent, Chemist.
1887. Teanby, G. W. A., Elvin Lodge, East Dereham, Norfolk, Analytical Chemist.
1899. Teas, Wm. Holmes, Marion, Va., U.S.A., Chemist.
1913. Tehbutt, Oswald N., 4, Salisbury Villas, Cambridge, Cement Works Manager.
- O.M. Teed, Dr. F. L., Chem. Lab., 9, Mining Lane, London, E.C., Analytical Chemist.
1905. Teeple, Dr. J. E., 50, East 41st Street, New York City, U.S.A., Director.
1904. Teller, George L., 31, North State Street, Chicago, Ill., U.S.A., Chemist.
1906. Tempamy, Dr. Harold A., Government Laboratory, St. John's, Antigua, West Indies, Analyst.
1913. Tennant, C. A., c/o C. Tennant Sons and Co. (Montreal), Ltd., C.P.R. Tel. Chambers, Montreal, Canada, Chemical Importer and Agent.
1884. Tennant, Jas., Fairlie, Ayrshire, Lead and Colour Manufacturer.
1913. Tennant, Robt., 9, Prince's Square, Strathbungo, Glasgow, Analytical Chemist.
1896. Tennille, Geo. F., c/o Southern Cotton Oil Co., 206, Bay Street East, Savannah, Ga., U.S.A., Chemist.
1908. Terleski, Fred. H., 11, Oaklands Road, Kersal, Manchester, Technical Chemist.
1911. Terrey, Augustus G., c/o The Limmer Asphalt Paving Co., Ltd., Leamouth Wharf, Orchard Place, Blackwall, E., Chemist.
884. Terry, Hubert L., (Journals) Fairfield House, Brook Road, Fallowfield, Manchester; and (Laboratory) 23, Hopwood Avenue, Manchester, Technical Chemist.
- O.M. Tervet, R., 68, Windsor Road, Leyton, Essex, Oil Works Manager.
1893. Tetley, C. F., Messrs. Jos. Tetley and Son, The Brewery, Leeds, Brewer.
1903. Thatcher, Ed. J., The Manor House, Chew Magna, near Bristol, Merchant and Manufacturer.
1909. Thaxter, Gerald N., c/o Brewer and Co., Worcester, Mass., U.S.A., Chemist.
1908. Theis, Dr. Friedrich C., Konigsteinerstrasse 60, Höchst a/Main, Germany, Chemist.
1910. Thom, T. Mathieson, Woodlands, Cheshunt, Herts, Chemical Engineer.
1908. Thom, Wm. H., 1024, Dovercourt Road, Toronto, Canada, Chemist.
1911. Thomas, D. Hibbert, 56, Wann Road, Morriston, Glamorganshire, Chemical Works Manager.
1912. Thomas, Frederick, c/o Williams Bros. and Co., Colour Manufacturers, Hounslow, Middlesex, Chemist and Works Manager.
1894. Thomas, H. Russell, Broad Plain Soap Works, Bristol, Soap Manufacturer.
1909. Thomas, John, Highfield, Brettell Lane, near Stourbridge, Analytical Chemist.
1902. Thomas, Nehemiah M., Willesley Road, Pymble, N.S.W., Australia, Inspector.
1901. Thomas, Octavius, Gas and Water Offices, Pentre, Glamorganshire, Gas and Water Engineer.
1908. Thomas, Oswald J. D., c/o Canada Cement Co., Ltd., Plant No. 3, Hull, Quebec, Canada, Analytical Chemist.
1888. Thomas, S. Percy, c/o Baird and Tatlock, 14, Cross Street, Hatton Garden, London, E.C., Technical Chemist.
1898. Thomas, Wm. Harrison, jun., c/o The Apponang Co., Apponang, R.I., U.S.A., Printworks Chemist.
1905. Thomlinson, Wm., Seaton Carew Ironworks, West Hartlepool, Ironmaster.
1905. Thompson, Alf. J., c/o R. W. Greeff and Co., Thames House, Queen Street Place, London, E.C., Chemical Merchant.
1885. Thompson, Prof. Claude M., 38, Park Place, Cardiff, Professor of Chemistry.
1898. Thompson, Edw. C., Froyle House, 42, Westcombe Park Road, Blackheath, S.E., Manufacturing Chemist.
1909. Thompson, Edwin, 25, Sefton Drive, Liverpool, Manufacturing Chemist.
1914. Thompson, F. C., 183, Hyde Park Road, Leeds, Demonstrator in Leather Industries Department.
1893. Thompson, G. Rudd, 69, Dock Street, Newport, Mon., Analytical and Consulting Chemist.
1895. Thompson, Gustave W., 129, York Street, Brooklyn, N.Y., U.S.A., Chemist.
1913. Thompson, Howard, 52, Church Road, Northwich, Cheshire, Analytical Chemist.
1907. Thompson, Jas. G., Donegall Quay Mills, Belfast, Ireland, Corn Miller.
1903. Thompson, Jno. T., Corporation Sewage Works, Knostrop, Leeds, Analyst.
1912. Thompson, Kenworthy J., 644, Mahbett Avenue, Milwaukee, Wis., U.S.A., Chemist, Federal Rubber Works.
1907. Thompson, Milton S., 72, Broad Street, Boston, Mass., U.S.A., Manufacturer.
- O.M. Thompson, W. P., Patent Office, 6, Lord Street, Liverpool, Patent Agent.
1896. Thomsen, Alonzo L., Maryland Club, 1, East Eager Street, Baltimore, Md., U.S.A., Manufacturing Chemist.
1884. Thomson, G. Carruthers, 53, Bedford Road, Rock Ferry, Birkenhead, Engineer.
1907. Thomson, H. N., United Verde Smelter, Clarkdale, Arizona, U.S.A., Metallurgist.
1891. Thomson, Jas. M., Royal Gunpowder Factory, and (Juls.) Powder Mill Lane, Waltham Abbey, Essex, Manager (Cordite Branch).
1884. Thomson, Robt. T., 156, Bath Street, Glasgow, Analytical Chemist.
1899. Thomson, Thos., c/o Waterproofing Co., Barrhead, near Glasgow, Manufacturer.

- O.M. Thomson, W., Royal Institution Laboratory, 79A, Princess Street, Manchester, Analytical and Consulting Chemist.
1890. Thomson, Wm. Thos., Royal Gunpowder Factory, and (Jnls.) The Rowans, Honey Lane, Waltham Abbey, Essex, Explosives Chemist.
1902. Thorburn, Jas., 30, Cromartie Avenue, Newlands, Glasgow, Analytical Chemist.
1910. Thorne, Carl B., c/o Riordan Paper Co., Hawkesbury, Ontario, Canada, Manager.
- O.M. Thorne, Dr. L. T., Highlands, The Crescent, Belmont, Surrey, and (Journals) Southampton Wharf, Battersca, S.W., Technical Chemist.
1907. Thornevell, A. R., 163, Rood End Road, Oldbury, Birmingham, Works Chemist.
- O.M. Thorneycroft, Wallace, (Jnls.) Pleau House, Pleau, Stirling, and 113, St. Vincent Street, Glasgow, Technical Chemist.
1904. Thornley, Thomas, 19, Hope Street, Glasgow, Chemical Manufacturer.
1887. Thoruton, H., Redbourn, Ashford, Middlesex, Analytical Chemist.
1899. Thornton, Wm., c/o J. S. MacArthur and Co., Porcupine, North Ontario, Canada, Chemist.
1895. Thorp, Dr. Frank H., Mass. Inst. of Technology, Boston, Mass., U.S.A., Assistant Professor of Industrial Chemistry.
1906. Thorp, Walter, Sorrentoville, Dalkey, Co. Dublin, Ireland, Analytical Chemist.
- O.M. Thorpe, Sir Edward, C.B., F.R.S., Whinfield, Salcombe, South Devon, Professor of Chemistry.
1905. Thorpe, Prof. J. F., F.R.S., The Imperial College, South Kensington, London, S.W., Professor of Organic Chemistry.
1905. Thresh, Dr. John C., Chelmsford, Essex, Medical Officer of Health and Sanitary Expert.
1898. Thurrauer, Dr. Gustav, c/o Aurora Metal Co., Aurora, Ill., U.S.A., Chemist.
1904. Thurston, Azor, Grand Rapids, Ohio, U.S.A., Chemist.
1904. Tickle, Thos., Laboratory, 83, Queen Street, Exeter, Analyst.
1913. Tilburn, Charles, The Australian Explosives and Chemical Co., Ltd., Deer Park, Vic., Australia, Works Manager and Explosives Chemist.
1908. Tillberg, Erik W., Westervik, Sweden, Extract Manufacturer.
1900. Tilley, Jas. W., 95A, Southwark Street, London, S.E., Research Chemist.
1906. Tillson, Henry E., 5946, Christian Street, Philadelphia, Pa., U.S.A., Dyer.
1901. Timmans, W. G., The Basford Chemical Co., Ltd., Basford, Nottingham, Chemical Manufacturer.
1894. Tipler, Fred. C., 2, Wellington Villas, Crewe, Analytical Chemist.
1907. Tischbein, Dr. Robert, The Heyden Chemical Works, Garfield, N.J., U.S.A., Chemist.
1894. Toch, Maximilian, 320, Fifth Avenue, New York City, U.S.A., Chemist.
1915. Tocher, Dr. J. F., Crown Mansions, Union Street, Aberdeen, Public Analyst.
1886. Todd, A. M., c/o The A. M. Todd Co., Kalamazoo, Mich., U.S.A., Manufacturing Chemist and Distiller of Essential Oils.
1911. Todd, Fred W., Gunpowder Works, Tonbridge, Kent, Chemist.
1913. Tomlinson, George G., Anglo-Chilian Nitrate and Railway Co., Tocopilla, Chile, South America, Chemist.
1914. Tompkin, Albert, 101, Lenton Boulevard, Nottingham, Pharmacist.
- O.M. Toms, F. Woodland, States Analyst's Office, St. Heliers, Jersey, Analytical Chemist.
1902. Tone, Frank Jerome, c/o The Carborundum Co., Niagara Falls, N.Y., U.S.A., Manager.
1909. Tonry, Wm. S., Passaic Street, near Elm Street, Maywood, N.J., U.S.A., Chemical Engineer.
1913. Toppin, Richmond D., Millett Street, Hurstville, Sydney, N.S.W., Chemist.
1907. Torrey, Dr. Joseph, Craigie Lea, Blundellsanda, Liverpool, Engineer.
- O.M. Towers, J. W., Widoes, Lancashire, Analytical Chemist.
1907. Towler, A. E., c/o Sulphide Corporation, Cockle Creek, N.S.W., Australia, Chemist.
1915. Townsend, Clinton P., 918, F. St. N.W., Washington, D.C., U.S.A., Patent Lawyer.
1897. Towse, Walter, Elswick Leather Works, Newcastle-on-Tyne, Technical Chemist.
1904. Toyne, Francis D., c/o Kelsal, and Kemp, Ltd., Woodhouse Mills, Norden, near Rochdale, Chemist.
1899. Trantom, Dr. Wm., Borås, Grappenhall, near Warrington, Chemist.
1894. Traphagen, Dr. Frank W., Colorado School of Mines, Golden, Colo., U.S.A., Professor of Metallurgy and Assaying.
1900. Traquair, Jno., Ayer, Mass., U.S.A., Analytical Chemist.
1906. Travell, Norman E., Grosvenor Avenue, Mapperley Park, Nottingham, Lace Dresser.
1893. Travers, Dr. Morris W., F.R.S., 17, Lexham Gardens, London, W.
1889. Trechmann, A. O., The Old Palace, Rochester, Kent, Cement Manufacturer.
1911. Trechmann, C. T., Warren Cement Works, Hittlepool, Cement Manufacturer.
1895. Trecharne, F. Gwilym, Wrangbrook, Llanishen, near Cardiff, Analytical Chemist.
1909. Trier, Thorvald G., 237, West 22nd Street, New York City, U.S.A., Technical Chemist.
1901. Trigger, Oliver, Chem. Dept., Royal Arsenal, Woolwich, S.E., Analytical Chemist.
1898. Tripp, Dr. E. Howard, 3, Milton Road, Bedford, Science Master.
- O.M. Trobridge, A., c/o Trobridge and Co., Ltd., Heworth Shore, Felling-on-Tyne, Technical Chemist.
1897. Trotman, Saml. R., The City Laboratory, 1, Regent Street, Nottingham, City Analyst.
1887. Tsukiyama, S., 2nd of No. 2116, Fukiai-chō, Kobe, Japan, Paper Mills Chemist.
1894. Tucker, Alex. E., 55, Station Street, Birmingham, Metallurgist and Chemist.
1897. Tucker, Samuel A., Columbia University, New York City, U.S.A., Tutor in Industrial Chemistry.
1886. Tuer, Arthur H., Douglas House, Worthington, near Wigan, Analytical Chemist.
1903. Tufts, C. G., c/o Somet-Solvay Co., Syracuse, N.Y., U.S.A., Chemical Engineer.
1909. Tulloch, Capt. T. G., Bank Buildings, St. James' Street, London, S.W., Director of Public Companies.
1901. Tulloch, Wm. F., c/o Joseph Watson and Sons, Ltd., Whitehall Soap Works, Leeds, Merchant.
1914. Tungay, Sydney J., Haughton's Ltd., 30, St. Mary at Hill, London, E.C., Chemical Engineer.
1909. Tunks, Dr. F. R., Powder Mills, Tonbridge, Kent, Manager.
1904. Tunnell, Raymond W., 251, West Walnut Lane, Germantown, Philadelphia, Pa., U.S.A., Manufacturer.
1899. Turnbull, Dr. Andrew, 18, Hackins Hey, Liverpool, Consulting Chemist.
1888. Turnbull, G. W., Ash Cottage, North Road, Carnforth, Lancashire, Metallurgical Chemist.
1901. Turnbull, R. H., Messrs. Turnbull's (Glasgow) Ltd., 20, Strand Road, Calcutta, India, Chemist.
1884. Turnbull, W. S., 38, Bath Street, Glasgow, Chemical Manufacturer.
1911. Turner, Prof. A. J., Technical Institute, Byculla, Bombay, India, Professor of Chemistry.
1902. Turner, Basil, 83, Pitt Street, Sydney, N.S.W., Australia, Metallurgist.
1902. Turner, Jos., c/o Read Holliday and Sons, Ltd., and (Jnls.) Azo House, Birkby, Huddersfield, Chemist.

1905. Turner, Prof. Thomas, 75, Middleton Hall Road, King's Norton, Birmingham, Professor of Metallurgy.
1897. Turney, Fred. N., 12, Dieghem Straat, Saventhom, near Brussels, Belgium, Leather Dresser.
1887. Turney, Sir J., Trent Bridge Leather Works, Nottingham, Tanner.
1908. Turnill, Thos. W., c/o Atlas Preservative Co., Windmill Lane, Deptford, S.E., Works Chemist.
1905. Tutwiler, Carrington C., Real Estate Trust Building, Philadelphia, Pa., U.S.A., Consulting Gas Chemist.
1890. Tweedy, Jas., 245, Burdett Road, Limehouse, E., Metallurgical Chemist.
1905. Twigg, Geo. F., 57, Val Plaisant, St. Heliers, Jersey, Gas Works Chemist.
1891. Twitchell, E., Wyoming, Ohio, U.S.A., Candle Works Manager.
1913. Twomey, Jerome, 21, Onslow Road, Elm Park, Liverpool, Research Chemist.
- O.M. Twynam, T., Wynyard House, Coatham Road, Redcar, Yorks, Metallurgist.
1904. Tyler, Chas. R., c/o Dr. Francis Wyatt, 402, West 23rd Street, New York City, U.S.A., Analytical Chemist.
- O.M. Typke, P. G. W., Lawn House, New Malden, Surrey, Chemical Manufacturer.
- O.M. Tyrer, Thos., Stirling Chemical Works, Stratford, E.; and (Journals) 14, Sandwell Mansions, West End Lane, N.W., Chemical Manufacturer.

U

1907. Udal, John P., Bellevue Road, Durban, Natal, Engineer.
1894. Uhlig, E. C., Citizens' Gas Works, Fifth and Hoyt Streets, Brooklyn, N.Y., U.S.A., Chemist.
1900. Uhlig, W. C., c/o Hygeia Distilled Water Co., 349, West 12th Street, New York City, U.S.A., Chemist.
- O.M. Umney, C., Fernbrake, Branksome Wood Road, Bournemouth; and (Journals) 48, Southwark Street, London, S.E., Manufacturing Chemist.
1905. Umney, John C., 48, Southwark Street, London, S.E., Wholesale Druggist.
1889. Underhill, Thos. J., 53, Lancroast Road, Tulse Hill, S.W., Inspector of Stores.
1885. Underwood, G. R., 10, Emerson Street, Peabody, Mass., U.S.A., Glue Works Chemist.
1904. Uyeda, Toyokitsu, 54, Matsugayechō Kitaku, Osaka, Japan, Chemist.

V

1911. Vakil, Kapibram H., No. 5, Santa Cruz, Bombay, India, Chemist.
1896. Van der Linde, Harold, c/o Century Rubber Co., Plainfield, N.J., U.S.A., President.
1895. Vanderpoel, Dr. Frank, 175, Park Avenue, Orange, N.J., U.S.A., Chemist.
1903. Van Dyck, Edwin M., 57, Greene Street, New York City, U.S.A., Chemist and Ink Maker.
1897. Van Gelder, Arthur P., c/o Hercules Powder Co., Kenil, N.J., U.S.A., Superintendent.
1891. Van Gundy, Chas. P., Laboratory, B. and O. R. R. Baltimore, Md., U.S.A., Metallurgical Chemist.
1896. Van Laer, Norbert, Truman's Brewery, Burton-on-Trent, Brewer and Chemist.
1897. Van Marken, J. C., 10, Amalia Straat, The Hague, Holland, Chemical Engineer.
1888. Vargas-Vergara, J. M., Apartado No. 120, Bogota, Colombia, S. America, Metallurgical Chemist.
1910. Vass, David, Gas Works, Perth, Manager.
1915. Vaughan, F. W., H. R. Vaughan and Co., Ltd., South Shore Road, Gateshead-on-Tyne, Roofing Felt Manufacturer.
1912. Vontress, Ernest W. S., c/o Messrs. Lover Bros., Kabushiki Kaisha, P.O. Box Sannomiya 174, Kobe, Japan, Oil Mill Manager.

1898. Verity, Ben., 550, Hood Street, Fall River, Mass. U.S.A., Print Works Chemist.
1904. Vernon, Dr. R. H., 55, Rhätelstrasse, Zürich, Switzerland, Chemical Engineer.
1908. Vickers, Benj. Threlfall, Gaseoigne Street, Boar Lane, Leeds, Oil Merchant.
- O.M. Vickers, Wm., c/o Thos. Vickers and Sons, Miles Platting, Manchester, Chemical Manufacturer.
1907. Vietinghoff-Scheel, Dr. Karl Freiherr von, "Chemiker-Zeitung," Cöthen (Anhalt), Germany, Editor in Chief.
1908. Vieweg, Dr. Walter, Ganghoferstrasse 11, Frankfurt a/M., Germany, Chemist.
1909. Virolleaud, Leopold, 3, Rue de Paris, St. Denis, Seine, France, Chemical Engineer.
1897. Vlies, Leonard E., Belmont, Gowan Road, Alexandra Park, Manchester.
- O.M. Voelcker, E. W., 1, Tudor Street, London, E.C., Analytical and Consulting Chemist.
1887. Voelcker, Dr. J. A., 20, Upper Phillimore Gardens, Kensington, W., Agricultural Chemist.
1897. Vogel, Julius L. F., Parliament Mansions, Victoria Street, Westminster, S.W., Engineer.
1899. Vogeler, Gustav, 17, Philpot Lane, London, E.C., Merchant.
1897. Voorhees, Louis A., 111, Carroll Place, New Brunswick, N.J., U.S.A., Agricultural Chemist.
1899. Voorhees, Samuel S., Bureau of Standards, Washington, D.C., U.S.A., Chemist.
1915. Vorce, L. D., c/o Pennsylvania Salt Manufacturing Co., Wyandotte, Mich., U.S.A., Superintendent.
1902. Vorisek, Dr. Anton, College of Pharmacy, 115-119, West 68th Street, New York City, U.S.A., Instructor.
1899. Voss, Walter A., Carlton Chemical Works, Glogall Road, Millwall, E., Manufacturing Chemist.

W

1896. Wachtel, Gregory, Alexandrowski Prospekt 15, Petrograd, Russia, Chemical Engineer.
1905. Waddell, Montgomery, 30, Church Street, New York City, U.S.A., Consulting Engineer.
1911. Waddock, Wm. P., 666, Harris Street, Ultimo, Sydney, N.S.W., Milk Analyst.
1913. Wade, Albert J., 21, Bengal Road, Ilford, E., Sugar Analyst.
1902. Wade, Frank, 26, St. Ronan's Avenue, Southsea, Analytical Chemist.
1890. Wade, Jas. L., 28, West Kensington Gardens, London, W., Chemical Manufacturer.
1889. Wadman, W. E., 102, Lord Avenue, Bayonne, N.J., U.S.A., Manufacturing Chemist.
1911. Waele, Armand de, c/o Linoleum Manufacturing Co., Staines, Technical Chemist.
1897. Wagner, Dr. Theodore B., Room 2229, 17, Battery Place, New York City, U.S.A., Chemist.
1893. Wagner, W. G., 12, North Common Road, Ealing, W., Manufacturing Chemist.
1906. Wahl, Dr. Robert, 1135-1147, Fullerton Avenue, Chicago, Ill., U.S.A., President, Brewers' School.
1895. Wainwright, Wm., c/o Spooner and Bailey, Manure Works, Eling, near Southampton, Chemist.
1908. Wait, Dongas, c/o R. Gay and Co., Ltd., Langthorne Works, Stratford Market, London, E., Analytical Chemist.
1899. Wakefield, Wm. C., Mill Street East, Savile Town, Dewsbury, Chemical Manufacturer.
1915. Waldo, Dr. Leonard, 49, Wall Street, New York City, U.S.A., Consulting Engineer.
1895. Waldstein, Dr. Martin E., 23, Broadwater Down, Tunbridge Wells, Kent, Manufacturing Chemist.
1887. Walker, Archibald, Newark Castle, Ayr, Scotland, Distiller.
1915. Walker, Arthur, "Woodbourne," Aneaster Road, Far Headingley, Leeds, Chemical Manufacturer.

1913. Walker, F. H., jun., 3 Stanington Grove, Heston, Newcastle-on-Tyne, Technical Chemist.
1914. Walker, Fred. W., Rosemont, Bath Street, Saltsbury, Yorks, Analytical Chemist.
1908. Walker, George, c/o Burmah Oil Co. Ltd., P.O. Box 67, Rangoon, Burmah, Analytical Chemist.
1913. Walker, Henry, 10 Melrose Terrace, West Kensington Park, London, W., Chemical Engineer.
1897. Walker, H. V., 193, Lincoln Avenue, Newark, N.J., U.S.A., Chemist.
1894. Walker, Prof. Jas., D.Sc., F.R.S., 5, Western Coates Road, Edinburgh, Professor of Chemistry (University of Edinburgh).
1897. Walker, Jas. W., Marine Lodge, Irvine, Scotland, Chemical Manufacturer.
1906. Walker, Jas. W., Farley, Oakmoor, Stoke-on-Trent, Assayer.
1902. Walker, Jno. H., Gourepore Works, Nadiati, E.R.S.R., Bengal, India, Chemist.
1910. Walker, John S., Hirasenka, Sagami, Japan, Explosives Chemist.
1884. Walker, S. R., Fern Bank, Starling Road, Radcliffe, Manchester, Foreman Dyer.
1912. Walker, Prof. W. O., Dept. of Chemistry, School of Mining, Kingston, Ont., Canada, Professor of Chemistry.
1895. Walker, W. Moane, c/o Walker, Ltd., Litherland, near Liverpool, Tanner.
1897. Wallace, Edwin C., 92, Corey Street, West Roxbury, Mass., U.S.A., Chemist.
1883. Wallace, Robert, 20, Murrayfield Avenue, Edinburgh, Distiller.
1897. Wallace, Robt. A., 66, Holland Road, London, W., Chemical Manufacturer.
- O.M. Waller, Dr. Elwyn, 7, Franklin Place, Morristown, N.J., U.S.A., Professor of Chemistry.
1903. Wallerstein, Leo, 171, Madison Avenue, New York City, U.S.A., Chemist.
1899. Wallerstein, Dr. Max, 171, Madison Avenue, New York City, U.S.A., Chemist.
1913. Walmsley, Samuel B., c/o Changoo, Ltd., Forsyth, North Queensland, Australia, Assayer.
1886. Walsh, P. T., 12, Valentine Street, West Newton, Mass., U.S.A., Colour Printer.
1901. Walsh, Lionel O. P., c/o Dominion Tar and Chemical Co., Ltd., Sydney, Cape Breton, Canada, Chemist.
1903. Walsh, Peter H., P.O. Box 569, Magog, Quebec, Canada, Analytical Chemist.
1904. Walsher, Wm., Holmstedt's Compositions Co., Ltd., Heworth Shore, Felling-on-Tyne, Chemist and Works Manager.
1905. Walton, Robert H., Railway Stores, Evesleigh, Sydney, N.S.W., Analyst.
1902. Walton, Thos. U., Colonial Sugar Refining Co., Ltd., O'Connell Street, Sydney, N.S.W., Australia, Analytical Chemist.
1911. Walton, Wm. Knightley, Beechwood, Upper Rushton Road, Thornbury, Bradford, Analyst.
1895. Wann, W. Philip, 194-200, Bishopsgate, London, E.C., Pharmacist and Editor.
1901. Warburton, Frank, 50, Rosebury Road, Muswell Hill, N., Manager.
1904. Warburton, George H., 75, Mill Lane, West Hampstead, N.W., Analytical Chemist.
1896. Warburton, Thos., Radcliff, Barch Hall Lane, Rusholme, Manchester, Chemist.
- O.M. Ward, Geo., Messrs. Hirst, Brookes, and Hirst, Ltd., Millgate Mills, Leeds, Chemical Manufacturer.
1891. Ward, G. J., Hadam Fields, Ilkerton, Notts, Civil Engineer.
1895. Ward, John, Ramstone Blue Lias Lime Co., Ltd., Ramstone, Notts, Manager.
1894. Ward, Wm. J., 28, Nelson Road, Salford, Manchester, Chemist.
1905. Wardlaw, Thos. H., 32, St. Gabriel Street, Montreal, Canada, Manufacturing Chemist.
1902. Waring, W. Geo. Webb City, Mo., U.S.A., Metallurgical Chemist.
1915. Warner, Arthur L. D., P.O. Box 203, Edgewater, N.J., U.S.A., Sugar Refiner.
1899. Warnes, Arthur R., 13-17, Green Lane, Hull, Consulting Technical Chemist.
1912. Warren, E. Bruce, c/o Indian Rubber and Gutta Percha Telegraph Works Co., Silvertown, E., Consulting Analytical Chemist.
1890. Warren, Fiske, c/o S. D. Warren and Co., Laboratory, Cumberland Mills, Maine, U.S.A., Paper Manufacturer.
1901. Warren, Jno. E., Eagle Chemical Works, Barchester Street, Poplar, E., Tar Distiller.
1912. Warriner, C. E., c/o U.S. Government, Honolulu, H.T., U.S.A., Analyst and Bacteriologist.
1911. Washburn, Frank S., (Jr.), c/o American Cyanamid Co., Niagara Falls, Ont., Canada, President, American Cyanamid Co.
1913. Wassmer, Dr. Eugene, Boulevard de la Tour, Geneva, Chemist.
1885. Waterfall, W. R., c/o Avon Manure Co., Bristol; and (Journals) Thirlmere, Clavering Road, Redland, Bristol, Manure Manufacturer.
1902. Watkins, E. J., 72, King's Road, Peckham, S.E., Works Chemist.
1898. Watkins, Willard H., c/o Schoellkopf, Hartford, and Hanna Co., P.O. Drawer 57, Buffalo, N.Y., U.S.A., Chemist.
1894. Watnough, Jno., c/o Brotherton and Co., Ltd., Ammonia Works, Wakefield, Chemist.
1884. Watson, Chas., Rose Bank, School Road, Moseley, Birmingham, Manufacturing Chemist.
1894. Watson, Chas. Ernest, 33, Oxford Road, St. Anne's on Sea, Lancashire, Chemical Assistant.
1908. Watson, C. I. Wilkinson, c/o Wailuku Sugar Co., Wailuku, Maui, Hawaiian Islands, Chemist.
1901. Watson, Herbert J., 64, Peel House Lane, Widnes, Chemist.
1894. Watson, Jas., Tyne View, Hebburn-on-Tyne, Alkali Works Manager.
1891. Watson, Jno., Langdon, Beaconsfield Road, Blackheath, S.E., Analytical Chemist.
- O.M. Watson, Jno. C., Farwell Blochery, Laurence, Mass., U.S.A., Printworks Chemist.
- O.M. Watt, A., c/o Macfie and Sons, 34, Moorfields, Liverpool, Sugar Works Chemist.
1901. Watt, Francis L., City Mart Building, 5, Hamilton Street, Sydney, N.S.W., Australia, Analytical Chemist.
1906. Watt, Dr. H. E., Blandfield Chemical Works, Wheatfield Road, Edinburgh, Chemist.
1893. Watts, Jno. Isaac, Fairleigh, Hartford, Cheshire, Alkali Works Manager.
1905. Watts, Jno. Wm., Newcastle Tar Works, Blaydon-on-Tyne, Manager.
1907. Weamsley, Harry, 12, Rowhill Mansions, Clapton, N.E., Chemical Engineer.
1903. Wayland, Wm. A., 12, Albert Road, Brockley, S.E., Manufacturing Chemist.
1906. Webb, Frank H., 7, Dustin Street, Haverhill, Mass., U.S.A., Chemist.
1905. Webster, W. J., 40, Central Street, Boston, Mass., U.S.A., Manufacturing Chemist.
1912. Weber, Dr. Max G., 151, Water Street, Perth Amboy, N.J., U.S.A., Works Manager.
1901. Webster, Geo. J., P.O. Box 1003, Marquette, Mich., U.S.A., Secretary.
1906. Waddell, George, 20, Grainger Street West, Newcastle-on-Tyne, Manufacturing Chemist.
1904. Wedekind, Rod., Verdinger, Niederrhein, Germany, Manufacturer of Alizarin and Bichromates.
1897. Wedge, Uley, Ardmore, Pa., U.S.A., Chemist.
1902. Weed, Hy. T., 962, Ocean Avenue, Brooklyn, N.Y., U.S.A., Teacher of Chemistry.
1893. Weeks, H. B., 2, Infield Park Road, Barrow-in-Furness, Analytical Chemist.
1904. Weil, Jacob A., 4, Rowesfield Lane, Stockton-on-Tees, Chemical Engineer.
1910. Weinberg, Dr. Arthur von, "Bothenrode," Forsthaus-strasse, Frankfurt a M., Germany, Dye-stuff and Chemical Manufacturer.
1906. Weir, James, c/o Imperial Varnish and Color Co., 6-24, Morse Street, Toronto, Canada, Chemist.

1910. Weiss, John M., c/o Barrett Manufacturing Co., Research Dept., Hudson Heights, N.J., U.S.A., Chemist.
1908. Weissmüller, Edward F., Spring Lodge, Helsby, Cheshire, Chemist.
1905. Weissmüller, Ernest C., "Ivy Dene," Overton, Frodsham, Cheshire, Research Chemist.
1910. Welch, Bertie M., 80, Hunter Street, Sydney, N.S.W., Australia, Assayer.
1912. Weld, Fred. C., 263, Fairmount Street, Lowell, Mass., U.S.A., Analytical Chemist.
1899. Weldon, Leonard E., Hadleigh, Alma Street, Sherwood Rise, Nottingham, Dyer.
1903. Wellcome, Henry S., Snow Hill Buildings, London, E.C., Manufacturing Chemist.
1914. Wells, E. E., 9, Dalhousie Street, Montreal, Quebec, Canada, Chemical Engineer.
1912. Wells, Jas. H., 21, Knoll Avenue, Uplands, Swansea, S. Wales, Metallurgist.
1885. Welsh, Jas., Standard Mills, Ferguson Road, Bombay, India, Printworks Manager.
1890. Welsh, Thos. L., 3, Prince's Gardens, Dowanhill, Glasgow, Analytical Chemist.
- O.M. Welsh, W., Holt Town Oil Works, Manchester.
1905. Welt, Dr. Ida, 101, West 109th Street, New York City, U.S.A., Chemist.
1906. Wenger, Francis E., Clivedon, Wolstanton, Stoke-on-Trent, Ceramic Colour Manufacturer.
1909. Wescott, J. P., jr., 55, Washington Park, Newtonville, Mass., U.S.A., Manager, Atlas Chemical Co.
1903. Wesener, Dr. John A., 31, North State Street, Chicago, Ill., U.S.A., Consulting Chemist.
1889. Wesson, D., 111, South Mountain Avenue, Montclair, N.J., U.S.A., Cotton-oil Expert.
1908. West, Chas. A., c/o American Camphor Refining Co., 14, Fulton Street, Boston, Mass., U.S.A., President.
1909. West, Percy C. H., 61—62, Chancery Lane, London, W.C., Analytical Chemist.
1900. Westenfelder, B. D., 1414, Race Street, Cincinnati, Ohio, U.S.A., Chemist.
1885. Westmoreland, J. W., 12, Arthington Terrace, Hunslet, Leeds, Metallurgical Chemist.
1898. Weston, David B., Sharon, Mass., U.S.A., Chemist.
1894. Weston, Robt. S., 14, Beacon Street, Boston, Mass., U.S.A., Chemist and Bacteriologist.
1890. Wetter, Jasper, Room 23, Holborn Hall, Gray's Inn Road, London, W.C., Patent Agent.
1912. Weyman, Geoffrey, The Cwm, Saltwell Road, Low Fell, Co. Durham, Technical Chemist.
- O.M. Whalley, L. J. de, 18, Brandram Road, Lee, S.E., Sugar Chemist.
1909. Wharton, Fredk. M., c/o The New Explosives Co., Ltd., Stowmarket, Suffolk, Chemist.
1908. Wheaton, H. J., 21, Chesterton Road, Cambridge, Chemical Engineer.
1909. Wheeler, Edward, 144, Earlsdon Avenue, Coventry, Demonstrator of Chemistry.
1898. Wheeler, Dr. Edwd. J., 79, Chapel Street, Albany, N.Y., U.S.A., Analytical Chemist.
1903. Wheeler, Ernest, 4, Fairfield Terrace, Higher Openshaw, Manchester, Metallurgical Chemist.
1906. Wheeler, Frank G., 683, Harris Street, Appleton, Wis., U.S.A., Chemist.
1907. Wheeler, R. Vernon, Home Office Experimental Station, Eskmeals, Cumberland, Chemist.
1912. Wheeler, Thorne L., c/o Edible Products Co., 156—186, East 22nd Street, Bayonne, N.J., U.S.A., Chemist.
1895. Wheelwright, Dr. E. W., 14, Carisbrooke Road, Edgbaston, Birmingham.
1909. Whiffen, G. Goodman, Lombard Road, Battersea, London, S.W., Chemical Engineer.
- O.M. Whiffen, Thos. J., Cerris House, West Hill, Putney, S.W., Manufacturing Chemist.
- O.M. Whiffen, W. G., Lombard Road, Battersea, London, S.W., Manufacturing Chemist.
1899. Whitaker, Milton C., Columbia University, New York City, U.S.A., Chemist.
1895. Whitaker, Thos., Aire Vale Dye Works, Newlay, near Leeds, Dyer.
- O.M. Whitaker, Thorpe, (Journals) Bradford Dyers' Association, Ltd., and 35, Pemberton Drive, Bradford, Yorks, Dyer's Chemist.
1893. White, Arthur F., 2, Melbourne Grove, Thornbury, Bradford, Yorks, Manufacturing Druggist.
1915. White, Gerald N., 15, West End Avenue, Pinner, Middlesex, Research Chemist.
1898. White, Jno., County Offices, St. Mary's Gate, Derby, Public Analyst to County of Derby.
1911. White, John W., c/o E.C. Powder Co., Green Street Green, Dartford, Kent, Works Chemist.
- O.M. White, Paul T., Hortonfield House, West Drayton, Chemical Manufacturer.
1910. White, P. Winzar, Mayfield, Hayes, Middlesex, Manufacturing Chemist.
1911. White, Walter W., c/o Citro Chemical Co., Maywood, N.J., U.S.A., Secretary and Manager.
1912. Whitehead, Charles E., Devonshire Villas, Barrow Hill, near Chesterfield, Derbyshire, Chemist.
1903. Whitehouse, P. L., 16, Lombard Street, West Bromwich, Staffordshire, Oil Chemist.
1906. Whiteley, C. E., 21, Brudenell View, Leeds, Demonstrator of Chemistry.
1885. Whiteley, R. Lloyd, The Institute, West Bromwich, Staffordshire, Principal.
1892. Whiteside, Jno. L., 378, St. Helen's Road, Bolton-le-Moors, Chemical Lecturer.
1911. Whitley, George, jr., c/o Ridley, Whitley, and Co., Ltd., Angel Road Works, Edmonton, N., Linoleum Manufacturer.
1912. Whitney, Wm. L., c/o U.S. Graphite Co., Saginaw, Mich., U.S.A., Chemist.
1885. Whittaker, C. J., Somerville, Fairhaven, Lytham, Lancashire, Chemical Engineer.
1913. Whittelsey, Dr. Theodore, c/o U.S. Rubber Co., 11th Avenue and 58th Street, New York City, U.S.A., Chemical Director.
1904. Whittier, Charles T., 78, Brinkerhoff Street, Jersey City, N.J., U.S.A., Manager.
1901. Whitton, Jas. T., Nobel Villa, Ardeer, Stevenston, Explosives Chemist.
1884. Whowell, F., Croich Hey, Tottington, Bury, Lanes, Bleacher.
1910. Whympers, R., St. Clare's, St. Mary's Road, Ditton Hill, Surbiton, Chemist.
1902. Whythead, Dr. Eric H., c/o Brotherton and Co., Ltd., Leeds, Works Manager.
1899. Wiarda, Jno. C., 259—273, Green Street, Brooklyn, N.Y., U.S.A., Manufacturing Chemist.
1913. Wickenden, Leonard, c/o West Virginia Paper and Pulp Co., 521, West 23rd Street, New York City, U.S.A., Research Chemist.
1908. Wickes, Clarence S., 28, Franklin Avenue, Merchantville, N.J., U.S.A., Factory Superintendent.
1905. Widmann, Eugeno A., 588, 5th Street, Brooklyn, N.Y., U.S.A., Dyestuff Merchant.
1901. Wieler, Eric E., Northern Assurance Buildings, Albert Square, Manchester, Chemical Merchant.
1906. Wiffen, Henry J., 17, Albany Road, Manor Park, Essex, Manufacturing Chemist.
1883. Wiggins, W. W., 55, George Street Parade, Birmingham, Nickel Refiner.
1897. Wigglesworth, H., 25, Broad Street, New York City, U.S.A., Manufacturing Chemist.
1913. Wigner, J. H., Wardlykes, Frodsham, Cheshire, Works Chemist.
1906. Wikner, Sigurd A., "Lynton," Kingsbury Road, Gravely Hill, Birmingham, Tar Works Chemist.
1899. Wild, Roland C., The Grange, New Eltham, Kent, Analytical Chemist.
1893. Wilder, F. L., 10, Forest Rise, Walthamstow, Essex, Assayer.
1902. Wilder, Salmon W., jun., 33, Broad Street, Boston, Mass., U.S.A., Treasurer.
1911. Wildt, Dr. Edwin, Homeland, Western Park Road, Leicester, Technical Chemist.
1912. Wiley, Samuel W., 15, South Gay Street, Baltimore, Md., U.S.A., Analytical Chemist.

1906. Wilke, Wm., 86, Norwood Avenue, Buffalo, N.Y., U.S.A., Chemical Engineer.
1899. Wilkens, H. A. J., 60, Broadway, New York City, U.S.A., Mining Engineer.
1903. Wilkie, Jno. M., 38, South Road, West Bridgford, Nottingham, Analytical Chemist.
1885. Wilkin, Sir Walter, K.C.M.G., Appold Street, Finsbury, E.C., Yeast Manufacturer.
1915. Wilkins, C. R., 8, Crookston Road, Eltham, S.E., Works Chemist.
1911. Wilkinson, Frank, West Lodge, Handsworth, near Sheffield, Chemical Manufacturer.
1904. Wilkinson, Prof. J. A., South African School of Mines and Technology, P.O. Box 1176, Johannesburg, Transvaal, Professor of Chemistry.
1886. Wilkinson, J. B., Tong Street, Dudley Hill, Bradford, Yorks, Chemical Manufacturer.
1903. Willard, C. T., c/o The Singer Manufacturing Co., Elizabethport, N.J., U.S.A., Chemist.
1893. Willcox, Benjamin, 47, Lincoln's Inn Fields, London, W.C., Patent Agent.
1911. Willcox, Stuart J., 34, Westbourne Road, Birkdale, Southport, Chemist.
1903. Williams, Chas. E., Thornhayes, Sleaford, Seed Crusher.
1895. Williams, David T., 42, Finsbury Square, London, E.C., Chemist and Assayer.
1912. Williams, Egbert R., c/o Northern Aluminium Co., Shawinigan Falls, P.Q., Canada, Chemist.
1891. Williams, Henry J., 30, Norfolk Road, Chestnut Hill, Mass., U.S.A., Chemical Engineer.
1908. Williams, Herbert E., 28, Cranston Road, Forest Hill, S.E., Chemist.
1914. Williams, J. A., Mackenzie, c/o A. E. Ames and Co., Union Bank Building, Toronto, Canada.
1904. Williams, Jno. T., 815, Madison Avenue, New York City, U.S.A.
1913. Williams, Jos. H., 49, Addison Road, Snaresbrook, Essex, Works Chemist.
1904. Williams, Naboth, 28, Rolleston Street, Warrington, Technical Chemist.
1902. Williams, Percy, 94, Telford Avenue, Streatham Hill, S.W., Chemist.
1885. Williams, Rowland, 79, Queen Square, Lancaster, Analytical Chemist.
1912. Williams, Sammel B., Penelvan, Roskear, Camborne, Cornwall, Metallurgist.
1900. Williams, Saml. H., Glastonbury, Conn., U.S.A., Soap Manufacturer.
1903. Williams, S. M., 269, Springdale Avenue, East Orange, N.J., U.S.A., Chemist.
1885. Williams, T. Howell. *See* Idris, T. H. W.
1884. Williams, Prof. W. Carleton, Broomgrove, Goring-on-Thames, Professor of Chemistry.
1902. Williams, Walter Scott, Baker's Corner, Attleboro', Mass., U.S.A., Textile Engineer.
1887. Williams, W. Collingwood, 36, Dansie Street, Liverpool, Analytical Chemist.
- O.M. Williams, W. J., 1503, Foulkrod Street, Frankford, Philadelphia, Pa., U.S.A., Analytical Chemist.
1894. Williamson, J. Alex., The Croft, Chase Court Gardens, Enfield, N., Analytical Chemist.
1911. Williamson, John, jun., Alne Hill, Camp Road, Maryport, Cumberland, Tanner.
1903. Wills, J. Lainson, 3457, Crittenden Street, St. Louis, Mo., U.S.A., Technical and Brewing Chemist.
1905. Wills, Wm. H., 23, Willow Street, Waltham, Mass., U.S.A., Dyer.
1888. Wilson, Cecil H., c/o Sheffield Smelting Co., Ltd., Royds Mills Street, Sheffield, Chemist.
1888. Wilson, Dr. David, Carbeth, Killearn, by Glasgow.
1910. Wilson, Dr. Forsyth J., Royal Technical College, Glasgow, Lecturer.
1885. Wilson, Frank, 7, Bedford Square, London, W.C., Brewer.
- O.M. Wilson, G. E., The Chemical Works, Oldbury, near Birmingham, Chemical Manufacturer.
1899. Wilson, Gordon, Benallan, Kirkintilloch, Chemist and Assayer.
1886. Wilson, Jno., Tyneside, 381, Hagley Road, Birmingham, Technical Chemist.
1896. Wilson, Jno., "Lynton," Dingle Hill, Colwyn Bay, North Wales, Chemical Engineer.
1909. Wilson, Jno., Battersea Polytechnic, London, S.W., Head of Chemical Dept.
1905. Wilson, J. E., c/o General Chemical Co., 25, Broad Street, New York City, U.S.A., Chemical Salesman.
1906. Wilson, J. Murray, c/o Canadian Explosives, Ltd., Transportation Building, Montreal, Canada, Technical Chemist.
1902. Wilson, Leonard P., Rosemount, Holyhead Road, Coventry, Technical Chemist.
1910. Wilson, Leslie, West Bank, Doxey, near Stafford.
- O.M. Wilson, R. H., Egglecliffe P.O., Co. Durham, Chemical Manufacturer.
1912. Wilson, S. Siddons, 154, Burges Road, East Ham, Essex, Analytical Chemist.
1908. Wilson, William James, Whangarei Club, Whangarei, New Zealand, Consulting Cement Engineer.
1890. Wilson, W. W., Dalmonach House, Alexandria, Dumbartonshire, Analytical Chemist.
1884. Wilton, Thos., Winsor House, Beckton, E., Tar Works Manager.
1912. Windsor, P. L., Library, University of Illinois, Urbana, Ill., U.S.A., Librarian.
1913. Windsor-Richards, W., c/o Allen West and Co., Ltd., Lewes Road, Brighton, Chemist.
1892. Wingfield, T. R., 12, Suffolk Road, Bournemouth West, Brewer.
- O.M. Wingham, A., 57, Victoria Road South, Southsea, Hants, Metallurgical Chemist.
1908. Winkler, Hermann, Bockenheimer Anlage 43, Frankfurt a/Main, Germany, Merchant.
- O.M. Winser, P. J., Heath House, Knutsford, Cheshire, Consulting Chemist.
1907. Winsloe, Louis S., 1, Booth Street, Manchester, Manufacturing Chemist.
1892. Winstanley, W. Hy., Birch House, Cheadle Hulme, Cheshire, Technical Chemist.
1886. Winstone, E. H., Members' Mansions, 36, Victoria Street, London, S.W., Ink Manufacturer.
1907. Winther, Dr. A., Chemische Fabrik Griesheim Elektron, Werk Oehler, Offenbach a/Main Germany, Chemist.
1892. Wirtz, Dr. Qnirin, 28, Great Ormond Street, London, W.C., Consulting Chemist.
1889. Wishart, Jno., Oakbank Oil Co., Ltd., 29, St. Vincent Place, Glasgow, General Manager.
1902. Withers, Prof. W. A., State A. and M. College, West Raleigh, N.C., U.S.A., Professor of Chemistry.
- O.M. Witt, Dr. Otto N., Ebereschallée 10, Westend, bei Berlin, Professor of Chemistry.
1903. Wolf, Jacques, c/o Jacques Wolf and Co., Passaic, N.J., U.S.A., Manufacturing Chemist.
1912. Wolff, Dr. Salamon, 7, Westerstraat, Utrecht, Holland, Chemical Engineer.
1911. Wollaston, T. Roland, Dirleton House, Priory Road, Sale, Cheshire, Consulting Engineer.
1903. Wolton, Wm. R., c/o Joseph Fison and Co., Ltd., Ipswich, Manager.
1914. Wood, A. S., Municipal Technical School, Suffolk Street, Birmingham, Works Chemist.
1906. Wood, E. Escott, Hurricane House, Brynabo, near Wrexham, North Wales, Chemist and Metallurgist.
1900. Wood, Frank, Ardsley House, near Barnsley, Yorks., Assistant Manager (Glass Works).
1901. Wood, Frank S., 12, Carlton Avenue, Hornsea, East Yorks Cement Works Chemist.
1909. Wood, Hubert R., c/o Fenner and Alder and Co., Fenner's Wharf, Millwall, E., Works Chemist.
1887. Wood, Jos. T., 62, Park Road, Nottingham, Tanner.
1915. Wood, William, 26, Rue General van Merlen, Antwerp, Belgium; and (temp.) c/o Mrs. Paulson, Broomhill, Woodhall Spa, Lincs, Chemical Manufacturer.

1906. Woodall, Sir Corbett, Palace Chambers, Westminster, London, S.W., Civil Engineer.
- O.M. Woodcock, R. C., c/o Sanitas Co., Ltd., Locksley Street, Limehouse, London, E., Chemist.
1910. Woodhead, Arthur E., Dyeing Dept., The University, Leeds, Research Chemist.
1884. Woodhead, Jas., Inglewood, Slaithwaite, near Huddersfield, Tar Distiller.
1915. Woodmansey, A., Royal Baths, Harrogate, Yorks, Analyst and Chemical Engineer.
1914. Woodroffe, David, 43, Mexboro' Street, Chapeltown Road, Leeds, Research Assistant.
1900. Woodrow, John, 84, Harpenden Road, Manor Park, E., Chemist.
1906. Woodward, Horace A., Cowell Avenue, West Orange, N.J., U.S.A., Chemist.
1904. Woolcott, Geo. H., Lady's Well Brewery, Cork, Ireland, Brewer's Chemist.
- O.M. Woolley, G. S., Victoria Bridge, Manchester, Pharmaceutical Chemist.
1905. Woore, N. L., c/o South Australian Gas Co., Brompton, Adelaide, South Australia, Works Chemist.
1901. Worden, Edw. C., Millburn, N.J., U.S.A., Manufacturing Chemist.
1914. Worley, Prof. Fred. P., University College, Auckland, New Zealand, Prof. of Chemistry.
- O.M. Worrall, H., Culmington House, Stanton Lacey, Ludlow, Dyer.
1903. Worstall, Robt. A., 21, North La Salle Street, Chicago, Ill., U.S.A., Paint and Varnish Specialist.
1900. Worthington, Arthur, Lynwood, Great Lever, Bolton, Chemist and Manager.
1896. Wrampelmeier, T. J., 565, Monadnock Building, San Francisco, Cal., U.S.A., Chemist.
1914. Wray, Edward, 1441, Ashton Old Road, Higher Openshaw, Manchester, Chemist.
- O.M. Wray, O. J. P., Hazlemere, Coleraine Road, Blackheath, S.E., Technical Chemist.
1904. Wright, Allister M., Box 617, G.P.O., Christchurch, N.Z., Chemist (Christchurch Meat Co.).
1912. Wright, Arthur, 111, Broadway, New York City, U.S.A., Lawyer.
1895. Wright, Arthur C., c/o Turner, Morrison, and Co., 6, Lyons Range, Calcutta, India, Chemist.
1908. Wright, C. Harold, Dept. of Agriculture, Suva, Fiji, Agricultural Chemist.
1901. Wright, Harold E., c/o Sir B. Samuelson and Co., Ltd., Middlesbrough, Chemist.
1907. Wright, John Henry, 16, Norwood Avenue, Shipley, Yorks. Technical Chemist.
1885. Wright, Jos., 19, Arboretum Street, Nottingham, Lace Dresser.
- O.M. Wright, L. T., Junior Constitutional Club, Piccadilly, London, W., Chemical Engineer.
1911. Wright, Robt., c/o Thos. Adams, Ltd., Sherwood Hill Works, Nottingham, Bleacher and Dyer.
1900. Wright, Walter J., 59, Stone Street, Faversham Kent, Chief Chemist (Cotton Powder Co.).
1890. Wülffing, Dr. Charles, Hönningen a/Rhein, Germany, Technical Chemist.
1907. Würster, Oscar H., c/o Chambers, Ltd., 80, Don Esplanade, Toronto, Canada, Soap Works Chemist.
1890. Wyatt, Dr. Francis, 402, West 23rd Street, New York City, U.S.A., Consulting Chemist.
1905. Wyer, Malcolm G., The Library, State University, Iowa City, Iowa, U.S.A., Librarian.
- O.M. Wyld, Jno., The Avenue, Lidgett Park, Roundhay, Leeds, Chemical Works Manager.
1908. Wyler, Dr. Max, c/o Levinstein, Ltd., Blackley, Manchester, Manufacturing Chemist.
1906. Wynne, Prof. W. Palmer, F.R.S., The University, Sheffield, and (Journals) 17, Tiptonville Road, Sheffield, Professor of Chemistry.

Y

1901. Yardley, Frank, c/o Henry Jutson and Sons, Liverpool Street, Birmingham, Chemical Manufacturer.
1897. Yates, W. H., Durley Park, Keynsham, Bristol, Technical Chemist.
1913. Yeomans, Wm. W., 40, Alleghany Street, Buffalo N.Y., U.S.A., Chemist.
1906. Yerkes, Leonard A., c/o Jos. Bancroft and Sons Co., Wilmington, Del., U.S.A., Bleacher and Finisher.
1898. Yetton, Thos., 86, Bow Road, London, E., Consulting Distiller's Chemist.
1894. Yocum, Dr. Jno. H., 325, Academy Street, Newark, N.J., U.S.A., Chemist.
1886. Yoshida, Prof. H., Imperial University of Kyoto, Kyoto, Japan, Professor of Chemistry.
1900. Yoshitake, E., Nishihara Machi, Koishikawa, Tokyo, Japan, Chemist.
1885. Young, Alfred C., 17, Vicar's Hill, Lewisham, S.E.
1885. Young, Brougham, 2A, Sigdon Road, Dalston, N.E., Analytical Chemist.
1902. Young, Chas. C., c/o The Bayer Co., 117, Hudson Street, New York City, U.S.A., Colourist.
1890. Young, Dr. Geo., Bradda, Church Crescent, Church End, Finchley, N., Chemist.
1913. Young, Hamish, Springfield, Brownside Road, Cambuslang, by Glasgow, Chemist.
1904. Young, James, Holmdene, London Lane, Bromley, Kent, Chemist.
- O.M. Young, Jno., 2, Montague Terrace, Kelvinside, Glasgow, Technical Chemist.
1886. Young, Jno., Claremont House, Beverly Road, Hull, Gas Engineer.
1909. Young, John, 89, Charlotte Street, Akron, Ohio, U.S.A., Analytical Chemist.
1904. Young, Jno. H., c/o The Cassel Cyanido Co., Ltd., Shuna Street, Maryhill, Glasgow, Technical Chemist.
1898. Young, J. W., 22, Maxwell Drive, Glasgow, S., Inspector under Alkali Acts.
1833. Young, Prof. Sydney, F.R.S., University Chemical Laboratory, Trinity College, Dublin, Professor of Chemistry.
- O.M. Young, W. C., Laboratory, 24, Aldgate, London, E., Gas Examiner and Consulting Chemist.
1898. Young, W. Gathorne, Analyst's Dept., G.N.R., Doncaster, Yorks, Chief Chemist.

Z

1899. Zabriskie, C. B., c/o Pacific Coast Borax Co., 100, William Street, New York City, U.S.A., Manager.
1897. Zacharias, Dr. P. D., Philhellion Street 22, Athens, Greece, Industrial Chemist.
1912. Zanetti, Joaquin E., Easthampton, Long Island, N.Y., U.S.A., Chemist.
1906. Zarembo, Edw., 707, D. S. Morgan Building, Buffalo, N.Y., U.S.A., President (Zarembo Co.).
1906. Zdanowicz, Joseph, 37, Queen's Gate Gardens, South Kensington, S.W., Chemical Engineer (Artificial Silk).
1899. Zilz, Henry, 26, Ellerker Gardens, Richmond, S.W., Merchant.
- O.M. Zimmermann, A., 3, Lloyd's Avenue, London, E.C., Chemical Agent.
1905. Zimmermann, Chas., 9 and 10, St. Mary-at-Hill, London, E.C., Chemical Merchant.
1897. Zinsser, Dr. Fred. G., Hastings-upon-Hudson, N.Y., U.S.A., Manufacturing Chemist.
1912. Zwingenberger, Dr. Otto K., c/o Roessler and Hasslacher Chem. Co., Perth Amboy, N.J., U.S.A., Chemical Engineer.

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